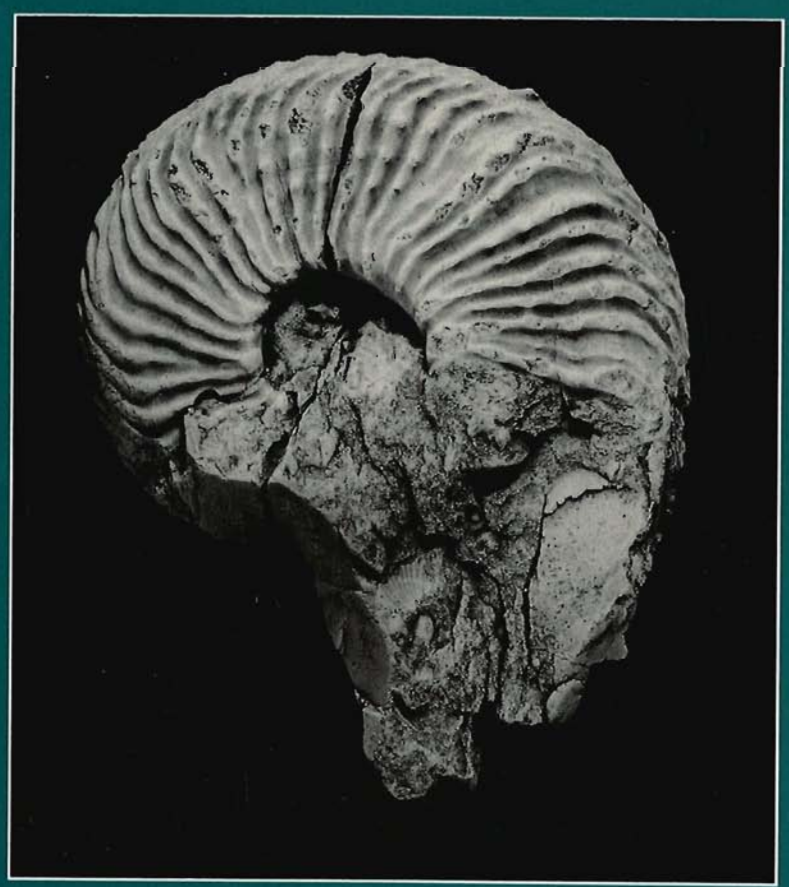
GEOLOGICAL SURVEY OF CANADA
BULLETIN 467

CANADIAN TRIASSIC AMMONOID FAUNAS

E.T. Tozer

1994



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Available in Canada through authorized
bookstore agents and other bookstores

or by mail from

Canada Communication Group–Publishing
Ottawa, Ontario Canada K1A 0S9

and from

Geological Survey of Canada offices:

601 Booth Street
Ottawa, Ontario K1A 0E8

3303 - 33rd Street N.W.
Calgary, Alberta T2L 2A7

100 West Pender Street
Vancouver, B.C. V6B 1R8

A deposit copy of this publication is also available
for reference in public libraries across Canada

Cat. No. M42-467E
ISBN 0-660-15368-8

Price subject to change without notice

Cover Illustration
Holotype of *Daxatina canadensis* (Whiteaves) x1.5. This specimen was collected by R.G. McConnell when travelling along Liard River in 1887. It is from beds now known to be of Middle Triassic (Ladinian) age. (See page 165.)

Critical reader

N.J. Silberling

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Manuscript submitted: 92.11.30
Approved for publication: 94.03.10

PREFACE

Marine Triassic rocks containing ammonoid faunas are widely distributed in the Sverdrup Basin of the Arctic Islands, and in Western Canada. Data from the morphology and distribution of these ammonoids as well as stratigraphic data have been used to construct a biochronology for the whole of the Triassic. This detailed biochronology is a useful tool for refining the stratigraphy of the Sverdrup Basin and Western Canada. Stratigraphic and paleontological data such as these are invaluable for estimating the potential abundance and probable distribution of fuel and mineral resources.

E.A. Babcock
Assistant Deputy Minister
Geological Survey of Canada

PRÉFACE

Les roches triasiques marines contenant des faunes d'ammonoïdés ont une large répartition dans le bassin de Sverdrup de l'archipel Arctique et dans l'Ouest canadien. Les données recueillies sur la morphologie et la répartition de ces ammonoïdés ainsi que les données stratigraphiques ont été utilisées pour établir une biochronologie de tout le Trias. Cette biochronologie détaillée est un outil utile pour affiner la stratigraphie du bassin de Sverdrup et de l'Ouest canadien. De telles données stratigraphiques et paléontologiques sont inestimables pour évaluer l'abondance potentielle et la répartition probable des ressources combustibles et minérales.

E.A. Babcock
Sous-ministre adjoint
Commission du géologique du Canada

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CANADIAN TRIASSIC AMMONOID FAUNAS

Abstract

Data are given on the morphology and distribution of all known Canadian Triassic Ammonoidea, except the Arcestaceae. Material is described from about 850 localities in the Arctic Islands, Yukon, British Columbia and Alberta. Localities in the Arctic Islands are in the Sverdrup Basin. Except for one collection from a well in northwest Alberta, all specimens from Western Canada are from exposures in the Cordillera. A biochronology is proposed covering the whole of the Triassic, from the earliest (Early Griesbachian) to latest (Late Norian). Fifty-six divisions (zones, subzones, horizons) are recognized, grouped within stages and substages as follows: Lower Griesbachian (2), Upper Griesbachian (2), Dienerian (4), Smithian (3), Spathian (2), Lower Anisian (3), Middle Anisian (3), Upper Anisian (2), Ladinian (10), Lower Carnian (3), Upper Carnian (4), Lower Norian (7), Middle Norian (7), Upper Norian (4). The ammonoids are classified as 522 species (243 new) in 256 genera (46 new).

Résumé

Les données recueillies sur la morphologie et la répartition de tous les Ammonoidea connus du Trias canadien, à l'exception d'Arcestaceae, sont présentées. Les fossiles décrits proviennent d'environ 850 localités situées dans l'archipel Arctique, au Yukon, en Colombie-Britannique et en Alberta. Dans l'archipel Arctique, les localités se trouvent dans le bassin de Sverdrup. À l'exception d'une collection provenant d'un puits foré dans le nord-ouest de l'Alberta, tous les spécimens de l'Ouest canadien ont été prélevés dans des affleurements dans la Cordillère. On propose une biochronologie couvrant tout le Trias, du Griesbachien précoce au Norien tardif. Cinquante-six divisions (zones, sous-zones, horizons) sont reconnues et regroupées en étages et sous-étages : Griesbachien inférieur (2), Griesbachien supérieur (2), Dienérien (4), Smithien (3), Spathien (2), Anisien inférieur (3), Anisien moyen (3), Anisien supérieur (2), Ladinien (10), Carnien inférieur (3), Carnien supérieur (4), Norien inférieur (7), Norien moyen (7), Norien supérieur (4). Les ammonoïdés sont classés en 522 espèces (243 nouvelles) dans 256 genres (46 nouveaux).

Summary

Marine Triassic rocks containing ammonoid faunas are widely distributed in the Sverdrup Basin of the Arctic Islands, and in Western Canada. Abundant material and a wealth of stratigraphic data permit the recognition of a biochronology for the whole of the Triassic. The exposed Triassic rocks of Western Canada are confined to the Cordillera. Triassic rocks also occur in the Interior Platform sequence, east of the Cordillera. The Triassic rocks of the Sverdrup Basin, Interior Platform and the eastern belt of the Cordillera (Rocky Mountains and Foothills) are entirely sedimentary, and were deposited on the North American Craton. Although in many places folded and faulted, they have not been subjected to continental drift with respect to the craton. In contrast, Triassic rocks of the central and western belts of the Cordillera (Intermontane and Insular belts) are both sedimentary and volcanic. They occur on terranes that appear to be allochthonous with respect to the North American Craton. Although these rocks now form a part of North America and are now close to those of the eastern belt, when they were formed, they were probably very far, in both longitude and latitude, from the eastern Triassic deposits that rest on the North American craton. Today, the Triassic rocks of these belts are at essentially the same latitude, but when they formed, the western formations were evidently at an appreciably lower latitude than the eastern formations.

Permian–Triassic boundary beds are well exposed in the Sverdrup Basin and in the eastern belt of the Cordillera. The Permian and Triassic strata differ lithologically and are separated by a distinct but concordant boundary. In both the Sverdrup Basin and the Cordillera, the boundary indicates a regional unconformity. In the Sverdrup Basin, the Triassic strata contain Lower Griesbachian ammonoids (*Otoceras*) that are as old as any Triassic ammonoids known elsewhere in the world. *Otoceras* is not known from the Cordillera; here the oldest determinable Triassic fossil is the bivalve *Claraia,* indicating a Griesbachian (probably Upper Griesbachian) age.

Data from the Lower Triassic ammonoid faunas permit the recognition of 11 zones, which are grouped into the Griesbachian, Dienerian, Smithian and Spathian stages. The type locality for the Hedenstroemi Zone is in Siberia; all the other zones have their type localities in the Sverdrup Basin. Earliest Triassic (Early Griesbachian) ammonoid faunas are known only from Ellesmere and Axel Heiberg islands. Dienerian, Smithian and Spathian ammonoids are known from both the Sverdrup Basin and the Eastern Cordillera, but not from the western belts of the Cordillera.

The Middle Triassic ammonoid faunas provide criteria for distinguishing 12 zones, grouped into the Anisian and Ladinian stages. The type locality for the Mulleri Zone is in Nevada. The type localities for the remaining zones are in the eastern part of the Cordillera, in northeastern British Columbia. Anisian and Ladinian faunas, like those of the Lower Triassic, are known only from the Sverdrup Basin and the eastern part of the Cordillera. Faunas from northeastern British Columbia are far more diverse than those in the Sverdrup Basin, but faunas from the Sverdrup Basin, although meagre, are nevertheless sufficient to permit the recognition of most of the zones. Although Lower and Middle Triassic ammonoids are unknown in the western belts of the Cordillera, radiolarians, bivalves and conodonts indicate that rocks of these ages are present.

On the basis of the ammonite faunas, fourteen zones, grouped into the Carnian and Norian stages, are recognized in the Upper Triassic. The Norian is treated as the ultimate Triassic stage and includes beds that, in some parts of the world, have been called Rhaetian. Type localities for the Desatoyense and Macrolobatus zones are in Nevada, and in California for the Dilleri and Welleri zones. The Amoenum and Crickmayi zones are defined in southwestern British Columbia. The remaining type localities are all in northeastern British Columbia. Upper Triassic faunas are more widely distributed than those of the Lower and Middle Triassic. Nearly all the zones can be recognized from diverse faunas in both the eastern and western parts of the Cordillera. Upper Triassic faunas from the Sverdrup Basin are less diverse, but nevertheless permit recognition of some Carnian zones and the Columbianus Zone. Lower and lower Middle Norian ammonoid faunas are unknown. Marine beds of Upper Norian age (Cordilleranus Zone) can be recognized in the Sverdrup Basin from occurrences of *Monotis,* but ammonoids of this age are not known.

Triassic–Jurassic boundary beds, like those at the Permian–Triassic boundary, are apparently concordant in the Sverdrup Basin, the eastern part of the Cordillera, in southwestern British Columbia, and in the Queen Charlotte Islands. Faunas younger than those of the Cordilleranus Zone do not occur in the Sverdrup Basin and are absent from nearly all sections in the Rocky Mountains and Foothills. There is one occurrence of Amoenum Zone ammonoids in the Peace River Foothills. Amoenum and Crickmayi Zone faunas occur at several localities in the Intermontane and Insular belts of the western Cordillera.

The following ammonoid genera are recorded from the successive zones.

Lower Griesbachian—***Concavum Zone***: *Otoceras.* ***Boreale Zone***: *Hypophiceras, Vishnuites, Otoceras.*

Upper Griesbachian—***Commune Zone***: *Tompophiceras, Ophiceras, Discophiceras, Wordieoceras.* ***Strigatus Zone***: *Wordieoceras, Bukkenites* (new).

Dienerian—***Candidus Zone***: *Meekophiceras* (new), *Proptychites, Dunedinites, Pleurogyronites* (new), *Ambites, Pleurambites* (new), *Prionolobus.* ***Sverdrupi Zone***: *Xenodiscoides, Koninckites, Vavilovites, Kingites, Heibergites* (new), *Wyomingites, Flemingites, Tellerites, Pseudosageceras.*

Smithian—***Hedenstroemi Zone***: *Hedenstroemia.* ***Romunderi Zone***: *Kashmirites, Melagathiceras, Juvenites, Thermalites, Gyronites, Prionolobus, Meekoceras, Euflemingites, Anaxenaspis, Arctoceras, Paranannites, Oxyussuria* (new), *Pseudosageceras.* ***Tardus Zone***: *Kashmirites, Xenoceltites,* ?*Arctoceras,* ?*Paranannites, Anasibirites, Prionites, Wasatchites, Anawasatchites, Arctoprionites, Pseudosageceras.*

Spathian—***Pilaticus Zone***: *Arctomeekoceras, Neomeekoceras* (new), *Olenikites, Pseudosageceras.* ***Subrobustus Zone***: *Sulioticeras* (new), *Isculitoides, Zenoites, Popovites, Monacanthites, Prosphingites, Cordillerites, Metadagnoceras, Procarnites, Olenikites, Svalbardiceras, Keyserlingites, Leiophyllites.*

Lower Anisian—***Mulleri Zone***: *Groenlandites, Grambergia, Paradanubites, Paracrochordiceras, Caucasites, Gymnites, Stenopopanoceras.* ***Caurus Zone***: *Groenlandites, Pearylandites, Lenotropites, Grambergia, Azarianites, Stenopopanoceras,* ?*Japonites, Columbisculites* (new), *Discogymnites* (new), *Sturia, Stenophyllites* (new), *Ussurites.*

Middle Anisian—***Hagei Zone***: *Alanites, Stenopopanoceras, Intornites, Hollandites, Anagymnotoceras, Gymnites, Buddhaites, Ussurites.* ***Hayesi Zone***: *Amphipopanoceras, Intornites, Czekanowskites, Tetsaoceras* (new), *Arctohungarites, Hollandites, Anagymnotoceras, Nicomedites, Gymnites,* (?)*Tropigastrites.* ***Minor Zone***: *Stenopopanoceras, Amphipopanoceras, Intornites, Hollandites, Anagymnotoceras, Nicomedites, Ptychites, Proarcestes.*

Upper Anisian—***Deleeni Zone***: *Amphipopanoceras, Intornites, Eogymnotoceras, Gymnotoceras, Tropigymnites, Japonites, Anagymnites, Ptychites, Ussurites.* ***Chischa Zone***: *Parapopanoceras, Longobardites, Frechites, Pleurofrechites* (new), *Paranevadites* (new), *Ptychites, Tozerites.*

Ladinian—***Matutinum Zone***: *Pleurofrechites* (new), *Ptychites, Longobardites, Eoprotrachyceras.* ***Poseidon Zone:*** *Tuchodiceras* (new), *Gymnites, Ptychites, Arctoptychites, Istreites, Eonathorstites* (new), *Indigirites, Proarcestes, Protrachyceras, Metatirolites, Monophyllites.* ***Meginae Zone***: *Nitanoceras, Eosagenites, Indigirites, Thanamites, Indoceltites, Drumoceras, Protrachyceras, Meginoceras, Silenticeras, Lobites.* ***Maclearni Zone***: *Nitanoceras, Hungarites, Nathorstites, Protrachyceras, Liardites, Otoarpadites* (new), *Anolcites, Zestoceras* (new), *Maclearnoceras, Asklepioceras, Lobites, Monophyllites.* ***Sutherlandi Zone***: *Nitanoceras, Nathorstites, Asklepioceras, Zestoceras* (new), *Muensterites, Frankites, Daxatina, Sympolycyclus, Lobites.*

Lower Carnian—***Desatoyense Zone***: *Badiotites, Stolleyites, Silenticeras, ?Protrachyceras, Daxatina, Trachyceras, Clionitites, Coroceras.* ***Obesum Zone***: *Austrotrachyceras, Sirenites.* ***Nanseni Zone***: *Sirenites, Striatosirenites, Clionitites, ?Discophyllites.*

Upper Carnian—***Dilleri Zone***: *Parahauerites, Spirogmoceras, Trachystenoceras, Hisnitites* (new), *Trachysagenites, Sympolycyclus, Leconteiceras, Sandlingites, Traskites, ?Shastites, Tropites, Gymnotropites, Pleurotropites* (new), *Discotropites, Indonesites, Paratropites.* ***Welleri Zone***: *Klamathites, Arctosirenites, Trachysagenites, Pamphagosirenites, Tropites, Discotropites, Homerites, Homeroceras* (new), *Margaritropites, Hoplotropites, Jovites, Tardeceras, Bacchites, Projuvavites, Goniojuvavites, Neotenoceras* (new). ***Endemic to Arctic Upper Carnian***: *Orthoceltites, Arctoarpadites* (new), *Yakutosirenites* (new), *Arctotropites* (new). ***Endemic to northern Yukon Upper Carnian***: *Epiceratites, Acanthotropites* (new). ***Macrolobatus Zone***: *Anatropites, Euisculites, Styrites, Tropiceltites, Thisbites, Hadrothisbites* (new), *Tropithisbites* (new), *Gonionotites, Griesbachites, Margarijuvavites* (new).

Lower Norian—Kerri Zone: *Pinacoceras, Pterosirenites, Clionitites, Tornquistites, Tropiceltites, Discostyrites* (new), *Thisbites, Metathisbites* (new), *Stikinoceras, Gonionotites, Griesbachites, Dimorphites, Guembelites, Discophyllites.* ***Dawsoni Zone***: *Norosirenites* (new), *Wangoceras, Malayites, Dryojuvavites* (new), *Pseudocardioceras, Discomalayites* (new), *Omojuvavites* (new). ***Magnus Zone***: *Oxytibetites* (new), *Dimorphotoceras, Sirenotibetites* (new), *Neotibetites, Prodrepanites* (new), *Acanthinites, Arietoceltites, Indojuvavites, Epijuvavites, Juvavites.*

Middle Norian—***Rutherfordi Zone***: *Paragymnites, Metaclionites* (new), *Carinacanthites* (new), *Cyrtopleurites, Drepanites, Acanthodrepanites* (new), *Hauerites, Heraclites, Parisculites* (new), *Didymites.* ***Columbianus Zone***: *Pinacoceras, Sagenites, Pseudosirenites, Alloclionites, Brouwerites, Steinmannites, Eosteinmannites, Himavatites, Mesohimavatites* (new), *Neohimavatites, Ectolcites, Pleurodistichites, Distichites, Leiodistichites* (new), *Eothetidites* (new), *Parathetidites, Pseudothetidites, Helictites, Leislingites, Idaoceras* (new), *Thetidites, Clydonites, Neodidymites* (new), *Episculites, Hypisculites, Parathisbites, Phormedites, Parajuvavites, Halorites, Rhacophyllites.*

Upper Norian—***Cordilleranus Zone***: *Paragymnites, Sagenites, Nassichukites, Paraguembelites, Gnomohalorites, Metasibirites, Lissonites, Ophiorhabdoceras* (new), *Rhabdoceras, Peripleurites, Tragorhacoceras.* ***Amoenum Zone***: *Pinacoceras, Arcestes, Placites, Sagenites, Tozeria, Rhabdoceras, Paracochloceras, Rhacophyllites.* ***Crickmayi Zone***: *Placites, Megaphyllites, Arcestes, Cycloceltites, Rhabdoceras, Vandaites, Choristoceras.*

Sommaire

Les roches triasiques marines contenant des faunes d'ammonoïdés ont une large répartition dans le bassin de Sverdrup (archipel Arctique) et dans l'Ouest canadien. Des fossiles en abondance et une multitude de données stratigraphiques permettent d'établir une biochronologie pour l'ensemble du Trias. Dans l'Ouest du Canada, les roches triasiques n'affleurent que dans la Cordillère. Des roches triasiques se rencontrent également dans la séquence de la Plate-forme de l'Intérieur, à l'est de la Cordillère. Les roches triasiques du bassin de Sverdrup, de la Plate-forme de l'Intérieur et de la zone orientale de la Cordillère (Rocheuses et Foothills) sont des roches entièrement sédimentaires qui se sont déposées sur le craton nord-américain. Même si, en de nombreux endroits, elles sont plissées et faillées, elles n'ont pas subi de dérive continentale par rapport au craton. Par contre, les roches triasiques des zones centrale et occidentale de la Cordillère (domaines intramontagneux et insulaire) sont à la fois sédimentaires et volcaniques. Elles reposent sur des terranes qui semblent être allochtones par rapport au craton nord-américain. Bien que ces roches fassent maintenant partie de l'Amérique du Nord et qu'elles soient maintenant proches de celles de la zone orientale, les roches triasiques de la Cordillère orientale étaient probablement largement séparées en longitude et latitude des roches de la zone occidentale de la Cordillère durant leur sédimentation. Aujourd'hui, les roches triasiques de ces zones se trouvent essentiellement à la même latitude, mais

lorsqu'elles se sont formées, les formations occidentales étaient évidemment à une latitude sensiblement plus basse que les formations orientales.

Les couches limites du Permien-Trias sont bien exposées dans le bassin de Sverdrup et dans la zone orientale de la Cordillère. Les couches permiennes et triasiques diffèrent par leur lithologie et sont séparées par un limite nette mais concordante. Dans le bassin de Sverdrup et dans la Cordillère, la limite indique une discordance régionale. Dans le bassin de Sverdrup, les couches triasiques contiennent des ammonoïdés (*Otoceras*) du Griesbachien inférieur qui sont aussi anciens que tous les autres ammonoïdés triasiques connus dans le monde. On n'a pas retrouvé *Otoceras* dans la Cordillère; en effet, le fossile triasique le plus ancien que l'on y trouve à ce jour est le bivalve *Claraia*, qui indique un âge Griesbachien (probablement Griesbachien supérieur).

Les données recueillies sur les faunes d'ammonoïdés du Trias inférieur permettent d'établir 11 zones, regroupées dans les étages Griesbachien, Dienérien, Smithien et Spathien. La localité type de la Zone à *Hedenstroemi* se situe en Sibérie; toutes les autres zones ont leurs localités types dans le bassin de Sverdrup. Les faunes d'ammonoïdés du Trias initial (Griesbachien précoce) ne se retrouvent que dans les îles d'Ellesmere et Axel Heiberg. Les ammonoïdés du Dienérien, du Smithien et du Spathien se rencontrent dans le bassin de Sverdrup et dans la Cordillère orientale, mais pas dans les zones occidentales de la Cordillère.

Les faunes d'ammonoïdés du Trias moyen offrent des critères permettant de distinguer 12 zones, regroupées dans les étages de l'Anisien et du Ladinien. La localité type de la Zone à *Mulleri* se situe dans le Nevada. Les localités types des autres zones se trouvent dans la partie orientale de la Cordillère, dans le nord-est de la Colombie-Britannique. Les faunes anisiennes et ladiniennes, comme celles du Trias inférieur, ne se rencontrent que dans le bassin de Sverdrup et dans la partie orientale de la Cordillère. Les faunes du nord-est de la Colombie-Britannique sont beaucoup plus diversifiées que celles du bassin de Sverdrup, mais les faunes du bassin de Sverdrup, bien que peu abondantes, sont néanmoins suffisantes pour permettre de reconnaître la plupart des zones. Bien que les ammonoïdés du Trias inférieur et moyen ne soient pas connus dans les zones occidentales de la Cordillère, les radiolaires, les bivalves et les conodontes indiquent qu'il y a des roches de ces âges.

En se basant sur les faunes d'ammonites, on reconnaît quatorze zones, regroupées dans les étages du Carnien et du Norien, dans le Trias supérieur. On considère le Norien comme l'étage triasique ultime et l'on y inclut des couches qui, dans certaines parties du monde, sont attribuées au Rhétien. Les localités types des zones à *Desatoyense* et à *Macrolobatus* se trouvent dans le Nevada, et celles des zones à *Dilleri* et à *Welleri* en Californie. Les zones à *Amoenum* et à *Crickmayi* sont définies dans le sud-ouest de la Colombie-Britannique. Toutes les autres localités types se situent dans le nord-est de la Colombie-Britannique. Les faunes du Trias supérieur ont une plus vaste répartition que celles du Trias inférieur et moyen. Il est possible de reconnaître presque toutes les zones à partir de différentes faunes présentes dans les parties orientale et occidentale de la Cordillère. Les faunes du Trias supérieur dans le bassin de Sverdrup sont moins diversifiées, mais elles permettent néanmoins de reconnaître certaines zones carniennes et la Zone à *Columbianus*. Les faunes d'ammonoïdés du Norien inférieur et de la partie inférieure du Norien moyen restent inconnues. On peut reconnaître des couches marines du Norien supérieur (Zone à *Cordilleranus*) dans le bassin de Sverdrup à partir d'occurrences de *Monotis*, mais aucun ammonoïdé de cet âge n'est connu.

Les couches limites du Trias-Jurassique, comme celles à la limite du Permien-Trias, sont apparemment concordantes dans le bassin de Sverdrup, dans la partie orientale de la Cordillère, dans le sud-ouest de la Colombie-Britannique et dans les îles de la Reine-Charlotte, sauf aux endroits où les faunes d'ammonoïdés de la Zone à *Cordilleranus* ont une large répartition. Les faunes des deux dernières zones noriennes (*Amoenum* et *Crickmayi*) sont beaucoup plus restreintes. Les faunes plus récentes que celle de la Zone à *Cordilleranus* ne se rencontrent pas dans le bassin de Sverdrup et sont absentes de presque toutes les coupes dans les Rocheuses et les Foothills. Il pourrait y avoir une occurrence d'ammonoïdés de la Zone à *Amoenum* dans les contreforts de la

rivière de la Paix. Les faunes des zones à *Amoenum* et à *Crickmayi* se présentent à plusieurs localités dans les domaines intérieur et insulaire de la Cordillère occidentale. La concordance avec les couches jurassiques est mise en évidence au ruisseau Tyaughton (dans le sud de la Colombie-Britannique) et dans les îles de la Reine-Charlotte.

Les genres d'ammonoïdés suivants ont été relevés dans les zones successives.

Griesbachien inférieur—Zone à Concavum : *Otoceras*. **Zone à Boreale :** *Hypophiceras, Vishnuites, Otoceras.*

Griesbachien supérieur—Zone à Commune : *Tompophiceras, Ophiceras, Discophiceras, Wordieoceras*. **Zone à Strigatus :** *Wordieoceras, Bukkenites* (nouveau).

Dienérien—Zone à Candidus : *Meekophiceras* (nouveau), *Proptychites, Dunedinites, Pleurogyronites* (nouveau), *Ambites, Pleurambites* (nouveau), *Prionolobus*. **Zone à Sverdrupi :** *Xenodiscoides, Koninckites, Vavilovites, Kingites, Heibergites* (nouveau), *Wyomingites, Flemingites, Tellerites, Pseudosageceras.*

Smithien—Zone à Hedenstroemi : *Hedenstroemia*. **Zone à Romunderi :** *Kashmirites, Melagathiceras, Juvenites, Thermalites, Gyronites, Prionolobus, Meekoceras, Euflemingites, Anaxenaspis, Arctoceras, Paranannites, Oxyussuria* (nouveau), *Pseudosageceras*. **Zone à Tardus :** *Kashmirites, Xenoceltites, ?Arctoceras, ?Paranannites, Anasibirites, Prionites, Wasatchites, Anawasatchites, Arctoprionites, Pseudosageceras.*

Spathien—Zone à Pilaticus : *Arctomeekoceras, Neomeekoceras* (nouveau), *Olenikites, Pseudosageceras*. **Zone à Subrobustus :** *Sulioticeras* (nouveau), *Isculitoides, Zenoites, Popovites, Monacanthites, Prosphingites, Cordillerites, Metadagnoceras, Procarnites, Olenikites, Svalbardiceras, Keyserlingites, Leiophyllites.*

Anisien inférieur—Zone à Mulleri : *Groenlandites, Grambergia, Paradanubites, Paracrochordiceras, Caucasites, Gymnites, Stenopopanoceras*. **Zone à Caurus :** *Groenlandites, Pearylandites, Lenotropites, Grambergia, Azarianites, Stenopopanoceras, ?Japonites, Columbisculites* (nouveau), *Discogymnites* (nouveau), *Sturia, Stenophyllites* (nouveau), *Ussurites.*

Anisien moyen—Zone à Hagei : *Alanites, Stenopopanoceras, Intornites, Hollandites, Anagymnotoceras, Gymnites, Buddhaites, Ussurites*. **Zone à Hayesi :** *Amphipopanoceras, Intornites, Czekanowskites, Tetsaoceras* (nouveau), *Arctohungarites, Hollandites, Anagymnotoceras, Nicomedites, Gymnites, Tropigastrites*(?). **Zone à Minor :** *Stenopopanoceras, Amphipopanoceras, Intornites, Hollandites, Anagymnotoceras, Nicomedites, Ptychites, Proarcestes.*

Anisien supérieur—Zone à Deleeni : *Amphipopanoceras, Intornites, Eogymnotoceras, Gymnotoceras, Tropigymnites, Japonites, Anagymnites, Ptychites, Ussurites*. **Zone à Chischa :** *Parapopanoceras, Longobardites, Frechites, Pleurofrechites* (nouveau), *Paranevadites* (nouveau), *Ptychites, Tozerites.*

Ladinien—Zone à Matutinum : *Pleurofrechites* (nouveau), *Ptychites, Longobardites, Eoprotrachyceras*. **Zone à Poseidon:** *Tuchodiceras* (nouveau), *Gymnites, Ptychites, Arctoptychites, Istreites, Eonathorstites* (nouveau), *Indigirites, Proarcestes, Protrachyceras, Metatirolites, Monophyllites*. **Zone à Meginae :** *Nitanoceras, Eosagenites, Indigirites, Thanamites, Indoceltites, Drumoceras, Protrachyceras, Meginoceras, Silenticeras, Lobites*. **Zone à Maclearni :** *Nitanoceras, Hungarites, Nathorstites, Protrachyceras, Liardites, Otoarpadites* (nouveau), *Anolcites, Zestoceras* (nouveau), *Maclearnoceras, Asklepioceras, Lobites, Monophyllites*. **Zone à Sutherlandi :** *Nitanoceras, Nathorstites, Asklepioceras, Zestoceras* (nouveau), *Muensterites, Frankites, Daxatina, Sympolycyclus, Lobites.*

Carnien inférieur—Zone à Desatoyense : *Badiotites, Stolleyites, Silenticeras, ?Protrachyceras, Daxatina, Trachyceras, Clionitites, Coroceras.* **Zone à Obesum :** *Austrotrachyceras, Sirenites.* **Zone à Nanseni :** *Sirenites, Striatosirenites, Clionitites, ?Discophyllites.*

Carnien—Zone à Dilleri : *Parahauerites, Spirogmoceras, Trachystenoceras, Hisnitites* (nouveau), *Trachysagenites, Sympolycyclus, Leconteiceras, Sandlingites, Traskites, ?Shastites, Tropites, Gymnotropites, Pleurotropites* (nouveau), *Discotropites, Indonesites, Paratropites.* **Zone à Welleri :** *Klamathites, Arctosirenites, Trachysagenites, Pamphagosirenites, Tropites, Discotropites, Homerites, Homeroceras* (nouveau), *Margaritropites, Hoplotropites, Jovites, Tardeceras, Bacchites, Projuvavites, Goniojuvavites, Neotenoceras* (nouveau). **Endémique du Carnien supérieur de l'Arctique :** *Orthoceltites, Arctoarpadites* (nouveau), *Yakutosirenites* (nouveau), *Arctotropites* (nouveau). **Endémique du Carnien supérieur de la partie nord du Yukon :** *Epiceratites, Acanthotropites* (nouveau). **Zone à Macrolobatus :** *Anatropites, Euisculites, Styrites, Tropiceltites, Thisbites, Hadrothisbites* (nouveau), *Tropithisbites* (nouveau), *Gonionotites, Griesbachites, Margarijuvavites* (nouveau).

Norien inférieur—Zone à Kerri : *Pinacoceras, Pterosirenites, Clionitites, Tornquistites, Tropiceltites, Discostyrites* (nouveau), *Thisbites, Metathisbites* (nouveau), *Stikinoceras, Gonionotites, Griesbachites, Dimorphites, Guembelites, Discophyllites.* **Zone à Dawsoni :** *Norosirenites* (nouveau), *Wangoceras, Malayites, Dryojuvavites* (nouveau), *Pseudocardioceras, Discomalayites* (nouveau), *Omojuvavites* (nouveau). **Zone à Magnus :** *Oxytibetites* (nouveau), *Dimorphotoceras, Sirenotibetites* (nouveau), *Neotibetites, Prodrepanites* (nouveau), *Acanthinites, Arietoceltites, Indojuvavites, Epijuvavites, Juvavites.*

Norien moyen—Zone à Rutherfordi : *Paragymnites, Metaclionites* (nouveau), *Carinacanthites* (nouveau), *Cyrtopleurites, Drepanites, Acanthodrepanites* (nouveau), *Hauerites, Heraclites, Parisculites* (nouveau), *Didymites.* **Zone à Columbianus :** *Pinacoceras, Sagenites, Pseudosirenites, Alloclionites, Brouwerites, Steinmannites, Eosteinmannites, Himavatites, Mesohimavatites* (nouveau), *Neohimavatites, Ectolcites, Pleurodistichites, Distichites, Leiodistichites* (nouveau), *Eothetidites* (nouveau), *Parathetidites, Pseudothetidites, Helictites, Leislingites, Idaoceras* (nouveau), *Thetidites, Clydonites, Neodidymites* (nouveau), *Episculites, Hypisculites, Parathisbites, Phormedites, Parajuvavites, Halorites, Rhacophyllites.*

Norien supérieur—Zone à Cordilleranus : *Paragymnites, Sagenites, Nassichukites, Paraguembelites, Gnomohalorites, Metasibirites, Lissonites, Ophiorhabdoceras* (nouveau), *Rhabdoceras, Peripleurites, Tragorhacoceras.* **Zone à Amoenum :** *Pinacoceras, Arcestes, Placites, Sagenites, Tozeria, Rhabdoceras, Paracochloceras, Rhacophyllites.* **Zone à Crickmayi :** *Placites, Megaphyllites, Arcestes, Cycloceltites, Rhabdoceras, Vandaites, Choristoceras.*

INTRODUCTION

This report introduces a new biochronology for the Triassic, based on the distribution of ammonoids in Canada. It documents all the ammonoid occurrences on which the biochronology depends. Data are provided on the stratigraphic and geographic distribution of 521 ammonoid species from about 850 localities in Western and Arctic Canada. Interpretation of these data has produced a chronology with 56 divisions for the Triassic (zones, subzones, horizons).

Several previous publications have dealt with the subject. The stratigraphic data available until 1966, mostly from the work of the late F.H. McLearn and the author have been described (Tozer, 1967). The 1967 report remains the basis for the present biochronological scheme, but the present scheme is more refined. Nearly all the zones previously defined have now been subdivided into subzones. The classification of the Upper Norian was revised previously (Tozer, 1979), and in this report some revisions of the Anisian and Ladinian classification are introduced. Sequential data from Canada and the United States were coordinated by Silberling and Tozer (1968). Data from the Middle Triassic faunas dealt with in that paper have been updated by Silberling and Nichols (1982), and Bucher (1988, 1989).

General aspects of biochronology were reviewed at intervals by the writer, resulting in the introduction of some new data (Tozer, 1971, 1974, 1981a, b).

Data from ammonoids provide the principal basis for recognizing the biochronological divisions, but not in isolation. Data from thin-shelled bivalves (*Claraia, Posidonia, Enteropleura, Daonella, Halobia, Eomonotis, Monotis*) also contribute. Some account of the significance of bivalves has been given (Tozer, 1967, 1980c) but much research remains to be done. Conodonts are now known from most of the zones (Beyers and Orchard, 1991; Mosher, 1973; Orchard, 1981, 1983, 1984, 1988, 1991a–c; Orchard and Bucher, 1992; Sweet et al., 1971; Woodsworth and Orchard, 1985). Radiolaria are also proving important (Blome, 1984; Carter, 1990, 1991; Carter et al., 1989; Cordey, 1986, 1990; Cordey et al., 1988, 1991, 1992; Cordey and Read 1992; Pessagno and Blome, 1980).

The historical development of Triassic ammonoid biochronology, both in Canada and elsewhere, is dealt with in Tozer (1984).

In Canada, much of Triassic time is well represented by ammonoid faunas, which range in age from earliest (Griesbachian) to latest Triassic (Late Norian). These faunas not only provide a chronology useful for dating rocks in Canada, but also cast light on general questions of the morphology, classification and stratigraphic range of Triassic ammonoids.

The Lower Triassic record is best displayed in the Queen Elizabeth Islands (Arctic Archipelago). This is the only place where the earliest Triassic (Lower Griesbachian) is represented. Beds of Lower Griesbachian age are separated from the underlying Permian rocks by a break in the record, indicated by the absence of faunas of latest Permian age (Nassichuk et al., 1972). The Middle and Upper Triassic are also represented by faunas in the Arctic Islands.

Particularly good faunas for most of the Lower Triassic, the Middle Triassic and nearly all of the Upper Triassic are found in the Foothills and eastern ranges of the Rocky Mountains, in northeastern British Columbia. Related occurrences are in Alberta and the Yukon. The occurrences in the Arctic Islands, Rocky Mountains and Foothills are in entirely sedimentary sequences that were deposited on the North American craton (Tozer, 1982b). The very latest Triassic (latest Norian) record is sparse, and is preserved with certainty only in western British Columbia, in the collage of autochthonous ("suspect") terranes that make up the western part of the Cordillera (Coney et al., 1980).

Most of the Canadian faunas occur in stratigraphic sections of relatively uniform facies without severe structural complications. This, of course, is the ideal situation for investigating the stratigraphic range of ammonoids, but it is one not commonly found in the Triassic of the classical areas in Europe where many of the ammonoids were first discovered. Investigation of the Canadian faunas revealed that nearly all the ages given for the ammonoids in the classical standard references (Diener, 1915a; Kutassy, 1933; Spath, 1934, 1951) are imprecise or incorrect, in general imputing much longer ranges to genera than can be supported by accurate and reliable stratigraphic data. Data from these old references were incorporated in the volume on Ammonoidea in the "Treatise on Invertebrate Paleontology" [Kummel *in* R.C. Moore (ed.), 1957]. Data derived from the Canadian sequence are thus of much more than local significance, particularly when combined with data from the United States (Silberling and Tozer, 1968; Tozer, 1965c, 1967, 1971). These general aspects of worldwide distribution and correlation of Triassic Ammonoidea will be dealt with in another publication.

SOURCE OF COLLECTIONS AND STRATIGRAPHIC DATA

Most of the collections dealt with in this report were made by the late F.H. McLearn, the writer, and other members of the Geological Survey of Canada. Geologists employed by oil companies and by British Columbia government agencies also contributed material. D. Carlisle and T. Susuki of the University of California kindly donated some of their collections from British Columbia. All the critical sequential relationships recorded here were observed in the field by the writer, but some were originally discovered by others, notably F.H. McLearn, J.A. Jeletzky, B.R. Pelletier, and R. Thorsteinsson. Many significant discoveries were made when N.J. Silberling of the U.S. Geological Survey accompanied the writer to northeastern British Columbia in 1965. More recently, D.W. Gibson, A.F. Embry, D.F. Stott, G.C. Taylor, and H.W. Tipper contributed data and collections. T. Susuki discovered the important occurrence of the Dilleri Zone near Klaskino Inlet, Vancouver Island, when visiting there with the writer in 1970. In the 1970s, important new outcrops of Triassic strata became exposed in the Peace River valley on the shores of Williston Lake. This lake formed behind the W.A.C. Bennett Dam, which was completed near Hudson Hope in 1967. The dam raised the water level by about 200 m. Although the classical localities at Beattie Ledge and Ne-parle-pas Rapids were flooded, excellent new outcrops developed at the newly formed shoreline. The writer and M.J. Orchard studied these exposures between 1980 and 1983. In 1980, we were accompanied by L. Krystyn, and in 1982 we were joined by Krystyn and F. Tatzreiter, both Triassic specialists from Vienna. These experienced collectors also made valuable additions to the material described in this report.

DISTRIBUTION OF TRIASSIC AMMONOIDS IN CANADA

REGIONAL DISTRIBUTION

The marine Triassic rocks of Canada are exposed in the Arctic Islands and Western Canada (Fig. 1). In the Arctic Islands, they occur in the Sverdrup Basin. In Western Canada, exposures are confined to the Cordillera. Marine Triassic rocks also occur in the subsurface of the Interior Platform. The Cordillera comprises five main geological belts: Eastern, Omineca, Intermontane, Coast Plutonic, and Insular. Marine Triassic rocks with ammonoids are known from all these belts.

The Triassic rocks of the Sverdrup Basin, Eastern Cordillera, and probably also the Omineca Belt, are entirely sedimentary. These Triassic sediments were deposited on the North American Craton and are essentially autochthonous. The rocks of the Intermontane, Coast Plutonic and Insular belts are both sedimentary and volcanic. Formerly, they were regarded as deposits of the Cordilleran eugeosyncline. Today, in plate tectonic terminology, they are interpreted as having formed on separate terranes that were probably far removed from the North American Craton in Triassic time, but later became welded to North America, probably during the Upper Jurassic. The allochthonous (or suspect) terrane concept for the Triassic of the Cordillera has been developed by Jones et al. (1977), Coney et al. (1980), and the writer (Tozer, 1970, 1982b).

The geology of the Triassic formations is not described in detail, but the salient features within each region and belt are briefly summarized. The lithostratigraphic nomenclature is given in Table 1.

Arctic Islands: Sverdrup Basin

The Triassic rocks of the Sverdrup Basin (Thorsteinsson and Tozer, 1970, p. 575) provide a record of the marine facies from the Lower Griesbachian to the lower Upper Norian. The youngest Triassic rocks are nonmarine.

In the axial part of the basin, the sequence is very thick (about 6000 m) and apparently devoid of unconformities. At the basin margins, the sequence is relatively thin, with overlapping of some formations.

At the margins of the basin, the formations are dominated by sandstone (Bjorne and Schei Point formations). In the axial part, shale and siltstone (Blind Fiord and Blaa Mountain formations) predominate. All these formations intertongue with one another. The youngest Triassic rocks (Heiberg Formation) are more uniformly developed throughout the basin.

Reference to the original definitions of the Triassic formations is made in Tozer (1961). In recent years, a vast amount of subsurface data has become available, and this has enabled Embry (1982, 1983a, 1983b, 1984a, 1984b, 1986) to propose an elaborate lithostratigraphic nomenclature. Schei Point and Blaa Mountain formations are groups in Embry's hierarchy, but for present purposes they are treated as formations, in accordance with the geological maps of

Ellesmere and Axel Heiberg islands (Nassichuk and Christie, 1969; Thorsteinsson, 1971 a-c; 1972 a-c; Thorsteinsson and Trettin, 1971, 1972 a-c).

The Bjorne and Blind Fiord formations are essentially contemporary, and of Lower Triassic age. Both are underlain in structural conformity by strata

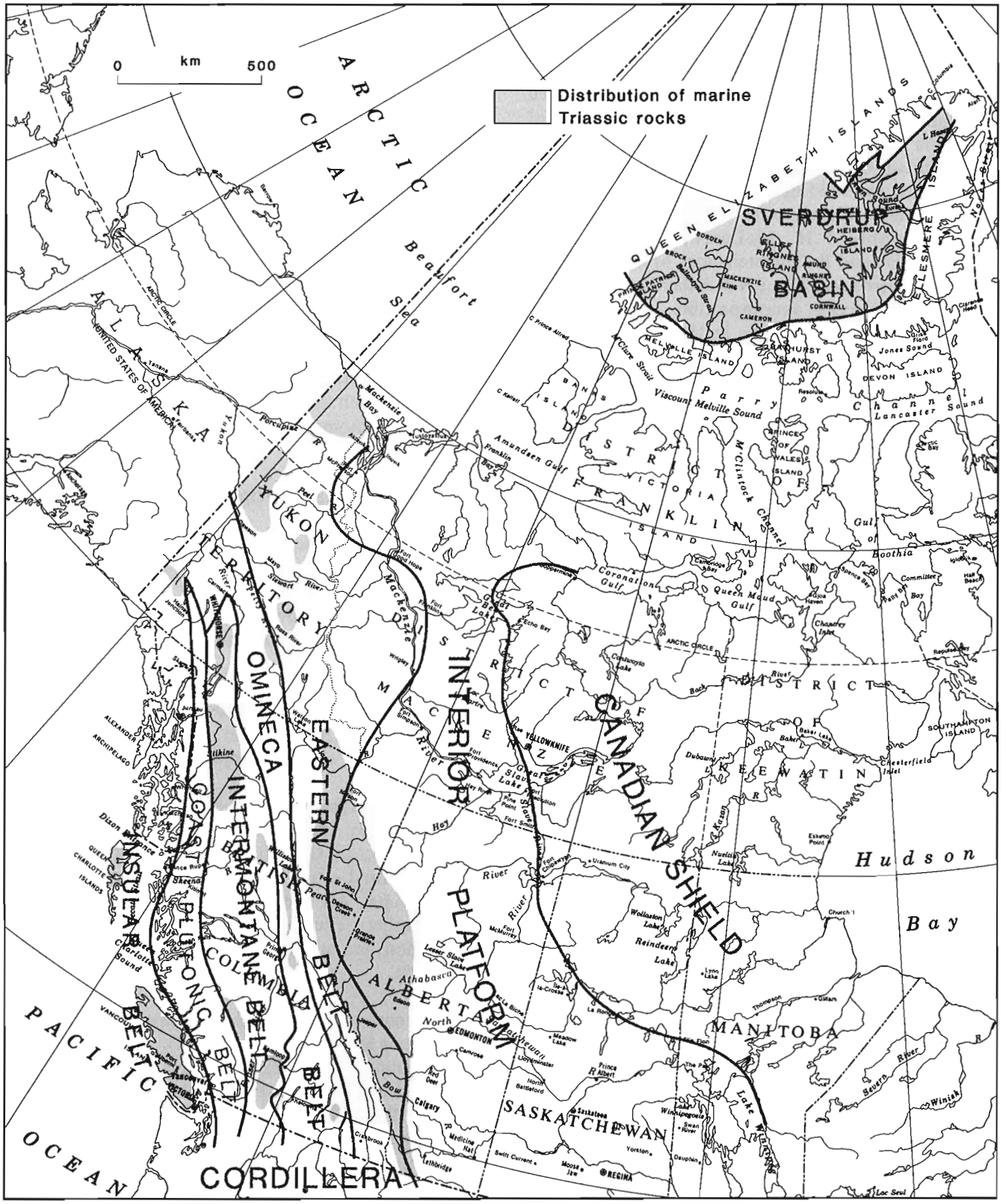


Figure 1. *Distribution of marine Triassic rocks, Western Canada.*

of late, but not latest, Permian age (Thorsteinsson, 1974, p. 73; Tozer, 1961, p. 8; 1967, p. 13). A regional unconformity separates the Permian and Triassic formations. The Bjorne beds, mainly sandstone with some conglomerate, were deposited at the margins of the Sverdrup Basin. They have yielded a few Griesbachian and Smithian ammonoids. The Blind Fiord rocks, composed of siltstone, shale, and sandstone contain the complete sequence of Lower Triassic zones. The basal beds of the Blind Fiord Formation are mainly shale, and this shale unit, which carries *Otoceras,* can also be recognized at the base of the Bjorne Formation (Roy, 1972; Thorsteinsson, pers. comm.; Embry, 1986).

Embry (1986) recently divided the Blind Fiord Formation into three members (Confederation Point, Smith Creek, Svartfjeld), with type sections near Smith Creek, Ellesmere Island. Each member is dominantly shale in the lower part and dominantly siltstone in the upper part. The shale of the lowest member (Confederation Point) is a very distinct unit, but the lithological differences higher in the sequence are subtle and less readily recognized. In the vicinity of Griesbach Creek, Axel Heiberg Island, the writer distinguished four units: 1) a basal grey shale (Concavum and Boreale zones); 2) a green siltstone (Commune and Strigatus zones); 3) a reddish and green sandstone (Sverdrupi Zone at the top); and 4) a grey siltstone (Hedenstroemi and Romunderi zones). The Tardus Zone and the Spathian zones are not represented, and are possibly absent.

The boundary between the Blind Fiord and Blaa Mountain formations is sharp and distinct in some places (e.g., Blaa Mountain), but is less so in others (e.g., Svartefjeld Peninsula, Raanes Peninsula) where there are extensive dark shaly beds in the boundary interval. The writer (1965a, p. 3; 1967, p. 21) assigned shaly beds of Spathian age at Spath Creek and Svartevaeg to the Blaa Mountain Formation. However, Embry (1986) placed these beds in the Svartefjeld Member of the Blind Fiord Formation and his procedure is followed here.

The Schei Point Formation overlies the Bjorne on the margins of the Sverdrup Basin. Dominant lithologies are calcareous siltstone, shale, and sandstone, but include some dark noncalcareous shale. Ammonoid faunas of Anisian, Ladinian and Carnian age are known. Informal units based on outcrops were proposed by Tozer (1961, p. 13, 1963c, p. 5). Five divisions, ranked as formations, have been named by Embry (1984b), with type sections in wells. These units are the Murray Harbour, Roche Point, Hoyle Bay, Pat Bay and Barrow. Embry has indicated the equivalence of his divisions with the previously recognized units. As mapped on Ellesmere Island, the top bed of the Schei Point is the *Gryphaea* Bed (Pat Bay Formation). The shale, siltstone, and sandstone unit above the Pat Bay (Barrow Formation) is included within the Heiberg Formation on the geological maps mentioned above.

The Blaa Mountain Formation, composed of shale, siltstone and sandstone, overlies the Blind Fiord Formation within the Sverdrup Basin. At most outcrops, five members have been distinguished (Tozer, 1961, p. 20; 1963c, p. 7). The Lower Shale Member has ammonoid faunas of Lower Anisian, Middle Anisian, Ladinian, and Lower Carnian age. The zonation shows that the upper boundary is diachronous. The Lower Calcareous Member in places includes beds of Ladinian age, but is more commonly entirely Carnian. The Middle Shale, Upper Calcareous and possibly also the Upper Shale Member contain Carnian ammonoids. No faunas younger than Upper Carnian occur in the Blaa Mountain Formation, as interpreted in this report. Middle and Upper Norian beds have been included in the Blaa Mountain Formation of Cornwall and Amund Ringnes Islands by Balkwill (1983, p. 68), but in the writer's interpretation these beds are a shaly facies of the Heiberg Formation.

The Schei Point and Blaa Mountain formations have an intertonguing relationship; the calcareous members of the Blaa Mountain being of Schei Point lithofacies (Tozer, 1961, p. 23; Embry, 1984b, p. 330).

The youngest Triassic rocks of the Sverdrup Basin are in the Heiberg Formation, composed of sandstone, siltstone, and shale. When the Heiberg Formation was first studied by J.G. Souther (*in* Fortier et al., 1963, p. 432), it was divided into two members. This division was generally applicable to the outcrops on Ellesmere and Axel Heiberg islands (Tozer, 1961, p. 25; Thorsteinsson and Tozer, 1970, p. 578). The Lower Member is relatively thin bedded. Marine faunas indicating the Middle Norian Columbianus Zone are known from outcrops of the Lower Member on Ellesmere, Axel Heiberg, and Cornwall islands, and from equivalent strata in the subsurface of Mackenzie King and Melville Islands (Norford et al., 1973, p. 18). The Upper Member is characterized by thick bedded sandstones. Marine fossils are generally absent. Thin coal seams and fossil plants are known. *Monotis ochotica* (Keyserling), indicating the Upper Norian Cordilleranus Zone, occurs in Heiberg outcrops on Cornwall and Brock islands, possibly in the Upper Member of Axel Heiberg Island, and in the subsurface of Amund Ringnes Island (Balkwill, 1983, p. 68). Throughout western Ellesmere Island and eastern Axel Heiberg Island, a thick bedded grey and yellow

sandstone is interpreted as the top stratum of the Heiberg Formation by the writer (Thorsteinsson and Tozer, 1970, p. 574). No marine fossils are known from this bed. Above the sandstone is a relatively thin unit (50–85 m) composed of soft grey sand and hard dusky-red beds of ferruginous sandstone (Tozer, 1963c, p. 16). These beds form a distinctive, readily mapped unit, but because the unit is thin, it has only been separated on the map of the Slidre Fiord area (Thorsteinsson, 1971a), where it is assigned to the Borden Island Formation. Souther (*in* Fortier et al., 1963, section 46) included these beds in the Heiberg Formation. Marine fossils of Pliensbachian age are present (Frebold, 1975, p. 4). The position of these sandstone beds shows that the upper Heiberg Formation beds are older than Pliensbachian, and probably not younger than uppermost Triassic. The Borden Island beds, in the sense of Henao-Londono (1977, p. 977), are much thicker and include upper Heiberg Formation strata as interpreted here. Stuart Smith and Wennerkers (1977, p. 13) state that the Heiberg Formation beds are partly Jurassic, but good evidence has not been provided. Beds with Sinemurian brachiopods on Cornwall Island have been assigned to the Heiberg Formation by Balkwill (1983, p. 18). This unique occurrence is impossible to reconcile with what is known from all other localities, and must be regarded as questionable.

Embry (1982, 1983a, 1983b) has made extensive studies of the Heiberg, both at outcrop and from the subsurface data. In the eastern Sverdrup Basin, the Heiberg is classed as a formation divided into three members (Romulus, Fosheim and Remus), defined in the subsurface of Fosheim Peninsula (Embry, 1983a). In the west it is a group, divided into the Skybattle, Grosvenor Island, Maclean Strait, Lougheed Island and King Christian formations, all defined in a well on Lougheed Island (Embry 1983b, Balkwill et al., 1982, Fig. 7). The Remus Member includes the marine Pliensbachian sandstone beds mentioned above. This accounts for Embry's description of the Heiberg as Upper Triassic and Lower Jurassic (Embry, 1982).

Suneby and Hills (1988) recognize a sequence of four palynological zones (upward AL, LT, AM, MD) in the Heiberg Formation. The lowest (AL) is divided into two subzones (SC, PA). The PA subzone contains *Eomonotis* and ammonoids of the Columbianus Zone. They are Middle Norian, not late Norian as stated by Suneby and Hills (1988, p. 356). The exact relationship between the younger palynological zones and the lower Upper Norian *Monotis* beds of the Heiberg has not yet been determined. Suneby and Hills state that the AM Zone has the final occurrence of distinctively Triassic palynomorphs. A Jurassic age is considered possible for the MD Zone, but is evidently not well established.

Interior Platform

Triassic rocks are extensive in the subsurface of the Interior Platform (Fig. 1), and much is known of the lithostratigraphy from wells drilled for oil and gas (Hunt and Ratcliffe, 1959; Armitage, 1962; Barss et al., 1965). The sequence is divided into the Montney, Doig, Halfway, Charlie Lake and Baldonnel formations (Table 1). Locally some beds assigned to the Pardonet Formation, defined at outcrop, top the sequence. Lithostratigraphic correlations with the surface formations have been made by Gibson (1972, 1975), but little is known of the faunas. The only known ammonoids are from the Doig Formation of the Guardian Well, about 120 km northwest of Grand Prairie, Alberta. They indicate the Lower Anisian Caurus Zone (Tozer, 1967, p. 72).

Eastern Belt of the Cordillera

The Triassic rocks of the Eastern Cordilleran Belt extend for about 2500 km from the Foothills and Rocky Mountains in Alberta and British Columbia, northwest to the Yukon Territory. The eastern limit of this belt is at the margin of the Cordilleran Orogen. The western limit is at the Rocky Mountain and Tintina trenches. The belt is more or less continuous in Alberta and British Columbia, but is discontinuous to the north. In terms of the plate tectonic model for the Canadian Cordillera proposed by Monger et al. (1972), the rocks are within the Rocky Mountain belt, which adjoins and is essentially autochthonous with respect to the North American Craton. These rocks may also be described as forming part of the Cordilleran miogeocline. All the rocks are sedimentary and marine. In British Columbia, they attain a maximum thickness of about 1500 m. The lithofacies, in decreasing volumetric importance, are siltstone, shale, sandstone, limestone, and anhydrite.

In northeastern British Columbia, these Triassic rocks provide sequential data for the Anisian, Ladinian, Carnian, and most of the Norian zones. Griesbachian bivalves, and Dienerian, Smithian and Spathian ammonoids are also known. At several levels, the Lower Triassic occurrences confirm the zonal divisions defined by the Arctic Islands sequence.

Between Alberta and Pine Pass in British Columbia, the sequence can be divided into lithostratigraphic units that have fairly clearly defined boundaries (Table 1). The nomenclature is that of Gibson (1968a, 1968b, 1969, 1971a, 1972, 1974, 1975). Overlying the Paleozoic, the Sulphur Mountain Formation is divided into four members: Phroso Siltstone, Vega Siltstone, Whistler and Llama. Previously, these had been known

as the Shaly Siltstone, Blocky Brown Siltstone, Black Shale, and Silty Dolomite members (Manko, 1960). The Phroso contains Griesbachian *Claraia* but has not yielded determinable ammonoids. Dienerian and Smithian ammonoids occur in the Vega; Anisian in the Whistler; and Anisian and Ladinian in the Llama. Above the Llama is the Whitehorse Formation, divided into the Starlight Evaporite, Brewster Limestone, and Winnifred members. No ammonoids are known from the Whitehorse.

The nomenclature for the Triassic formations in northeastern British Columbia north of Pine Pass is essentially that of Gibson (1971a), Taylor and Stott (1973) and Thompson (1989). Here, unlike the country south of Pine Pass, much of the sequence does not form lithostratigraphic units with distinct boundaries, and efforts to classify these rocks have led to a number of different schemes. Early schemes, which differ in some details from that of Gibson, are given in McLearn and Kindle (1950), Colquhoun (1962), Pelletier (1964) and Tozer (1967).

In ascending order above the Permian rocks, the Grayling, Toad, Liard, Ludington, Baldonnel, Pardonet and Bocock formations are recognized by Gibson (Table 1). An equivalent in the evaporitic facies of the Ludington is the Charlie Lake Formation. These formations consist mainly of siltstone, fine grained quartzose sandstone, limestone, dolomitic limestone, and some evaporitic rocks. Detailed lithological descriptions are provided by Gibson (1971a, 1972, 1975). Volcanogenic rocks, so abundant in the western belts of the Cordillera, are wholly absent. The Grayling, Toad, and Pardonet formations are mostly thin bedded, fine grained, clastic and calcareous rocks that form recessive topographic features. Coarser grained sediments, which in thick beds form cliffs and ledges, occur in the Liard and Ludington formations. Carbonate rocks characterize the Baldonnel and Bocock formations and also occur in the Ludington and Pardonet formations. Evaporitic rocks characterize the Charlie Lake Formation. Study of directional current features and the distribution of facies belts indicates that the principal direction of sedimentary transport was toward the west and southwest (Pelletier, 1965). Gibson (1971a, p. 28) believes that some beds in the upper part of the succession were derived from the northwest. Exposures of the Charlie Lake evaporitic rocks are well developed only in the eastern Foothills, as at Mount Wooliever. To the west, for example at Mount Ludington and Mount Laurier, they are replaced by the Ludington Formation. The Baldonnel carbonates are more extensive, being recognizable as far to the northwest as Mount McLearn. In the westernmost Foothills, exemplified by the section at Mile Post 428 on the Alaska Highway, the Toad, Liard, Ludington and Baldonnel formations lose their distinct identity and even the Pardonet is barely distinguishable from the underlying beds. In this area the lithostratigraphic units merge, and nearly the whole of the Triassic succession is dark siltstone and some limestone. There are also some synsedimentary conglomeratic beds of uncertain significance (Pelletier, 1961, p. 30; Taylor and Stott, 1973, p. 24).

The Grayling Formation consists of grey shale and sandstone, typically developed in the Liard River valley. Toward the south, the Grayling beds lose their identity. Unquestioned Grayling strata have been identified near Tuchodi Lake, but further south, near Mount Laurier and at Needham Creek, the beds correlative with the Grayling are inseparable from the Toad Formation. The Grayling contains Griesbachian *Claraia* and Dienerian ammonoids.

The Toad Formation consists mainly of dark grey calcareous siltstone and shale. The Toad, as defined by Gibson (1971a) and as mapped by Taylor and Stott (1973), is more comprehensive, regarding the upper boundary, than interpreted previously by the writer (Tozer, 1967). The Toad in this broad sense includes the "Flagstones" and "Dark siltstones" of McLearn and Kindle (1950) and the Mount Wright Formation of Colquhoun (1962). The "Dark siltstones" recognized by McLearn on Peace River, have ammonoids of the Meginae Zone and are thus appreciably older than the similarly designated beds of Mount Stearns (=Mount Wright), which contain ammonoids of the Sutherlandi Zone. The Toad Formation, as used in this report, includes these upper beds. Formerly (Tozer, 1967) they were included in the Liard Formation. Along the Alaska Highway, and Toad and Liard rivers, where the Toad Formation overlies the Grayling, Smithian, Anisian and Ladinian ammonoids, as well as Spathian *Posidonia aranea*, occur in unquestioned Toad strata. To the south, around Mount Laurier and at Needham Creek, the Grayling is not recognizable, and beds of Toad Formation lithology rest directly on the Permian. Here the Toad contains Dienerian in addition to Smithian, Spathian, Anisian and Ladinian ammonoids. The youngest ammonoids are of the Sutherlandi Zone.

The Liard Formation consists of relatively resistant sandstone and siltstone beds overlying the more recessive Toad Formation. As interpreted by Gibson (1971a), and Taylor and Stott (1973), the Liard includes fewer beds than formerly (e.g., *in* Tozer, 1967). In this restricted sense, the Liard contains ammonoids of Ladinian and Lower Carnian age.

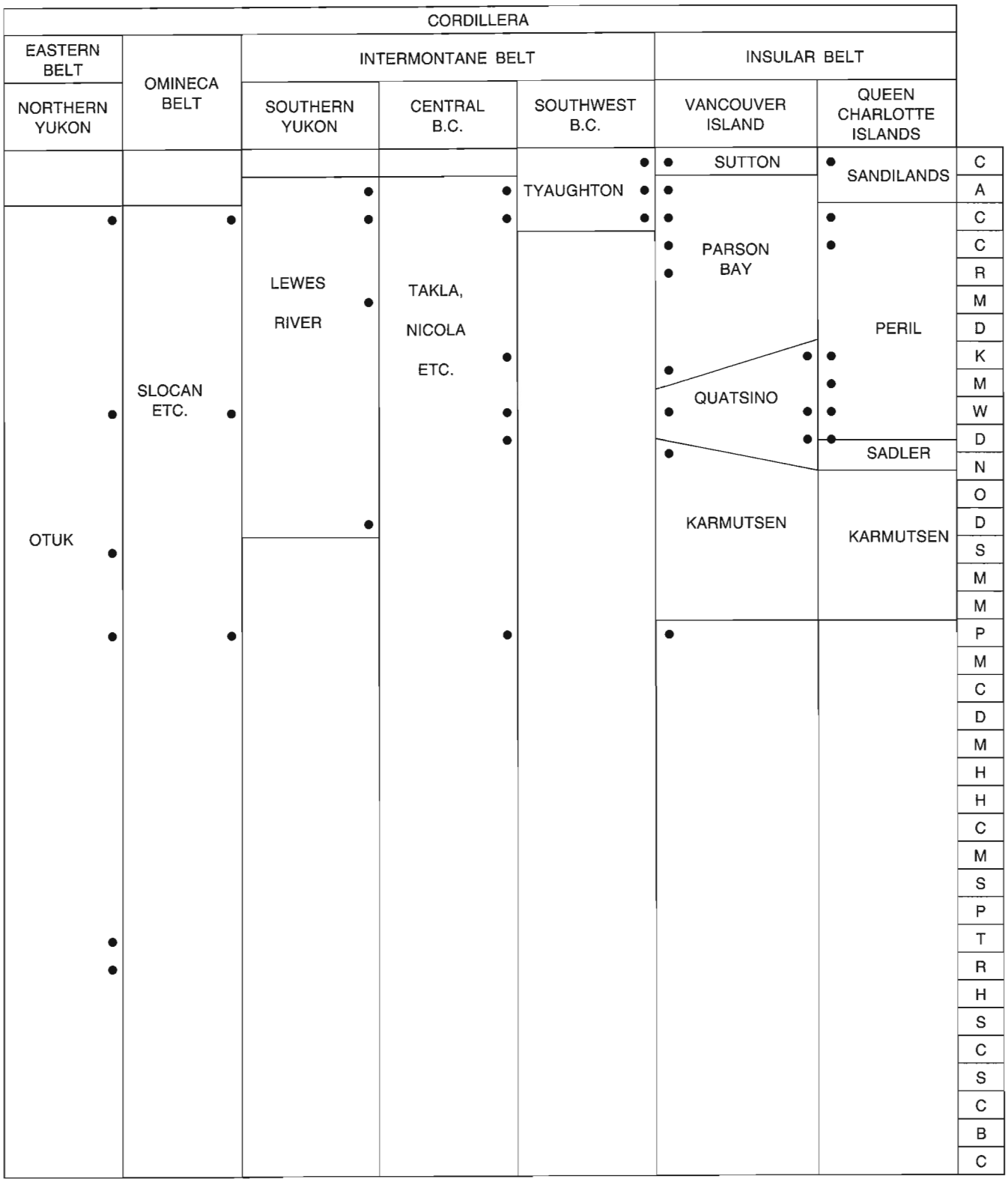
The Ludington Formation is composed of siltstone, sandstone, and limestone, characteristically light grey

TABLE 1

Correlation of principal Triassic formations

SERIES	STAGE	SUBSTAGE	ZONE	ARCTIC ISLANDS: SVERDRUP BASIN MARGIN	ARCTIC ISLANDS: SVERDRUP BASIN	INTERIOR PLATFORM	CORDILLERA: EASTERN BELT: ROCKY MOUNTAINS AND FOOTHILLS: SOUTH	CORDILLERA: EASTERN BELT: ROCKY MOUNTAINS AND FOOTHILLS: NORTH (WEST)	CORDILLERA: EASTERN BELT: ROCKY MOUNTAINS AND FOOTHILLS: NORTH (EAST)	
UPPER TRIASSIC	NORIAN	U	Crickmayi	HEIBERG	HEIBERG			BOCOCK		C
			Amoenum					●		A
			Cordilleranus		●			●	●	C
		M	Columbianus		●			●	●	C
			Rutherfordi					●	●	R
		L	Magnus					● PARDONET	● PARDONET	M
			Dawsoni			PARDONET		●	●	D
			Kerri					●	●	K
	CARNIAN	U	Macrolobatus	SCHEI POINT	BLAA MOUNTAIN	BALDONNEL		●	● BALDONNEL	M
			Welleri	●	●		WHITEHORSE	●	●	W
			Dilleri			CHARLIE LAKE		●	CHARLIE LAKE	D
		L	Nanseni	●	●			● LUDINGTON		N
			Obesum					●	●	O
			Desatoyense						● LIARD	D
MIDDLE TRIASSIC	LADINIAN		Sutherlandi	●		HALFWAY		●	●	S
			Maclearni						●	M
			Meginae		●				●	M
			Poseidon	●	●	DOIG	LLAMA		●	P
			Matutinum							M
	ANISIAN	U	Chischa	●					●	C
			Deleeni						●	D
		M	Minor						●	M
			Hayesi						●	H
			Hagei		●		WHISTLER	TOAD	●	H
		L	Caurus	●	●	●			●	C
			Mulleri						●	M
LOWER TRIASSIC	SPATHIAN		Subrobustus	BJORNE	●	MONTNEY	SULPHUR MOUNTAIN		TOAD	S
			Pilaticus		●				●	P
	SMITHIAN		Tardus		●			●	●	T
			Romunderi		●		VEGA		●	R
			Hedenstroemi	●	●					H
	DIENERIAN		Sverdrupi		●				●	S
			Candidus		●			●	●	C
	GRIES-BACHIAN	U	Strigatus		●	BLIND FIORD				S
			Commune		●		PHROSO	GRAYLING ●		C
		L	Boreale	●	●					B
			Concavum		●					C

TABLE 1 (cont'd)



● occurrence of diagnostic macrofaunas

in colour. Spectacular banks composed of bivalve and other shells occur within the Ludington near Mount Laurier (Gibson, 1975; Gibson and Hedinger, 1989). Around Mount McLearn, Ludington beds have Carnian faunas (Obesum, Nanseni, Dilleri zones). To the west, at Mile Post 428 on the Alaska Highway, the beds mapped as Ludington by Taylor and Stott (1973) are of a darker colour and much like the underlying Toad and overlying Pardonet. At this locality, the Ludington beds have an Upper Carnian (Welleri Zone) fauna. Near Mount Laurier, Ludington beds have Upper Carnian faunas (Welleri and Macrolobatus zones). At Pardonet Hill, they have a Welleri Zone fauna.

The Charlie Lake Formation, composed of evaporitic facies, has provided no ammonoids.

The Baldonnel carbonates are generally devoid of ammonoids, although brachiopods and benthonic bivalves are locally abundant. Beds now assigned to the Baldonnel are the source of the "*Lima*" *poyana* fauna (McLearn and Kindle, 1950, p. 35). Around Mount McLearn, the Baldonnel beds contain Upper Carnian ammonoids (Welleri Zone).

The strata now included in the Charlie Lake and Ludington formations constitute the greater part of the "Grey beds" of earlier reports (McLearn and Kindle, 1950, p. 46; Pelletier, 1964, p. 7; Tozer, 1967, p. 7).

The Pardonet Formation overlies the Baldonnel in most sections, and consists mainly of bituminous limestone and calcareous siltstone. Coquinoid rock composed of *Halobia* and *Monotis* shells is a substantial component. Four members, for which informal names are suggested, can be recognized. Lowest are the *Halobia* beds, mostly dark grey bituminous limestone, that weather a lighter grey. Next is a distinctive member of grey, brown-weathering siltstone with numerous layers of coquina composed of shells of *Eomonotis pinensis* Westermann (=*Monotis alaskana* of McLearn, e.g., 1960a, p. 15). This member is followed by the *Monotis* beds, lithologically much like the underlying strata, but with *Monotis subcircularis* Gabb and *M. ochotica* (Keyserling) in place of *Eomonotis pinensis*. The highest member, named the *Rhacophyllites* beds (Tozer, 1982a, p. 387), consists of dark grey calcareous siltstone with beds of phosphatic nodules. This member occurs only along the Peace River, at the site of Ne-parle-pas Rapids (McLearn, 1960a, p. 6). In the Peace River Foothills, the thickness of complete Pardonet sections ranges from about 100 m in the east to at least 200 m farther west. At the northernmost occurrences, Mount Prudence and at Mile Post 428 on the Alaska Highway, beds assigned to the Pardonet contain ammonoids of the Upper Carnian Welleri Zone. At Pardonet Hill and Mount McLearn, the basal beds, representing the *Halobia* Member, are uppermost Carnian (Macrolobatus Zone). At Brown Hill, the basal beds are Lower Norian (Kerri Zone). The higher beds of the *Halobia* Member contain faunas of the Dawsoni, Magnus, and Rutherfordi zones and subzones 1-3 of the Columbianus Zone. The member with *Eomonotis pinensis* represents Columbianus Subzone 4; the *Monotis* beds, the Upper Norian Cordilleranus Zone. Generally, the *Monotis* beds overly the member with *Eomonotis pinensis*, but at Mount Ludington the *E. pinensis* beds are absent and the *Monotis* beds (Cordilleranus Zone) rest directly on Subzone 3 of the Columbianus Zone. The youngest ammonoids in the Pardonet, dated as Amoenum Zone, are in the *Rhacophyllites* beds. Conodonts recently recovered from these beds also indicate the Amoenum Zone (M.J. Orchard, pers. comm., 1991).

No ammonoids are known from the Bocock Limestone, a formation of relatively restricted extent (Gibson, 1971a, p. 23).

North of the boundary between British Columbia and Yukon Territory, there is not much evidence of Triassic rocks beneath the sub-Cretaceous unconformity. However, sufficient remnants occur, for example in the Nahanni area, to show that they were originally extensive and part of the same belt that is well preserved in northeastern British Columbia.

Triassic rocks in northernmost Yukon have been described by Mountjoy (1967) and regarded as the eastern extension of the Shublik Formation, which was defined in northern Alaska. The beds are dated as Triassic from occurrences of *Halobia, Eomonotis* and *Monotis*. No ammonoids are known.

Triassic rocks also occur in central and northern Yukon. Occurrences have been described by Green and Roddick (1961), Tempelman-Kluit (1970, 1979) and Green (1972). Their extent in northern Yukon has been mapped by Norris (1984). These rocks include dark shale and limestone and are probably the southeastern extension of the Triassic part of the Otuk Formation of northern Alaska (Mull et al., 1982). Ammonoids and bivalves of Smithian, Ladinian, Carnian and Norian age are known, but except for some faunas of Upper Carnian age from the Mount Westman area, described below, the faunas have not been extensively studied.

Omineca Belt of the Cordillera

Discontinuous occurrences of Triassic rocks are present in the Omineca Belt, in areas of structural complexity. Relationships with older and younger formations are

generally not known. Occurrences extend from Finlayson Lake area (105 G) in south central Yukon Territory, through the McDame (104 P), Fort Fraser (93 K), Prince George (93 G) and Lardeau (82 K) areas in British Columbia (Cairnes, 1934, p. 30; Armstrong, 1949, p. 58; Tipper, 1961; Gabrielse, 1963, p. 13; Tempelman-Kluit, 1979). The Triassic rocks of the eastern part of the McConnell Creek area (94 D) (Monger 1977) are probably also of this belt.

Ammonoids are rare and poorly preserved. *Projuvavites* sp. indicating an Upper Carnian (Welleri Zone) age, occurs in the Slocan Group of the Lardeau area. Upper Carnian, and possibly also Lower Norian, ammonoids are known from the McConnell Creek area (Monger, 1977, p. 33–37). *Monotis,* indicating an Upper Norian age, occurs at some of the other localities.

Intermontane Belt of the Cordillera

The Triassic rocks of the Intermontane Belt are very different from those of the Eastern Belt. The main difference is that volcanic rocks and thick limestones, unrepresented in the eastern sequences, are abundant and widely distributed. These differences are interpreted as indicating that the rocks are allochthonous with respect to the North American craton. They show many signs of having been deposited in relatively warm water at a lower latitude than contemporary rocks in the Eastern Cordillera (Tozer, 1970, p. 635; 1982b). It seems that these rocks experienced post-Triassic movement in both latitude and longitude with respect to the North American Craton.

The only known ammonoid faunas from the Intermontane Belt are Upper Triassic. However, discoveries of conodonts and radiolarians show that rocks of Lower, Middle, and Upper Triassic age are present in several formations of the Intermontane Belt, particularly in the Cache Creek and Bridge River ophiolitic complexes (Beyers and Orchard, 1991; Cordey, 1986, 1990; Cordey et al., 1988; Cordey, Greig and Orchard, 1992; Cordey and Read, 1992; Orchard, 1981, 1984). There are also some occurrences of Ladinian *Daonella* in the Intermontane Belt (Tozer, 1967, p. 83).

Northernmost of the Intermontane Belt occurrences is the Lewes River Group of southern Yukon (Lees, 1934; Bostock and Lees, 1938; Tozer, 1958; Wheeler, 1961). Lewes River rocks are mostly limestone and greywacke. Some of the limestones are reefs with a sponge-coral framework (Reid and Tempelman-Kluit, 1987). In the Laberge area, Tozer (1958) divided the group into seven formations, designated A to G. A is composed of limestone and clastic rocks; B, mainly of clastics; C, of limestone; D, of shale and dark limestone; E, of limestone; F, of interbedded limestone and clastic rocks; G, of limestone. The aggregate thickness is about 2500 m. Formation A has poorly preserved ammonoids, probably of Lower Carnian age. D has ammonoids indicating the Norian Magnus and Cordilleranus zones. E has *Paracochloceras* indicating the Amoenum Zone.

Also in the Intermontane Belt are the Triassic rocks of the Tulsequah (104 K), Telegraph Creek (104 G) and Iskut River areas (104 B) in northern British Columbia (Kerr, 1948; Souther, 1971, 1972; H.W. Tipper, pers. comm.). The King Salmon Formation, comprising mostly clastic rocks, has Upper Carnian (Dilleri Zone) ammonoids. Unnamed sedimentary rocks in the Telegraph Creek area have Upper Carnian (Welleri Zone) and Lower Norian (Kerri Zone) ammonoids. The Upper Norian Cordilleranus Zone is known from occurrences of *Monotis* in clastic rocks, and from *Monotis* with *Gnomohalorites* in the Sinwa Limestone of the Tulsequah area. *Paracochloceras*, indicative of the Amoenum Zone, has recently been found by H.W. Tipper in the eastern part of the Telegraph Creek area.

The Triassic Tyaughton Group is in the southwest part of the Intermontane Belt (Taseko Lakes area, 92 O). This purely sedimentary formation is of particular importance because it shows the sequence of the Upper Norian Cordilleranus, Amoenum and Crickmayi zones (Tozer, 1967, p. 75–79; 1979; Umhoefer and Garver, 1988). It was formerly supposed that the Crickmayi Zone was overlain by lowermost Jurassic strata containing *Psiloceras* (Frebold, 1967, p. 9; Tozer, 1979, p. 128). The identification and age significance of this ammonite has been questioned by Guex (1980, p. 139). The writer now believes that the specimens are Triassic *Rhacophyllites,* not Jurassic *Psiloceras.* Recent work by H.W. Tipper (pers. comm.) has led to new discoveries of Hettangian ammonites in the Tyaughton Creek area, which will probably clarify the nature of the Triassic–Jurassic boundary in this area.

The Takla and Nicola Groups of south-central British Columbia are also in the Intermontane Belt. They are composed mostly of volcanic rocks and some sedimentary rocks (Dawson, 1896; Crickmay, 1930; Rice, 1947; Cockfield, 1948; Duffell and McTaggart, 1952; Schau, 1970; McMillan, 1974; Preto, 1977; Monger, 1977; Travers, 1978). Ammonoids indicating the Carnian Dilleri Zone, and the Norian Kerri and Magnus zones are known. *Monotis* indicative of the Norian Cordilleranus Zone, is also present.

Coast Plutonic Belt of the Cordillera

Poorly preserved ammonoids, probably of Upper Norian age, are known from the Randall Formation of Dunira Island, northwest of Prince Rupert (Woodsworth and Orchard, 1985, p. 1333). This occurrence is on the western side of the Coast Plutonic Belt.

Insular Belt of the Cordillera

Two terranes are generally recognized in the Insular Belt: the Alexander and Wrangellia terranes (Monger and Berg, 1987; Wheeler et al., 1991).

The best known occurrences of Triassic rocks in the Alexander Terrane are in Alaska. References to these occurrences are in Tozer (1982b, p. 1082). Ammonoids of Middle Norian (Columbianus Zone) and Upper Norian (Cordilleranus Zone) age collected by C.R. Dodds in the Tatshenshini area, northernmost British Columbia, are believed to be from the Alexander Terrane.

Wrangellia is named for the Wrangell Mountains in south-central Alaska (Jones et al., 1977). In Canada, the principal Triassic exposures are on Vancouver and adjacent smaller islands, and in the Queen Charlotte Archipelago. The Triassic rocks in the Kluane Lake area, Yukon (Muller, 1967), are also believed to be part of Wrangellia.

The Triassic record for Wrangellia extends from the Ladinian to uppermost Norian. Ammonoids are known only from the Upper Triassic.

On Vancouver Island, the Ladinian is represented by *Daonella* beds in the "sediment-sill unit" that lies between the Upper Paleozoic rocks of the Sicker Group and the overlying Karmutsen volcanic rocks; the latter attaining a thickness of about 6500 m (Carlisle, 1972b; Carlisle and Susuki, 1974, p. 268; Muller et al., 1974, p. 9). Middle Triassic strata with *Daonella* are also known in the Kluane Lake area, southwest Yukon (Muller, 1967, p. 52). On both Vancouver Island and the Queen Charlotte Islands, the Karmutsen is followed by a entirely sedimentary sequence representing most or all of the Upper Carnian and Norian.

On Vancouver Island, Upper Carnian (Dilleri Zone) ammonoids are known from limestone lenses in the upper part of the Karmutsen (Givens and Susuki, 1964; Surdam, 1968, Muller et al., 1974, p. 12). The Dilleri Zone is also in the Quatsino Limestone that overlies the Karmutsen (Muller et al., 1974, p. 15, Carlisle and Susuki, 1974, p. 278). The Welleri Zone is well represented in collections made by J.A. Jeletzky from Ououkinsh Inlet, Malksope Inlet, and Union Island, from strata assigned to the Quatsino.

The strata above the Quatsino Limestone include a variety of sedimentary rocks, both clastic and carbonate (Gunning, 1932; Jeletzky, 1950, 1954, 1970, 1976; Hoadley, 1953; Surdam et al., 1964; Muller and Carson, 1969; Muller and Rahmani, 1970; Muller et al., 1974; Carlisle 1972b). Jeletzky (1970, 1976) recognized three units, in ascending order the "Thinly bedded member", "Arenaceous member", and the Sutton Limestone. Jeletzky treated these units as parts of the Bonanza Group named by Gunning (1932). Carlisle (1972b) and Muller et al. (1974) adopted a different nomenclature, and assigned the strata above the Quatsino Limestone to the Parson Bay Formation (Bancroft, 1913; Crickmay, 1928). On Vancouver Island, these rocks have yielded ammonoids of the Lower Norian (Kerri Zone), Middle Norian (Rutherfordi Zone, Columbianus Zone), and Upper Norian (Cordilleranus Zone, Amoenum Zone).

There is some disagreement regarding the position of the Quatsino–Parson Bay boundary. Near Klaskino Inlet, on the west coast of the island, Jeletzky (1970, p. 3) and J.E. Muller (*in* Muller et al., 1974, p. 15) included beds with the Welleri Zone in the Quatsino Limestone. Carlisle and Susuki (1974, p. 265) placed the boundary at this locality in a lower position, with the Welleri Zone in the Parson Bay Formation. However, there seems to be general agreement with Jeletzky's conclusion (1976, p. 13) that the Quatsino Limestone at Rupert Inlet, in Quatsino Sound, includes younger beds than are present in the Quatsino Limestone of Klaskino Inlet. This interpretation is based on his discovery of ammonoids and bivalves of the Lower Norian Kerri Zone in the Quatsino Limestone at this locality.

A well documented occurrence of the Dilleri Zone has been provided by Carlisle and Susuki (1965) from the Open Bay Formation of Quadra Island, between Vancouver Island and the mainland (Mathews, 1947).

On southern Vancouver Island, an important occurrence of well preserved ammonoids is at the type locality of the Sutton Limestone at Cowichan Lake (Clapp and Shimer, 1911; Clapp, 1912, Fyles, 1955; Tozer, 1967, p. 79). This ammonoid fauna is now interpreted as very late Norian (Crickmayi Zone) (Tozer, 1979). Unfortunately, the locality is isolated stratigraphically and the position in the sequence is not demonstrable.

The Triassic rocks of the Queen Charlotte Islands are much like those of western Vancouver Island: equivalents of the Karmutsen, Quatsino and Parson Bay formations are easily identified. Sutherland Brown (1968, p. 50) included the Triassic beds above the Karmutsen in the Kunga Formation. Three members (grey limestone, black limestone, and black argillite members) were distinguished. Sutherland Brown collected ammonoids and bivalves from the black limestone member indicating Upper Carnian (Welleri Zone) and Lower Norian ages, overlain by Upper Norian (Cordilleranus Zone) *Monotis* beds at the top. He found Sinemurian ammonites in the black argillite member, but noting that there were unfossiliferous beds above those with *Monotis,* astutely did not suggest that the boundary between the black limestone and black argillite members represented the Triassic-Jurassic boundary (Sutherland Brown, 1968, p. 61). Cameron and Tipper (1985, p. 11) proposed the name Sandilands Formation for the black argillite member with typical exposures on Sandilands Island. The relationship between the typical Sandilands and the *Monotis* beds (top black limestone member) is not exposed on Sandilands Island. Recent work in the Queen Charlotte Islands, briefly reported by Orchard (1988) and Carter et al. (1989) has added appreciably to our knowledge of the lithological and faunal succession. Desrochers and Orchard (1991) have now raised the Kunga to group status, naming the grey limestone the Sadler Limestone and the black limestone the Peril Formation. The Dilleri Zone has been found in the Sadler and in the basal beds of the Peril. The two subzones of the Welleri Zone are in higher beds of the Peril, followed by a fauna with *Margarijuvavites carlottensis* (Whiteaves), dated as uppermost Carnian Macrolobatus Zone. Higher beds of the Peril have bivalves of the Kerri Zone and poorly preserved ammonoids indicating the Columbianus Zone. The top Peril beds are Upper Norian (Cordilleranus Zone), containing *Heterastridium,* flattened ammonoids, and *Monotis.* The most recent discovery, by H.W. Tipper, is of *Choristoceras,* indicating the youngest Triassic Crickmayi Zone. This occurrence is stratigraphically above *Monotis* beds of the Peril, in strata assigned to the Sandilands Formation. Ammonoid faunas of the Amoenum Zone are not known. The nature of the Triassic-Jurassic boundary within the Sandilands Formation is currently being investigated by H.W. Tipper.

FAUNAL FACIES

Most of the Triassic ammonoid faunas known from Canada represent a fairly similar biofacies in which the ammonoids are associated with other fossils indicative of a pelagic habitat. The most commonly associated macrofossils are thin-shelled bivalves *(Claraia, Posidonia, Enteropleura, Daonella, Halobia, Eomonotis, Monotis)* that were evidently pelagic, probably attached to, or entangled with, floating seaweed (Hayami, 1969). Also common is the association of ammonoid faunas with bones or marine reptiles, conodonts, and, in the Queen Charlotte Islands, radiolarians (Blome, 1984; Carter et al., 1989; Carter, 1990). Fossils unquestionably indicative of benthonic habitat are seldom encountered with the ammonoids. There are some exceptions, however. *Nathorstites* is commonly associated with brachiopods and benthonic bivalves, but is not confined to this faunal facies. The more varied faunas of the Ladinian, in which *Nathorstites* also occurs, are those of the pelagic facies: black calcareous siltstone containing *Daonella* and ichthyosaur bones. Upper Norian ammonoids, many of them heteromorphs, are commonly intimately associated with benthonic mollusca, but not invariably. *Rhabdoceras,* for example, occurs in both the pelagic facies (with *Monotis),* as well as in the benthonic assemblages. Indeed, the only occurrences of abundant *Rhabdoceras* in Canada, in the Pardonet Formation, are in the pelagic facies. Localities where *Rhabdoceras* occurs with benthos are numerous, but the number of specimens is small. Probably the favoured habitat of *Rhabdoceras,* as of the other ammonoids, was the pelagic environment.

FAUNAL PROVINCIALISM

Faunal provincialism does not seriously interfere with the application of the same chronostratigraphic scheme to the Triassic rocks of the three regions: Arctic Islands, Eastern Cordillera and Western Cordillera. Differences exist between Boreal and Tethyan ammonoid faunas (Dagys, 1988), but in northeastern British Columbia many occurrences include Tethyan and Boreal taxa in association. These occurrences assist in correlating chronostratigraphic divisions recognized in the Arctic with those in the Tethys.

Ammonoid faunas now at mid-latitude, in the autochthonous occurrences of northeastern British Columbia, show greater taxonomic diversity than contemporary assemblages in the Sverdrup Basin (Arctic Islands). For example, only seven genera are known in the Ladinian of the Arctic Islands, whereas in northeastern British Columbia, beds of the same age have at least 20 genera. The difference probably indicates a gradient related to a difference in the temperature of the Triassic seas. Kummel (1973) reached a similar conclusion from considering the

Lower Triassic faunas. The decrease in diversity toward the north suggests that the seas in the Arctic Islands area were cooler than those of the Eastern Cordillera in the Triassic. Comparable differences between the ammonoid faunas of the Eastern Cordillera and the Arctic Islands occur in the Dienerian, Spathian, Anisian, Carnian and Norian. Despite differences in diversity, most levels contain a few cosmopolitan ammonoids and bivalves that are useful in correlating the rocks of the Arctic Islands with those of the Eastern Cordillera. Examples are the Griesbachian genus *Claraia*; the Dienerian *Proptychites* and *Vavilovites*; the Smithian *Meekoceras, Euflemingites* and Prionitidae; the Spathian *Keyserlingites*; the Anisian *Anagymnotoceras* and *Frechites*; the Ladinian *Indigirites* and *Nathorstites*; the Carnian *Sirenites* and *Jovites*; the Norian *Neohimavatites, Eomonotis*, and *Monotis*.

Except in the Spathian and Anisian, ammonoid faunas of the Eastern Cordillera are not appreciably less diverse than those of the Tethys, which was presumably at a lower, probably equatorial, latitude in the Triassic. Differences exist, however. Some of the red ammonite-bearing Hallstatt limestones characteristic of the Tethys contain suites of ammonoids somewhat different from those in the dark limestones of northeastern British Columbia. But there are enough similarities to permit correlation (Tozer, 1971, p. 996).

The Upper Triassic faunas in the terranes of the Western Cordillera are in some respects unlike those of the Eastern Cordillera and Sverdrup Basin. They include beds with ammonoids, but also have corals and a variety of benthonic molluscs, including megalodont bivalves, which are unknown in the other regions. Clearly, these faunas indicate deposits in waters warmer than those of contemporary deposits now at the same latitude in the Eastern Cordillera (Tozer, 1970, p. 635; 1982b). This is dramatically shown by the presence of Upper Triassic reefs on the Stikinia Terrane of the southern Yukon (Reid and Tempelman-Kluit, 1987). These reefs are now at a latitude of 61 degrees. No comparable rocks occur in the contemporary deposits of the Eastern Cordillera, which are today at a lower latitude and were deposited under bathymetric conditions that would not have precluded reef development. In spite of these differences, at several levels, notably in the Dilleri and Welleri zones of the Carnian and in the Columbianus and Cordilleranus zones of the Norian, identical ammonoid faunas occur in both the Eastern Cordillera and in the terranes of the Western Cordillera. Whatever restrained Triassic corals from reaching the site of the Eastern Cordillera did not constitute a barrier to the pelagic ammonoid faunas. The *Monotis* faunas of the three regions show some provincialism, but have enough in common for correlation (Silberling, 1985; Grant-Mackie and Silberling, 1990).

These differences in benthonic faunas and environments, evident by comparing the Triassic rocks of the Eastern and Western Cordillera, are best explained by relating differences to post-Triassic tectonic events (Tozer, 1970, p. 635; 1971, p. 1006; 1982b). Evidence of extensive right-lateral transcurrent faulting occurs in the Cordillera, both at the boundary between the eastern and western parts, and within the western part. The Tintina Fault, according to Roddick (1964) is one example. Structural interpretations of this nature suggest that the warm water deposits now in the terranes of the Western Cordillera were originally at sites south of the latitude of contemporary rocks deposited on the North American craton and now preserved in the Eastern Cordillera. The present day juxtaposition of such different Triassic rocks at comparable latitudes is best explained as the result of appreciable movement of the western rocks to the north in post-Triassic time. Furthermore, the individual terranes in the Western Cordillera were evidently separated, not only from the North American Plate, but also from one another, probably forming island archipelagos occupying a substantial part of Panthalassa, the ancestral Pacific Ocean (Tozer, 1982b; 1984, p. 4, 5).

STRATIGRAPHIC DISTRIBUTION

The stratigraphic divisions established by the ammonoid sequences found in Canada are shown in Tables 2 to 4. The smallest divisions are referred to as horizons, following Callomon (1984, p. 82), the progressively larger divisions are subzones and zones. The zones are grouped into substages and stages, definitions of which are given in Tozer (1984, p. 144–149). The Lower Triassic stages have their stratotypes in Canada. The Middle and Upper Triassic stages were defined in western Europe. In some cases, application of the Middle and Upper Triassic stage names to the Canadian zonal sequence presents problems. These problems have been discussed on previous occasions (e.g., *in* Tozer, 1981b) and will not be considered further here.

The nature of the zones and smaller divisions has been discussed previously (Tozer, 1967, p. 10; 1971, p. 990–992). Here it is only necessary to emphasize that they are chronostratigraphic divisions with type localities where their identity is beyond dispute. These localities are given in parentheses in Tables 2 to 4. The

larger divisions are interpreted in a hierarchial rather than typological sense (Callomon, 1965; Callomon and Donovan, 1966; Harland, 1970, p. 36). The typological foundation of any hierarchial stratigraphic scheme, like the one proposed here, is based only on the smallest divisions. Larger divisions are interpreted in terms of their smaller components. At the type locality for each division, the base, and only the base, is defined. The top is defined at the base of the succeeding division.

The distinction between a zone, subzone, and horizon is to a degree arbitrary. Faunas from different localities treated as representative of a horizon are so closely similar that they are judged to be as strictly contemporaneous as methods permit. Faunas treated as representative of subzones and zones were probably not so strictly contemporaneous. Generally, subzones and horizons are characterized by species, and zones are characterized by genera or associations of genera.

Some zones, not yet subdivided, are probably amenable to subdivision, as will be mentioned below. Subdivision must be postponed pending the acquisition of more sequential data. At least one zone (Meginae), now divided into three subzones, will probably eventually be divided into four. The exact position of the fauna that suggests a fourth subzone in relation to the three subzones has not yet been determined.

In the account of the zones, etc. that follows, precise localities are given in the appendix.

LOWER TRIASSIC SERIES

GRIESBACHIAN STAGE

(Tozer, 1965b, p. 1; 1967, p. 13; 1984, p. 145)

Type locality. Blind Fiord Formation, Griesbach Creek, Axel Heiberg Island (Tozer, 1967, p. 53).

LOWER GRIESBACHIAN SUBSTAGE

(Tozer, 1967, p. 15)

Concavum Zone (Tozer, 1967, p. 15)

Index species. Otoceras concavum Tozer.

Synonym. Otoceras n. sp. Zone (Tozer, 1965b, p. 4).

Type locality. Blind Fiord Formation, Griesbach Creek, Axel Heiberg Island (GSC locs. 64774-64781) (Tozer, 1967, p. 53).

Occurrence. Arctic Islands - Blind Fiord Formation, Axel Heiberg Island.

At the type locality, the Concavum Zone is the lowest in the Blind Fiord Formation. There, Permian rocks assigned to the Degerbols Formation underly the Blind Fiord Formation (Thorsteinsson, 1974, p. 73; Sec. 58, Fig. 8). No fossils are known from the Degerbols at this locality, but all the evidence indicates that the formation is of Guadalupian age (Nassichuk et al., 1972, p. 655; Thorsteinsson, 1974, p. 72). Between the Degerbols and the lowest occurrence of Triassic fossils there are about 12 m of strata of Blind Fiord lithology, which appear to be unfossiliferous (Tozer, 1967, p. 54).

Ammonoid fauna.
Otoceras gracile n. sp. (Pl. 1, fig. 2)
Otoceras concavum Tozer (Pl. 1, fig. 3)
Otoceras gracile occurs 75 cm below the first appearance of *O. concavum.*

Boreale Zone (Tozer, 1965b, p. 4)

Index species. Otoceras boreale Spath.

Type locality. Blind Fiord Formation, Griesbach Creek, Axel Heiberg Island (GSC locs. 64782, 64783).

TABLE 2

Lower Triassic zones and subzones

SPATHIAN
- *Keyserlingites subrobustus* (Spath Creek)[1]
- *Olenikites pilaticus* (Svartevaeg)

SMITHIAN
- *Anawasatchites tardus* (Toad River)
- *Euflemingites romunderi* (Smith Creek)
- *Hedenstroemia hedenstroemi* (NE Russia)

DIENERIAN
- *Vavilovites sverdrupi* (Lindstroem Creek)
  - 3. *Kingites discoidalis* (Svartevaeg)
  - 2. *Vavilovites obtusus* (Diener Creek)
  - 1. *Koninckites dimidiatus* (Calnan Creek)
- *Proptychites candidus* (Diener Creek)

UPPER GRIESBACHIAN
- *Bukkenites strigatus* (Griesbach Creek)
- *Ophiceras commune* (East Greenland)

LOWER GRIESBACHIAN
- *Otoceras boreale* (Griesbach Creek)
- *Otoceras concavum* (Griesbach Creek)

[1]Type localities are in parentheses

Occurrence. Arctic Islands - Blind Fiord Formation, Ellesmere and Axel Heiberg islands; Bjorne Formation, Ellesmere Island.

At the type locality, the Boreale Zone overlies the Concavum Zone (GSC locs. 64782 and 64783 above GSC loc. 64781). The ammonoid fauna is enhanced by occurrences at Bjarnason Island (GSC loc. 47578) and near Blind Fiord (GSC locs. 47548, 51588).

Ammonoid fauna.
Hypophiceras gracile (Spath) (Pl. 2, figs. 2–7, 10)
Vishnuites kummeli n. sp. (Pl. 1, figs. 5, 6)
Otoceras boreale Spath (Pl. 2, figs. 1, 8)

UPPER GRIESBACHIAN SUBSTAGE

(Tozer, 1967, p. 16)

Commune Zone (Grasmuck and Trümpy, 1969, p. 16; Trümpy, 1969, p. 82)

Index species. Ophiceras commune Spath.

Type locality. Upper *Ophiceras* beds, Wordie Creek Formation, East Greenland (Trümpy, 1961, p. 249). Reference locality for Canada: Blind Fiord Formation, Griesbach Creek, Axel Heiberg Island (GSC locs. 64744–64747, 64750, 64762) (Tozer, 1967, p. 53, 54).

Occurrence. Arctic Islands - Blind Fiord Formation, Ellesmere and Axel Heiberg islands.

At the reference locality it overlies the Boreale Zone (GSC loc. 64744 etc. above GSC loc. 64782) (Tozer, 1967, p. 53). The ammonoid fauna is enhanced by occurrences near Blind Fiord (e.g., GSC loc. 51591).

Ammonoid fauna.
Tompophiceras extremum (Spath) (Pl. 3, figs. 1–6)
Ophiceras greenlandicum Spath (Pl. 4, fig. 3)
Ophiceras commune Spath (Pl. 4, fig. 1)
Ophiceras subsakuntala Spath (Pl. 4, fig. 2)
Discophiceras wordiei (Spath) (Pl. 2, fig. 9)
Wordieoceras wordiei (Spath) (Pl. 5, figs. 1–3; Pl. 6, fig. 3)

At Griesbach Creek the Ophiceratidae appear in the following sequence: *Ophiceras greenlandicum, Ophiceras commune, Ophiceras subsakuntala, Discophiceras wordiei, Wordieoceras wordiei.*

Strigatus Zone (Tozer, 1965b, p. 4; 1967, p. 17)

Index species. Bukkenites strigatus (Tozer).

Type locality. Blind Fiord Formation, Griesbach Creek, Axel Heiberg Island (GSC loc. 64763).

Occurrence. Arctic Islands - Blind Fiord Formation, Ellesmere and Axel Heiberg islands. At the type locality it overlies the Commune Zone (GSC loc. 64763 above GSC loc. 64762).

The ammonoid fauna is augmented from occurrences on Bjarnason Island (GSC locs. 47525, 47610), south of Bunde Fiord (GSC locs. 64765, 64769, 64771) and near Blind Fiord (GSC loc. 51593).

Ammonoid fauna.
Wordieoceras wordiei (Spath) (Pl. 7, figs. 1–4)
Bukkenites incisus n. sp. (Pl. 9, figs. 1, 2)
Bukkenites nitidus n. sp. (Pl. 7, fig. 5; Pl. 8, fig. 4)
Bukkenites strigatus (Tozer) (Pl. 7, fig. 6; Pl. 8, figs. 2, 3)
Bukkenites macilentus n. sp. (Pl. 7, fig. 7)
Bukkenites nanus n. sp. (Pl. 8, fig. 1)

Possibly the different species of *Bukkenites* characterize different levels, but owing to insufficient stratigraphic data this has not been determined.

DIENERIAN STAGE

(Tozer, 1965b, p. 1; 1967, p. 17; 1984, p. 145)

Type locality. Blind Fiord Formation at Diener Creek, Ellesmere Island (Tozer, 1967, p. 51). This division is again ranked as a stage, not a substage (cf. Tozer, 1984, p. 145).

Candidus Zone (Tozer, 1965b, p. 4; 1967, p. 18)

Index species. Proptychites candidus Tozer.

Type locality. Blind Fiord Formation at Diener Creek, Ellesmere Island (GSC locs. 51691, 51692, 51694) (Tozer, 1967, p. 51).

Occurrence. Arctic Islands - Blind Fiord Formation, Ellesmere and Axel Heiberg islands. Eastern Cordillera - Grayling and Toad formations, northeastern British Columbia.

At the type locality, the Candidus Zone overlies the Strigatus Zone (e.g., GSC loc. 51691 above GSC loc. 51689) (Tozer, 1967, p. 51).

Ammonoid fauna.
Meekophiceras columbianum (Tozer) (Pl. 10, fig. 1)

Meekophiceras franklini n. sp. (Pl. 11, figs. 1-3)
Proptychites candidus Tozer (Pl. 11, figs. 4, 5; Pl. 12, figs. 3-5)
Proptychites mulleri Tozer (Pl. 10, fig. 6)
Proptychites kummeli Tozer (Pl. 10, fig. 4)
Proptychites newelli Tozer (Pl. 10, fig. 3)
Dunedinites pinguis Tozer (Pl. 10, fig. 2)
Pleurogyronites kraffti n. sp. (Pl. 10, fig. 5)
Ambites fuliginatus n.sp (Pl. 13, figs. 4, 5, 7; Pl. 14, fig. 8)
Ambites ferruginus n. sp. (Pl. 14, figs. 1-7)
Ambites wissneri n. sp. (Pl. 13, fig. 8)
Pleurambites frechi n. sp. (Pl. 13, figs. 1-3, 6)
Prionolobus welteri n.sp. (Pl. 12, figs. 1, 2)

Nowhere do the 13 species listed above occur in the same bed. The fauna listed includes that of the Blind Fiord Formation from south of Bunde Fiord (GSC loc. 64729), the Grayling Formation of Dunedin River (GSC loc. 42372), and near Tuchodi Lake (GSC locs. 68273-68275 etc.) and the Toad Formation south of Mount Laurier (GSC locs. 56180-56183) and north of Mount Laurier (GSC locs. 56202-56204, 56218). The species of *Meekophiceras* and *Ambites* are mutually exclusive, introducing the probability that two subzones might be distinguished, but the relative position of these ammonoids is unknown. *Meekophiceras franklini* is in a bed south of Bunde Fiord (GSC locs. 64729, 64730) that closely follows the Strigatus Zone; *Ambites ferruginus* is in a comparable position at Diener Creek (GSC loc. 51694). The difference in age is probably small.

Sverdrupi Zone (Tozer, 1965b, p. 5; 1967, p. 18)

Index species. Vavilovites sverdrupi (Tozer).

Type locality. Blind Fiord Formation, Lindstroem Creek, Ellesmere Island (GSC loc. 47543) (Tozer, 1963, p. 14; 1967, p. 50). Three subzones are now recognized. The typical fauna is in Subzone 2. Definition of the base of the zone is revised whereby the lowest subzone (1), known only from the Eastern Cordillera, is included within the Sverdrupi Zone.

Occurrence. Arctic Islands - Blind Fiord Formation, Ellesmere and Axel Heiberg islands. Eastern Cordillera - Toad Formation, northeastern British Columbia; Sulphur Mountain Formation, Vega Member, Alberta.

Subzone 1

Index species. Koninckites dimidiatus n. sp.

Type locality. Toad Formation (GSC loc. 56225), northeastern British Columbia.

Occurrences. Eastern Cordillera - Toad Formation, northeastern British Columbia; Sulphur Mountain Formation, Vega Member, Alberta.

At the type locality, Subzone 1 overlies the Candidus Zone (GSC loc. 56225 above GSC loc. 56220, etc.).

Ammonoid fauna.
Koninckites dimidiatus n. sp. (Pl. 20, figs. 3, 4)

Subzone 2

Index species. Vavilovites obtusus n. sp.

Type locality. Blind Fiord Formation, Diener Creek, Ellesmere Island (GSC locs. 51695, 51666) (Tozer, 1967, p. 51).

Occurrence. Arctic Islands - Blind Fiord Formation, Ellesmere and Axel Heiberg islands. Eastern Cordillera - Toad Formation, northeastern British Columbia; Sulphur Mountain Formation, Vega Member, Alberta.

In the Arctic Islands, Subzone 2 overlies the Candidus Zone (GSC locs. 51695 and 51666 above GSC loc. 51694). Subzone 2 overlies Subzone 1 in the Toad Formation north of Mount Laurier (GSC loc. 56222 above GSC loc. 56225).

Ammonoid fauna.
Vavilovites sverdrupi (Tozer) (Pl. 15, figs. 1-3; Pl. 20, fig. 2)
Vavilovites obtusus n. sp. (Pl. 16, figs. 1-5)
Wyomingites scapulatus n. sp. (Pl. 20, figs. 8, 9)

Subzone 3

Index species. Kingites discoidalis n. sp.

Type locality. Blind Fiord Formation, northern Axel Heiberg Island (GSC loc. 64716).

Occurrence. Arctic Islands - Blind Fiord Formation, Axel Heiberg Island. At the type locality, Subzone 3 overlies Subzone 2 (GSC loc. 64716 above GSC loc. 64715) (Tozer, 1967, p. 51).

Ammonoid fauna.
Kingites discoidalis n. sp. (Pl. 19, figs. 1-3)
Heibergites heibergensis (Tozer) (Pl. 17, fig. 1)

Occurrences of *Pseudosageceras multilobatum* Noetling (Pl. 18, fig. 1) associated with *Heibergites heibergensis* (Pl. 18, fig. 2) (GSC loc. 64731 etc.) are provisionally correlated with Subzone 3.

Kingites thulensis n. sp. (Pl. 17, fig. 2) is from a bed (GSC loc. 64717) between subzones 2 and 3.

The exact age of *Xenodiscoides calnani* n. sp. (Pl. 20, fig. 1), *Prionolobus konincki* n. sp. (Pl. 20, figs. 12, 13), *Flemingites reticulatus* n. sp. (Pl. 20, figs. 5–7) and *Tellerites* sp. indet. (Pl. 20, fig. 10) is unknown. They are from beds in the Toad Formation that closely follow Subzone 2.

SMITHIAN STAGE

(Tozer, 1965b, p. 1, 1967, p. 19; 1984, p. 148)

Type locality. Blind Fiord Formation at Smith Creek, Ellesmere Island (Tozer, 1967, p. 48). As interpreted in 1967 (Tozer, 1967, p. 19), the Smithian comprised only two zones (Romunderi and Tardus), with the Romunderi Zone placed immediately above the Sverdrupi Zone (Dienerian). There is now evidence that a correlative of the Hedenstroemi Zone, defined in Siberia, lies between the Sverdrupi and Romunderi zones. The scope of the Smithian is now enlarged to include the Hedenstroemi Zone.

Hedenstroemi Zone (Dagys et al., 1979, p. 127; Rostovstev and Zhamoida, 1984, p. 28; Dagys and Tozer, 1989)

Index species. Hedenstromia hedenstroemi (Keyserling).

Synonyms. Paranorites Zone, in part, (Popov, 1961a, p. 6); *Meekoceras gracilitatis* Zone (Archipov, 1974, p. 29; Dagys et al., 1974, p. 9); *Hedenstroemia mojsisovicsi* Zone (Bychkov et al., 1976, p. 12).

Type locality. Northeast Russia. Reference locality for Canada: Blind Fiord Formation, Griesbach Creek, Axel Heiberg Island (GSC loc. 89675).

Occurrence. Arctic Islands – Blind Fiord Formation, Axel Heiberg Island; Bjorne Formation, Ellesmere Island. At Griesbach Creek the Hedenstroemi Zone (GSC loc. 89675) overlies Sverdrupi Subzone 2 (GSC loc. 64723), probably also Subzone 3 (GSC loc. 47584).

Ammonoid fauna.

Hedenstroemia hedenstroemi (Keyserling) (Pl. 25, fig. 3; Pl. 27, fig. 2)

Romunderi Zone (Tozer, 1967, p. 19)

Index species. Euflemingites romunderi Tozer.

Synonym. Meekoceras gracilitatis Subzone of *Arctoceras blomstrandi* Zone (Tozer, 1965b, p. 5).

Type locality. Blind Fiord Formation, Smith Creek (GSC loc. 28680), Ellesmere Island (Tozer, 1967, p. 48).

Occurrence. Arctic Islands – Blind Fiord Formation, Ellesmere and Axel Heiberg islands. Eastern Cordillera – Toad Formation, northeastern British Columbia; Sulphur Mountain Formation, Vega Member, northeastern British Columbia and Alberta.

At the type locality, no well preserved ammonoids are known from the underlying beds. At Griesbach Creek, *Euflemingites cirratus* (White) indicating the Romunderi Zone, evidently occurs above the Hedenstroemi Zone (GSC loc. 64792 above GSC loc. 89675). At Lindstroem Creek, Ellesmere Island, and at Needham Creek, British Columbia, the Romunderi Zone follows Sverdrupi Subzone 2 (GSC loc. 47801 above GSC loc. 47621; GSC locs. 46471, 56166 etc. above GSC loc. 46470).

Ammonoid fauna.

Kashmirites borealis (Tozer) (Pl. 21, fig. 3)*
Kashmirites columbianus n. sp. (Pl. 22, figs. 1, 2)
Melagathiceras depressum (Smith) (Pl. 22, fig. 11)
Melagathiceras crassum (Tozer) (Pl. 23, fig. 1)*
Juvenites laevis n. sp. (Pl. 22, figs. 9, 10)
Thermalites canadensis (Tozer) (Pl. 21, fig. 1)*
Thermalites needhami (Tozer) (Pl. 22, figs. 5, 6)
Gyronites recentis n. sp. (Pl. 22, fig. 3)
Prionolobus lucinus n. sp. (Pl. 22, fig. 4)
Meekoceras gracilitatis White (Pl. 21, fig. 2)*
Meekoceras haydeni (Smith) (Pl. 22, fig. 12; Pl. 25, fig. 1)
Euflemingites cirratus (White) (Pl. 22, fig. 13; Pl. 23, figs. 4, 5)
Euflemingites romunderi Tozer (Pl. 21, fig. 4; Pl. 25, figs. 4, 5)*
Anaxenaspis dieneri n. sp. (Pl. 24, figs. 2, 3)
Anaxenaspis welteri n. sp. (Pl. 24, fig. 1)
Anaxenaspis kraffti n. sp. (Pl. 23, figs. 2, 3)*
Anaxenaspis sp. indet. (Pl. 22, fig. 14)
Arctoceras blomstrandi (Lindstroem) (Pl. 26, figs. 1–3)*
Paranannites aspenensis Hyatt and Smith (Pl. 22, figs. 7, 8)
Paranannites spathi (Frebold) (Pl. 36, figs. 1, 2)*
Oxyussuria canadensis n. sp. (Pl. 22, figs. 15, 16)

Pseudosageceras longilobatum Kiparisova (Pl. 21, fig. 5)*

Species marked with an asterisk (*) occur at the type locality. Most of the others are from beds with genera, but not species, in common with the fauna at the type locality. Localities in the Arctic Islands that contribute to the fauna are Bjarnason Island (GSC loc. 47526), Griesbach Creek (GSC locs. 47558, 64792), and Lindstroem Creek (GSC locs. 47801, 47623). In the Eastern Cordillera, the principal locality is at Needham Creek (GSC locs. 56166, 56169 etc.). *Euflemingites romunderi* and *E. cirratus* are mutually exclusive, probably indicating a slight difference in age.

Tardus Zone (Tozer, 1967, p. 20)

Index species. Anawasatchites tardus McLearn.

Synonym. Wasatchites tardus Subzone of *Arctoceras blomstrandi* Zone (Tozer, 1965b, p. 5).

Type locality. Toad Formation, Toad River, northeastern British Columbia (GSC locs. 42363, 42364) (McLearn and Kindle, 1950, p. 40; Tozer, 1967, p. 74).

Occurrence. Arctic Islands - Blind Fiord Formation, Ellesmere and Axel Heiberg islands. Eastern Cordillera - Toad Formation, northeastern British Columbia.

At the type locality, well preserved ammonoids are not known from the underlying beds. The Tardus Zone overlies the Romunderi Zone at Smith Creek, Ellesmere Island (GSC loc. 47547 above GSC loc. 28680), and on Liard River, British Columbia (GSC loc. 68184 above GSC loc. 68183) (Tozer, 1967, p. 49, 74).

Ammonoid fauna.

Kashmirites warreni (McLearn) (Pl. 36, figs. 10–14)
Xenoceltites subevolutus Spath (Pl. 36, figs. 3–8)
(?)*Arctoceras blomstrandi* (Lindstroem) (Pl. 27, fig. 1)
(?)*Arctoceras gigas* n. sp. (Pl. 26, figs. 4–6)
(?)*Paranannites spathi* (Frebold) (Pl. 36, figs. 1, 2)
Anasibirites crickmayi Mathews (Pl. 28, fig. 1)
Anasibirites robustus Welter (Pl. 28, fig. 2)
Anasibirites kummeli n. sp. (Pl. 29, fig. 4)
Prionites hollandi McLearn (Pl. 27, figs. 3, 4; Pl. 33, figs. 1–4)
Wasatchites perrini Mathews (Pl. 29, fig. 5; Pl. 35, figs. 2–4)
Wasatchites tridentinus Spath (Pl. 28, figs. 4, 5, 8, 9)
Wasatchites deleeni McLearn (Pl. 28, figs. 3, 6, 7, 10; Pl. 32, fig. 4)
Wasatchites procurvus McLearn (Pl. 29, figs. 1–3)
Wasatchites macconnelli n. sp. (Pl. 34, figs. 7, 8)
Anawasatchites tardus McLearn (Pl. 30, figs. 2, 3; Pl. 31, fig. 3; Pl. 32, fig. 5)
Anawasatchites merrilli McLearn (Pl. 30, fig. 1; Pl. 32, fig. 1)
Anawasatchites kindlei n. sp. (Pl. 30, fig. 4)
Anawasatchites spathi n. sp. (Pl. 31, fig. 2; Pl. 32, fig. 2)
Anawasatchites dawsoni n. sp. (Pl. 31, fig. 1; Pl. 32, figs. 3, 6)
Arctoprionites nodosus (Frebold) (Pl. 34, figs. 5, 6)
Arctoprionites williamsi n. sp. (Pl. 34, figs. 1–4)
Pseudosageceras plicatum n. sp. (Pl. 36, fig. 9)

On Toad River, *Xenoceltites subevolutus* (GSC loc. 42363) occurs 1.5 m above the bed with *Anawasatchites tardus, Wasatchites tridentinus*, etc. In Spitsbergen, *X. subevolutus* and *W. tridentinus* occur together (Weitschat and Lehmann, 1978, p. 91).

Arctoceras, Prionites and *Paranannites* are undoubtedly in the same bed in the Blind Fiord Formation at GSC locality 51672, Ellesmere Island. This association is not known elsewhere. This bed is possibly a cemetery, with ammonoids of the Romunderi Zone mixed with others of the Tardus Zone.

Assignment of the beds containing *Arctoceras gigas* (GSC locs. 47534, 47559, 64718) is also questionable, because it is based solely on their high position in relation to the Romunderi Zone at Lindstroem Creek (Tozer, 1967, p. 50).

SPATHIAN STAGE

(Tozer, 1965b, p. 4; 1967, p. 20; 1984, p. 148)

Type locality. Blind Fiord Formation, Spath Creek, Ellesmere Island, where the Subrobustus Zone lies between Smithian and Lower Anisian beds (Tozer, 1967, p. 47). At this locality, the Blind Fiord–Blaa Mountain boundary is not obvious. The Spathian beds were first assigned to the Blind Fiord (Tozer, 1961, p. 12), later they were assigned to the Blaa Mountain (Tozer, 1967, p. 47). Embry (1986) favours assignment to the Blind Fiord.

Pilaticus Zone (Tozer, 1967, p. 21)

Index species. Olenikites pilaticus (Tozer).

Synonym. Nordophiceras pilatum Zone (Tozer, 1965b, p. 5).

Type locality. Blind Fiord Formation, south of Svartevaeg, Axel Heiberg Island (GSC locs. 64719, 101889, C-134797).

Occurrence. Arctic Islands - Blind Fiord Formation, Axel Heiberg Island.

At the type locality, the Pilaticus Zone overlies beds with *Arctoceras gigas* n. sp. tentatively correlated with the Tardus Zone (GSC loc. 64719 above GSC loc. 64718).

Ammonoid fauna.

Arctomeekoceras obtusum n. sp. (Pl. 37, figs. 20, 21)
Neomeekoceras scalariforme n. sp. (Pl. 37, figs. 22-26)
Olenikites pilaticus Tozer (Pl. 37, fig. 10)
Olenikites subtilis n. sp. (Pl. 37, figs. 12-19)
Pseudosageceras sp. indet.

Subrobustus Zone (Tozer, 1965b, p. 5; 1967, p. 21)

Index species. Keyserlingites subrobustus (Mojsisovics).

Type locality. Blind Fiord Formation, Spath Creek, Ellesmere Island (GSC locs. 32363, 47545, 47544) Tozer, 1961, p. 12; 1965a, p. 3; 1967, p. 47).

Occurrence. Arctic Islands - Blind Fiord Formation, Ellesmere Island. Eastern Cordillera - Toad Formation, northeastern British Columbia.

The bivalve *Posidonia aranea* Tozer is characteristic of the Subrobustus Zone. South of Svartevaeg, Axel Heiberg Island, this species occurs above the Pilaticus Zone (Tozer, 1967, p. 48).

Ammonoid fauna. The list includes species from both the Arctic Islands and the Eastern Cordillera.

Sulioticeras intermedium (Tozer) (Pl. 38, fig. 4)
Isculitoides minor Tozer (Pl. 37, fig. 9)
Zenoites arcticus Tozer (Pl. 37, fig. 7)
Popovites occidentalis Tozer (Pl. 37, fig. 5)
Popovites borealis Tozer (Pl. 37, fig. 4)
Monacanthites monoceros Tozer (Pl. 37, fig. 3)
Prosphingites czekanowskii Mojsisovics (Pl. 37, fig. 6)
Cordillerites bicarinatus (Tozer) (Pl. 37, fig. 8)
Metadagnoceras pulchrum Tozer (Pl. 38, fig. 7)
Procarnites modestus Tozer (Pl. 38, fig. 6)
Olenikites canadensis Tozer (Pl. 38, fig. 1)
Olenikites bombus n. sp. (Pl. 37, fig. 2)
Olenikites triton n. sp. (Pl. 37, fig. 1)
Svalbardiceras freboldi Tozer (Pl. 38, fig. 2)
Svalbardiceras chowadei Tozer (Pl. 38, fig. 3)
Keyserlingites subrobustus (Mojsisovics) (Pl. 38, figs. 8, 9)
Leiophyllites sp. indet. (Pl. 38, fig. 5)

MIDDLE TRIASSIC SERIES

ANISIAN STAGE

(Waagen and Diener, *in* von Mojsisovics, Waagen and Diener, 1895, p. 1292; Tozer, 1984, p. 144)

Type locality. Grossreifling, Austria.

TABLE 3

Middle Triassic zones and subzones

LADINIAN
- *Frankites sutherlandi* (Boiler Canyon)[1]
  - 2. *Asklepioceras laurenci* (Boiler Canyon)
  - 1. *Frankites glaber* (Boiler Canyon)
- *Maclearnoceras maclearni* (Fossil Gate, Liard River)
  - 3. *Maclearnoceras ensio* (Boiler Canyon)
  - 2. *Anolcites angustus* (Boiler Canyon)
  - 1. *Anolcites impolitus* (Boiler Canyon)
- *Meginoceras meginae* (Boiler Canyon)
  - 3. *Meginoceras aylardi* (Mount Withrow)
  - 2. *Silenticeras hatae* (Mount Withrow)
  - 1. *Meginoceras triviale* (Mount Withrow)
- *Tuchodiceras poseidon* (Tuchodi Bluff)
- *Eoprotrachyceras matutinum* (northwest of Wapiti Lake)

UPPER ANISIAN
- *Frechites chischa* (Chischa River)
- *Eogymnotoceras deleeni* (Alaska Highway)

MIDDLE ANISIAN
- *Hollandites minor* (Alaska Highway)
- *Tetsaoceras hayesi* (Alaska Highway)
- *Buddhaites hagei* (Lower Liard River)

LOWER ANISIAN
- *Lenotropites caurus* (MP 375 East)
  - 2. *Grambergia nahwisi* (Lower Liard River)
  - 1. *Azarianites bufonis* (Alaska Highway)
- *Silberlingites mulleri* (Humboldt Range, Nevada)

[1]Type localities are in parentheses

LOWER ANISIAN SUBSTAGE (Tozer, 1967, p. 23; Silberling and Tozer, 1968, p. 11; Tozer, 1984, p. 146)

Originally, the whole of the Lower Anisian was classed as the Caurus Zone. It was recognized that more than one level was represented, but the stratigraphic data were insufficient, particularly regarding the relationship with the Spathian, to justify a more elaborate classification. Bucher (1989) provided important sequential data from Nevada that permits a more refined classification for the Lower Anisian, which can be applied to interpreting the data from Canada. In Nevada, Bucher found that *Lenotropites* is restricted to the higher part of the Lower Anisian. He restricts the Caurus Zone to these beds. This procedure is now followed in dealing with the succession in Canada. Between the Spathian Haugi Zone and the restricted Caurus Zone, Bucher recognizes three Lower Anisian faunal levels. Lowest are the *Japonites welteri* beds; next the *Pseudokeyserlingites guexi* beds; finally the *Silberlingites mulleri* Zone. In northeastern British Columbia, there is one occurrence (GSC loc. 68226) of Lower Anisian ammonoids below *Lenotropites*. From the stratigraphic position, at least an approximate correlation with the Mulleri Zone of Nevada seems justified for the GSC locality 68226 fauna, despite the absence of the index species, *Silberlingites mulleri*. Except for *Stenopopanoceras*, all the genera at GSC locality 68226 are also in the fauna at the type locality in Nevada. Most or all, however, range into younger Anisian beds. There is nevertheless evidence to recognize two zones in the Lower Anisian of Canada: an approximate correlative of the Mulleri Zone, followed by the Caurus Zone. With this treatment, the Caurus Zone has essentially the same scope in both Nevada and British Columbia.

Mulleri Zone (Bucher, 1989, p. 953)

Index species. Silberlingites mulleri Bucher.

Type locality. Fossil Hill Member, Prida Formation, Humboldt Range, Nevada.

Occurrence. Eastern Cordillera - Toad Formation, northeastern British Columbia.

The only certain occurrence is at GSC locality 68226, Alaska Highway (Tozer, 1967, p. 69), where the ammonoid fauna comprises:

Groenlandites silberlingi n. sp. (Pl. 39, figs. 1–12; Pl. 45, fig. 1)
Grambergia tetsaensis McLearn (Pl. 43, figs. 3, 4)
Paradanubites shevyrevi n. sp. (Pl. 45, figs. 4, 12)
Paracrochordiceras benderi n. sp. (Pl. 45, figs. 2, 3)
Caucasites mulleri n. sp. (Pl. 44, figs. 11, 12)
Gymnites procerus n. sp. (Pl. 46, figs. 7, 8)
Stenopopanoceras falcatum n. sp. (Pl. 39, figs. 13–15).

Caurus Zone (Tozer, 1967, p. 23)

Index species. Lenotropites caurus (McLearn).

Type locality. Toad Formation, Alaska Highway, British Columbia (GSC loc. 68203, Tozer, 1967, p. 69). The lower bed originally included (GSC loc. 68226) is now excluded and assigned to the Mulleri Zone.

Occurrence. Arctic Islands - Blaa Mountain Formation, Ellesmere Island; Schei Point Formation, Exmouth Island. Interior Platform - Doig Formation. Eastern Cordillera - Toad Formation, northeastern British Columbia; Sulphur Mountain Formation, Whistler Member, Alberta.

The beds at the type locality overly the Mulleri Zone (GSC loc. 68203 above GSC loc. 68226). Superposition of the Caurus Zone above the Subrobustus Zone (GSC loc. 32363 etc.) is evident at Spath Creek, Ellesmere Island (Tozer, 1967, p. 47). The two beds of the Caurus Zone at this locality (GSC locs. 47550, 47580) represent either Subzone 1 or Subzone 2, defined below.

Subzone 1

Index species. Azarianites bufonis (McLearn).

Type locality. Toad Formation, Alaska Highway British Columbia (GSC loc. 68203) (Tozer, 1967, p. 69).

Occurrence. Eastern Cordillera - Toad Formation, northeastern British Columbia; Sulphur Mountain Formation, Whistler Member, Alberta.

At the type locality, on the Alaska Highway, Subzone 1 overlies the Mulleri Zone (GSC loc. 68203 above GSC loc. 68226). Subzone 1 is also recognized on Liard River (GSC locs. 42339, 99580, 99581).

Ammonoid fauna.
Groenlandites canadensis n. sp. (Pl. 40, figs. 6–12)

Groenlandites kummeli n. sp. (Pl. 40, figs. 1–5)
Lenotropites caurus (McLearn) (Pl. 41, figs. 1–12, 16; Pl. 42, fig. 10; Pl. 45, fig. 10)
Lenotropites tardus McLearn (Pl. 41, figs. 13–15; Pl. 42, figs. 4–9; Pl. 43, figs. 8, 9)
Lenotropites(?) tricarinatus n. sp. (Pl. 45, fig. 9)
Grambergia tetsaensis McLearn (Pl. 44, figs. 3, 4, 10)
Grambergia liardensis n. sp. (Pl. 45, figs. 5–8)
Azarianites bufonis (McLearn) (Pl. 40, fig. 14)
Paracrochordiceras americanum McLearn is probably also in the fauna of this subzone (McLearn, 1969, p. 8).
Stenophyllites kindlei (McLearn) (Pl. 46, fig. 4–6)
Ussurites muskwa McLearn (Pl. 46, fig. 1)

Subzone 2

Index species. Grambergia nahwisi (McLearn).

Type locality. Toad Formation, *Sturia* bed, Liard River, British Columbia (GSC locs. 42338, 99579) (Tozer, 1967, p. 71).

Occurrence. Eastern Cordillera - Toad Formation, northeastern British Columbia.

At the type locality, Subzone 2 overlies Subzone 1 (GSC loc. 42338 = 99579 above GSC loc. 42339 = 99581). Subzone 2 is also represented at GSC locality 74733 on Chischa River.

Ammonoid fauna.
Groenlandites amplus n. sp. (Pl. 40, fig. 13)
Lenotropites caurus (McLearn) (Pl. 41, figs. 6–8)
Lenotropites tardus (McLearn) (Pl. 43, fig. 9)
Grambergia mackenzii (McLearn) (Pl. 43, fig. 2; Pl. 44, figs. 5–9)
Grambergia nahwisi (McLearn) (Pl. 43, figs. 10, 11)
Discogymnites hollandi (McLearn) (Pl. 43, fig. 12; Pl. 46, figs. 9, 10; Pl. 47, fig. 3)
Sturia sansovinii (Mojsisovics) (Pl. 46, fig. 11)

Pearylandites peregrinus n. sp. (Pl. 47, fig. 4), *Grambergia mackenzii* (McLearn) (Pl. 47, figs. 5, 6) and *Japonites wrighti* n. sp. (Pl. 47, fig. 7) which occur in the condensed bed on Chischa River (GSC loc. 74740), probably represent this subzone.

The fauna from the Toad Formation at Cameron Hill, Alaska Highway (GSC loc. 10732) includes the following (McLearn, 1969, p. 8):

Grambergia tetsaensis McLearn
Paracrochordiceras americanum McLearn (Pl. 42, figs. 1–3)
Stenopopanoceras normale (McLearn) (Pl. 46, fig. 12)
Columbisculites maclearni n. sp. (Pl. 45, fig. 11)
Stenophyllites kindlei (McLearn)
Ussurites muskwa McLearn

The species of *Grambergia, Stenophyllites* and *Ussurites,* and probably also *Paracrochordiceras americanum* occur in the Caurus Zone. Despite the absence of *Lenotropites*, this fauna is attributed to the Caurus Zone.

Occurrences of *Pearylandites troelseni* Kummel (Pl. 43, figs. 5, 6), *Lenotropites undulatus* Spath (Pl. 44, figs. 1, 2, 13) and *Lenotropites ellesmerensis* n. sp. (Pl. 43, fig. 1) in the Arctic Islands also indicate the Caurus Zone but the subzone is not certain.

MIDDLE ANISIAN SUBSTAGE (Tozer, 1967, p. 24; Silberling and Tozer, 1968, p. 11; Tozer, 1984, p. 147)

Until now, as used in Canada, this substage has been synonymous with the Varium Zone (*Anagymnotoceras varium* Zone). Three zones are now introduced as divisions of the Middle Anisian.

Hagei Zone

Index species. Buddhaites hagei (McLearn).

Type locality. Toad Formation, Liard River, British Columbia (GSC loc. 42337 = 99578).

Occurrence. Arctic Islands - Blaa Mountain Formation, Lower Shale Member, Ellesmere Island. Eastern Cordillera - Toad Formation, northeastern British Columbia; Sulphur Mountain Formation, Whistler Member, Alberta.

At the type locality, the Hagei Zone overlies Caurus Subzone 2 (GSC loc. 99578 above GSC loc. 99579). This relationship is also evident on Chischa River (GSC loc. 74736 above GSC loc. 74735).

Ammonoid fauna.
Alanites laevis n. sp. (Pl. 51, fig. 5)
Stenopopanoceras angulatum n. sp. (Pl. 57, figs. 1–3)
Stenopopanoceras obesum (McLearn) (Pl. 57, figs. 4, 5)
Intornites mactaggarti (McLearn) (Pl. 47, figs. 1, 2; Pl. 49, figs. 1, 2, 4; Pl. 50, figs. 1–6).

Intornites intornatus (McLearn) (Pl. 49, fig. 3; Pl. 50, figs. 11–12)
Hollandites dieneri n. sp. (Pl. 55, figs. 5, 6)
Hollandites liardensis n. sp. (Pl. 55, fig. 4)
Hollandites pelletieri McLearn (Pl. 52, figs. 11–13; Pl. 53, figs. 4–9)
Anagymnotoceras tozeri McLearn (Pl. 54, fig. 1)
Gymnites compressus n. sp. (Pl. 51, fig. 3)
Buddhaites hagei (McLearn) (Pl. 48, figs. 6, 7; Pl. 49, figs. 5–7)
Ussurites yabei Diener (Pl. 48, fig. 10)

On Chischa River (GSC loc. 74740), a bed 1 m thick contains *Intornites mactaggarti* (McLearn) and also species of *Grambergia* and *Pearylandites* that probably indicate the Caurus Zone. On upper Liard River *I. mactaggarti* is associated with *Anagymnotoceras* and *Buddhaites hagei*, thus justifying *I. mactaggarti* as a member of the Hagei Zone fauna. The position of *I. mactaggarti* on Chischa River suggests that *I. mactaggarti* characterizes the oldest beds of the Hagei Zone. The faunas from upper Liard River (GSC locs. 42400, 42406, 42409) with *I. mactaggarti* may be interpreted in this light. The holotype of *I. mactaggarti* was collected by E.D. Kindle in 1943, supposedly from the lower Liard River section (GSC loc. 10660). Extensive collections have been made since then. *Intornites mactaggarti* is represented by several specimens from the upper Liard River locality, but none have been found from the lower Liard. Probably there was a mistake in labelling, and the holotype of *I. mactaggarti* was obtained from the upstream locality.

The fauna at Chlotapecta Creek (GSC loc. 40109) has some unique elements (*Alanites laevis, Hollandites pelletieri*) with *Intornites intornatus,* but not *I. mactaggarti.* This association probably represents relatively young beds within the zone.

The holotype of "*Longobardites*" *larvalis* McLearn, which is placed in synonymy with *Intornites mactaggarti,* is from a locality (GSC loc. 10696) on the Alaska Highway where most of the ammonoids are clearly of the Hayesi Zone. The specimen was collected by F.H. McLearn. McLearn's published account (McLearn and Kindle, 1950, p. 38) does not indicate the thickness of beds from which he collected the fossils at this locality. Locality 10696 may include fossils of both the Hagei and Hayesi zones.

Hayesi Zone

Index species. Tetsaoceras hayesi (McLearn).

Type locality. Toad Formation, Chischa River, British Columbia (GSC locs. 74737, 74738).

Occurrence. Eastern Cordillera - Toad Formation, northeastern British Columbia; Sulphur Mountain Formation, Whistler Member, Alberta and northeastern British Columbia.

At the type locality, the Hayesi Zone overlies the Hagei Zone (GSC loc. 74737 above GSC loc. 74736; GSC loc. 74738 above GSC loc. 74739). This relationship is also known at Chlotapecta Creek (GSC loc. 40110 above GSC loc. 40109). Other localities that contribute to the fauna are at upper Liard River (GSC locs. 42407, 42410), Toad River (GSC loc. 89548), the Alaska Highway (GSC locs. 42413, 46512, 68294), and Bat Creek (GSC loc. 16008).

Ammonoid fauna.
Amphipopanoceras medium (McLearn) (Pl. 57, figs. 6–8)
Amphipopanoceras selwyni (McLearn) (Pl. 57, fig. 9; Pl. 58, figs. 5, 6).
Intornites intornatus (McLearn) (Pl. 50, figs. 7, 8; Pl. 51, figs. 9–11)
Czekanowskites pinguis (McLearn) (Pl. 52, figs. 2, 4)
Czekanowskites acuteplicatus n. sp. (Pl. 52, fig. 1)
Tetsaoceras hayesi (McLearn) (Pl. 52, figs. 3, 5–7)
Tetsaoceras angulatum (McLearn) (Pl. 52, fig. 8)
Arctohungarites liardensis n. sp. (Pl. 48, fig. 5; Pl. 52, figs. 9, 10).
Hollandites macconnelli McLearn (Pl. 54, fig. 2)
Anagymnotoceras varium (McLearn) (Pl. 53, figs. 1, 2; Pl. 54, fig. 7)
Anagymnotoceras columbianum (McLearn) (Pl. 54, fig. 6)
Anagymnotoceras ino (McLearn)
(?)*Anagymnotoceras wrighti* (McLearn) (Pl. 54, figs. 3–5)
Nicomedites moderatus (McLearn) (Pl. 52, fig. 14; Pl. 53, fig. 3; Pl. 56, fig. 3)
Gymnites compressus n. sp. (Pl. 51, figs. 1, 2)
Gymnites(?) *perplanus* (Meek) (Pl. 48, fig. 8)
Tropigastrites(?) *costatus* n. sp. (Pl. 51, fig. 4)

Minor Zone

Index species. Hollandites minor n. sp.

Type locality. Toad Formation, Alaska Highway, British Columbia (GSC loc. 68295) (Tozer, 1967, p. 70).

Occurrence. Eastern Cordillera - Toad Formation, northeastern British Columbia; Sulphur Mountain Formation, Whistler Member, northeastern British Columbia.

At the type locality, the Minor Zone overlies the Hayesi Zone (GSC loc. 68295 above GSC loc. 68294). The zone is also represented on Toad River (GSC loc. 99565) and near Hook Lake (GSC loc. 83873). At the Toad River locality, the fauna includes *Enteropleura bittneri* Kittl.

Ammonoid fauna.

Stenopopanoceras celere n. sp. (Pl. 58, fig. 3)
Amphipopanoceras selwyni (McLearn) (Pl. 58, figs. 2, 4)
Amphipopanoceras inconstans (Dagys and Ermakova) (Pl. 58, fig. 1)
Intornites williamsi n. sp. (Pl. 51, figs. 12, 13)
Hollandites minor n. sp. (Pl. 55, figs. 1-3)
Hollandites spivaki McLearn (Pl. 55, fig. 7)
Anagymnotoceras wrighti McLearn (Pl. 55, fig. 8)
Nicomedites arthaberi n. sp. (Pl. 56, figs. 1, 2, 4)
Ptychites guloensis n. sp. (Pl. 48, figs. 1, 2)
(?)*Ptychites wrighti* McLearn (Pl. 48, figs. 3, 4)
Proarcestes sp. indet.

UPPER ANISIAN SUBSTAGE (Tozer, 1967, p. 25; Silberling and Tozer, 1968, p. 11; Tozer, 1984, p. 148)

In addition to the ammonoids listed below, the Upper Anisian is characterized by the appearance of the bivalve *Daonella.*

Deleeni Zone (Tozer, 1967, p. 25)

Index species. Eogymnotoceras deleeni (McLearn).

Type locality. Toad Formation, Alaska Highway, British Columbia (GSC locs. 68228, 68297).

Occurrence. Eastern Cordillera - Toad Formation, northeastern British Columbia; Sulphur Mountain Formation, Llama Member, Alberta.

At the type locality, the Deleeni Zone overlies the Minor Zone (GSC loc. 68228 above GSC loc. 68295) (Tozer, 1967, p. 70). A bed on Chischa River (GSC loc. 74724) contributes to the fauna.

Ammonoid fauna.

Amphipopanoceras acutum Popov (Pl. 61, figs. 3, 4)
Amphipopanoceras tetsa (McLearn) (Pl. 61, figs. 5-8)
Intornites canadensis (McLearn) (Pl. 59, figs. 1-9)
Eogymnotoceras beachi (McLearn) (Pl. 60, figs. 1-3)
Eogymnotoceras deleeni (McLearn) (Pl. 59, figs. 10, 11; Pl. 60, figs. 10-12)
Eogymnotoceras liardense (McLearn) (Pl. 60, figs. 4-9)
Gymnotoceras smithi n. sp. (Pl. 59, figs. 12, 13)
Japonites readi n. sp. (Pl. 63, fig. 1)
Tropigymnites haueri n. sp. (Pl. 61, figs. 1, 2)
Anagymnites via alaska McLearn (Pl. 63, figs. 2, 3)
Ptychites trochleaeformis (Lindstroem) (Pl. 62, fig. 1)
Ussurites cameroni McLearn (Pl. 62, figs. 2-4)

The Deleeni Zone is a relatively gross division, in which two or more subzones might be represented. There is probably a succession of *Eogymnotoceras* species: *E. beachi, E. deleeni, E. liardense,* but at present the stratigraphic data are insufficient to formalize subzones.

Chischa Zone (Tozer, 1967, p. 26)

Index species. Frechites chischa (Tozer).

Type locality. Toad Formation, Chischa River British Columbia (GSC loc. 40088 = 74726).

Occurrence. Arctic Islands - Schei Point Formation, Exmouth and Ellesmere Islands. Eastern Cordillera - Toad Formation, northeastern British Columbia; Sulphur Mountain Formation, Llama Member, northeastern British Columbia.

At the type locality, the Chischa Zone overlies the Deleeni Zone (GSC loc. 74726 above GSC loc. 74724).

Ammonoid fauna.

Parapopanoceras malmgreni (Lindstroem) (Pl. 65, figs. 5, 6; Pl. 66, fig. 12)
Parapopanoceras(?) *torelli* (Mojsisovics) (Pl. 66, fig. 11)
Longobardites murrayensis n. sp. (Pl. 65, figs. 7-12; Pl. 66, figs. 3, 4)
Frechites chischa (Tozer) (Pl. 65, fig. 1; Pl. 66, figs. 16, 17)
Frechites laqueatus (Lindstroem) (Pl. 66, figs. 13-15)
Frechites hamatus n. sp. (Pl. 64, figs. 9-11)
Pleurofrechites lineatus n. sp. (Pl. 64, figs. 1-8)

Pleurofrechites subsidens n. sp. (Pl. 65, fig. 2; Pl. 66, figs. 5–10)
Paranevadites sp. indet. (Pl. 65, fig. 3)
Ptychites hamatus n. sp. (Pl. 65, figs. 13, 14)
Ptychites trochleaeformis (Lindstroem) (Pl. 62, fig. 1)
Tozerites polygyratus (Smith) (Pl. 65, fig. 4; Pl. 66, figs. 1, 2).

Not all the species listed above are known to occur together. The fauna from the type locality (GSC locs. 40088, 74726) has close counterparts near Hook Lake (GSC locs. 83875, 83890) and near Wapiti Lake (GSC loc. 83852). These Chischa Zone assemblages are at about the same level as those with a different fauna (e.g., GSC locs. 83867, 83882, 83883) dominated by *Frechites hamatus* and *Pleurofrechites lineatus*. Probably there is a difference in age, but at present there are insufficient stratigraphic data to determine the sequence.

The faunas from the Arctic Islands only contain *Frechites laqueatus* and *Ptychites trochleaeformis*.

LADINIAN STAGE
(Bittner, 1892, p. 392)

Type locality. Buchenstein and Wengen Beds, Dolomites, northern Italy (Tozer, 1984, p. 146).

In Nevada, the base of the Ladinian is drawn at the Subasperum Zone in which occur the first Trachyceratidae, associated with *Beyrichitinae*, much like those of the Upper Anisian (Silberling and Tozer, 1968, p. 12, 37; Silberling and Nichols, 1982, p. 10, 11). In British Columbia, the early Ladinian strata were formerly correlated with the Subasperum Zone (Tozer, 1967, p. 27); the relationship with the supposedly younger Ladinian zones was not demonstrable at that time. Later, the Poseidon Zone was found in sequence above the beds correlated with the Subasperum Zone (Tozer, 1971, p. 1018). Thus, the beds in British Columbia correlated with the Subasperum Zone have a well defined upper limit, whereas the upper limit in Nevada is indefinite (Silberling and Tozer, 1968, p. 37). The scope of the typical Subasperum Zone does not demonstrably correspond with that of the Ladinian beds in British Columbia that underly the Poseidon Zone, i.e., with the beds formerly correlated with the Subasperum Zone. The British Columbia sequence is more clearly expressed by recognizing a new zone (*Eoprotrachyceras matutinum*) for the earliest Ladinian beds formerly correlated with the Subasperum Zone.

Matutinum Zone

Index species. Eoprotrachyceras matutinum Tozer.

Type locality. Sulphur Mountain Formation, Llama Member, northwest of Wapiti Lake, British Columbia (GSC locs. 46484, 83862) where it overlies the Chischa Zone (GSC loc. 83867).

Occurrence. Sulphur Mountain Formation, Llama Member, northeastern British Columbia and Alberta.

Ammonoid fauna.
Pleurofrechites fellersi n. sp. (Pl. 67, figs. 7–14)
Pychites hamatus n. sp. (Pl. 67, figs. 1–4)
Longobardites murrayensis n. sp. (Pl. 67, fig. 15)
Eoprotrachyceras matutinum Tozer (Pl. 67, figs. 5, 6)
Eoprotrachyceras gibsoni n. sp. (Pl. 68, figs. 8, 10)

Poseidon Zone (Tozer, 1967, p. 28)

Index species. Tuchodiceras poseidon (Tozer).

Type locality. Toad Formation, north of Tuchodi Lakes, British Columbia (GSC locs. 68284–68286, 68288, 68289) (Tozer, 1967, p. 67).

Occurrence. ?Arctic Islands – Schei Point Formation, Ellesmere Island; Blaa Mountain Formation, Ellesmere and Axel Heiberg islands. Eastern Cordillera – Toad Formation, northeastern British Columbia; Sulphur Mountain Formation, Llama Member, northeastern British Columbia.

At the type locality, no earlier Ladinian faunas are known. Northwest of Wapiti Lake the Poseidon Zone (GSC loc. 83860) overlies the Matutinum Zone (GSC loc. 83862).

Ammonoid fauna.
Tuchodiceras poseidon (Tozer) (Pl. 68, figs. 5–7; Pl. 69, figs. 1, 2)
Tuchodiceras costatum n. sp. (Pl. 69, figs. 3, 4)
Gymnites(?) sp. indet. (Pl. 71, fig. 1)
Ptychites hamatus n. sp. (Pl. 71, fig. 2)
Arctoptychites lingulatus n. sp. (Pl. 69, figs. 5, 6)
Eonathorstites dieneri n. sp. (Pl. 70, figs. 1–6)
Indigirites freboldi n. sp. (Pl. 70, figs. 7–18)
Proarcestes sp. indet.
Protrachyceras sikanianum McLearn (Pl. 71, figs. 6–8)
Metatirolites withrowi n. sp. (Pl. 71, figs. 3, 4)
Monophyllites aonis Mojsisovics (Pl. 71, fig. 5)

Eonathorstites dieneri occurs below *Tuchodiceras poseidon* at Mount Withrow (GSC loc. 74758). It possibly characterizes a distinct subzone, but because it is known only from one locality where the position with respect to the Matutinum Zone is not demonstrable, the relationships are not certainly known.

Probably approximately correlative with the Poseidon Zone are the *Daonella frami* beds in the Schei Point and Blaa Mountain formations of Ellesmere and Axel Heiberg islands (Tozer, 1961, p. 33; 1967, p. 45). The ammonoid fauna comprises:

Longobardites sp. indet. (Pl. 68, figs. 1, 2)
Istreites nanuk (Tozer) (Pl. 68, fig. 3)
Protrachyceras sp. indet. (Pl. 68, fig. 4)

The presence of *Protrachyceras* is more suggestive of correlation with the Poseidon Zone than with older Ladinian beds, as previously suggested (Tozer, 1967, p. 45).

Meginae Zone (Tozer, 1967, p. 29)

Index species. Meginoceras meginae (McLearn).

Type locality. Toad Formation, Boiler Canyon, Liard River, British Columbia where it is represented by beds now assigned to Subzone 2 (GSC locs. 68243, 68248, 68251) (Tozer, 1967, p. 66).

Three subzones are now discriminated; a distinctive fauna, not exactly placed in the sequence, probably indicates a fourth.

Occurrence. ?Arctic Islands - Blaa Mountain Formation, Ellesmere and Axel Heiberg islands. Eastern Cordillera - Toad Formation; Liard Formation; Sulphur Mountain Formation, Llama Member, northeastern British Columbia.

Subzone 1

Index species. Meginoceras triviale n. sp.

Type locality. Toad Formation, Mount Withrow, British Columbia (GSC loc. 74769).

Occurrence. Eastern Cordillera - Toad Formation, northeastern British Columbia; Sulphur Mountain Formation, Llama Member, northeastern British Columbia.

At the type locality, Subzone 1 overlies the Poseidon Zone (GSC loc. 74769 above GSC loc. 74755). This relationship is also shown north of the Tuchodi Lakes (GSC loc. 68277 above GSC loc. 68286). The fauna is also known near Hook Lake (GSC loc. 45651).

Ammonoid fauna.
Indigirites boehmi n. sp. (Pl. 76, figs. 1-7)
Eosagenites gethingi (McLearn) (Pl. 74, figs. 10-14)
Meginoceras triviale n. sp. (Pl. 73, figs. 1-12)
Silenticeras gibsoni (Pl. 75, fig. 14)

Subzone 2

Index species. Silenticeras hatae McLearn. The most widely distributed diagnostic species is *Meginoceras meginae* (McLearn), index species of the zone.

Type locality. Toad formation, Mount Withrow, British Columbia (GSC locs. 74765, 74766, 74768).

Occurrence. Eastern Cordillera - Toad Formation, northeastern British Columbia.

At the type locality, Subzone 2 overlies Subzone 1 (GSC loc. 74765 above GSC loc. 74769). Subzone 2 is represented also at the Beattie Ledge locality on Peace River (GSC locs. 9131, 9163 etc.) now flooded by the waters of Williston Lake, and at Boiler Canyon, Liard River (GSC loc. 68248 etc.) (Tozer, 1967, p. 66, 67).

Ammonoid fauna.
Nitanoceras selwyni (McLearn) (Pl. 74, figs. 1-4)
Eosagenites gethingi (McLearn) (Pl. 74, figs. 10-14)
Indigirites boehmi n. sp. (Pl. 76, figs. 1-17)
Thanamites schooleri (McLearn) (Pl. 75, figs. 1-3)
Thanamites parvus (McLearn) (Pl. 75, figs. 4, 5)
Indoceltites transiens n. sp. (Pl. 75, fig. 6)
Drumoceras tuberculatum n. sp. (Pl. 75, figs. 7-10)
Drumoceras anodosum (Pl. 75, fig. 11)
Protrachyceras sikanianum McLearn (Pl. 75, figs. 12, 13)
Meginoceras meginae McLearn (Pl. 73, figs. 13-15)
Silenticeras hatae McLearn (Pl. 74, figs. 6-9)
Silenticeras liardense (Pl. 74, fig. 5)
Lobites pacianus McLearn (Pl. 74, figs. 15-18)

Subzone 3

Index species. Meginoceras aylardi McLearn.

Type locality. Toad Formation, Mount Withrow, British Columbia (GSC loc. 74767).

Occurrence. Eastern Cordillera - Toad Formation, Liard Formation, northeastern British Columbia.

At the type locality, Subzone 3 overlies Subzone 2 (GSC loc. 74767 above GSC loc. 74766).

Ammonoid fauna.
Indigirites boehmi n. sp.
Meginoceras aylardi (McLearn) (Pl. 73, figs. 16–20)
Lobites pacianus McLearn

A distinctive assemblage occurs at several localities in northeastern British Columbia (GSC locs. 10790=74748, 42535, 84246, 89782, 98902, 98903). The ammonoid fauna comprises:

Nitanoceras selwyni (McLearn)
Indigirites stolleyi n. sp. (Pl. 72, figs. 11, 12)
Protrachyceras sikanianum McLearn
Meginoceras tetsa (McLearn) (Pl. 72, figs. 1–4)
Silenticeras bamberi n. sp. (Pl. 72, figs. 6–10)
Lobites pacianus McLearn (Pl. 72, fig. 5)

In the Sulphur Mountain Formation at Watson Peak, this fauna is in beds above the Poseidon Zone (GSC loc. 84246 above GSC loc. 84247). In the Liard Formation on the Alaska Highway, the fauna occurs below that of Subzone 3 (e.g., GSC loc. 98902 below 98906). Although bracketed between the Poseidon Zone and Subzone 3, the exact position with respect to Subzones 1 and 2 is not known.

Beds with *Indigirites* and *Sphaerocladiscites* in the Blaa Mountain Formation of Ellesmere and Axel Heiberg islands (Tozer, 1961, p. 21; 1967, p. 45) are probably roughly correlative with the Meginae Zone.

Maclearni Zone (Tozer, 1967, p. 29)

Index species. Maclearnoceras maclearni Tozer.

Type locality. Liard Formation, Fossil Gate, Liard River, British Columbia (GSC loc. 42355) (Tozer, 1963b, p. 32; 1967, p. 66). The bed is exposed in the core of an anticline and does not demonstrably overly any other zone.

Three subzones are now recognized in the sequence at Boiler Canyon on Liard River (Tozer, 1967, p. 65). The fauna at the type locality is attributed to Subzone 2.

Occurrence. Eastern Cordillera - Toad Formation, Liard Formation, Sulphur Mountain Formation, northeastern British Columbia.

Subzone 1

Index species. Anolcites impolitus n. sp.

Type locality. Toad Formation, Boiler Canyon, Liard River (GSC loc. 68242) (Tozer, 1967, p. 66).

Occurrence. Eastern Cordillera - Toad Formation, northeastern British Columbia.

At the type, locality Subzone 1 overlies Meginae Subzone 2 (GSC loc. 68242 above GSC loc. 68251). Also known from Mount Withrow where it overlies Meginae Subzone 3 (GSC loc. 50042 above GSC loc. 74767).

Ammonoid fauna.
Nathorstites maclearni n. sp. (Pl. 81, figs. 1, 3, 4)
Meginoceras effervescens n. sp. (Pl. 78, fig. 4)
Anolcites impolitus n. sp. (Pl. 77, figs. 8, 9; Pl. 78, figs. 10, 11)
Anolcites politus n. sp. (Pl. 78, figs. 8, 9)

Subzone 2

Index species. Anolcites angustus n. sp.

Type locality. Toad Formation, Boiler Canyon, Liard River (GSC loc. 68237).

Occurrence. Eastern Cordillera - Toad Formation, Liard Formation, northeastern British Columbia.

At the type locality, Subzone 2 overlies Subzone 1 (GSC loc. 68237 above GSC loc. 68242). Ammonoid fauna at the type locality:

Protrachyceras sikanianum McLearn (Pl. 77, fig. 6)
Anolcites angustus n. sp. (Pl. 78, fig. 2)
Anoclites rasilis n. sp. (Pl. 78, fig. 1)
Lobites pacianus McLearn

Ammonoid fauna at type locality of Maclearni Zone (GSC loc. 42355):
Nathorstites maclearni n. sp. (Pl. 81, figs. 2, 5, 6, 7)
Protrachyceras sikanianum McLearn (Pl. 79, figs. 14, 15)
Liardites whiteavesi Tozer (Pl. 77, fig. 5)

Anolcites angustus n. sp. (Pl. 78, fig. 3)
Anolcites gemmatus n. sp. (Pl. 78, fig. 7)
Maclearnoceras maclearni (Pl. 77, figs. 1, 2)
Clionitites(?) *venerabilis* n. sp. (Pl. 79, fig. 1)

Subzone 3

Index species. Maclearnoceras ensio n. sp.

Type locality. Toad Formation, Boiler Canyon, Liard River (GSC loc. 68236) (Tozer, 1967, p. 65).

Occurrence. Eastern Cordillera - Toad Formation; Sulphur Mountain Formation, Llama Member, northeastern British Columbia.

At the type locality, Subzone 3 overlies Subzone 2 (GSC loc. 68236 above GSC loc. 68237).

Ammonoid fauna.
Nitanoceras compressum n. sp. (Pl. 77, fig. 10)
Hungarites inermis n. sp. (Pl. 80, figs. 1, 2)
Nathorstites maclearni n. sp.
Protrachyceras sikanianum McLearn
Otoarpadites auritus n. sp. (Pl. 79, figs. 6–13)
Anolcites anguinus n. sp. (Pl. 80, figs. 7, 8, 10)
Zestoceras nitidum n. sp. (Pl. 80, fig. 9)
Maclearnoceras ensio n. sp. (Pl. 79, figs. 2–5)
Asklepioceras exilis n.sp (Pl. 80, fig. 3)
Asklepioceras altilis n. sp. (Pl. 80, figs. 4–6)
Lobites pacianus McLearn
Monophyllites aonis Mojsisovics

Anolcites papillatus n. sp. (Pl. 78, fig. 6) from the Liard Formation at GSC locality 36420 is associated with *Nathorstites maclearni* n. sp. Correlation with the Maclearni zone, probably Subzone 2, is indicated.

Meginoceras caurinum (McLearn) (Pl. 77, fig. 3; Pl. 78, fig. 5) probably also represents the Maclearni Zone (Tozer, 1967, p. 67).

Sutherlandi Zone (Tozer, 1967, p. 30)

Index species. Frankites sutherlandi (McLearn).

Type locality. Toad Formation, Boiler Canyon, Liard River (Tozer, 1967, p. 65). Two subzones are now recognized at this locality.

Occurrence. ?Arctic Islands - Schei Point Formation, Table Island. Eastern Cordillera - Toad Formation, Liard Formation, Sulphur Mountain Formation, northeastern British Columbia.

Subzone 1

Index species. Frankites glaber n. sp.

Type locality. Toad Formation, Boiler Canyon, Liard River (GSC loc. 68234).

Occurrence. Eastern Cordillera - Toad Formation, northeastern British Columbia.

At the type locality, this subzone overlies Maclearni Subzone 3 (GSC loc. 68234 above GSC loc. 68236).

Ammonoid fauna.
Nitanoceras compressum n. sp. (Pl. 87, fig. 9)
Frankites glaber n. sp. (Pl. 83, figs. 13–15)

Subzone 2

Index species. Asklepioceras laurenci McLearn.

Type locality. Toad Formation, Boiler Canyon, Liard River (GSC locs. 68229, 68231, 68232, 68233) (Tozer, 1967, p. 65).

Occurrence. Eastern Cordillera - Toad Formation, Liard Formation, northeastern British Columbia.

At the type locality Subzone 2 overlies Subzone 1 (GSC loc. 68233 above GSC loc. 68234). The fauna from the type locality is augmented from occurrences at Middle Canyon, 2 km below Boiler Canyon (GSC locs. 42335, 68267) and at Fossil Gate, 4 km below Boiler Canyon (GSC locs. 42351, 89783, 89784). The Fossil Gate locality is probably where R.G. McConnell collected the type specimens of *Nathorstites macconnelli* in 1887. Other significant localities are at Chischa River (GSC loc. 40084), near the Tuchodi Lakes (GSC locs. 68278–68280), south of Halfway River (GSC loc. 82645), and in the Peace River Valley (GSC locs. 9797, 9799, 9800, 9806).

Ammonoid fauna.
Nitanoceras compressum n. sp.
Nathorstites macconnelli (Whiteaves) (Pl. 86, figs. 1–7; Pl. 87, figs. 1–8)
Asklepioceras laurenci McLearn (Pl. 82, figs. 11–13; Pl. 83, figs. 1–7)
Zestoceras cerastes n. sp. (Pl. 82, fig. 4)
Zestoceras enode (Tozer) (Pl. 82, figs. 2, 3, 5)
Muensterites glaciensis (McLearn) (Pl. 84, figs. 1–11)
Muensterites helenae (Renz) (Pl. 82, fig. 8)
Muensterites delicatulus (McLearn) (Pl. 82, fig. 9)

Frankites sutherlandi (McLearn) (Pl. 82, fig. 10; Pl. 83, figs. 8–12)
Daxatina canadensis (Whiteaves) (Pl. 85, figs. 2–9)
Daxatina laubei n. sp (Pl. 85, fig. 1)
Daxatina megabrotheus n. sp. (Pl. 82, figs. 6, 7)
Sympolycyclus antiquus n. sp. (Pl. 82, fig. 1)
Lobites ellipticus (Hauer) (Pl. 87, figs. 11–16)
Lobites sp. indet. (Pl. 87, fig. 10)

At the type locality, *Daxatina canadensis* is above *Frankites sutherlandi* (GSC locs. 68229 and 68231 above GSC loc. 68232). At Middle Canyon, *Daxatina* occurs both above (GSC loc. 68272) and below (GSC loc. 68264) the bed with *Frankites sutherlandi* and *Daxatina laubei* (GSC loc. 68267).

The *Nathorstites* bed of the Schei Point Formation, Table Island (Tozer, 1961, p. 15) is probably a correlative of the Sutherlandi Zone.

UPPER TRIASSIC SERIES

CARNIAN STAGE
(Mojsisovics, 1869, p. 127)

Type locality. Originally defined in Austria, but in vague terms (Tozer, 1984, p. 145).

LOWER CARNIAN SUBSTAGE

Now interpreted as comprising three zones: Desatoyense, Obesum and Nanseni. The Nanseni Zone was dropped (Tozer, 1984, p. 8), but is now reinstated.

Desatoyense Zone (Silberling and Tozer, 1968, p. 35)

Index species. Trachyceras desatoyense Johnston.

Synonym. Joannites Zone (Johnston, 1941, p. 447).

Type locality. Star Peak Group, South Canyon, New Pass Range Nevada (Silberling, 1956, p. 1151; Nichols and Silberling, 1977, p. 62).

Occurrence. Eastern Cordillera - Ludington Formation, Liard Formation, northeastern British Columbia.

At the type locality in Nevada, the Desatoyense Zone overlies a correlative of the Sutherlandi Zone (Silberling and Tozer, 1968, p. 36). This relationship is not demonstrable with certainty in Canada.

Ammonoid fauna. The following are from several different localities in beds correlated with the Desatoyense Zone:
Badiotites scapulatus n. sp. (Pl. 89, figs. 2, 3)
Stolleyites sp. indet. (Pl. 88, fig. 12)
Silenticeras involutum n. sp. (Pl. 88, fig. 9)
Protrachyceras(?) sp. (Pl. 88, fig. 13)
Daxatina limpida n. sp. (Pl. 88, figs. 15–19)
Trachyceras desatoyense Johnston (Pl. 89, figs. 4–7; Pl. 90, fig. 1)
Trachyceras aonoides Mojsisovics (Pl. 89, fig. 8)
Trachyceras(?) sp. indet. (Pl. 88, fig. 14)

TABLE 4

Upper Triassic zones, subzones and horizons

UPPER NORIAN
Choristoceras crickmayi (Tyaughton Creek)[1]
Paracochloceras amoenum (Tyaughton Creek)
Gnomohalorites cordilleranus (Mt. Ludington)
2. *Lissonites pecki* (Ducette Creek)
1. *Paraguembelites ludingtoni* (Black Bear Ridge)

MIDDLE NORIAN
Mesohimavatites columbianus (Brown Hill)
4. *Alloclionites welteri* (Pardonet Hill)
3. *Neohimavatites canadensis* (Crying Girl)
2. *Leiodistichites ursidens* (Crying Girl)
1. *Parathisbites oineus* (Crying Girl)
1c. *Pleurodistichites stotti* (Childerhose)
1b. *Eothetidites lacrimosus* (Childerhose)
1a. *Ectolcites childerhosei* (Childerhose)
Drepanites rutherfordi (Brown Hill)

LOWER NORIAN
Juvavites magnus (Brown Hill)
2. *Pterotoceras caurinum* (Brown Hill)
1. *Indojuvavites brunneus* (Brown Hill)
Malayites dawsoni (Brown Hill)
3. *Discomalayites carinatus* (Brown Hill)
2. *Pseudocardioceras idunae* (Brown Hill)
1. *Wangoceras pax* (Brown Hill)
Stikinoceras kerri (Brown Hill)
2. *Gonionotites rarus* (Brown Hill)
1. *Discostyrites ireneanus* (Pardonet Hill)

UPPER CARNIAN
Klamathites macrolobatus (Shoshone Mountains, Nevada)
Tropites welleri (Shasta County, California)
2. *Hoplotropites auctus* (Alaska Highway)
1. *Projuvavites brockensis* (Vancouver Island)
Tropites dilleri (Shasta County, California)

LOWER CARNIAN
Sirenites nanseni (Ewe Mountain)
Austrotrachyceras obesum (Ewe Mountain)
Trachyceras desatoyense (New Pass, Nevada)

[1]Type localities are in parentheses

Clionitites callazonensis n. sp. (Pl. 88, figs. 1–3)
Clionitites reesidei (Johnston) (Pl. 88, figs. 4–8)
Coroceras nasutum (Mojsisovics) (Pl. 89, fig. 1)
Coroceras sp. indet. (Pl. 88, figs. 10, 11)

Obesum Zone (Tozer, 1967, p. 31)

Index species. Austrotrachyceras obesum (Tozer).

Type locality. Ludington Formation, Ewe Mountain, British Columbia (GSC loc. 42308) (Tozer, 1967, p. 63).

Occurrence. Eastern Cordillera – Ludington Formation, Liard Formation, northeastern British Columbia.

Superposition above the Desatoyense Zone has not been established at the type locality, but is demonstrable in the Liard Formation, 6.5 km north of Clearwater Lake, British Columbia (GSC loc. 84200 above GSC loc. 84212).

Ammonoid fauna.
Austrotrachyceras obesum (Tozer) (Pl. 90, figs. 2, 3, 5, 6)
Sirenites sp. indet. (Pl. 90, fig. 4)

Nanseni Zone (Tozer, 1967, p. 37)

Index species. Sirenites nanseni **Tozer.**

Type locality. Ludington Formation, Ewe Mountain, British Columbia (GSC loc. 42311).

Occurrence. Arctic Islands – Schei Point Formation, Hat Island; Blaa Mountain Formation, Ellesmere and Axel Heiberg islands. Eastern Cordillera – Ludington Formation, northeastern British Columbia.

At the type locality, the Nanseni Zone overlies the Obesum Zone (GSC loc. 42311 above GSC loc. 42308) (Tozer, 1967, p. 63). In the Arctic Islands, it overlies beds with *Discophyllites taimyrensis* Popov and *Halobia zitteli* Lindstroem (Tozer, 1967, p. 45), which are Lower Carnian, but of unknown exact age.

Ammonoid fauna.
Sirenites nanseni Tozer (Pl. 91, figs. 4–6, 8–12)
Sirenites ovinus n. sp. (Pl. 91, figs. 2, 7)
Striatosirenites striatofalcatus (Hauer) (Pl. 91, fig. 1)
Clionitites arietinus n. sp. (Pl. 91, fig. 3)

UPPER CARNIAN SUBSTAGE (Tozer, 1984, p. 148)

Dilleri Zone (Silberling and Tozer, 1968, p. 42)

Index species. Tropites dilleri Smith.

Synonyms. Trachyceras Subzone of *Tropites subbullatus* Zone (Smith, 1927, p. 4); *Tropites dilleri* Subzone of *Tropites subbullatus* Zone (Silberling, 1956, p. 1152).

Type locality. Hosselkuss Limestone of Shasta County, California.

Occurrence. Eastern Cordillera – Ludington Formation, northeastern British Columbia. Intermontane Belt – Nicola Group and King Salmon Formation. Insular Belt (Wrangellia) – Karmutsen Group, Open Bay Formation, Quatsino Limestone, Sadler Limestone.

At the type locality in California, the underlying Pit Formation probably includes a correlative of the Nanseni Zone (Silberling and Tozer, 1968, p. 43). In the vicinity of Mount McLearn, British Columbia, the Dilleri Zone overlies the Obesum Zone (GSC loc. 68208 above GSC loc. 68209). There is also little doubt that the Dilleri Zone is in a higher stratigraphic position than the Nanseni Zone of GSC loc. 68215 (Tozer, 1967, p. 63).

Ammonoid fauna.
Parahauerites sp. indet. (Pl. 92, fig. 2)
Spirogmoceras shastense (Smith) (Pl. 92, fig. 13)
Trachystenoceras gabbi (Hyatt and Smith) (Pl. 92, fig. 1)
Hisnitites janmulleri n. sp. (Pl. 93, figs. 11, 14)
Trachysagenites sp. indet. (Pl. 94, fig. 5)
Sympolycyclus gunningi n. sp. (Pl. 92, fig. 17)
Leconteiceras californicum (Hyatt and Smith) (Pl. 92, fig. 16)
Sandlingites oribasus (Dittmar) (Pl. 104, fig. 1)
Traskites sp. indet. (Pl. 92, fig. 18)
Tropites dilleri Smith (Pl. 94, fig. 4)
Tropites keiliformis n. sp. (Pl. 93, fig. 13)
Gymnotropites americanus Hyatt and Smith (Pl. 92, fig. 15)
Pleurotropites gracilis (Smith) (Pl. 93, figs. 7–10, 12)
Pleurotropites sp. indet. (Pl. 93, fig. 4)
Pleurotropites gabbi (Smith) (Pl. 93, figs. 1–3, 5, 6; Pl. 94, fig. 2)
Discotropites sandlingensis (Hauer) (Pl. 92, figs. 6–11)
Indonesites sphaericus (Smith) (Pl. 94, fig. 1)
Paratropites sulfurensis n. sp. (Pl. 92, figs. 3–5)

Shastites vulcanus n. sp. (Pl. 92, figs. 12, 14), a species not known to be associated with any other, and from an isolated stratigraphic situation, is possibly of the Dilleri Zone fauna.

Welleri Zone (Silberling and Tozer, 1968, p. 42)

Index species. Tropites welleri Smith.

Synonyms. Juvavites Subzone of *Tropites subbullatus* Zone (Smith, 1927, p. 4), *Tropites welleri* Subzone of *Tropites subbullatus* Zone (Silberling, 1959, p. 21).

Type locality. Hosselkuss Limestone of Shasta County, California (Smith, 1927, p. 4).

Occurrence. Arctic Islands - Blaa Mountain Formation, Axel Heiberg Island; Schei Point Formation, Table Island. Eastern Cordillera - Ludington, Baldonnel and Pardonet formations, northeastern British Columbia. ?Otuk Formation, central Yukon. Omineca Belt - Slocan Group. Intermontane Belt - unnamed rocks, Telegraph Creek area. Insular Belt (Wrangellia) - Quatsino Limestone, Vancouver Island; Peril Formation, Queen Charlotte Islands.

At the type locality in California, the Welleri Zone overlies the Dilleri Zone (Smith, 1927, p. 4, Silberling and Tozer, 1968, p. 42). Two subzones are now recognized in Canada.

Subzone 1

Index species. Projuvavites brockensis (Smith).

Type locality. Quatsino Limestone near Klaskino Inlet, Vancouver Island (GSC locs. 53340, 82936, 86284).

Occurrence. Eastern Cordillera - Ludington Formation, northeastern British Columbia. Intermontane Belt - Unnamed rocks of Telegraph Creek area, British Columbia. Insular Belt (Wrangellia) - Quatsino Limestone, Vancouver Island; Peril Formation, Queen Charlotte Islands.

At the type locality, Subzone 1 overlies the Dilleri Zone (GSC loc. 86284 above GSC loc. 86293) (see also Carlisle and Susuki, 1974, p. 263, 278).

Ammonoid fauna. The following occur in the Cordillera. E indicates Eastern Cordillera; W, Western Cordillera.

Arctosirenites columbianus n. sp. (Pl. 97, figs. 1, 2) E
Trachysagenites sp. indet. (Pl. 94, fig. 10) W
Pamphagosirenites pamphagus (Dittmar) (Pl. 97, fig. 4) W
Pamphagosirenites pacificus n. sp. (Pl. 94, fig. 6; Pl. 97, fig. 3) W
Tropites izardi n. sp. (Pl. 95, fig. 10) W
Discotropites smithi Kutassy (Pl. 96, figs. 1-7; Pl. 104, fig. 14) E and W
Homerites semiglobosus (Hauer) (Pl. 98, figs. 1-4) E and W
Homeroceras grandis n. sp. (Pl. 98, figs. 5-7) E and W
Margaritropites johnsoni (Smith) (Pl. 95, figs. 13-15) E and W
Margaritropites kokeni (Smith) (Pl. 95, fig. 12) W
Jovites ellipticus n. sp. (Pl. 94, fig. 11) E and W
Tardeceras parvum Hyatt and Smith (Pl. 94, fig. 9; Pl. 99, figs. 1-4) W
Bacchites hyatti (Smith) (Pl. 94, fig. 8; Pl. 99, figs. 12-14) E and W
Projuvavites brockensis (Smith) (Pl. 94, fig. 7; Pl. 99, figs. 7-10) E and W
Projuvavites strongi (Smith) (Pl. 99, fig. 11) E

The following species from the Arctic Islands are tentatively attributed to Subzone 1 on the grounds that they occur at, or about, the level of *Arctosirenites*, which is in Subzone 1 of northeastern British Columbia. Some are demonstrably lower than *Jovites borealis* Tozer, which probably indicates Subzone 2.

Arctoarpadites costatus (Tozer) (Pl. 102, fig. 11)
Arctosirenites canadensis Tozer (Pl. 102, figs. 13-15)
Arctosirenites southeri n. sp. (Pl. 102, fig. 3)

Subzone 2

Index species. Hoplotropites auctus (Dittmar).

Type locality. Pardonet Formation, Alaska Highway, British Columbia (GSC loc. 42389 etc.) (Tozer, 1967, p. 62).

Occurrence. Arctic Islands - Schei Point Formation, Table Island; Blaa Mountain Formation, Ellesmere and Axel Heiberg islands. Eastern Cordillera - Baldonnel and Pardonet formations, northeastern British Columbia. Insular Belt (Wrangellia) - Quatsino Limestone, Vancouver Island; Peril Formation, Queen Charlotte Islands.

At the type locality, superposition of GSC loc. 42389 etc. above Subzone 1 (GSC locs. 42306, 42384) is probable, but not certain. Fragmentary specimens of *Discotropites* evidently indicate Subzone 2 (GSC loc. C-157063) above Subzone 1 (GSC loc. C-157061) in the Peril Formation at Bluejay Cove, Burnaby Island. Near Mount McLearn, Subzone 2 (GSC loc. 42320 etc.) overlies the Dilleri Zone (GSC loc. 68208) (Tozer, 1967, p. 64).

Ammonoid fauna. The following are known from the Cordillera. E, indicates Eastern Cordillera; W, the Insular Belt of the Cordillera.

Klamathites sp. indet. (Pl. 99, figs. 5, 6) E
Sympolycyclus kellyi (Smith) (Pl. 95, figs. 1-3) E
Pamphagosirenites pacificus n.sp.
Tropites bufonis n. sp. (Pl. 95, figs. 4, 8, 9) E
Paratropites teres n. sp. (Pl. 95, figs. 5-7, 11) E
Discotropites theron (Dittmar) (Pl. 96, figs. 8-15) E and W
Hoplotropites circumspinatus (Mojsisovics) (Pl. 104, fig. 13) W
Hoplotropites marii (Gemmellaro) (Pl. 97, fig. 9) E
Hoplotropites auctus (Dittmar) (Pl. 97, figs. 10-18; Pl. 98, fig. 10) E
Hoplotropites(?) *globosus* n. sp. (Pl. 97, figs. 5, 6) E
Hoplotropites(?) *intermedius* n. sp. (Pl. 97, figs. 7, 8) E
Jovites bosnensis Mojsisovics (Pl. 98, figs. 8, 9) E and W
Goniojuvavites kellyi (Smith) (Pl. 100, figs. 1-6; Pl. 101, figs. 1-9) E and W
Neotenoceras simplex n. sp. (Pl. 104, fig. 2) W

Hoplotropites circumspinatus possibly characterizes a level lower than the remainder, and may be of an age intermediate between Subzones 1 and 2.

The following occur in the Arctic Islands, and probably indicate correlatives of Subzone 2, suggested by the close similarity between *Jovites borealis* and *J. bosnensis.*

Orthoceltites belcheri n. sp. (Pl. 103, fig. 1)
Yakutosirenites pentastichus (Vozin) (Pl. 102, fig. 1)
Sirenites yakutensis Kiparisova (Pl. 102, fig. 10)
Sirenites serotinus n. sp. (Pl. 102, figs. 2, 4-9)
Paratropites arcticus n. sp. (Pl. 103, figs. 7-9)
Jovites borealis Tozer (Pl. 103, fig. 6)
Arctotropites richardsi (Pl. 103, fig. 10)

The fauna from the Otuk Formation of Rackla River, Yukon (GSC loc. 97561) has:

Epiceratites yukonensis n. sp. (Pl. 103, fig. 2)
Sirenites serotinus n. sp. (Pl. 102, figs. 6-8)
Acanthotropites racklaensis n. sp. (Pl. 103, figs. 3-5)

The presence of *Sirenites serotinus* suggests correlation with the *Jovites borealis* beds of the Arctic Islands and, in turn, with Subzone 2.

Macrolobatus Zone (Silberling, 1959, p. 22)

Index species. Klamathites macrolobatus Silberling.

Type locality. Luning Formation, Union District, Shoshone Mountains, Nevada.

Occurrence. Eastern Cordillera - Ludington and Pardonet formations, northeastern British Columbia. Insular Belt (Wrangellia) - Peril Formation, Queen Charlotte Islands.

At the type locality, the Macrolobatus Zone overlies the *Klamathites schucherti* Zone, correlated with the Welleri Zone (Silberling, 1959, p. 18). At Mount Prudence, British Columbia, the Macrolobatus Zone is above Welleri Subzone 2 (GSC loc. 68221 above GSC loc. 68220). On Pardonet Hill, it is above Welleri Subzone 1 (GSC loc. 64627 above GSC loc. 64650). On Kunghit Island, the bed with *Margarijuvavites carlottensis* and *Tropithisbites densicostatus* overlies the Welleri Zone, probably Subzone 2 (GSC loc. C-157382 above GSC loc. C-157373). Other occurrences (GSC locs. 9687, 9688, 94738, C-157123) are not closely bracketed. The individual faunas differ from one another, and are probably not exactly the same age. Rough equivalence is indicated by the presence of *Anatropites. Tropithisbites densicostatus* occurs at the top of the zone in Nevada (Silberling, 1959, p. 19).

Ammonoid fauna. E indicates occurrence in the Eastern Cordillera; W, the Insular Belt.

Anatropites pardoneti n. sp. (Pl. 108, figs. 13-15) E
Anatropites cupressus n. sp. (Pl. 105, fig. 3) E
Anatropites maclearni n. sp. (Pl. 105, fig. 6; Pl. 108, figs. 11, 12) E
Anatropites silberlingi n. sp. (Pl. 105, fig. 2) E
Anatropites cascadensis n. sp. (Pl. 105, fig. 4; Pl. 108, fig. 16) E
Anatropites ausoniformis n. sp. (Pl. 105, fig. 5) E
Anatropites sulfurensis n. sp. (Pl. 108, figs. 9, 10) E

Anatropites sp. indet. (Pl. 104, fig. 12) W
Euisculites krystyni n. sp. (Pl. 107, figs. 7, 8) E
Styrites dawsoni n. sp. (Pl. 104, figs. 4–6) W
Tropiceltites pacificus n. sp. (Pl. 104, fig. 7) W
Thisbites huxleyi n. sp. (Pl. 104, fig. 3) W
Thisbites selwyni n. sp. (Pl. 108, figs. 1, 2) E
Hadrothisbites taylori n. sp. (Pl. 107, figs. 1, 2) E
Tropithisbites densicostatus (Silberling) (Pl. 104, figs. 8–10) W
Gonionotites avarus n. sp. (Pl. 105, fig. 1; Pl. 107, figs. 3–6) E
Gonionotites nobilis n. sp. (Pl. 106, figs. 2–7) E
Griesbachites auctoris n.sp (Pl. 106, figs. 1, 8) E
Margarijuvavites carlottensis (Whiteaves) (Pl. 104, fig. 11; Pl. 105, figs. 7–9) E and W

NORIAN STAGE

(Mojsisovics, 1869, p. 127)

Type locality. Triassic rocks in Hallstatt area, Austria (Tozer, 1984, p. 147). The Norian is regarded here as the ultimate Triassic stage. As such, it includes equivalents of the stratotype Rhaetian (Tozer, 1980c).

LOWER NORIAN SUBSTAGE (Tozer, 1984, p. 146)

Following Krystyn (1973, p. 130), the Magnus Zone is now included in the Lower Norian instead of the Middle Norian, as in Tozer (1967, p. 37).

Kerri Zone (Tozer, 1965c, p. 223; 1967, p. 35)

Index species. Stikinoceras kerri McLearn.

Synonyms. Stikinoceras Zone (McLearn, 1960a, p. 21; *Guembelites* Zone (Silberling, 1959, p. 22).

Type locality. Pardonet Formation, Brown Hill, Peace River, British Columbia where it comprises the *Metathisbites dawsoni* and overlying *Stikinoceras kerri* beds (GSC locs. 9851, 9854, 9856) (McLearn, 1960a, p. 21). Two subzones are now recognized, both present at Brown Hill (GSC locs. 97547, 97548).

Occurrence. Eastern Cordillera - Pardonet Formation, northeastern British Columbia. Intermontane Belt - unnamed rocks, Telegraph Creek area; Nicola Group, Ashcroft area. Insular Belt (Wrangellia) - Quatsino Limestone, Parson Bay Formation, Vancouver Island.

Subzone 1

Index species. Discostyrites ireneanus (McLearn).

Type locality. Pardonet Formation, Juvavites Cove, Pardonet Hill (GSC locs. 98512–98515).

Synonym. Styrites ireneanus Zone (McLearn, 1960a, p. 23).

Occurrence. Eastern Cordillera - Pardonet Formation, northeastern British Columbia.

As explained in the description of the localities, there is little doubt that this subzone at GSC locality 98880 is in a higher stratigraphic position than the Macrolobatus Zone of GSC locality 64628. Both these localities are about 800 m southeast of Juvavites Cove. The Macrolobatus Zone was located *in situ* in 1964, the Ireneanus Subzone in 1982. Failure to find the Macrolobatus Zone in 1982 was probably due to the increase in vegetation during the intervening 18 years. Evidence for this position for the Ireneanus Subzone is provided near Mount McLearn (GSC loc. 68181 above GSC loc. 68202). Carnian ammonoids are not known from the beds below the occurrences at Brown Hill (GSC loc. 97548) and near Carbon Creek (GSC loc. 42444).

Ammonoid fauna. (*indicates species also in Subzone 2).
Pinacoceras sp. indet. (Pl. 110, fig. 4)
Pterosirenites auritus Tozer (Pl. 110, figs. 6–10)*
Tornquistites transiens n. sp. (Pl. 118, fig. 5)
Tropiceltites columbianus (McLearn) (Pl. 109, figs. 3, 5, 7)*
Discostyrites ireneanus (McLearn) (Pl. 109, fig. 8; Pl. 110, figs. 1–3)
Thisbites custi McLearn (Pl. 108, figs. 5–8)
Thisbites petralis n. sp. (Pl. 108, figs. 3, 4)
Thisbites robustus n. sp. (Pl. 112, fig. 4)
Gonionotites gethingi McLearn (Pl. 114, fig. 4)
Gonionotites scapulatus n. sp. (Pl. 116, figs. 1–3)
Gonionotites spiekeri McLearn (Pl. 114, fig. 9)
Griesbachites pinensis n. sp. (Pl. 115, figs. 8, 9)
Dimorphites pardonetiensis McLearn (Pl. 114, fig. 1) *
Guembelites clavatus (McLearn) (Pl. 118, figs. 1–4)

Subzone 2

Index species. Gonionotites rarus (McLearn).

Type locality. Pardonet Formation, GSC locality 98510, GSC locality 98561 and intervening beds, Juvavites Cove, Pardonet Hill, British Columbia.

Occurrence. Eastern Cordillera - Pardonet Formation, northeastern British Columbia. Intermontane Belt - unnamed rocks, Telegraph Creek area; Nicola Group, Ashcroft area. Insular Belt (Wrangellia) - Quatsino Limestone and Parson Bay Formation, Vancouver Island.

At the type locality, Subzone 2 overlies Subzone 1 (GSC loc. 98561 above GSC loc. 98515). This relationship is also evident at Brown Hill (GSC loc. 97547 above GSC loc. 97548) and near Mount McLearn (GSC loc. 68180 above GSC loc. 68181).

Ammonoid fauna. From the Eastern Cordillera:
- *Pterosirenites auritus* Tozer (Pl. 111, figs. 2-6)
- *Clionitites punctulus* n. sp. (Pl. 109, fig. 14)
- *Clionitites laevis* n. sp. (Pl. 109, fig. 15)
- *Styrites communis* Mojsisovics (Pl. 109, figs. 9, 10)
- *Tropiceltites columbianus* (McLearn) (Pl. 109, fig. 4)
- *Tropiceltites inflatus* n. sp. (Pl. 109, figs. 1, 2)
- *Metathisbites dawsoni* (McLearn) (Pl. 109, figs. 11-13; Pl. 117, fig. 6)
- *Stikinoceras kerri* McLearn (Pl. 109, figs. 17, 19, 20; Pl. 119, fig. 1)
- *Gonionotites rarus* McLearn (Pl. 119, fig. 8)
- *Griesbachites humi* (McLearn) (Pl. 115, figs. 1-7; Pl. 117, fig. 2)
- *Griesbachites laevis* n. sp. (Pl. 114, figs. 5-7)
- *Griesbachites borealis* n. sp. (Pl. 112, figs. 1-3; Pl. 113, figs. 1-5)
- *Griesbachites selwyni* (McLearn) (Pl. 114, fig. 8)
- *Dimorphites pardonetiensis* McLearn (Pl. 114, figs. 2, 3)
- *Guembelites jandianus* Mojsisovics (Pl. 117, figs. 3-5)
- *Discophyllites ebneri* (Mojsisovics) (Pl. 111, fig. 1)

Metathisbites(?) *griphus* n. sp. (Pl. 109, fig. 16; Pl. 113, fig. 6) is of an uncertain stratigraphic position, probably close to that of this subzone.

A new genus of Tibetitidae (Pl. 110, fig. 5) and *Stikinoceras kerri* McLearn occur in close association in the Nicola Group of the Intermontane Belt.

Dawsoni Zone (Tozer, 1965c, p. 223; 1967, p. 36)

Index species. Malayites dawsoni McLearn.

Type locality. Pardonet Formation, Brown Hill, Peace River, British Columbia (GSC loc. 9850) (McLearn, 1960a, p. 15). The "*Gonionotites belli* bed" (GSC loc. 9845), formerly regarded as an upper division of the Dawsoni Zone (Tozer, 1965c, p. 223; 1967, p. 36), is now treated as Subzone 1 of the Magnus Zone. Three subzones, typically developed at Brown Hill, are now recognized.

Occurrence. Eastern Cordillera - Pardonet Formation, northeastern British Columbia.

Subzone 1

Index species. Wangoceras pax (Tozer).

Type locality. Pardonet Formation, Brown Hill, Peace River, British Columbia (GSC locs. 64664, 97546).

Occurrence. Eastern Cordillera - Pardonet Formation, northeastern British Columbia.

At the type locality, and at Pardonet Hill, Subzone 1 overlies Kerri Subzone 2 (GSC loc. 64664 above GSC loc. 64666; GSC loc. 64606 above GSC loc. 64607). Also known from an isolated occurrence south of Christina Falls (GSC loc. 47005).

Ammonoid fauna.
- *Norosirenites krystyni* n. sp. (Pl. 119, figs. 2-5)
- *Wangoceras pax* (Tozer) (Pl. 120, figs. 1-6)
- *Malayites bococki* (McLearn) (Pl. 120, figs. 8-13)

Subzone 2

Index species. Pseudocardioceras idunae (Diener).

Type locality. Pardonet Formation, (GSC locs. 97543, 97544, 97576), Brown Hill, Peace River, British Columbia.

Occurrence. Eastern Cordillera - Pardonet Formation, northeastern British Columbia.

At the type locality, and on Pardonet Hill, this subzone overlies Subzone 1 (GSC loc. 97544 above GSC loc. 97546; GSC loc. 64605 above GSC loc. 64606). Also represented at numerous localities between Pine Pass and Mount McLearn, northeastern British Columbia. Localities that contribute to the fauna are northwest of Mount McLearn (GSC loc. 68200), south of Mount McLearn (GSC locs. 42328, 42329), and at Pardonet Hill (GSC loc. 9722).

Ammonoid fauna.
- *Malayites dawsoni* McLearn (Pl. 121, figs. 8-13)
- *Dryojuvavites orchardi* n. sp. (Pl. 119, fig. 6)
- *Pseudocardioceras idunae* (Diener) (Pl. 121, fig. 2)

Pseudocardioceras acutum (Mojsisovics) (Pl. 121, fig. 1)
Omojuvavites fuscus (McLearn) (Pl. 119, fig. 7)
Omojuvavites magnumbilicatus n. sp. (Pl. 121, fig. 6)
Omojuvavites minor n. sp. (Pl. 121, fig. 7)

Subzone 3

Index species. Discomalayites carinatus n. sp.

Type locality. Pardonet Formation, Brown Hill, Peace River, British Columbia (GSC loc. 97542).

Occurrence. Eastern Cordillera – Pardonet Formation, northeastern British Columbia.

At the type locality, and northwest of Mount McLearn, Subzone 3 overlies Subzone 2 (GSC loc. 97542 above GSC loc. 97543; GSC loc. 68193 above GSC loc. 68190) (Tozer, 1967, p. 60).

Ammonoid fauna.
Discomalayites carinatus n. sp. (Pl. 121, figs. 3–5)
Omojuvavites rostratus n. sp. (Pl. 122, fig. 1)
Omojuvavites ventroplicatus n. sp. (Pl. 122, figs. 2–5).

Magnus Zone (Tozer, 1965c, p. 223; 1967, p. 37)

Index species. Juvavites magnus McLearn.

Type locality. Pardonet Formation, Brown Hill, Peace River, British Columbia. Originally defined for the *Juvavites magnus* bed (GSC loc. 9836) alone. Now interpreted as including the underlying "*Gonionotites belli*" bed (GSC loc. 9845). Two subzones, both typically developed at Brown Hill, are now recognized.

Occurrence. Eastern Cordillera – Pardonet Formation, northeastern British Columbia. Intermontane Belt – Lewes River Group, Formation D, southern Yukon.

Subzone 1

Index species. Indojuvavites brunneus n. sp.

Type locality. Pardonet Formation Brown Hill, Peace River (GSC locs. 9845, 97541).

Occurrence. Eastern Cordillera – Pardonet Formation, northeastern British Columbia.

At the type locality, Subzone 1 overlies Dawsoni Subzone 3 (GSC loc. 97541 above GSC loc. 97542). Also represented at Crying Girl Prairie Creek (GSC locs. 97558, 97560), Mount Laurier (GSC loc. 83894), northeast of Mount Stearns (GSC loc. 50028) and probably also near Mount McLearn (GSC loc. 68199).

Ammonoid fauna.
Oxytibetites welteri n. sp. (Pl. 128, fig. 1)
Epijuvavites transiens n. sp. (Pl. 122, figs. 6–8)
Indojuvavites laurieri n. sp. (Pl. 123, figs. 2–5; Pl. 127, figs. 4, 5)
Indojuvavites brunneus n. sp. (Pl. 123, fig. 1; Pl. 127, figs. 3, 7, 8).

Subzone 2

Index species. Dimorphotoceras caurinum (McLearn).

Type locality. Pardonet Formation Brown Hill, Peace River, British Columbia (GSC locs. 9836, 97539).

Occurrence. Eastern Cordillera – Pardonet Formation, northeastern British Columbia.

At the type locality, and at Crying Girl Prairie Creek, Subzone 2 overlies Subzone 1 (GSC loc. 97539 above GSC loc. 97541; GSC loc. 83829 above GSC loc. 97558). Also recognized at McLay Spur (GSC loc. 98537), Black Bear Section (GSC loc. 64636), south of Halfway River (GSC locs. 82452, 82663), and probably also near Mount McLearn (GSC locs. 68191, 68198). At Crying Girl Prairie Creek, *Neotibetites minor* occurs 1.2 m above *Juvavites magnus* (GSC loc. 83830 above GSC loc. 83829).

Ammonoid fauna.
Dimorphotoceras caurinum (McLearn) (Pl. 126, figs. 2, 4)
Dimorphotoceras arctum (McLearn) (Pl. 126, fig. 1)
Dimorphotoceras elegantulum (McLearn) (Pl. 126, fig. 3; Pl. 128, fig. 14)
Dimorphotoceras ursinum n. sp. (Pl. 128, fig. 13)
Sirenotibetites cornutus n. sp. (Pl. 127, figs. 1, 2)
Neotibetites minor n. sp. (Pl. 128, fig. 3)
Prodrepanites catenatus n. sp. (Pl. 128, fig. 7)
Acanthinites magnificus (McLearn) (Pl. 124, figs. 1, 5, 6)
Indojuvavites falcatus n. sp. (Pl. 125, fig. 6)
Juvavites subangulatus n. sp. (Pl. 125, figs. 1–5)
Juvavites gibbosus n. sp. (Pl. 126, figs. 7, 8)
Juvavites magnus McLearn (Pl. 123, fig. 8; Pl. 124, fig. 4)
Juvavites concretus McLearn (Pl. 123, fig. 6; Pl. 124, fig. 3; Pl. 126, figs. 5, 6)

Juvavites biornatus McLearn (Pl. 124, fig. 2)
Juvavites levigatus n. sp. (Pl. 123, fig. 7; Pl. 127, fig. 6)

Ammonoids from the Lewes River Group are not well preserved, but probably represent the Magnus Zone. They comprise:

Sirenotibetites? sp. indet. (Pl. 126, fig. 9)
Arietoceltites lewesensis n. sp. (Pl. 126, fig. 10)
Indojuvavites sp. indet. (Pl. 126, figs. 11–15) (= *Juvavites subinterruptus* Mojsisovics of Lees, 1934, p. 40).

MIDDLE NORIAN SUBSTAGE (Tozer, 1984, p. 147)

Rutherfordi Zone (Tozer, 1965c, p. 222; 1967, p. 37)

Index species. Drepanites rutherfordi McLearn.

Type locality. Pardonet Formation, Brown Hill, Peace River, British Columbia where it comprises the *Drepanites* beds and overlying *Cyrtopleurites* beds of McLearn (1960a, p. 15) (GSC locs. 9840–9842, 97529–97534).

Occurrence. Eastern Cordillera – Pardonet Formation, northeastern British Columbia. Insular Belt (Wrangellia) – Parson Bay Formation, Vancouver Island.

At the type locality, at McLay Spur, and at Crying Girl Prairie Creek, the Rutherfordi Zone overlies Magnus Subzone 2 (GSC loc. 97536 above GSC loc. 97539; GSC loc. 98876 above GSC loc. 98537; GSC loc. 83831 above GSC loc. 83830). The Rutherfordi Zone is also known north of Carbon Peak (GSC loc. 83896). At both Crying Girl Prairie Creek and Brown Hill, several successive beds are attributed to this zone, but at present no formal subzonal scheme is recognized.

Ammonoid fauna.
Paragymnites symmetricus (Mojsisovics) (Pl. 129, fig. 5)
Metaclionites taylori n. sp. (Pl. 129, fig. 12)
Carinacanthites calypso (Mojsisovics) (Pl. 129, fig. 11)
Cyrtopleurites bicrenatus (Hauer) (Pl. 129, figs. 1–4)
Cyrtopleurites hersiliae Diener (Pl. 128, figs. 11, 12)
Drepanites rutherfordi McLearn (Pl. 128, figs. 5, 6)
Acanthodrepanites dieneri n. sp. (Pl. 128, figs. 8–10)
Hauerites piceus n. sp. (Pl. 129, figs. 6–9)
Hauerites astrictus n. sp. (Pl. 128, fig. 2)
Heraclites canadensis n. sp. (Pl. 128, fig. 4)
Parisculites mundus (McLearn) (Pl. 129, figs. 13–14)
Didymites quenstedti Mojsisovics (Pl. 129, fig. 10)
Didymites sp.

The recognition of this zone in the Parson Bay Formation is based on the occurrence of *Didymites* sp. indet. (Muller et al., 1981, p. 13).

Columbianus Zone (Tozer, 1965c, p. 222; 1967, p. 37)

Index species. Himavatites columbianus McLearn.

Type locality. McLearn (1960a, p 26) gave no type locality for the *Himavatites* Zone. The Columbianus Zone was first introduced to include the *Parathisbites oineus* beds and the *Himavatites* Zone (Tozer, 1965c, p. 222), the two being in sequence on Pardonet Hill, as shown by McLearn's observations. Later, the beds with *Himavatites* that overly the Rutherfordi Zone at Brown Hill were designated as typical (Tozer, 1967, p. 37). *Parathisbites oineus* is now known at Brown Hill (GSC loc. 97526).

Four subzones are now recognized in the Columbianus Zone, with three horizons in the earliest (Subzone 1).

Occurrence. Arctic Islands – Heiberg Formation, Axel Heiberg Island. Eastern Cordillera – Pardonet Formation, northeastern British Columbia. Insular Belt (Wrangellia) – Parson Bay Formation, Vancouver Island; Peril Formation, Queen Charlotte Islands.

Subzone 1

Index species. Parathisbites oineus McLearn.

Type locality. Pardonet Formation, Childerhose Cove, Williston Lake where it overlies the Rutherfordi Zone and is divisible into three horizons (1a–1c).

Occurrence. Eastern Cordillera – Pardonet Formation, northeastern British Columbia. Insular Belt (Wrangellia) – Parson Bay Formation, Vancouver Island?

Horizon 1a

Index species. Neodidymites tatzreiteri n. sp.

Type locality. Pardonet Formation, Childerhose Cove, Williston Lake (GSC loc. 98885). At this locality, Horizon 1a is at a higher level than the Rutherfordi Zone of McLay Spur (GSC loc. 98885 being higher than GSC locs. 98876 and 98875).

Ammonoid fauna.
Pseudosirenites pardoneti (McLearn)
Himavatites sp. indet.
Ectolcites childerhosei n. sp. (Pl. 143, figs. 10, 11)
Neodidymites tatzreiteri n. sp. (Pl. 142, fig. 4)
Parathisbites oineus McLearn

Horizon 1b

Index species. Eothetidites lacrimosus n. sp.

Type locality. Pardonet Formation, McLay Spur (GSC locs. 98877, 98878), where it overlies Horizon 1a of Childerhose Cove (GSC loc. 98885). Also represented at Crying Girl Prairie Creek (GSC loc. 83835) and at Brown Hill (GSC loc. 97528), where it overlies the Rutherfordi Zone (GSC locs. 83849, 97529).

Ammonoid fauna.
Pseudosirenites pardoneti (McLearn) (Pl. 135, figs. 6, 7)
Himavatites planiplicatus n. sp. (Pl. 132, figs. 1–4)
Ectolcites childerhosei n. sp. (Pl. 143, fig. 12)
Distichites columbianus n. sp. (Pl. 137, fig. 9)
Distichites gethingi McLearn (Pl. 137, fig. 7)
Eothetidites lacrimosus (Pl. 138, figs. 1–7)
Parathisbites oineus McLearn (Pl. 135, fig. 4; Pl. 142, fig. 16)

Horizon 1c

Index species. Pleurodistichites stotti Tozer.

Type locality. Pardonet Formation, Childerhose Cove, Williston Lake, (GSC loc. 98542), where it overlies Horizon 1b of McLay Spur (GSC loc. 98877). Also represented at Nevis Creek (GSC loc. 66027).

Ammonoid fauna.
Pseudosirenites pardoneti (McLearn)
Himavatites planiplicatus n. sp.
Pleurodistichites stotti (Tozer) (Pl. 137, figs. 1, 2)
Distichites columbianus n. sp.
Distichites gethingi McLearn
Distichites canadensis McLearn
Parathisbites obtusus n. sp. (Pl. 142, fig. 15)
Phormedites transiens n. sp. (Pl. 142, fig. 14)
Phormedites juvavicus Mojsisovics (Pl. 130, figs. 1, 2)

The *Parathisbites* bed of Pardonet Hill (GSC loc. 98518) has the following, indicating Subzone 1, but not the precise horizon:

Pseudosirenites pardoneti (McLearn)
Distichites gethingi McLearn
Pleurodistichites sp. indet. (Pl. 143, fig. 2)
Helictites minor n. sp. (Pl. 142, fig. 6)
Parathisbites oineus McLearn
Parathisbites pardoneti n. sp. (Pl. 142, fig. 7)

Pleurodistichites hindei (Mojsisovics) (Pl. 136, fig. 1), from the Parson Bay Formation of Vancouver Island (GSC loc. 21430), probably also indicates Subzone 1.

Subzone 2

Index species. Leiodistichites ursidens n. sp.

Type locality. Pardonet Formation, Crying Girl Prairie Creek (GSC locs. 83834 = 97555, 97557).

Occurrence. Eastern Cordillera, Pardonet Formation, northeastern British Columbia. Insular Belt (Wrangellia), Parson Bay Formation, Vancouver Island.

At the type locality, Subzone 2 overlies Subzone 1, Horizon 1b (GSC loc. 83834 above GSC loc. 83835). Occurrences correlated with Subzone 2 also overly Subzone 1 at Pardonet Hill (GSC locs. 9767 and 9781 above GSC loc. 9764). Occurrences of Subzone 2 not known to be in sequence with Subzone 1 are at Sikanni Chief River (GSC loc. 10739), Mount Stearns (GSC loc. 74775), probably south of Halfway River (GSC loc. 82454 = 82662), at the Black Bear section (GSC locs. 9741, 9744, 98552 = 98870, 98550 = 98868, 98549 = 98867) and from the Parson Bay Formation of Vancouver Island (GSC locs. 19275, 19678).

Two horizons are known at Crying Girl Prairie Creek, three at the Black Bear Section, but formal designation is not introduced at present.

Ammonoid fauna.

Paragymnites symmetricus (Mojsisovics (Pl. 129, fig. 5)
Pinacoceras parma Mojsisovics
Pseudosirenites pardoneti (McLearn) (Pl. 135, fig. 7)
Pseudosirenites pressus (McLearn) (Pl. 143, fig. 4)
Steinmannites pacificus n. sp. (Pl. 131, figs. 5, 6)
Eosteinmannites orientalis n. sp. (Pl. 143, fig. 3)
Himavatites multiauritus McLearn (Pl. 132, fig. 5; Pl. 134, figs. 2, 12, 13)
Himavatites apinnatus n. sp. (Pl. 134, figs. 3-5)
Mesohimavatites parvus n. sp. (Pl. 133, figs. 1-4, 9)
Mesohimavatites costatus n. sp. (Pl. 134, fig. 6)
Mesohimavatites columbianus (McLearn) (Pl. 133, figs. 5-8; Pl. 134, fig. 11)
Distichites gethingi McLearn (Pl. 137, fig. 8)
Distichites canadensis McLearn (Pl. 136, figs. 7, 11)
Leiodistichites ursidens n. sp (Pl. 137, figs. 3-5)
Leiodistichites beachi n. sp. (Pl. 143, fig. 9)
Eothetidites pardoneti n. sp. (Pl. 141, fig. 9)
Parathetidites exquisitus (McLearn) (Pl. 139, figs. 11, 19)
Parathetidites robustus n. sp. (Pl. 138, fig. 8)
Parathetidites laevis n. sp. (Pl. 142, fig. 8)
Helictites decorus McLearn (Pl. 137, fig. 6)
Helictites pacalis n. sp. (Pl. 135, fig. 5)
Leislingites semiviatus n. sp. (Pl. 142, fig. 5)
Episculites browni (McLearn) (Pl. 132, figs. 11, 12)
Episculites teres (McLearn) (Pl. 133, fig. 10; Pl. 141, figs. 1-3; Pl. 142, figs. 12, 13)
Hypisculites stelcki (McLearn) (Pl. 136, fig. 9)
Hypisculites minor n. sp. (Pl. 136, fig. 8)
Phormedites juvavicus Mojsisovics
Parajuvavites canadensis n. sp. (Pl. 140, figs. 4-9).
Rhacophyllites debilis (Hauer) (Pl. 136, fig. 3)

Subzone 3

Index species. Neohimavatites canadensis (McLearn).

Type locality. Pardonet Formation, Crying Girl Prairie Creek (GSC locs. 83848 = 97554, 97552).

Occurrence. Arctic Islands: Heiberg Formation, Axel Heiberg and Ellesmere islands. Eastern Cordillera - Pardonet Formation, northeastern British Columbia.

At the type locality, Subzone 3 overlies Subzone 2 (GSC locs. 97552 and 97554 above GSC loc. 97555). This relationship is also evident at the Black Bear Section (GSC loc. 98909 above GSC loc. 98867) and at Mount Stearns (GSC loc. 74776 and 74777 above GSC loc. 74775), probably also along the Sikanni Chief River (GSC loc. 10740 above GSC loc. 10739), and Pardonet Hill (GSC loc. 98522 above GSC loc. 9767). The subzone is also known from Halfway River (GSC loc. 82455) and at Mount Ludington (e.g., GSC loc. 68301). Occurrences with *Neohimavatites burlingi* near Besa River (GSC loc. 65935) and along the Peace River (GSC loc. 9784) correlate closely with one another and at least roughly with Subzone 3. A faunule from a talus block at Brown Hill (GSC loc. 9471) containing *Idaoceras maclearni* probably represents a distinct horizon within this subzone. Ammonoids from the Parson Bay Formation of Vancouver Island (GSC locs. 21431, 24352) probably also represent this subzone.

Ammonoid fauna.

Sagenites sp. indet. (McLearn, 1960a, Pl. 19, fig. 5)
Pseudosirenites bullatus n. sp. (Pl. 136, figs. 5, 10; Pl. 143, fig. 8)
Alloclionites dieneri n. sp. (Pl. 130, fig. 3; Pl. 131, figs. 8, 9)
Alloclionites jeanneti n. sp. (Pl. 130, fig. 7)
Steinmannites sp. indet. (Pl. 131, fig. 7)
Eosteinmannites nitidus n. sp. (Pl. 131, fig. 4)
Eosteinmannites ursensis n. sp. (Pl. 131, fig. 3)
Mesohimavatites sp.
Neohimavatites canadensis (McLearn) (Pl. 132, figs. 9, 10).
Neohimavatites peregrinus n. sp. (Pl. 135, figs. 1-3)
Neohimavatites burlingi (McLearn) (Pl. 132, fig. 8; Pl. 134, fig. 1)
Pseudothetidites brysonis (Diener) (Pl. 139, fig. 15)
Leislingites quadratus n. sp. (Pl. 139, figs. 1-10)
Leislingites politus n. sp. (Pl. 135, figs. 11-13; Pl. 139, figs. 12-14)
Leislingites vancouverensis n. sp. (Pl. 139, figs. 16-18)
Idaoceras maclearni n. sp. (Pl. 142, figs. 1-3)
Thetidites nudus n. sp. (Pl. 142, fig. 9)
Episculites crassus n. sp. (Pl. 142, figs. 10, 11)
Episculites wrighti n. sp. (Pl. 136, fig. 2; Pl. 141, fig. 4)
Parajuvavites canadensis n. sp. (Pl. 140, figs. 1-3; Pl. 141, figs. 7, 8)
Halorites sp. indet. (Pl. 141, fig. 6)

Subzone 4

Index species. Alloclionites welteri n. sp.

Type locality. Pardonet Formation, Pardonet Hill (GSC locs. 9768, 64634, 64643, 98521).

Occurrence. Eastern Cordillera - Pardonet Formation, northeastern British Columbia. Insular Belt (Wrangellia) - Parson Bay Formation, Vancouver Island?

At the type locality, Subzone 4 overlies Subzone 3 (GSC loc. 98521 above GSC loc. 98522). A similar relationship is evident at Sikanni Chief River (GSC locs. 10741, 10742 and 10750 above GSC loc. 10740), and at Crying Girl Prairie Creek (GSC loc. 83847 above GSC loc. 83848). The subzone is also represented at Blue Grave Creek (GSC loc. 47004), and possibly near Nevis Creek (GSC loc. 52233).

Ammonoid fauna.

Sagenites sp. indet. (Pl. 141, fig. 5)
Pseudosirenites falcatus n. sp. (Pl. 135, figs. 8–10)
Alloclionites welteri n. sp. (Pl. 130, figs. 4–6, 8)
Brouwerites maclearni n. sp. (Pl. 130, fig. 9; Pl. 143, figs. 6, 7)
Brouwerites stotti n. sp. (Pl. 130, figs. 10–13)
Mesohimavatites caponicus n. sp. (Pl. 132, fig. 7; Pl. 134, figs. 7–10)

Eomonotis pinensis (Westermann) also characterizes Subzone 4.

Clydonites pacificus n. sp. (Pl. 136, fig. 4), which occurs 10 m below *Monotis subcircularis* Gabb off the west coast of Vancouver Island (GSC loc. 20255), possibly indicates a correlation with Subzone 4.

UPPER NORIAN SUBSTAGE (Tozer, 1984, p. 148)

Cordilleranus Zone (Tozer, 1979, p. 127)

Index species. Gnomohalorites cordilleranus Tozer.

Synonym. Lower Suessi Zone (Tozer, 1967, p. 39)

Type locality. Pardonet Formation, Mount Ludington, British Columbia (GSC locs. 68300, 68304) (Tozer, 1967, p. 55).

Occurrence. Eastern Cordillera - Pardonet Formation, northeastern British Columbia. Interior Belt - Lewes River Group, Formation D, southern Yukon; Sinwa Formation, northern British Columbia; Tyaughton Group, southern British Columbia. Insular Belt - Parson Bay Formation, Vancouver Island; Peril Formation, Queen Charlotte Islands.

Two subzones are now recognized. At the type locality, the lower subzone overlies Columbianus Subzone 3 (GSC locs. 68300, 68304 above GSC locs. 68301, 68302, 68303). At Pardonet Hill, beds with *Monotis subcircularis* Gabb, correlated with Cordilleranus Subzone 1, overly Columbianus Subzone 4 (GSC locs. 64634, 64643, 98521).

Subzone 1

Index species. Paraguembelites ludingtoni Tozer.

Type locality. Pardonet Formation, Black Bear Section (GSC loc. 98534).

Occurrence. Eastern Cordillera - Pardonet Formation, northeastern British Columbia. Interior Belt - Lewes River Group, southern Yukon; Sinwa Formation, northern British Columbia; Tyaughton Group, southern British Columbia. Insular Belt (Wrangellia) - Parson Bay Formation, Vancouver Island.

At the type locality, this subzone is above beds with *Eomonotis pinensis* Westermann, which correlate with Columbianus Subzone 4.

In addition to the type locality, this subzone is represented at Mount Ludington (GSC locs. 68300, 68304), near the headwaters of Eleven Mile Creek (GSC locs. 98558, 98559) and at Pine Pass (GSC loc. 97550). The combined fauna from these localities is:

Ammonoid fauna.

Paragymnites symmetricus (Mojsisovics) (Pl. 144, fig. 13)
Sagenites sp. indet. (Pl. 144, fig. 9)
Nassichukites dimidiatus Tozer (Pl. 146, figs. 15–17)
Paraguembelites ludingtoni Tozer (Pl. 145, figs. 7–14)
Paraguembelites inflatus n. sp. (Pl. 144, figs. 14–18)
Gnomohalorites cordilleranus Tozer (Pl. 145, figs. 3, 4)
Metasibirites columbianus (Pl. 146, fig. 13)
Metasibirites speratus n. sp. (Pl. 146, fig. 14)
Ophiorhabdoceras canadense n.sp. (Pl. 144, figs. 20, 21)
Rhabdoceras suessi Hauer (Pl. 144, figs. 1–8)

Peripleurites roemeri Mojsisovics (Pl. 144, figs. 10–12)
Tragorhacoceras occultum (Mosjsisovics) (Pl. 146, fig. 18)

Gnomohalorites yukonensis Tozer (Pl. 145, fig. 1) and *Rhacophyllites debilis* (Hauer) (Pl. 145, fig. 6) from the Lewes River Group of southern Yukon probably indicate this subzone. *Gnomohalorites southeri* Tozer (Pl. 145, fig. 2) from the Sinwa Formation of the Intermontane Belt and occurrences of *Gnomohalorites* from the Tyaughton Group (GSC loc. 56410) and Parson Bay Formation (Pl. 145, fig. 5) probably also indicate Subzone 1. *Nannosteinmannites yukonensis* n. sp. (Pl. 144, fig. 19), which occurs with *Monotis* in northern Yukon, represents either Subzone 1 or Subzone 2.

Subzone 2

Index species. Lissonites pecki n. sp.

Type locality. Pardonet Formation, near headwaters of Eleven Mile Creek, British Columbia (GSC locs. 83816, 83817).

Occurrence. Eastern Cordillera – Pardonet Formation, northeastern British Columbia.

At the type locality (GSC loc. 83816), Subzone 2 is in beds with *Monotis ochotica* (Keyserling) near the top of the Pardonet Formation. Faunas with *Monotis subcircularis* Gabb and ammonoids indicating Subzone 1 (GSC locs. 98558, 98559) occur in loose blocks derived from nearby lower beds. Superposition of Subzone 2 above Subzone 1 is also evident at the Black Bear Section (GSC loc. 98545 above GSC loc. 98534).

Ammonoid fauna.
Lissonites canadensis Tozer (Pl. 146, figs. 1–7, 9–12)
Lissonites pecki n. sp. (Pl. 146, fig. 8)

Monotis subcircularis Gabb, *M. ochotica* (Keyserling) and *M. alaskana* Smith characterize the Cordilleranus Zone and permit the recognition of correlatives at localities in the Arctic Islands and northern Yukon, where Upper Norian ammonoids are unknown.

Amoenum Zone (Tozer, 1979, p. 127)

Index species. Paracochloceras amoenum Mojsisovics.

Synonym. Upper Suessi Zone (Tozer, 1967, p. 39).

Type locality. Cassianella Beds of Tyaughton Group (GSC locs. 56405, 56414, 56415 etc.) Tyaughton Creek Valley, British Columbia.

Occurrence. Eastern Cordillera – Pardonet Formation, *Rhacophyllites* beds, northeastern British Columbia. Intermontane Belt – Tyaughton Group, southern British Columbia; Lewes River Group, Formation F, southern Yukon. Insular Belt (Wrangellia) – Parson Bay Formation, Vancouver Island.

At the type locality, the *Cassianella* Beds overly beds with *Gnomohalorites* (GSC loc. 56410) and *Monotis subcircularis* Gabb, indicating the Cordilleranus Zone (Tozer, 1967, p. 77). This relationship is also evident in the Lewes River Group of southern Yukon (Tozer, 1958, p. 7) and, as determined by J.A. Jeletzky, in the Parson Bay Formation of Vancouver Island (Tozer, 1967, p. 80). The principal occurrences in the Lewes River Group are at GSC loc. 14860 and GSC loc. 23429, and in the Parson Bay Formation at GSC loc. 23072 and GSC loc. 24333.

Ammonoid fauna.
Placites polydactylus (Mojsisovics) (Pl. 147, fig. 24)
Sagenites sp. indet. (Pl. 147, fig. 23)
Arcestes sp.
Tozeria yukonensis n. sp. (Pl. 147, fig. 4)
Rhabdoceras suessi Hauer (Pl. 147, figs. 1, 2)
Paracochloceras canaliculatum (Hauer) (Pl. 147, fig. 10)
Paracochloceras suessi Mojsisovics (Pl. 147, figs. 7, 8)
Paracochloceras amoenum Mojsisovics (Pl. 147, fig. 9)
Rhacophyllites debilis (Hauer) (Pl. 147, fig. 6)

The faunas from the *Rhacophyllites* beds in the Pardonet Formation of Peace River, (GSC locs. 9778, 64594, 64595, 98886, 98887) (Tozer, 1982a), which overly beds with *Monotis,* include *Placites polydactylus* (Mojsisovics), *Pinacoceras* sp. indet., *Arcestes syngonus* Mojsisovics, *Rhabdoceras suessi* Hauer (Pl. 144, figs. 1, 2) and *Rhacophyllites debilis* (Hauer). In Canada, *Placites polydactylus* is unknown in beds older than the Amoenum Zone, which indicates that these beds may be of that age. The conodont fauna of the *Rhacophyllites* beds confirms this interpretation (M.J. Orchard, pers. comm.).

Crickmayi Zone (Tozer, 1979, p. 128)

Index species. Choristoceras crickmayi Tozer.

Synonym. Choristoceras marshi Zone of Tozer (1967, p. 42).

Type locality. Green sandstone and conglomerate unit of Tyaughton Group, Tyaughton Creek valley, southern British Columbia (GSC locs. 10095, 56395) (Tozer, 1967, p. 77).

Occurrence. Intermontane belt - Tyaughton Group, southern British Columbia. Insular Belt (Wrangellia) - Sutton Formation, Vancouver Island; Sandilands Formation, Queen Charlotte Islands.

At the type locality, the Crickmayi Zone overlies the *Cassianella* beds (Amoenum Zone) (Tozer, 1967, p. 77).

Augmented, by including fauna of the Sutton Formation (GSC locs. 23370, 23372, 23374, 23379, 23380) and Sandilands Formation (GSC locs. C-156962, C-156963, C-157651) on the grounds that their Choristoceratidae indicate a correlation with the Crickmayi Zone.

Ammonoid fauna.

Placites polydactylus (Mojsisovics) (Fig. 120, f)
Megaphyllites sp. indet. (Pl. 147, fig. 5)
Arcestes sp. indet.
Cycloceltites cowichanensis n. sp. (Pl. 147, fig. 11)
Rhabdoceras suessi Hauer (Pl. 147, fig. 3)
Vandaites suttonensis (Clapp and Shimer) (Pl. 147, figs. 13-18)
Choristoceras crickmayi Tozer (Pl. 147, figs. 19-22)
Choristoceras nobile Mojsisovics (Pl. 148, figs. 1-10)
Choristoceras rhaeticum (Guembel) (Pl. 148, figs. 11-16)

SYSTEMATIC PALEONTOLOGY

The morphology and distribution for 521 ammonoid species are given in the following section. All Triassic Ammonoidea that contribute to the biochronology are included, and data for nearly all Canadian Triassic Ammonoidea, except the Arcestaceae, are recorded. Arcestaceae are not very abundant, except locally, and at present contribute little to the biochronology.

Emphasis is on the discrimination and recognition of species, and the role species play in characterizing the successive faunas. This report does not provide an overview of Triassic ammonoid classification. The essentials of the classification have been proposed already (Tozer, 1971; 1981a). A companion report, providing a full treatment of the morphology, classification, geographic and stratigraphic distribution of all Triassic Ammonoidea has been prepared and will be published in due course. It provides the classification of Triassic Ammonoidea that will be in the proposed new edition of the "Treatise on Invertebrate Paleontology". New families, subfamilies and genera introduced in this report are considered in a broader context in the companion report.

REMARKS ON TAXONOMY

General questions on ammonoid taxonomy have been discussed previously (Tozer, 1961, p. 42; 1984, p. 15). In the earlier report, the case was made for the population approach to naming ammonoid species, a procedure for which Silberling (1956) was an early advocate. Species thus defined are based on assemblages that may display considerable variation in morphology. Specimens, although morphologically distinct, are interpreted as variants of one species if they appear to be linked by other specimens, of intermediate morphology, that are believed to be of the same age. Some species defined in this way may have been biologically real entities. But in practice, giving the same name to ammonoids that look entirely different has disadvantages in that the name, unless qualified with a description, does not indicate what the specimen looks like. Population taxonomy contrasts with typological taxonomy, in which each genus and species is defined within rather rigid morphological limits, and the name, without qualification, does indicate what the specimen looks like.

Typological taxonomy is general in the classical monographs on Triassic ammonoids by Mojsisovics, Waagen, Diener, Arthaber, James Perrin Smith and Welter. Taxa named typologically serve a useful purpose by providing nomenclature to categorize morphological characters precisely. As remarked by Spath (1934, p. 3), the typology practised by the "masters" should not be condemned. Critics of typologically defined species believe that they did not have biological reality. This may be so. But as remarked by Arkell (1956, p. 98), generally, no proof exits of the biological reality of species interpreted as comprising many morphologically different variants.

Population taxonomy may have some merit. But it is only acceptable if the limits of the taxon are established by specimens that, on the evidence, were contemporaries. The treatment by Silberling and Nichols (1982, p. 30) of *Frechites occidentalis* (Smith), with eight, and possibly ten typologically defined taxa

in synonymy, is based on this approach and is justifiable, because the specimens were obtained in place in the course of bed-by-bed investigation. Unacceptable, on the other hand, is much of the taxonomy adopted by the late Bernhard Kummel. Many of his so-called populations were based on the interpretation of specimens in museums. These specimens were not accompanied by accurate data on stratigraphic position. The inaccuracy of Kummel's taxonomy is shown by his treating nine previously named taxa from East Greenland as synonyms of one species (Kummel, 1970, p. 181). Documentation is given below for an interpretation in which these nine taxa represent two species, of two different genera [(*Hypophiceras gracile* (Spath), *Tompophiceras extremum* (Spath)], of two different ages. Even where accurate sequential information was available, Kummel did not take it into account. For example, in considering the named species of *Otoceras,* he concluded that *Otoceras concavum* is "nothing more than an intraspecific variant of *Otoceras woodwardi boreale*" (Kummel, 1972, p. 391), without reference to the fact that *Otoceras concavum* was known to occur at a lower level than *Otoceras boreale* (Tozer, 1967, p. 54). Population taxonomy of this sort suppresses morphological differences that have biochronological significance.

The taxonomy adopted in this report is not consistent. Rigid rules cannot be applied. The kind of taxonomy that best deals with one assemblage is not necessarily suited for another. Some assemblages recognized as species (e.g., *Lenotropites caurus* (McLearn), *Arctosirenites canadensis* Tozer) include variants with different morphology. The species definition is from assemblages interpreted as populations. In dealing with other groups, typology has been adopted in order to provide morphological benchmarks deemed necessary to describe the different kinds of ammonoids. Examples are the naming of five species of *Bukkenites,* 16 of Prionitidae (in five genera), and five of Czekanowskitinae (in three genera). Many of these species may be variants, but they require names to characterize their distinctive morphology. Most species are based on more or less complete specimens with the body chamber preserved. Typological taxonomy has been avoided for assemblages of incomplete specimens, even when a great morphological variety is evident. For example, more than 100 specimens identified as *Goniojuvavites kellyi* (Smith) are available. Nearly all are ribbed phragmocones. There is great variety in the strength and density of the ribbing. There are also a few specimens with body chambers, which are smooth. The phragmocones suggest that we are dealing with a species of highly variable morphology. But if all the specimens were complete, the appearance of the population might have been much more uniform—probably smooth ammonoids varying only in degree of inflation. In this case, typological species, defined only on phragmocone characters, would almost certainly not have biological reality.

The possibility of dimorphism in Triassic ammonoids has not yet been extensively studied. Of the 521 species considered in this report, four instances of possible dimorphism have been noticed. The large forms, possibly macroconchs, are *Anolcites impolitus* n. sp., *Anolcites angustus* n. sp., *Muensterites glaciensis* (McLearn), and *Homeroceras grandis* n. sp. The equivalent possible microconchs are *Anolcites politus* n. sp., *Anolcites rasilis* n. sp., *Muensterites helenae* (Renz) and *Homerites semiglobosus* (Hauer). These instances of possible dimorphism are not strictly comparable with the type of dimorphism now widely recognized in Jurassic ammonites. Lappets, which characterize many Jurassic microconchs, are not present on any Triassic ammonoids, large or small. The large forms of *Anolcites* and *Muensterites* differ from the small forms in having tuberculation on the body chamber. *Homerites* and *Homeroceras,* although contemporaries and having in common rather unusual external nodes, differ from one another in other details of sculpture. For these reasons it would be premature to unite the small and large forms of these pairs as members of one taxon.

Following the recommendation of Sinclair (1953), the etymology of all trivial names, except patronymics, is not given. This procedure guarantees stability of the nomenclature.

CONVENTIONS

Measurements are given as in Spath (1934): diameter (in mm), followed by whorl height (H), whorl width (W) and umbilical width (U) expressed as a decimal fraction (percentage) of the diameter.

Abbreviations in describing suture lines are as follows: external (ventral) lobe, E; first lateral lobe, L; umbilical lobe, U; internal lobe, I. U is commonly divided, the outer element, U2, is commonly also known as the second lateral lobe. The 5-lobe formula that characterizes many Triassic Ammonoidea is thus E, L, U2, U1, I. Abbreviations are not used for saddles. The term "external saddle" is used for the saddle that lies between E and L, as in the classical literature, but not in the last edition of the "Treatise" (Arkell et al., 1957, p. L4).

REPOSITORIES

All type and other illustrated specimens have unique registration catalogue numbers, and are stored in the type collection of the Geological Survey of Canada, 601 Booth Street, Ottawa. In the text, these registration numbers are preceded by "GSC". The type collection also includes specimens that are not illustrated, or for which only the suture lines are figured. Numbers for these specimens have an asterisk (*).

GSC locality numbers are not unique to a specimen, but are on all specimens from one locality. There are two GSC catalogues of localities. Numbers without a prefix refer to the Ottawa catalogue. Numbers prefixed "C" are recorded at the Institute of Sedimentary and Petroleum Geology, Calgary. All localities are described, and their faunas listed, in the Appendix. The number of specimens of each species studied is also given. The application of these conventions may be explained by referring to the first species described, *Hypophiceras gracile,* as an example. There are seven individually catalogued hypotypes, GSC 28029–28035, all from GSC locality 51588. This information is coded "GSC 28029–28035 (GSC loc. 51588)". Locality data for this species, and the number of specimens studied at that locality, are given as "GSC loc. 51588 (10)" meaning that the total collection from that locality is 10 specimens.

Class CEPHALOPODA

Subclass AMMONOIDEA

Order CERATITIDA

Superfamily XENODISCACEAE Frech, 1902

Family XENODISCIDAE Frech, 1902

Genus *Hypophiceras* Trümpy, 1969

Type species. Glyptophiceras triviale Spath.

Hypophiceras gracile (Spath)

Plate 1, figures 4a, b; Plate 2, figures 2–7, 10; Figure 5b–e (p. 352)

Glyptophiceras gracile Spath, 1930, p. 34, Pl. 7, figs. 3–6; Pl. 8, figs. 10a, b; SPATH, 1935, p. 51, Pl. 11, fig. 9; Pl. 18, figs. 5a, b, 6; ERMAKOVA, 1981, p. 72, Pl. 2, figs. 1a, b; KORCHINSKAYA and VAVILOV, 1987, p. 65, Pl. 9, fig. 7.

Glyptophiceras nielseni Spath, 1935, p. 53, Pl. 5, figs. 2a, b; Pl. 9, figs. 4, 5; Pl. 11, fig. 10; Pl. 17, figs. 2a, b; Pl. 19, figs. 1a, b; KORCHINSKAYA and VAVILOV, 1987, p. 67, Pl. 9, figs. 3–6.

Ophiceras (Metophiceras) subdemissum var. *ornata* Spath, 1935, p. 36, Pl. 17, figs. 3a, b.

Metophiceras sp. cf. *M. subdemissum* Spath. TOZER, 1967, p. 16, 52, 53.

Xenodiscus sp. cf. *X. gracile* (Spath). TOZER, 1981a, Fig. 4b, p. 81.

Tompophiceras nielseni (Spath). KORCHINSKAYA, 1986, Pl. 1, fig. 2.

Tompophiceras gracile (Spath). KORCHINSKAYA, 1986, Pl. 1, fig. 6.

Registered material. Seven hypotypes, GSC 28029–28035 (GSC loc. 51588). Hypotype GSC 28036 (GSC loc. 47578).

Occurrence. Lower Griesbachian, Boreale Zone. Blind Fiord Formation, Ellesmere and Axel Heiberg islands. GSC locs. 47578 (1), 51588 (10).

Remarks. The specimens from Canada are mostly smaller and a little more evolute than those from Greenland described by Spath. The ribbing, however, is closely comparable. GSC 28031 (Pl. 2, fig. 4) is comparable with the holotype of "*Glyptophiceras*" *gracile*; GSC 28034 (Pl. 2, fig. 7) resembles "*G. nielseni*", and GSC 28032 (Pl. 2, fig. 5) invites comparison with "*Ophiceras (Metophiceras) subdemissum* var. *ornata*".

Genus *Tompophiceras* Popov, 1961a

Type species. Tompophiceras fastigatum Popov.

Tompophiceras extremum (Spath)

Plate 3, figures 1–6; Figure 6 (p. 354)

Glyptophiceras extremum Spath, 1935, p. 57, Pl. 11, fig. 4; Pl. 18, fig. 4; Pl. 19, figs. 7a–c; TOZER, 1967, p. 16, 52, 53; ARCHIPOV, 1974, Pl. 2, fig. 1.

Glyptophiceras subextremum Spath, 1935, p. 56, Pl. 5, figs. 6a, b; Pl. 6, figs. 4a, b.

Tompophiceras extremum (Spath). TOZER, 1969, p. 353, Pl. 16, figs. g–j; BYCHKOV et al., 1976, p. 95, Pl. 1, fig. 1.

Glyptophiceras (*Glyptophiceras*) sp. aff. *G.* (*G.*) *extremum* Spath. TRÜMPY, 1969, p. 92, Pl. 1, fig. 8; Pl. 2, fig. 2.

Tompoites extremum (Spath). ERMAKOVA, 1977, p. 37, Pl. 4, figs. 1–3; ERMAKOVA, 1981, p. 69, Pl. 1, figs. 3–5.

Registered material. Hypotype GSC 22738 (GSC loc. 51605). Three hypotypes GSC 28037–28039 (GSC loc. 51591). GSC 28040 (GSC loc. 55470). GSC 28041 (GSC loc. 47571).

Occurrence. Upper Griesbachian, Commune Zone. Blind Fiord Formation, Ellesmere and Axel Heiberg islands. GSC locs. 47571 (1), 51591 (7), 51605 (1), 55470 (1).

Remarks. Specimens with dense and with distant ribs on the phragmocone (Pl. 3, figs. 1, 2) occur together at GSC locality 51591. One with ribbing of an intermediate nature (Pl. 3, fig. 4) was collected at a nearby locality. The prominently sculptured whorls of the specimens in Plate 3, figures 2–5 have ribs with their maximum elevation outside the middle of flank, as on the holotype. GSC 28038 (Pl. 3, fig. 2) is sculptured like the holotype of "*Glyptophiceras*" *subextremum*. GSC 22738 (Pl. 3, fig. 6) has particularly bullate rib terminations and a coronate whorl section at the beginning of the last whorl. GSC 28041 (Pl. 3, fig. 3) has alternating dense and distant ribbing on the phragmocone. The thick ribs of this species distinguish it from *Hypophiceras gracile* (Spath), which characterizes older beds (Boreale Zone). For this reason the taxonomy proposed by Kummel (1970, p. 181), in which the two are synonyms, is not accepted.

Family XENOCELTITIDAE Spath, 1930

Genus *Xenodiscoides* Spath, 1930

Type species. Xenodiscus perplicatus Frech.

Xenodiscoides calnani n. sp.

Plate 20, figures 1a, b; Figure 18c (p. 388)

"*Dinarites*" sp. cf. "*D.*" *minutus* Waagen. TOZER, 1967, p. 18, 73.

Registered material. Holotype GSC 28049 (GSC loc. 56223).

Occurrence. Dienerian, Sverdrupi Zone. Toad Formation, Sulphur Mountain Formation (Phroso Member), northeastern British Columbia. GSC locs. 56223 (3), 85556 (5).

Diagnosis. Xenodiscoides attaining a diameter of about 20 mm; H about 40 per cent, W about 30 per cent, U about 33 per cent of diameter. Umbilical wall distinct, inclined; ventral shoulders rounded but distinct; venter narrow, arched. Outer whorl with about 15 blunt ribs, which are more or less straight and radial on the flank, and projected at the ventral shoulder, where they fade abruptly.

Measurements. Holotype GSC 28049 (Pl. 20, fig. 1): 21; 0.40; 0.29; 0.33.

Remarks. At least half of the outer whorl of the holotype appears to be body chamber. Near the aperture, the ribs are more closely spaced than on the preceding part of the outer whorl. This may indicate that the specimen is complete and mature. What is visible of the penultimate whorl appears to be sculptured like the outer whorl. The inner whorls also appear to be sculptured. The blunt ribbing is taken to indicate affinity with *Xenodiscoides perplicatus* (Frech), which differs in being larger and having more distinct ventral shoulders. *Xenodiscoides calnani* is probably congeneric with "*Dinarites*" *minutus* Waagen (1895, p. 31), which is only known from appreciably smaller specimens that have much less prominent sculpture.

Genus *Kashmirites* Diener, 1913

Type species. Celtites armatus Waagen.

Kashmirites borealis (Tozer)

Plate 21, figures 3a, b; Figures 19b, c (p. 390)

Anakashmirites borealis Tozer, 1961, p. 63, Pl. 14, figs. 1–6; TOZER, 1967, p. 49; TOZER, 1970, Pl. 16, figs. 12a, b; KORCHINSKAYA, 1982, p. 18, Pl. 8, figs. 2, 3.

Registered material. Holotype GSC 14077 (Tozer, 1961, Pl. 14, figs. 6a–c), paratype GSC 14074 (ibid., Pl. 14, fig. 5), paratype GSC 14075 (ibid., Pl. 14, figs. 4a–c), paratype GSC 14076* (all GSC loc. 28681). Paratype GSC 14072 (ibid., Pl. 14, figs. 2a, b), paratype GSC 14073 (ibid., Pl. 14, figs. 1a–c) (both GSC loc. 28680). Topotype GSC 28042* (28680).

Occurrence. Smithian, Romunderi Zone. Blind Fiord Formation, Ellesmere Island. GSC locs. 28680 (8), 28681 (3).

Diagnosis. Kashmirites attaining a diameter of about 55 mm; H about 25 per cent, W 25–33 per cent, U 50–55 per cent of diameter. Phragmocone sculptured with about 10 slightly crescentic ribs per whorl. Peripheral projection of growth lines faint.

Kashmirites columbianus n. sp.

Plate 22, figures 1, 2

Anakashmirites sp., Tozer, 1967, p. 74.

Registered material. Holotype GSC 28044 (GSC loc. 56174), paratype GSC 28043 (GSC loc. 56173).

Occurrence. Smithian, Romunderi Zone. Toad Formation, Sulphur Mountain Formation, northeastern British Columbia. GSC locs. 56173 (1), 56174 (1), 98863 (1).

Diagnosis. Kashmirites like *Kashmirites borealis* (Tozer) but with very weak ribbing on phragmocone and a body chamber that may be virtually smooth.

Measurements. Holotype GSC 28044 (Pl. 22, fig. 2): at 36, 0.29, 0.26, 0.50. Paratype GSC 28043 (Pl. 22, fig. 1): 28, 0.25, 0.26, 0.56.

Remarks. The outer and penultimate whorls of the holotype (Pl. 22, fig. 2) are virtually smooth, but the inner whorls have faint bulges indicative of *Kashmirites*. Both the specimen and the external mould are preserved. Suture lines are not preserved. GSC 28043 (Pl. 22, fig. 1) has about 10 rather poorly defined, slightly crescentic ribs on the outer whorl and is more obviously a *Kashmirites*, like *K. borealis*, but with fainter ribs. Of the suture line only the external lobe (E) and the external saddle are visible. E forms a single point.

Kashmirites warreni (McLearn)

Plate 36, figures 10–14; Figure 24a–c (p. 420)

Xenoceltites warreni McLearn, 1945, p. 2, Pl. 1, figs. 2, 3; TOZER, 1962a, Pl. 3, figs. 3a, b; TOZER, 1967, p. 20, 74.

Xenoceltites robertsoni McLearn, 1945, p. 2, Pl. 1, figs. 8, 9; TOZER, 1967, p. 20, 74.

Xenoceltites sp. cf. *X. hannai* (Mathews). McLEARN, 1945, Pl. 1, fig. 7.

Registered material. Holotype GSC 9477, GSC 9476 (holotype of *Xenoceltites robertsoni)*, topotype, GSC 9600 (all GSC loc. 10657). Five topotypes GSC 14231 (Tozer, 1962a, Pl. 3, figs. 3a, b), GSC 28045, GSC 28046, GSC 28047*, GSC 28048* (all GSC loc. 42364).

Occurrence. Smithian, Tardus Zone. Blind Fiord Formation, Ellesmere Island; Toad Formation, northeastern British Columbia. GSC locs. 10657 (5), 10658 (1), 42340 (10), 42342 (3), 42360 (9), 42364 (30), 47531 (1).

Diagnosis. Kashmirites attaining a diameter of about 60 mm; H 25–30 per cent, W 20–25 per cent, U 50–55 per cent of diameter. Phragmocone sculptured with 12–20 ribs per whorl. Venter smooth or crenulate. Peripheral projection of growth lines pronounced.

Measurements. Topotype GSC 28046 (Pl. 36, fig. 14): 60, 0.27, 0.21, 0.53.

Remarks. The variation shown by more than 50 specimens from one thin bed in the Toad Formation justify the broad interpretation of this species. GSC 28045 (Pl. 36, fig. 14), with about 20 ribs on the last septate whorl, followed by about half a whorl of densely ribbed, and ultimately striate body chamber, is evidently complete and mature. The ribbing of the holotype (Pl. 36, fig. 11) is comparable with that of GSC 28045 although the ribbing changed at a smaller diameter, presumably indicating that maturity was attained at a smaller size. Compared with these two specimens, the ribs on the septate part of GSC 9476 (Pl. 36, fig. 12), holotype of *"Xenoceltites" robertsoni*, are appreciably wider and blunter. However GSC 9600 (Pl. 36, fig. 10) has blunt ribs on the penultimate preserved whorl, followed on the outer whorl by narrow ribs. This specimen forms a morphological link that is used to justify regarding *"Xenoceltites" warreni* and *"X." robertsoni* as synonyms. All specimens show widely spaced, bulge-like ribs on the inner whorls. The strength of ribbing at the venter varies. All that is preserved of the outer whorl of GSC 28045 (Pl. 36, fig. 14) is smooth. GSC 9477 (Pl. 36, fig. 11), GSC 9476 (Pl. 36, fig. 12) and GSC 28046 (Pl. 36, fig. 13) have outer whorls that are initially smooth, ultimately crenulate. On these three specimens, the crenulations on the venter assume the character of indistinct secondaries, a feature mentioned by Spath (1934, p. 128) in his description of *"Xenoceltites" spitsbergensis*. The change from projected to nearly radial crenulations, another feature

noted by Spath, is seen in GSC 28046 (Pl. 36, fig. 13). Compared with *Kashmirites borealis* (Tozer) and *K. columbianus* n. sp., all variants of *K. warreni* have more closely spaced ribs; also, no variants of *K. borealis* have the crenulation of the venter shown by many specimens of *K. warreni*. Possibly conspecific with *Kashmirites warreni* are "*Xenodiscus*" *hannai* Mathews (1929, p. 5) and "*Xenoceltites*" *spitsbergensis* Spath (1934, p. 128).

Genus *Xenoceltites* Spath, 1930

Type species. Xenoceltites subevolutus Spath.

Xenoceltites subevolutus Spath

Plate 36, figures 3–8; Figure 24d, e (p. 420)

Xenodiscus sp. cf. *X. comptoni* Diener. FREBOLD, 1930, p. 14, Pl. 3, figs. 1–3.

Lecanites sp. cf. *L. ophioneus* Waagen. FREBOLD, 1930, p. 12, Pl. 3, figs. 4, 4a, 5.

Xenoceltites subevolutus Spath, 1930, p. 12; 1934, p. 130, Pl. 2, fig. 2; Pl. 8, fig. 2; Pl. 9, fig. 4; Pl. 11, fig. 2; TOZER, 1961, p. 53, Pl. 16, figs. 1a, b; TOZER, 1962a, Pl. 3, figs. 1a, b; TOZER, 1967, p. 20, 74; TOZER, 1970, Pl. 16, figs. 15a, b; WEITSCHAT and LEHMANN, 1978, p. 95, Pl. 11, figs. 1, 2, 3a; KORCHINSKAYA, 1982, p. 17, Pl. 7, figs. 2a, b; DAGYS and ERMAKOVA, 1990, p. 23, pl. 5, figs. 4a–c.

Registered material. Hypotype GSC 14183 (Tozer, 1961, Pl. 16, figs. 1a, b) (GSC loc. 32365). Four hypotypes, GSC 14303, GSC 28050, GSC 28051, GSC 28052 (all GSC loc. 42538). Two hypotypes, GSC 28053, 28054 (GSC loc. 42363).

Occurrence. Smithian, Tardus Zone. Blind Fiord Formation, Axel Heiberg Island; Toad Formation, northeastern British Columbia. GSC locs. 32365 (1), 42363 (15), 42538 (10).

Measurements. Hypotype GSC 28053 (Pl. 36, fig. 7): 23, 0.33, 0.17, 0.35.

Remarks. Of the specimens from Canada, GSC 28053 (Pl. 36, fig. 7) most closely resembles the holotype (*Xenodiscus* sp. cf. *X. comptoni* of Frebold, 1930, Pl. 3, fig. 1; Spath 1934, p. 131). GSC 28052 (Pl. 36, fig. 6) is comparable with *Lecanites* sp. cf. *L. ophioneus* of Frebold. GSC 28054 (Pl. 36, fig. 8, Fig. 24e) shows a suture line with very weak denticulation of L and U2. The other specimens show no septa.

Genus *Sulioticeras* n. gen.

Type species. Xenodiscus sulioticus Arthaber, 1911, p. 229.

Diagnosis. Xenoceltitid with ovoid whorl section, and a phragmocone with dense regular ribbing, which is reduced or absent on the body chamber.

Species assigned. Xenodiscus sulioticus Arthaber (1911, p. 229), *Preflorianites intermedius* Tozer (1965a, p. 18).

Occurrence. Spathian. Albania, Chios, northeastern British Columbia.

Remarks. Distinguished from *Preflorianites* Spath (1930, p. 90) by having a smoother body chamber.

Sulioticeras intermedium (Tozer)

Plate 38, figures 4a, b; Figure 26b (p. 424)

Preflorianites intermedius Tozer, 1965a, p. 18, Pl. 2, figs. 9a–c; TOZER, 1967, p. 73.

Registered material. Holotype GSC 18815 (GSC loc. 56240).

Occurrence. Spathian, Subrobustus Zone. Toad Formation, northeastern British Columbia. GSC loc. 56240 (1).

Remarks. Although the nature of the body chamber of this species is not known, it is interpreted as congeneric with *Sulioticeras sulioticum* because of the regular ribbing of the phragmocone.

Family MELAGATHICERATIDAE Tozer, 1971

Genus *Melagathiceras* Tozer, 1971

Type species. Juvenites crassus Tozer.

Melagathiceras depressum (Smith)

Plate 22, figures 11a, b

Prenkites depressus Smith, 1932, p. 110, Pl. 31, figs. 16–18.

Registered material. GSC 28162 (GSC loc. 56172).

Occurrence. Smithian, Romunderi Zone. Toad Formation, northeastern British Columbia. GSC loc. 56172 (1).

Remarks. GSC 28162 (Pl. 22, fig. 11), although imperfectly preserved, appears to be a species of *Melagathiceras* like *M. crassum* (Tozer) but with thinner whorls (60–70 per cent of the diameter). Only parts of the suture line are visible. E is narrow, apparently with a single point at the base. L is only partly visible and has small shallow denticulations. Shape and proportions are like those of the holotype of "*Prenkites*" *depressus*, a species of *Melagathiceras* (Tozer, 1971, p. 1029).

Melagathiceras crassum (Tozer)

Plate 23, figures 1a, b

Juvenites crassus Tozer, 1961, p. 60, Pl. 13, figs. 4–7; TOZER, 1967, p. 49, 50.

Melagathiceras crassum (Tozer). TOZER, 1971, p. 1029.

Registered material. Holotype GSC 14081 (Tozer, 1961, Pl. 13, figs. 7a–c), three paratypes GSC 14080 (ibid., figs. 6a–d), 14083 (ibid., figs. 4a, b), 14084 (ibid., figs. 5a, b) (all GSC loc. 28681). Paratype GSC 14082* (GSC loc. 32371). Hypotype GSC 28161 (GSC loc. 47801).

Occurrence. Smithian, Romunderi Zone. Blind Fiord Formation, Ellesmere Island. GSC locs. 28680 (1), 28681 (5), 28455 (5), 32371 (1), 47801 (1).

Measurements. Hypotype GSC 28161 (Pl. 23, fig. 1): 22, 0.50, 0.90, 0.16.

Remarks. GSC 28161 (Pl. 23, fig. 1) is closely comparable with GSC 14084, a paratype from the type locality. Both have approximated septa and are probably complete and mature. "*Paranannites*" *globosus* Popov (1961a, p. 43) from Kenelichi River, Kolyma Basin, Siberia, is congeneric and closely related, differing only in being somewhat less inflated.

Genus *Juvenites* Smith, 1927

Type species. Juvenites kraffti Smith.

Juvenites laevis n. sp.

Plate 22, figures 9, 10

Registered material. Holotype GSC 28168, paratype GSC 28167 (both GSC loc. 56166).

Occurrence. Smithian, Romunderi Zone. Toad Formation, northeastern British Columbia. GSC loc. 56166 (2).

Diagnosis. Juvenites about 25 mm in diameter; H about 30 per cent, W about 70 per cent, U about 40 per cent of diameter. Whorl section depressed, umbilical wall perpendicular, umbilical shoulder rounded but distinct. Venter arched, with no suggestion of ventral shoulders. Ribs and constrictions absent; growth striae radial.

Measurements. Holotype GSC 28168 (Pl. 22, fig. 9): 25, 0.30, 0.68, 0.40.

Remarks. The outer whorl of the holotype (Pl. 22, fig. 9) is nearly all body chamber, suggesting that the specimen was nearly or wholly complete. The suture line is incompletely known. Details of E are not exposed. The external saddle is broad and rounded. L, although not perfectly preserved, is apparently goniatitic. The summit of the lateral saddle is 1.5 mm outside the umbilical shoulder; the inner part is intersected by the umbilical shoulder. Similarities in whorl section, and what is known of the suture line, leave little doubt that this species is congeneric with *Juvenites kraffti* Smith (1927, p. 23), which differs in being more involute. The holotype of *J. laevis* also differs from *J. kraffti* in having a smoother surface. GSC 28167 (Pl. 22, fig. 10) has a surface with a suggestion of ribbing, much like that of *J. kraffti*.

Genus *Thermalites* Smith, 1927

Type species. Thermalites thermarum Smith.

Thermalites canadensis (Tozer)

Plate 21, figures 1a, b

Juvenites canadensis Tozer, 1961, p. 60, Pl. 13, figs. 3a–d; TOZER, 1967, p. 49.

Registered material. Holotype GSC 14079 (GSC loc. 28681).

Occurrence. Smithian, Romunderi Zone. Blind Fiord Formation, Ellesmere Island. GSC loc. 28681 (1).

Remarks. The suture line is ceratitic. The species is accordingly now assigned to *Thermalites* instead of *Juvenites*.

Thermalites needhami (Tozer)

Plate 22, figures 5, 6

Juvenites needhami Tozer, 1963a, p. 25, Pl. 5, figs. 1-5; TOZER, 1967, p. 74.

Registered material. Holotype GSC 14292 (Tozer, 1963a, Pl. 5, figs. 4a, b), three paratypes GSC 14290 (ibid., figs. 2a-c), 14291 (ibid., figs. 3a, b), 14293 (ibid., figs. 5a-c) (all GSC loc. 48850). Topotype GSC 28163 (GSC loc. 56166). Topotype GSC 28164 (GSC loc. 56171).

Occurrence. Smithian, Romunderi Zone. Toad Formation, northeastern British Columbia. GSC locs. 46471 (2), 48850 (12), 56166 (6), 56171 (1), 56173 (3).

Measurements. Topotype GSC 28163 (Pl. 22, fig. 5): 19.5, 0.41, 0.44, 0.28. Topotype GSC 28164 (Pl. 22, fig. 6): 13.5, 0.41, 0.50, 0.33.

Remarks. Because the suture line is ceratitic, this species is now assigned to *Thermalites*. GSC 28163 (Pl. 22, fig. 5) is the largest known specimen. GSC 28164 (Pl. 22, fig. 6), provisionally assigned to this species, has a less prominent umbilical shoulder, more convex flanks and less prominent ventral shoulders, compared with the holotype.

Superfamily OTOCERATACEAE Hyatt, 1900

Family OTOCERATIDAE Hyatt, 1900

Genus *Otoceras* Griesbach, 1880

Type species. Otoceras woodwardi Griesbach.

Otoceras gracile n. sp.

Plate 1, figures 2a, b; Figure 4g (p. 350)

Registered material. Holotype GSC 28235 (GSC loc. 64775).

Occurrence. Lower Griesbachian, Concavum Zone. Blind Fiord Formation, Axel Heiberg Island. GSC loc. 64775 (1).

Diagnosis. Otoceras with phragmocone about 70 mm in diameter; H about 55 per cent, W about 33 per cent, U about 10 per cent of diameter. Phragmocone venter tricarinate, flanks weakly convex, umbilical margin without a raised rim. Surface sculptured only with weak growth striae. Suture line with lobe in second lateral saddle.

Measurements. Holotype GSC 28235 (Pl. 1, fig. 2): at 70, 0.54, 0.32, 0.09.

Remarks. The holotype is a complete phragmocone with part of the body chamber preserved. Septa are approximated, suggesting that the specimen was mature. Compared with typical examples of *Otoceras concavum* Tozer, which occur in immediately overlying beds, this species is much more compressed and has convex, not concave flanks. There is also a close resemblance to compressed forms interpreted as variants of *Otoceras boreale* (Spath) (see below) but *Otoceras gracile* is not known to be linked by intermediate forms with *Otoceras concavum*. *Otoceras latilobatum* Wang (in Wang and He, 1976, p. 267) is another form closely resembling *O. gracile*, possibly differing only in having proportionately wider lobes and an unindented lobe in the lateral saddle. *Otoceras dieneri* Spath (1930, p. 90) (type species of *Metotoceras*, Spath) has a similar whorl section but has a simpler suture line, with fewer elements outside the umbilical shoulder.

Otoceras concavum Tozer

Plate 1, figures 3a, b; Figure 4h (p. 350)

Otoceras concavum Tozer, 1967, p. 15, 54, 86, Pl. 1, figs. 1-3; DAGYS et al., 1979, Pl. 1, figs. 1a, b.

Otoceras woodwardi boreale Spath. KUMMEL, 1972, p. 374, 375 (in part).

Registered material. Holotype GSC 18882 (Tozer, 1967, Pl. 1, figs. 1a, b) (GSC loc. 64777). Paratype GSC 18881 (ibid., figs. 3a, b) (GSC loc. 64779). Paratype GSC 18883 (GSC loc. 47539). Paratype GSC 18884 (ibid., figs. 2a, b) (GSC loc. 64732).

Occurrence. Lower Griesbachian, Concavum Zone. Blind Fiord Formation, Axel Heiberg Island. GSC locs. 47539 (1), 47620 (1), 64732 (1), 64733 (1), 64734 (1), 64735 (1), 64774 (1), 64776 (1), 64777 (2), 64778 (3), 64779 (4), 64780 (2), 64781 (2).

Remarks. Identified with this species are inflated *Otoceras* (W about 50 per cent of diameter) with

concave flanks. GSC 18884 (Tozer, 1967, Pl. 1, figs. 2a, b), which has a phragmocone about 95 mm in diameter, indicates that this species attained a diameter of about 150 mm. The suture line invariably has a small lobe at the summit of the second lateral saddle.

Otoceras boreale Spath

Plate 1, figures 1a, b; Plate 2, figures 1, 8; Figures 4a–f (p. 350), 5a (p. 352)

Otoceras sp. aff. *O. fissisellatum* Diener. SPATH, 1930, p. 10, Pl. 1, figs. 1a–d.

Otoceras boreale Spath, 1935, p. 9, Pl. 1, figs. 1, 6; Pl. 2, figs. 2, 3; Pl. 3, fig. 1 (lectotype, TOZER, 1967, p. 86), figs. 2, 3; Pl. 4, fig. 1; Pl. 5, fig. 1; Pl. 6, fig. 8; TOZER, 1961, p. 45, Pl. 6, figs. 1–3; Pl. 7, figs. 1–3; Pl. 8, figs. 1–4; POPOV, 1961a, p. 20, Pl. 3, figs. 4, 5; TOZER, 1967, p. 15, 16, 51–54, Pl. 2, figs. 1, 2; TOZER and PARKER, 1968, p. 527, Pl. 27, figs. b, c, d; ZACHAROV, 1971, p. 50, Pl. 5, figs. 1–10; ARCHIPOV, 1974, Pl. 1, figs. 1a, b; BYCHKOV et al., 1976, p. 94, Pl. 2, figs. 9a, b; DAGYS et al., 1979, p. 124, Pl. 1, fig. 2; Pl. 2, fig. 1; KORCHINSKAYA 1986, p. 77, Pl. 1, fig. 1; NAKAZAWA, NAKAMURA, and KIMURA, 1987, p. 172, Fig. 2b; DAGYS and KORCHINSKAYA, 1987, Pl. 8, figs. 1–4; KORCHINSKAYA and VAVILOV, 1987, Pl. 9, figs. 1, 2; ZACHAROV and RYBALKA, 1987, Pl. 1, figs. 12, 13.

Otoceras woodwardi boreale Spath. KUMMEL, 1972, p. 374, 375, 391 (in part).

Registered material. Eight hypotypes GSC 14015 (Tozer, 1961, Pl. 6, figs. 2a, b), GSC 14016*, GSC 14019, GSC 14021*, GSC 14023 (ibid., Pl. 7, fig. 1), GSC 14024*, GSC 14025 (ibid., Pl. 8, fig. 3), GSC 14027* (all GSC loc. 28440). Four hypotypes GSC 14014 (ibid., Pl. 8, figs. 4a, b), GSC 14017*, GSC 14020 (ibid., Pl. 8, fig. 1), GSC 14022* (all GSC loc. 28441). Hypotype GSC 14018 (ibid., Pl. 7, figs. 3a, b (GSC loc. 28448). Hypotype GSC 14026 (Tozer, 1967, Pl. 2, figs. 1a, b) (GSC loc. 32215). Two hypotypes GSC 14028 (Tozer, 1961, Pl. 6, figs. 1a, b), GSC 14029 (ibid., Pl. 6, fig. 3, Pl. 7, fig. 2) (GSC loc. 34001). Two hypotypes GSC 18895 (Tozer, 1967, Pl. 2, fig. 2), GSC 28239* (both GSC loc. 47524). Hypotype GSC 28237 (GSC loc. 51588). Hypotype GSC 28236 (GSC loc. 64783). Hypotype GSC 28238* (GSC loc. 51605).

Occurrence. Lower Griesbachian, Boreale Zone. Blind Fiord Formation, Ellesmere and Axel Heiberg islands; Bjorne Formation, Ellesmere Island. GSC locs. 28440 (16), 28441 (4), 28448 (1), 32215 (2), 34001 (2), 47524 (12), 47538 (1), 47548 (1), 47578 (1), 47590 (3), 47622 (2), 51588 (2), 51605 (1), 64766 (2), 64782 (1), 64783 (1), 68350 (2).

Remarks. Identified with this species are *Otoceras* that attained a diameter of at least 300 mm. This is shown by GSC 18895 (Tozer, 1967, Pl. 2, fig. 2), a complete phragmocone, with approximated septa, 235 mm in diameter, preserving also part of the body chamber. The phragmocone width is highly variable. GSC 28237 (Pl. 2, fig. 1) is an example of a compressed variant; GSC 14019 (Pl. 2, fig. 8), which has the width about 50 per cent of the diameter, illustrates an inflated variant. Whether or not complete adult specimens display comparable variation cannot be determined from the available material. Typical examples of *Otoceras boreale* are readily distinguished from *Otoceras concavum* by the differences in whorl section (Tozer, 1967, p. 86, 87). Accordingly, the two taxa are not treated as synonyms, as by Kummel (1972, p. 374). The specimens from the Bjorne Formation, although only fragments, have no suggestion of concave flanks and are almost certainly referable to this species, not *O. concavum*. Both *Otoceras concavum* and *O. boreale* resemble *O. woodwardi* Griesbach (1880, p. 106) but are recognized as distinct species because they invariably have a small, denticulate lobe in the second lateral saddle. By comparison, this character in *Otoceras woodwardi*, as interpreted by Kummel (1972), is variable. The holotype of *Otoceras woodwardi* has no such lobe.

Superfamily MEEKOCERATACEAE Waagen, 1895

Family OPHICERATIDAE Arthaber, 1911

Genus *Vishnuites* Diener, 1897

Type species. Xenaspis (*Vishnuites*) *pralambha* Diener.

Vishnuites kummeli n. sp.

Plate 1, figures 5, 6; Figure 4i (p. 350)

Ophiceras sp. indet., TOZER, 1967, p. 16, 53.

Vishnuites sp., KUMMEL, 1972, p. 388

Registered material. Holotype GSC 33142, two paratypes GSC 33143, 38628* (all GSC loc. 47548).

Occurrence. Lower Griesbachian, Boreale Zone. Blind Fiord Formation, Ellesmere Island. 47548 (10).

Diagnosis. Vishnuites at least 55 mm in diameter; H about 40 per cent, W about 18 per cent, U about 30 per cent of diameter. Venter bluntly acute. Surface striae slightly concave, forming a very shallow sinus just outside the mid-flank; slightly fasciculate on inner flank.

Measurements. Paratype GSC 33143 (Pl. 1, fig. 5): 33, 0.41, 0.18, 0.30.

Remarks. This species evidently attained a diameter of at least 55 mm, judging from GSC 38628*, a fragment on which the phragmocone whorl height is 16 mm. GSC 33143 (Pl. 1, fig. 5), in which parts of the body chamber are preserved, is probably the remains of a more or less complete specimen. These specimens, and also the holotype, have a bluntly acute venter on the whole of the outer whorl and a rounded, indistinct, umbilical shoulder. The holotype (Pl. 1, fig. 6) preserves impressions of the growth lines on the steinkern. They are slightly concave, forming a very shallow sinus on the outer flank. At intervals, some growth lines achieve particular prominence. On the holotype, there are four such lines on the adapical quadrant of the body chamber. Similar lines are also apparent on what is visible of the penultimate whorl. The test of GSC 33143 (Pl. 1, fig. 5) is similar but the widely spaced growth lines are less conspicuous. The suture line of the holotype, as preserved, shows no denticulations in E (Fig. 4i). E of GSC 38628 is narrow, like that of the holotype, but the denticulation is preserved, the base apparently having three points. *Vishnuites kummeli* is more inflated and a little more involute compared with *Vishnuites pralambha* Diener (1897, p. 88); more evolute compared with "*Paravishnuites*" *oxynotus* Spath (1935, p. 45), "*P.*" *striatus* Spath (1935, p. 46) and "*P.*" *sterni* Trümpy (1969, p. 105); more involute and with a less acute venter, compared with "*P.*" *paradigma* Trümpy (1969, p. 106).

Genus *Ophiceras* Griesbach, 1880

Type species. Ophiceras tibeticum Griesbach.

Ophiceras greenlandicum Spath

Plate 4, figures 3a, b; Figure 7a, b (p. 356)

Ophiceras greenlandicum Spath, 1930, p. 16, Pl. 2, figs. 12a, b; SPATH, 1935, p. 13, Pl. 2, figs. 1a, b; Pl. 5, figs. 5a, b; Pl. 10, figs. 1a, b; Pl. 19, figs. 11a, b.

Ophiceras commune Spath. TOZER, 1967, p. 16, 52, 54 (in part), Pl. 3, figs. 1a, b.

Registered material. Hypotype GSC 18897 (Tozer, 1967, Pl. 3, figs. 1a, b (GSC loc. 47525). GSC 28055 (GSC loc. 64744).

Occurrence. Upper Griesbachian, Commune Zone. Blind Fiord Formation, Axel Heiberg Island. GSC locs. 47525 (5), 64744 (1).

Measurements. Hypotype GSC 28055 (Pl. 4, fig. 3): 124, 0.33, 0.24, 0.42. Hypotype GSC 18897: 117, 0.32, 0.21, 0.42.

Remarks. GSC 28055 (Pl. 4, fig. 3), an apparently complete specimen, has a high, nearly perpendicular umbilical wall. Most of the body chamber is crushed on one side, but an undistorted whorl section is preserved at the end of the phragmocone, showing a wide arched venter with moderately distinct ventral shoulders and the maximum whorl width near the umbilicus. The holotype (Spath, 1930, Pl. 2, figs. 12a, b), also virtually complete, has comparable proportions and a very similar whorl section. GSC 18897 (Tozer, 1967, Pl. 3, figs. 1a, b) has proportions close to those of the holotype, but has a more inclined umbilical wall, and thus shares characters of *Ophiceras commune* Spath (with which it was formerly identified) and *O. greenlandicum.*

Ophiceras commune Spath

Plate 4, figures 1a–c

Ophiceras (*Lytophiceras*) *commune* Spath, 1930, p. 24, Pl. 2, figs. 9a–d, 13, 14; Pl. 3, fig. 3 (holotype); Pl. 4, figs. 3, 11; SPATH, 1935, p. 16, Pl. 13, fig. 13; Pl. 15, figs. 1a, b, 4a, b, 9; Pl. 19, fig. 8 (not Pl. 4, figs. 3a, b, = *O. subsakuntala* Spath). TRÜMPY, 1969, p. 99.

Ophiceras commune Spath. TOZER, 1961, p. 48, Pl. 9, figs. 1, 2; TOZER, 1967, p. 16, 52, 54 (in part, not Pl. 3, figs. 1a, b = *O. greenlandicum* Spath).

Ophiceras greenlandicum Spath, 1930, p. 16, Pl. 1, figs. 2a, b; Pl. 4, figs. 12a, b (only).

Ophiceras (*Lytophiceras*) sp. aff. *O.* (*L.*) *evolutum* Frech and Noetling. SPATH, 1930, p. 22, Pl. 3, figs. 1, 4a, b.

Registered material. Three hypotypes, GSC 14030 (Tozer, 1961, Pl. 9, figs. 1a, b), GSC 14031*, GSC 14032 (ibid., figs. 2a, b) (all GSC loc. 32364). Hypotype GSC 28056 (GSC loc. 64745).

Occurrence. Upper Griesbachian, Commune Zone. Blind Fiord Formation, Ellesmere and Axel Heiberg islands. GSC locs. 32364 (3), 47525 (5), 51592 (2), 64745 (1).

Measurements. Hypotype GSC 28056 (Pl. 4, fig. 1): at 54, 0.39, 0.26, 0.31.

Remarks. GSC 28056 (Pl. 4, fig. 1) is smooth, has an inclined umbilical wall and a narrowly rounded venter. The extent of the umbilical seam shows that the original diameter was about 70 mm. Complete details of the suture line are not exposed. The lateral lobes are about the same width as the adjacent saddles. On the holotype, the saddles are appreciably wider than the lobes, but apart from this difference, the two specimens are closely similar. Of those described previously (Tozer, 1961, p. 48), GSC 14031* closely resembles "var. *evolvens*" of Spath (1930, Pl. 3, fig. 1; 1935, p. 17). GSC 14030, which has faint blunt ribs, forms a morphological link with *Ophiceras greenlandicum* Spath. All specimens identified as *Ophiceras commune* are more involute (U less than 40 per cent of diameter) and compressed (W less than 28 per cent), have a more rounded venter and more distinctly inclined umbilical wall compared with those referred to *O. greenlandicum*. The specimens from Ellesmere Island (GSC loc. 51592), are fragmentary, but have a rounded venter.

Ophiceras subsakuntala Spath

Plate 4, figures 2a, b

Ophiceras (Lytophiceras) ptychodes Diener. SPATH, 1930, p. 21, Pl. 4, figs. 4a, b (holotype, *subsakuntala*); Pl. 5, figs. 3a, b (not of Diener, 1897, p. 120).

Ophiceras (*Lytophiceras*) *sakuntala* Diener. SPATH, 1930, p. 19, Pl. 2, fig. 8; Pl. 4, figs. 7a, b (not of Diener, 1897, p. 114).

Ophiceras (*Lytophiceras*) *subsakuntala* Spath, 1935, p. 19, Pl. 15, figs. 3a, b, TRÜMPY, 1969, p. 100.

Ophiceras (*Lytophiceras*) *commune* var. *aperta* Spath, 1935, p. 17, Pl. 4, figs. 3a, b (only).

Ophiceras commune Spath. TOZER, 1967, p. 16, 52, 54 (in part).

Registered material. Hypotype GSC 28057 (GSC loc. 64747).

Occurrence. Upper Griesbachian, Commune Zone. Blind Fiord Formation, Axel Heiberg Island. GSC locs. 47525 (1), 64746 (1), 64747 (1).

Measurements. Hypotype GSC 28057 (Pl. 4, fig. 2): 92, 0.39, 0.25, 0.35.

Remarks. Specimens identified as this species closely resemble *Ophiceras commune* Spath in most characters but have a broader venter, with moderately distinct ventral shoulders, at least on the outer whorl. The venter is thus much like that of *O. greenlandicum* Spath, but compared with that species, the umbilical wall is distinctly inclined and the umbilicus is smaller. GSC 28057 (Pl. 4, fig. 2), although larger, otherwise closely resembles the holotype. It is a complete specimen with fairly well preserved suture lines. The lateral saddle is a trifle wider than E. No approximation is evident. GSC 28057 also resembles a specimen identified as *Ophiceras commune* var. *aperta* by Spath (1935, Pl. 4, figs. 3a, b). The other specimen referred to this variety by Spath (1930, Pl. 1, figs. 2a, b; Spath, 1935, p. 13), a wholly septate example originally identified as *O. greenlandicum*, does not have the broad venter taken to be characteristic of *O. subsakuntala* and is retained in *O. commune*.

Genus *Discophiceras* Spath, 1935

Type species. Ophiceras (*Lytophiceras*) *subkyokticum* Spath.

Discophiceras wordiei (Spath)

Plate 2, figures 9a, b; Figure 5f (p. 352)

Ophiceras (*Lytophiceras*) *wordiei* Spath, 1930, p. 26, Pl. 5, figs. 1a, b, 2a, b (holotype), 9a, b; Pl. 6, figs. 1a, b, 2a, b; TRÜMPY, 1969, p. 102, Pl. 2, fig. 1.

Ophiceras (*Discophiceras*) *wordiei* Spath. SPATH, 1935, p. 32, Pl. 7, figs. 7a, b; Pl. 8, figs. 5a, b; Pl. 16, figs. 8a, b, Textfig. 1h (p. 48).

Discophiceras wordiei (Spath). TOZER, 1967, p. 16, 54.

Registered material. Hypotype GSC 28069* (GSC loc. 47525). Hypotype GSC 28070 (GSC loc. 64750).

Occurrence. Upper Griesbachian, Commune Zone. Blind Fiord Formation, Axel Heiberg Island. GSC locs. 47525 (1), 64750 (1).

Measurements. Hypotype GSC 28070 (Pl. 2, fig. 9): at 81, 0.45, 0.22, 0.27.

Remarks. GSC 28070 (Pl. 2, fig. 9) is the remains of a complete mature example, with approximated septa, originally about 90 mm in diameter. GSC 28069*, only the suture line of which is illustrated (Fig. 5f), closely resembles GSC 28070 in size, proportions and whorl section. Both have a rounded venter with no trace of ventral shoulders. They are a little more evolute than the holotype, but closely resemble another specimen illustrated by Spath (1935, Pl. 8, figs. 5a, b). The well preserved suture line of GSC 28069 (Fig. 5f) has an unusually wide E; that of GSC 28079 is narrow.

Genus *Wordieoceras* Tozer, 1971

Type species. Vishnuites wordiei Spath.

Wordieoceras wordiei (Spath)

Plate 5, figures 1–3; Plate 6, figures 1–3; Plate 7, figures 1–4; Figure 8a–c (p. 358)

Vishnuites wordiei Spath, 1930, p. 31, Pl. 2, figs. 11a, b (holotype); SPATH, 1935, p. 41, Pl. 4, figs. 5a, b; Pl. 12, figs. 2a, b.

Vishnuites decipiens Spath, 1930, p. 31, Pl. 3, figs. 2a–g; Pl. 4, figs. 2a, b; SPATH, 1935, p. 41, Pl. 4, figs. 4a, b; Pl. 9, figs. 3a, b; Pl. 10, figs. 2–5; Pl. 12, figs. 1a, b; Pl. 13, figs. 4, 7.

Ophiceras decipiens (Spath). TOZER, 1967, p. 16, 17, 51, 52, 54.

Wordieoceras wordiei (Spath). TOZER, 1971, p. 1031.

Registered material. Hypotype GSC 28058 (GSC loc. 64762). Three hypotypes, GSC 28059–GSC 28061 (all GSC loc. 47527). Three hypotypes GSC 28062, GSC 28063, GSC 28064* (all GSC loc. 47525). Hypotype GSC 28065 (GSC loc. 64769). Hypotype GSC 28066 (GSC loc. 47610). Two hypotypes GSC 28067, 28068 (both GSC loc. 51689).

Occurrence. Upper Griesbachian, Commune and Strigatus zones. Blind Fiord Formation, Ellesmere and Axel Heiberg islands. GSC locs. 47525 (35), 47527 (20), 47610 (2), 51689 (4), 64762 (1), 64767 (1), 64769 (1), 64772 (1), 64773 (1).

Measurements. Hypotype GSC 28060 (Pl. 5, fig. 3): 121, 0.37, 0.21, 0.36. Hypotype GSC 28059 (Pl. 5, fig. 2): 73, 0.44, 0.25, 0.29. Hypotype GSC 28062 (Pl. 6, fig. 1): 96, 0.46, 0.28, 0.29. Hypotype GSC 28067 (Pl. 7, fig. 1): 27, 0.42, 0.29, 0.29. Hypotype GSC 28065 (Pl. 7, fig. 3): 59, 0.39, 0.25, 0.34. Hypotype GSC 28066 (Pl. 7, fig. 4): 65, 0.40, 0.21, 0.32. All have body chambers and are virtually complete.

Remarks. A very broad interpretation is given to this species. Among the specimens included, proportions are highly variable, as shown by the measurements. Also variable is the sculpture, some specimens having blunt ribs, others being smooth. As far as known there are no consistent morphological characters that differentiate specimens from the Commune Zone from those of the Strigatus Zone. GSC 28060 (Pl. 5, fig. 3), which is complete and probably mature, is the largest known example. The most evolute (GSC 28063, Pl. 6, fig. 2) is a complete phragmocone (U about 39 per cent of diameter). The measurements of the holotype (Spath, 1930, p. 31, U 33 per cent) are within the range of those of the specimens from Canada. The holotype of "*Vishnuites*" *decipiens*, a complete phragmocone, is a little more involute (U 27 per cent) but others identified with this species by Spath, as "var. *rotunda*" (e.g., Spath, 1935, Pl. 9, figs. 3a, b, U 34 per cent) have proportions within the range encountered in Canadian specimens. Canadian specimens, unlike those described from the type locality in Greenland, show the nature of the mature body chamber, e.g., on GSC 28062 (Pl. 6, fig. 1). This specimen, with approximated septa, and thus probably mature, has a fastigate venter on the phragmocone followed by a body chamber on which angularity on the venter is barely perceptible. The phragmocone whorl section closely resembles that of the holotype, from which it differs in being merely striate, without blunt ribs. Blunt ribs are present on many specimens from Canada, for example GSC 28063 (Pl. 6, fig. 2), an apparently complete mature phragmocone, which has about 12 ribs on the inner part of the outer whorl. This specimen closely resembles the holotype in all features except proportions, being more evolute. Of three specimens from one bed (GSC loc. 47527), well defined ribs are present on the phragmocone, but not on the body chamber, of GSC 28060 (Pl. 5, fig. 3); on the body chamber of GSC 28061 (Pl. 6, fig. 3); absent on the body chamber and much of the phragmocone of GSC 28059 (Pl. 5, fig. 2). The inner whorls of GSC 28059, however, show some ribbing at a diameter of about 10 mm. In this specimen, the test is unusually well preserved. Near the umbilicus spiral lirae are well developed on the body chamber, but not on the earlier formed whorls. Comparable lirae are not shown by the other specimens but because unusually good preservation is necessary to show them, their systematic significance cannot be assessed. GSC 28066

(Pl. 7, fig. 4) has a trace of ribbing; GSC 28058 (Pl. 5, fig. 1) is apparently smooth. GSC 28068 (Pl. 7, fig. 2), the remains of a specimen originally no more than about 50 mm in diameter, has an almost rounded venter at this size. It is interpreted as a small mature representative of *W. wordiei*. GSC 28067 (Pl. 7, fig. 1), a small specimen from the same bed, has the fastigate venter characteristic of *Wordieoceras*. These two have no ribs. Their suture lines are not perfectly preserved, but the visible parts do not conflict with the identification.

Family PROPTYCHITIDAE Waagen, 1895

Genus *Bukkenites* new genus

Type species. Bukkenites nitidus n. sp.

Diagnosis. Smooth proptychitid with subtrigonal or ovoid whorl section and a vertical or undercut umbilical wall. Suture line with numerous deep indentations in the suspensive lobe but with no discrete auxiliary lobe. Suture line on the dorsum has a weakly developed lobe adjacent to the internal lobe.

Species assigned. Bukkenites incisus n. sp., *B. nitidus* n. sp., *B. strigatus* (Tozer), *B. macilentus* n. sp., *B. nanus* n. sp.; probably also *Proptychites rosenkrantzi* Spath (1930, p. 40), *P. anomalus* Spath (1935, p. 61), *P. intermedius* Spath (1935, p. 63), *P. grandis* Spath (1935, p. 64), *P. subdiscoides* Spath (1935, p. 65), *P. simplex* Spath (1935, p. 65).

Occurrence. Upper Griesbachian. Ellesmere and Axel Heiberg islands, probably also East Greenland.

Remarks. This genus accomodates most, if not all, of the earliest proptychitids, of Griesbachian age. They are distinguished from true *Proptychites*, of Dienerian age, by lacking an auxiliary lobe. The difference between the suture line of *Proptychites rosenkrantzi* Spath and that of typical forms of *Proptychites* from the Salt Range was noted by Spath (1930, p. 41). This difference is apparent by comparing the suture lines of *Bukkenites nitidus* n. sp. and "*Proptychites*" *grandis* Spath with that of Salt Range species such as *Proptychites latifimbriatus* (de Koninck) and *P. ammonoides* Waagen (Waagen, 1895, Pls. 18, 19) which clearly have a discrete auxiliary lobe. The absence of an auxiliary lobe, clearly shown by *Bukkenites nitidus* is also demonstrable on the holotypes of *B. macilentus* n. sp. and *B. nanus* n. sp. and also on specimens referred to *B. incisus* n. sp. and *B. strigatus* (Tozer). The suture line of the type species of *Proptychites* (*Ceratites lawrencianus* de Koninck) (Waagen, 1895, p. 168) is known only in a somewhat weathered state and the existence of a distinct auxiliary lobe is not as clearly demonstrable as on *P. latifimbriatus* and *P. ammonoides*. However, all three species are from the Ceratite Marls of the Salt Range so it may be safely concluded that the presence of an auxiliary lobe is a generic character for *Proptychites*. Some species of *Bukkenites*, notably *B. incisus* n. sp. and *B. nitidus* n. sp., less noticably *B. strigatus* (Tozer), have a subtrigonal whorl section unlike the ovoid section of *Proptychites lawrencianus* and the other species from the Salt Range. This difference is not taken to be of generic significance in that mature specimens of *B. strigatus* acquire an ovoid whorl section, like that of *Proptychites lawrencianus*. On *Bukkenites macilentus* n. sp., and *B. nanus* n. sp. the ovoid whorl section indicating affinity with *Proptychites* is even more apparent.

The remarkable similarity between some of the ammonoids referred to *Bukkenites* and the drawings of *Proptychites otoceratoides* Diener (1895a, p. 36), the type species of *Pachyproptychites* Diener, was at one time considered significant (Tozer, 1967, p. 17). The species now placed in *Bukkenites* were assigned to *Pachyproptychites* although it was recognized that the unique specimen on which Diener's species was based is poorly preserved (Tozer, 1963a, p. 17). Thanks to Vavilov and Zacharov (1976) it is now known that Diener's specimen is not only badly preserved but is almost certainly from beds of Ajaxian (Smithian) age, much younger than the beds that yield *Bukkenites*. Vavilov and Zacharov consider that Diener's specimen, which was examined by me in 1966, is probably a poorly preserved example of either *Arctoceras septentrionale* (Diener) or "*Proptychites*" *robinsoni* Kiparisova. Vavilov and Zacharov recommend that *Pachyproptychites* be regarded as a nomen dubium, a procedure I have also advocated (Tozer, 1971, p. 1021). There are certainly no grounds for considering *Bukkenites* and *Pachyproptychites* to be congeneric.

Bukkenites incisus n. sp.

Plate 9, figures 1a, b, 2a, b

Proptychites strigatus Tozer, 1961, Pl. 11, figs. 4a–c (only).

Registered material. Holotype GSC 28081 (GSC loc. 51593). Paratype GSC 28082 (GSC loc. 64765). Hypotype GSC 14035 (Tozer, 1961, Pl. 11, figs. 4a–c) (GSC loc. 32373).

Occurrence. Upper Griesbachian, Strigatus Zone. Blind Fiord Formation, Ellesmere and Axel Heiberg islands. GSC locs. 32373 (1), 51593 (1), 64765 (1).

Diagnosis. Bukkenites with very small umbilicus (about 12 per cent of diameter), no excentrumbilication. Flanks flat or concave, whorls thick (about 50 per cent of diameter), thickest at the umbilical edge. Umbilical wall undercut.

Measurements. Paratype GSC 28082 (Pl. 9, fig. 2) 112, 0.55, 0.48, 0.12.

Remarks. In the holotype, much of the body chamber is preserved, but little of the phragmocone. The last two septa are preserved and are closely spaced, suggesting approximation. The specimen indicates a species of *Bukkenites* that attained a large size with the retention of a small umbilicus, without excentrumbilication. The other specimens are well preserved phragmocones. The only closely similar species is *Bukkenites nitidus* n. sp., which differs in being excentrumbilicate and more evolute.

Bukkenites nitidus n. sp.

Plate 7, figures 5a, b; Plate 8, figures 4a, b; Figure 9c (p. 362)

Proptychites strigatus Tozer, 1961, p. 55, Pl. 11, figs. 2a, b (only).

Pachyproptychites strigatus (Tozer). TOZER, 1967, Pl. 3, figs. 2a, b.

Registered material. Holotype GSC 18896 (GSC loc. 64765). Hypotype GSC 28077* (GSC loc. 51689). Hypotype GSC 14037 (Tozer, 1961, Pl. 11, figs. 2a, b) (GSC loc. 32373). Hypotype GSC 14039* (GSC loc. 32367).

Occurrence. Upper Griesbachian, Strigatus Zone. Blind Fiord Formation, Ellesmere and Axel Heiberg islands. GSC locs. 32367 (1), 32373 (1), 51689 (4), 64765 (1).

Diagnosis. Bukkenites with small umbilicus (about 18 per cent of diameter), excentrumbilicate. Flanks flat, whorls thick (about 50 per cent of diameter), thickest at the umbilical edge. Umbilical wall undercut.

Measurements. Holotype GSC 18896 (Pl. 8, fig. 4): 82, 0.49, 0.49, 0.18.

Remarks. In the holotype, only part of the body chamber is preserved, but enough to show that the umbilical seam is excentric. The phragmocone reveals both the internal and external suture lines. Morphologically this species forms a link between *Bukkenites incisus* n. sp. and *B. strigatus* (Tozer). Compared with *B. incisus* it is more evolute; compared with *B. strigatus* the whorls are thicker, with an undercut, not vertical umbilical wall, and the flanks are flat, not convex.

Bukkenites strigatus (Tozer)

Plate 7, figures 6a, b; Plate 8, figures 2a, b, 3a, b; Figure 9b (p. 362)

Proptychites strigatus Tozer, 1961, p. 55, Pl. 10, figs. 1a, b, 2a, b; not Pl. 11, figs. 2a, b (= *Bukkenites nitidus* n. sp.); not Pl. 11, figs. 3a, b (= *Bukkenites macilentus* n. sp.); not Pl. 11, figs. 4a–c (= *Bukkenites incisus* n. sp.).

not *Pachyproptychites strigatus* (Tozer). TOZER, 1967, Pl. 3, figs. 2a, b (= *Bukkenites nitidus* n. sp.).

not *Vavilovites strigatus* (Tozer). ERMAKOVA, 1981, p. 109, Pl. 10, fig. 1; Pl. 11, fig. 1 (= *Vavilovites* sp.).

Registered material. Holotype GSC 14042 (Tozer, 1961, Pl. 10, figs. 2a, b), paratype GSC 14043 (ibid., figs. 1a, b) (both GSC loc. 32373). Hypotype GSC 28076 (GSC loc. 47525). Hypotype GSC 28078 (GSC loc. 47611). Hypotype GSC 28079 (GSC loc. 47530). Hypotype GSC 28083* (GSC loc. 64763).

Occurrence. Upper Griesbachian, Strigatus Zone. Blind Fiord Formation, Axel Heiberg Island. GSC locs. 32373 (2), 47525 (1), 47530 (2), 47553 (2), 47570 (1), 47607 (1), 47611 (1), 51664 (7), 64763 (1), 64765 (8), 64768 (1), 64770 (1).

Diagnosis. Bukkenites with large umbilicus (U about 25 per cent of diameter), excentrumbilicate. Flanks flat on the inner whorls, convex on the outer. Whorls thick, at least on the phragmocone, where W is about 40 per cent of diameter. Umbilical wall vertical.

Measurements. Holotype GSC 14042: 95, 0.47, 0.41, 0.21. Hypotype GSC 28076 (Pl. 8, fig. 3): 197, 0.44, 0.30, 0.26. Hypotype GSC 28078 (Pl. 7, fig. 6): 194, –, –, 0.25.

Remarks. The diagnosis is based on large specimens (e.g., GSC 28076, Pl. 8, fig. 3), GSC 28078 (Pl. 7, fig. 6) which have an outer whorl with distinctly convex rather than flat flanks, and inner whorls essentially like those of the holotype. Both have

approximated septa. GSC 28076 (Pl. 8, fig. 3) is excentrumbilicate, U at a diameter of 80 mm being 20 per cent of the diameter. This specimen is evidently complete and mature.

Bukkenites macilentus n. sp.

Plate 7, figures 7a, b; Figure 9a (p. 362)

Proptychites strigatus Tozer. TOZER, 1961, Pl. 9, fig. 3, Pl. 11, figs. 3a, b (only).

Registered material. Holotype GSC 28080 (GSC loc. 64771). Two hypotypes GSC 14040 (Tozer, 1961, Pl. 9, fig. 3), GSC 14033 (ibid., Pl. 11, figs. 3a, b) (both GSC loc. 32373).

Occurrence. Upper Griesbachian, Strigatus Zone. Blind Fiord Formation, Axel Heiberg Island. GSC locs. 32373 (2), 64771 (1).

Diagnosis. Bukkenites with large umbilicus (about 25 per cent of diameter), excentrumbilicate. Flanks convex, outer whorls thin (about 33 per cent of diameter). Umbilical wall vertical.

Measurements. Holotype GSC 28080 (Pl. 7, fig. 7): 65, 0.48, 0.34, 0.23.

Remarks. The holotype shows the inner whorls in section. They are much like the outer whorl of GSC 14033 (Tozer, 1961, Pl. 11, fig. 3), i.e., they have convex flanks and an almost ovoid, not subtrigonal whorl section. Part of the body chamber and an excentric umbilicus are seen in GSC 14040 (ibid., Pl. 9, fig. 3). This species most closely resembles *Bukkenites strigatus* (Tozer), but is more compressed. At no stage has it the thick subtrigonal whorl section characteristic of the inner whorls of *B. strigatus* and the whole conch of *B. incisus* n. sp. and *B. nitidus* n. sp. The whorl section is somewhat like that of *Proptychites rosenkrantzi* Spath (1930, p. 40), which differs in being more involute and in having somewhat more convex flanks.

Bukkenites nanus n. sp.

Plate 8, figures 1 a, b; Figure 10 (p. 364)

Registered material. Holotype GSC 28075 (GSC loc. 47525).

Occurrence. Upper Griesbachian, Strigatus Zone. Blind Fiord Formation, Bjarnason Island (Axel Heiberg Island). GSC loc. 47525 (1).

Diagnosis. Bukkenites with very large umbilicus (about 30 per cent of diameter), which is not markedly excentrumbilicate. Flanks convex, whorls fairly thin (about 36 per cent of diameter). Umbilical wall vertical.

Measurements. Holotype GSC 28075 (Pl. 8, fig. 1): 72, 0.43, 0.36, 0.30.

Remarks. This species is known only from the holotype. The whorl section is like that of *B. macilentus* and the outer whorl of *B. strigatus,* but *B. nanus* is appreciably more evolute.

Genus *Proptychites* Waagen, 1895

Type species. Ceratites lawrencianus de Koninck.

Proptychites candidus Tozer

Plate 11, figures 4a, b, 5; Plate 12, figures 3a, b, 4, 5a, 5b; Figures 13c, d (p. 372)

Proptychites candidus Tozer, 1961, p. 57, Pl. 11, figs. 1a–c; TOZER, 1967, p. 18, 51, 52, Pl. 4, figs. 1a, b.

Proptychites sp. cf. *P. candidus* Tozer. TOZER, 1963a, p. 22, Pl. 3, figs. 1a–c; 2, 3.

Registered material. Holotype GSC 14044 (Tozer, 1961, Pl. 11, figs. 1a–c), two paratypes GSC 14045*, GSC 14046* (all GSC loc. 32368). Two hypotypes GSC 14284 (Tozer, 1963a, Pl. 3, fig. 2), GSC 14286 (ibid., Pl. 3, fig. 3) (both GSC loc. 48848). Hypotype GSC 14285 (ibid., Pl. 3, figs. 1a–c) (GSC loc. 48847). Hypotype GSC 28084 (GSC loc. 51693). Hypotype GSC 28085 (GSC loc. 51691). Hypotype GSC 28086* (GSC loc. 51694). Three topotypes GSC 28087*, GSC 28088*, GSC 72208* (all GSC loc. 47575). Topotype GSC 28089* (GSC loc. 64729). Two hypotypes GSC 28090, GSC 28091 (GSC loc. 68274). Hypotype GSC 28092 (GSC loc. 56220).

Occurrence. Dienerian, Candidus Zone. Blind Fiord Formation, Ellesmere and Axel Heiberg islands; Toad Formation northeast British Columbia. GSC locs. 32368 (4), 47551 (1), 47575 (3), 48847 (1), 48848 (2), 51691 (6), 51692 (5), 51693 (1), 51694 (4), 56180 (1), 56181 (5), 56204 (2), 56220 (2), 64729 (3), 64730 (1), 68274 (2).

Measurements. Topotype GSC 28089*: 105, 0.42, 0.30, 0.28. Topotype GSC 28087*: 113, 0.44, 0.29, 0.27. Topotype GSC 72208*: 142, 0.44, 0.30, 0.29. Hypotype GSC 28084 (Pl. 11, fig. 4): 93, 0.44, 0.21,

0.30. Hypotype GSC 28092 (Pl. 12, fig. 5): 180, 0.44, 0.33, 0.28.

Remarks. Incomplete specimens that attained a diameter of about 200 mm are known from both Axel Heiberg Island (GSC 28087*) and British Columbia (GSC 28090, Pl. 12, fig. 4). Some from Diener Creek (e.g., GSC 28084, Pl. 11, fig. 4) are more compressed than those from Axel Heiberg Island and British Columbia. Others from Diener Creek (e.g., GSC 28084*), although incomplete, evidently had proportions much like those of the specimens from the type locality (Axel Heiberg Island). Preparation of the suture line of paratype GSC 14046 (Fig. 13c) shows that E, although not perfectly preserved, is wider than that of the holotype (Tozer, 1961, Pl. 11, fig. 1b) and much like that of GSC 28091 from British Columbia (Fig. 13d). The internal suture line has been exposed on GSC 72208. There is an unusually deep lobe adjacent to I.

Proptychites mulleri Tozer

Plate 10, figure 6

Proptychites mulleri Tozer, 1963a, p. 18, Pl. 2, figs. 1a–d; TOZER, 1967, p. 18, 75.

Registered material. Holotype GSC 14268 (GSC loc. 42372).

Occurrence. Dienerian, Candidus Zone. Grayling Formation, northeastern British Columbia. GSC loc. 42372 (1).

Remarks. This species may be no more than an evolute variant of *Proptychites candidus* Tozer with a wider E. The septal surface shows that the internal suture line is similar, with a deep lobe adjacent to I.

Proptychites kummeli Tozer

Plate 10, figures 4a, b; Figure 11c (p. 368)

Proptychites kummeli Tozer, 1963a, p. 20, Pl. 1, figs. 1–3; TOZER, 1967, p. 18, 75.

Registered material. Holotype GSC 14272 (Tozer, 1963a, Pl. 1, figs. 1a–c), paratype GSC 14273 (ibid., figs. 2a, b), paratype GSC 14274 (ibid., figs. 3a, b) (all GSC loc. 42372).

Occurrence. Dienerian, Candidus Zone. Grayling Formation, northeastern British Columbia. GSC loc. 42372 (3).

Proptychites newelli Tozer

Plate 10, figures 3a, b; Figure 11b (p. 368)

Proptychites newelli Tozer, 1963a, p. 19, Pl. 1, figs. 4a–d; TOZER, 1967, p. 18, 75.

Registered material. Holotype GSC 14270, paratype GSC 14271* (GSC loc. 42372).

Occurrence. Dienerian, Candidus Zone. Grayling Formation, northeastern British Columbia. GSC loc. 42372 (2).

Genus *Dunedinites* Tozer, 1963a

Type species. Dunedinites pinguis Tozer.

Dunedinites pinguis Tozer

Plate 10, figures 2a, b; Figure 11d (p. 368)

Dunedinites pinguis Tozer, 1963a, p. 24, Pl. 1, figs. 6a–d, 7; TOZER, 1967, p. 18, 75.

Registered material. Holotype GSC 14287, paratype GSC 14288 (Tozer, 1963a, Pl. 1, fig. 7) (both GSC loc. 42372).

Occurrence. Dienerian, Candidus Zone. Grayling Formation, northeastern British Columbia. GSC loc. 42372 (2).

Genus *Koninckites* Waagen, 1895

Type species. Koninckites vetustus Waagen.

Koninckites dimidiatus n. sp.

Plate 20, figures 3a, b, 4; Figure 18a (p. 388)

Paranorites n. sp. aff. *P. inflatus* Spath. TOZER, 1967, p. 18, 73.

Registered material. Holotype GSC 28107, paratypes GSC 28108, 28109* (all GSC loc. 56225).

Occurrence. Dienerian, Sverdrupi Subzone 1. Toad Formation, northeastern British Columbia; Sulphur Mountain Formation, Vega Siltstone Member, Alberta. GSC locs. 56225 (6), 68872 (3).

Diagnosis. Koninckites attaining a diameter of about 65 mm; H about 50 per cent, W about 25 per cent, U

about 22 per cent of diameter. Umbilical wall inclined or perpendicular, umbilical shoulder well defined, venter a low arch defined by prominent ventral shoulders. Surface nearly smooth with radial striae and spiral lirae. Suspensive lobe with poorly developed auxiliary lobe.

Measurements. Holotype GSC 28107 (Pl. 20, fig. 4): at 40, 0.51, 0.25, 0.22.

Remarks. The holotype is an almost complete specimen having most of the body chamber preserved only in the umbilical area. The complete diameter was about 60 mm. GSC 28109* is a body chamber fragment with a maximum whorl height of 30 mm, indicating a specimen that attained a diameter of about 65 mm. What is exposed of the umbilical wall on the holotype is perpendicular, that of GSC 28108 is inclined. Delicate spiral lirae are preserved only on the holotype.

Closely similar species include "*Meekoceras*" *shalshalense* Krafft (in Krafft and Diener, 1909, p. 33), *Koninckites vetustus* Waagen (1895, p. 261) and "*Paranorites*" *inflatus* Spath (1934, p. 149). Krafft's species differs in having low falcoid ribs; *K. vetustus* has less prominent umbilical and ventral shoulders; "*P.* " *inflatus* has a flatter venter.

Genus *Vavilovites* Tozer, 1971

Type species. Paranorites sverdrupi Tozer.

Vavilovites sverdrupi (Tozer)

Plate 15, figures 1–3; Plate 20, figures 2a, b; Figure 16a (p. 380)

Paranorites sverdrupi Tozer, 1963a, p. 12, Pl. 4, figs. 1–6; TOZER, 1965b, p. 5; TOZER, 1967, p. 18, 50–52, 73, 74, Pl. 4 , figs. 2a, b; TOZER, 1970, Pl. 16, figs. 7a, b.

Vavilovites sverdrupi (Tozer). TOZER, 1971, p. 1031.

Registered material. Holotype GSC 14277 (Tozer, 1963a, Pl. 4, figs. 2a–d), five paratypes GSC 14275, GSC 14276 (ibid., Pl. 4, fig. 1), 14278*, 14279*, 14280* (ibid., Pl. 4, fig. 3) (all GSC loc. 47543). Two paratypes GSC 14281*, GSC 28098 (both GSC loc. 47621). Two hypotypes GSC 14282 (ibid., Pl. 4, figs. 5a, b), GSC 14283 (ibid., Pl. 4, figs. 6a–c) (both GSC loc. 46470). Hypotype GSC 18898 (Tozer, 1967, Pl. 4, figs. 2a, b) (GSC loc. 64715). Hypotype GSC 28099* (GSC loc. 51670). Hypotype GSC 28100 (GSC loc. 56222).

Occurrence. Dienerian, Sverdrupi Subzone 2. Blind Fiord Formation, Ellesmere and Axel Heiberg islands; Toad Formation, northeastern British Columbia; Sulphur Mountain Formation, Vega Siltstone Member, Alberta. GSC locs. 26109 (1), 42397 (1), 46470 (2), 47543 (28), 47621 (5), 51666 (4), 51670 (3), 56205 (1), 56222 (3), 56233 (1), 64715 (8), 64723 (1), 64725 (4), 64863 (1).

Measurements. Hypotype GSC 18898: 114, 0.42, 0.29, 0.25. Hypotype GSC 28099*: 118, 0.46, 0.30, 0.24. Paratype GSC 14276: 200, 0.43, 0.30, 0.25 (D estimated).

Remarks. Specimens like those from the type locality occur at several localities in the Arctic Islands, e.g., GSC 18898 (Tozer, 1967, Pl. 4, figs. 2a, b) from northern Axel Heiberg Island and GSC 28099* from the Diener Creek area, Ellesmere Island. None have an umbilical width exceeding 25 per cent of the diameter. Phragmocones attain a maximum width of 36 per cent. The inner whorls, e.g., those of GSC 28098 (Pl. 15, fig. 3) may be much like those of *Koninckites dimidiatus* n. sp. The largest known specimen, which was probably complete and mature, is GSC 14276 (Tozer, 1963a, Pl. 4, fig. 1). The specimens from British Columbia do not show suture lines.

Vavilovites obtusus n. sp.

Plate 16, figures 1–5; Figures 16b, c (p. 380)

Registered material. Holotype GSC 28097, four paratypes GSC 28093, GSC 28094, GSC 28095, GSC 28096 (all GSC loc. 51695).

Occurrence. Dienerian, Sverdrupi Subzone 2. Blind Fiord Formation, Ellesmere Island. GSC loc. 51695 (15).

Diagnosis. Vavilovites with H about 40 per cent, W about 25 per cent and U about 35 per cent of diameter. Ventral shoulders, on outer whorl, relatively blunt.

Measurements. Holotype GSC 28097 (Pl. 16, fig. 5): 100, 0.40, 0.25, 0.34.

Remarks. The holotype is appreciably more evolute and has much blunter ventral shoulders compared with examples of *Vavilovites sverdrupi* (Tozer).

Genus *Kingites* Waagen, 1895

Type species. Kingites lens Waagen.

Kingites discoidalis n. sp.

Plate 19, figures 1–3

Clypeoceras n. sp., TOZER, 1967, p. 18, 19, 50, 51.

Registered material. Holotype GSC 28102, paratype GSC 28103 (both GSC loc. 64716). Paratype GSC 28101 (GSC loc. 47584).

Occurrence. Dienerian, Sverdrupi Subzone 3. Blind Fiord Formation, Axel Heiberg Island. GSC locs. 47584 (1), 64716 (4).

Diagnosis. Kingites attaining a diameter of about 200 mm; H about 45 per cent, W about 18 per cent, U about 25 per cent of diameter. Umbilical wall narrow, perpendicular; umbilical shoulder rounded. Whorls widest at inner third. Venter narrowly rounded. Surface smooth. Suspensive lobe with large indentations but no discrete auxiliary lobe.

Remarks. This species is known only from incomplete specimens. The holotype is the remains of a phragmocone which attained a diameter of about 140 mm. With half a whorl of body chamber, it would have been about 200 mm in diameter. The generic assignment of this species is questionable, but resemblance to *Kingites lens* Waagen is closer than might be supposed from comparison with the published illustrations (Waagen, 1895, p. 232, Pl. 26, figs. 4a–d). A photograph of the type specimen, kindly provided by the late Professor B. Kummel, shows the umbilical width to be about 15 per cent of the diameter (not 7 per cent, as indicated by Waagen), and the umbilical wall to be much like that of *K. discoidalis*, not funnel shaped, as stated by Spath (1934, p. 157). In whorl section and suture line the two are different, the whorls of *K. discoidalis* being more lanceolate in section and the suspensive lobe having more prominent and even indentations. *Kumaonites collignoni* Jeannet (type species of *Kumaonites*) is possibly congeneric with *Kingites discoidalis*. Preservation of the only known specimen of *Kumaonites collignoni* is poor. The suture line seems to have been incorrectly interpreted by Jeannet (1959, fig. 32, p. 43) as the result of joining the external saddle of one septum with part of the external lobe of the preceding one. *Kumaonites* is interpreted as a synonym of *Kingites*.

Kingites thulensis n. sp.

Plate 17, figures 2a, b

Paranorites sp. cf. *P. kingianus* (Waagen). TOZER, 1967, p. 18, 51.

Registered material. Holotype, GSC 28104 (GSC loc. 64717).

Occurrence. Dienerian, Sverdrupi Zone. Blind Fiord Formation, Axel Heiberg Island. GSC loc. 64717 (1).

Diagnosis. Kingites attaining a diameter of about 250 mm, H is about 45 per cent, W about 25 per cent, and U about 25 per cent of diameter. Umbilical shoulder rounded. Whorls widest at inner third. Venter broadly rounded. Surface smooth. Suture line with discrete auxiliary lobe.

Remarks. The only known specimen is a phragmocone whorl fragment, which attained a height of about 80 mm. It is the remains of a specimen at least 250 mm in diameter. There is resemblance, particularly in suture line, to *Paranorites kingianus* (Waagen) (1895, p. 225) but that species, from Waagen's description, differs in having a somewhat flattened venter and broad radial undulations on the flank.

Genus *Heibergites* n. gen.

Type species. Prionolobus heibergensis Tozer, 1962b, p. 1128 (= *Prionolobus plicatus* Tozer, 1961, p. 49, not of Waagen, 1895, p. 315).

Diagnosis. Smooth or very weakly ribbed discoidal proptychitid with compressed whorls, a narrow, perpendicular umbilical wall, rounded umbilical shoulder and a tabulate or slightly sulcate venter defined by sharp ventral shoulders. Suture line with a wide E, with deep indentations; rounded, non-phylloid saddles and a suspensive lobe with deep indentations and a moderately well individualized auxiliary lobe (U4).

Species assigned. Heibergites heibergensis (Tozer), probably also "*Meekoceras*" *magnumbilicatum* Waagen (1895, p. 251).

Occurrence. Dienerian. Axel Heiberg Island, probably also Salt Range.

Remarks. The discoidal shape and tabulate venter of *Heibergites* could be taken to indicate affinity with Meekoceratidae but the deep indentations in the suture line, particularly those of the suspensive lobe, distinguish *Heibergites* from comparably coiled Meekoceratidae (*Prionolobus, Ambites, Meekoceras*), all of which have shallow indentations in the suspensive lobe. The suture line of *Heibergites* is like that of Proptychitidae, e.g., *Paranorites* and *Vavilovites*, but they have thick whorls, broad venters

and blunt ventral shoulders and are thus distinguished from *Heibergites*.

Heibergites heibergensis (Tozer)

Plate 17, figures 1a, b; Plate 18, figures 2a, b

Prionolobus plicatus Tozer, 1961, p. 49, Pl. 20, figs. 4a–c, 5a–c (not of Waagen, 1895, p. 315).

Prionolobus heibergensis Tozer, 1962b, p. 1128.

Registered material. Holotype GSC 14047 (Tozer, 1961, Pl. 20, figs. 5a–c), paratype GSC 14048 (ibid., figs. 4a–c) (both GSC loc. 32366). Topotype GSC 28105 (GSC loc. 64731). Hypotype GSC 28106 (GSC loc. 64716).

Occurrence. Dienerian, Sverdrupi Subzone 3. Blind Fiord Formation, Axel Heiberg Island. GSC locs. 32366 (3), 32367 (1), 47554 (2), 64716 (2), 64731 (10), 64856 (2).

Measurements. Topotype GSC 28105 (Pl. 18, fig. 2): at 120, 0.44, 0.19, 0.24.

Remarks. The proportions and suture line of GSC 28106 (Pl. 17, fig. 1) closely resemble those of the holotype. Preservation of the venter and umbilical wall is imperfect, but there is not much doubt that the venter was narrowly tabulate. Two features characteristic of this species, a narrow, perpendicular umbilical wall and faint ribbing, are not shown by GSC 28106 but their absence may be due to imperfect preservation. Topotype GSC 28105 (Pl. 18, fig. 2) has faint ribbing, appreciably less prominent than on the holotype, the flanks being much like those of GSC 28106. GSC 28105 is the largest known specimen. With the body chamber it probably attained a diameter of about 180 mm.

Genus *Arctomeekoceras* Popov, 1962

Type species. Meekoceras rotundatum Mojsisovics.

Arctomeekoceras obtusum n. sp.

Plate 37, figures 20, 21; Figure 25a (p. 422)

Registered material. Holotype GSC 85767 (GSC loc. 101889). Paratype GSC 85768 (GSC loc. C-134797).

Occurrence. Spathian, Pilaticus Zone. Blind Fiord Formation, Axel Heiberg Island. GSC locs. 101889 (1), C-134797 (1).

Diagnosis. Arctomeekoceras with H about 60 per cent, W about 20 per cent, U about 10–12 per cent of diameter. Umbilical wall perpendicular, umbilical shoulder rounded, flanks nearly flat, venter arched. Phragmocone with low, slightly convex ribs on inner half of flank, about six per half whorl; body whorl merely striate. Suture line with slightly phylloid saddles and rather deeply denticulated lobes. Suspensive lobe long, with numerous denticulations, those on the outer part smaller than on the inner but not forming a true auxiliary lobe.

Measurements. Holotype GSC 85767 (Pl. 37, fig. 20): 31, 0.58, 0.22, 0.10. Paratype GSC 85768 (Pl. 37, fig. 21): 22, 0.55, 0.25, 0.13.

Remarks. The ribbing of the phragmocone is best shown by the paratype, GSC 85768 (Pl. 37, fig. 21). The general form suggests affinity with *Arctomeekoceras rotundatum* (Mojsisovics) (1886, p. 83) from which the new species differs in having a ribbed phragmocone and a suture line with a longer suspensive lobe.

Family MEEKOCERATIDAE Waagen, 1895

Genus *Meekophiceras* n. gen.

Type species. Meekophiceras franklini n. sp.

Diagnosis. Smooth discoidal Meekoceratidae with a moderately excentric umbilical spiral, attaining an umbilical width of about 25 per cent of the diameter. Venter subtabulate with distinct ventral shoulders on the inner whorls; shoulders more rounded on the outer whorl. Suture line with very delicately indented lobes; E wide, auxiliary lobe absent.

Species assigned. Meekophiceras franklini n. sp., *"Koninckites" columbianus* Tozer, probably also *"Ophiceras (Lytophiceras)" dubium* Spath (1935, p. 26), *"Koninckites" kraffti* Spath (1930, p. 28), *"Meekoceras" kyokticum* v. Krafft (Krafft and Diener, 1909, p. 52).

Occurrence. In Canada *Meekophiceras* is known only in the Dienerian (Candidus Zone). In Greenland it may appear earlier, *"Ophiceras (Lytophiceras)" dubium* Spath, supposedly of Griesbachian age, evidently being a representative of *Meekophiceras*. Axel Heiberg Island, northeastern British Columbia, East Greenland, Himalayas.

Remarks. Meekophiceras seems to provide a link between the Ophiceratidae and Meekoceratidae. Ophiceratidae are characterized by rounded venters,

Meekoceratidae by tabulate venters. The venter of *Meekophiceras* is morphologically in between. The suture line of the new genus, with very shallow, delicate denticulation and a suspensive lobe without an auxiliary lobe, is like that of some Ophiceratidae, although members of that family characteristically have a narrow, not wide E, unlike *Meekophiceras*. *Discophiceras* appears to be the most closely related genus, but differs in lacking a subtabulate venter on the inner whorls and characteristically, but not invariably, by having a narrow E. *Koninckites* differs in having a more divided suture line, with a distinct auxiliary lobe. *Prionolobus* and *Meekoceras* differ in retaining a tabulate venter on much or all of the outer whorl.

Meekophiceras columbianum (Tozer)

Plate 10, figures 1a, b; Figure 11e (p. 368)

Koninckites columbianus Tozer, 1963a, p. 15, Pl. 5, figs. 7, 8.

Discophiceras columbianum (Tozer), TOZER, 1967, p. 18, 75.

Registered material. Holotype GSC 14266 (Tozer, 1963a, Pl. 5, figs. 7a–c), paratype GSC 14267 (ibid., figs. 8a–c) (both GSC loc. 42372).

Occurrence. Dienerian, Candidus Zone. Grayling Formation, northeastern British Columbia. GSC loc. 42372 (2).

Meekophiceras franklini n. sp.

Plate 11, figures 1–3; Figure 12 (p. 370)

Registered material. Holotype GSC 28071, paratype GSC 28072* (both GSC loc. 47551). Two paratypes GSC 28073, GSC 28074 (both GSC loc. 64729).

Occurrence. Dienerian, Candidus Zone. Blind Fiord Formation, Axel Heiberg Island. GSC locs. 47551 (2), 64729 (4), 64730 (3).

Diagnosis. Meekophiceras attaining a diameter of about 125 mm; H about 40 per cent, W about 25 per cent, U about 28 per cent of diameter; inner whorls appreciably more involute. Inner whorls, to a diameter of at least 40 mm, with distinct ventral shoulders and a subtabulate venter.

Remarks. The holotype (Pl. 11, fig. 1) shows the subtabulate inner whorls; the paratypes (e.g., GSC 28074, Pl. 11, fig. 2) show the more rounded shoulders of the outer whorl. This species closely resembles *Meekophiceras columbianum* (Tozer). The inner whorls of *M. columbianum* are less perfectly known, compared with those of *M. franklini*, but there seems to be no doubt that the whorls of the new species have more distinct ventral shoulders than those of *M. columbianum*.

Genus *Pleurogyronites* n. gen.

Type species. Pleurogyronites kraffti n. sp.

Diagnosis. Serpenticone meekoceratid (umbilical width about 45 per cent of diameter) with a tabulate venter and angular ventral shoulders. Phragmocone sculptured with thin, simple, distant, radial, blunt ribs. Suture line with narrow E and very delicately indented lateral lobes.

Species assigned. Type species.

Occurrence. Dienerian. Northeastern British Columbia, probably also Himalayas.

Remarks. The mode of coiling, whorl section and the simple ceratitic suture line indicate affinity with *Gyronites* Waagen (1895), which differs in having smooth flanks. *Xenodiscoides* Spath (1930) differs in having much thicker ribs and less pronounced ventral shoulders.

Pleurogyronites kraffti n. sp.

Plate 10, figures 5a, b; Figure 11a (p. 368)

Xenodiscoides sp. cf. *X. radians* (Waagen). TOZER, 1963a, p. 11, Pl. 1, figs. 5a–c; TOZER, 1967, p. 18, 75.

Registered material. Holotype GSC 14269 (GSC loc. 42372).

Occurrence. Dienerian, Candidus Zone. Grayling Formation, northeastern British Columbia. GSC loc. 42372 (1).

Diagnosis. Pleurogyronites attaining a diameter of about 50 mm; H about 34 per cent, W about 27 per cent, U about 45 per cent of diameter. Umbilical and ventral shoulders well defined, umbilical wall inclined, venter flat. On phragmocone inner two thirds of whorl side have radial ribs, about 20 on the outer septate whorl.

Measurements. Holotype GSC 14269 (Pl. 10, fig. 5): at 32, 0.34, 0.27, 0.45.

Remarks. The holotype is a phragmocone, apparently complete, about 40 mm in diameter followed by a poorly preserved portion of the body chamber. The original complete diameter was about 50 mm.

Pleurogyronites kraffti closely resembles specimens identified as *Xenodiscus radians* (Waagen), *Xenodiscus* sp. cf. *X. plicosus* (Waagen) and *Xenodiscus rotula* (Waagen) by Krafft and Diener (1909, Pl. 23, figs. 4a, b; Pl. 25, figs. 1–4). These specimens, which are from the Himalayas, have prominent ventral shoulders, like those of *P. kraffti*. They probably represent one or more species congeneric with *P. kraffti*. However, the type specimens of Waagen's species, which are from the Salt Range, do not have comparable shoulders and do not closely resemble *P. kraffti* and the specimens from the Himalayas.

Genus *Ambites* Waagen, 1895

Type species. Ambites discus Waagen.

Ambites fuliginatus n. sp.

Plate 13, figures 4, 5, 7; Plate 14, figures 8a, b; Figure 15a (p. 376)

Prionolobus sp. cf. *P. lilangense* (Krafft). TOZER, 1967, p. 18, 73.

Prionolobus lilangense (Krafft). TOZER, 1970, Pl. 16, figs. 6a, b (not *Meekoceras lilangense* Krafft, in Krafft and Diener, 1909, p. 23).

Registered material. Holotype GSC 28123 (GSC loc. 88732). Paratype GSC 28121 (GSC loc. 88733). Paratype GSC 28124 (GSC loc. 68273). Three paratypes GSC 21768 (Tozer, 1970, Pl. 16, figs. 6a, b), GSC 28125, GSC 28126* (all GSC loc. 56202).

Occurrence. Dienerian, Candidus Zone. Grayling and Toad formations, northeastern British Columbia. GSC locs. 56180 (6), 56181 (10), 56202 (8), 56204 (2), 56231 (3), 68273 (6), 68274 (1), 88732 (2), 88733 (15).

Diagnosis. Ambites attaining a diameter of about 85 mm; H about 45 per cent, W about 23 per cent, U about 25 per cent of diameter. Umbilical wall inclined, umbilical shoulder moderately well defined, flanks weakly convex. Surface of phragmocone smooth; on body chamber there are convex striae, which may be grouped to form low ribs.

Measurements. Holotype GSC 28123 (Pl. 14, fig. 8): at 79, 0.44, 0.23, 0.24.

Remarks. Blunt ribbing is shown only by the larger specimens, less prominently by the holotype (Pl. 14, fig. 8), more so by GSC 28184 (Pl. 13, fig. 7). GSC 28184 also shows spiral lirae on the surface of the test at the venter and, less clearly, spiral ridges on both the test and the steinkern on the flank. Resemblance to "*Meekoceras*" *lilangense* Krafft (Krafft and Diener, 1909, p. 23) is very close, but the new species differs in having appreciably more conspicuous ribs and striae on the body chamber.

Ambites ferruginus n. sp.

Plate 14, figures 1–7; Figure 15b (p. 376)

Prionolobus sp. cf. *P. lilangense* (Krafft). TOZER, 1967, p. 51.

Registered material. Holotype GSC 28134, three paratypes GSC 28131, 28132, 28133 (all GSC loc. 51665). Three paratypes GSC 28128, GSC 28129, GSC 28130 (all GSC loc. 51694).

Occurrence. Dienerian, Candidus Zone. Blind Fiord Formation, Ellesmere Island. GSC locs. 51665 (25), 51693 (1), 51694 (10).

Diagnosis. Ambites attaining a diameter of about 100 mm; H about 44 per cent, W about 30 per cent, U about 30 per cent of diameter. U on phragmocone as small as 12 per cent of diameter. Umbilical wall perpendicular, umbilical shoulder rounded, flanks weakly convex. Surface smooth on both phragmocone and body chamber.

Measurements. Holotype GSC 28134 (Pl. 14, fig. 7): 68, 0.44, 0.31, 0.30.

Remarks. The size attained is indicated by GSC 28131 (Pl. 14, fig. 4), a body chamber fragment with a whorl height of about 50 mm. The suture lines of GSC 28132 and GSC 28133 show rounded lateral lobes, with delicate denticulation and a similarly denticulated suspensive lobe.

This species closely resembles "*Meekoceras*" *lilangense* Krafft and *Ambites fuliginatus* n. sp. Compared with the former, it is slightly more evolute; compared with the latter, it has a rounded instead of slightly angular umbilical margin and a smoother body chamber.

Ambites wissneri n. sp.

Plate 13, figures 8a–c

Registered material. Holotype GSC 28122 (GSC loc. 88732).

Occurrence. Dienerian, Candidus Zone. Grayling Formation, northeastern British Columbia. GSC loc. 88732 (1).

Diagnosis. Ambites with relatively small umbilicus, being no more than 15 per cent of the diameter on the phragmocone. Umbilicus deep, with undercut umbilical wall and abruptly rounded umbilical shoulder; flanks flat.

Remarks. This species is known only from the holotype. No sutures are visible, but the specimen is probably wholly septate because the extension of the umbilical seam shows that an additional half whorl was originally present. The angular ventral shoulders and tabulate venter suggest assignment to *Ambites* but the deep umbilicus and undercut umbilical wall distinguish this species from *A. fuliginatus* n.sp. and all other *Ambites* species.

The name is for Ulrich Wissner, who discovered the type specimen and the type locality.

Genus *Pleurambites* n. gen.

Type species. Pleurambites frechi n. sp.

Diagnosis. Discoidal meekoceratid (umbilical width 30–35 per cent of diameter) with almost concentric coiling, a tabulate venter and angular ventral shoulders. Flanks sculptured with simple, somewhat convex ribs. Suture line with delicately indented lobes.

Species assigned. Pleurambites frechi n. sp., "*Prionolobus*" *plicatus* Waagen (1895, p. 315).

Occurrence. Dienerian. Northeastern British Columbia, Salt Range (Pakistan).

Remarks. Distinguished from *Ambites* Waagen by being ribbed instead of smooth. *Prionolobus* Waagen not only differs in being smooth, but also in having less prominent ventral shoulders. Some example of *Meekoceras* Hyatt have ribs, but they are less regular than those of *Pleurambites*; also, the coiling of *Meekoceras* is more excentric compared with that of *Pleurambites*. *Pleurogyronites* n. gen. is more evolute.

Pleurambites frechi n. sp.

Plate 13, figures 1–3, 6; Figure 14 (p. 374)

Prionolobus sp. cf. *P. plicatus* Waagen. TOZER, 1967, p. 18, 73.

Registered material. Holotype GSC 28114 (GSC loc. 88732). Two paratypes GSC 28112, GSC 28113 (both GSC loc. 68275). Paratype GSC 28115* (GSC loc. 56230). Paratype GSC 28116 (GSC loc. 56218).

Occurrence. Dienerian, Candidus Zone. Grayling and Toad formations, northeastern British Columbia. GSC locs. 56203 (1), 56218 (1), 56230 (1), 68275 (2), 88732 (1).

Diagnosis. Pleurambites attaining a diameter of about 60 mm; H about 38 per cent, W about 25 per cent, U about 33 per cent of diameter. Umbilical shoulder rounded, ventral shoulders well defined, venter flat. Flanks with convex ribs, 8–10 on a quarter whorl. Surface with delicate spiral lirae.

Measurements. Holotype GSC 28114 (Pl. 13, fig. 3): at 48, 0.38, 0.25, 0.33. Paratype GSC 28116 (Pl. 13, fig. 2): at 54, 0.39, 0.24, 0.32.

Remarks. Density of ribbing is variable, the holotype (Pl. 13, fig. 3) having more prominent, widely spaced ribs compared with GSC 28116 (Pl. 13, fig. 2). Suture lines, showing the narrow E and simple suspensive lobe are shown only by GSC 28112 (Fig. 14). The holotype invites comparison with "*Prionolobus*" *plicatus* Waagen (1895, p. 315) (=*Xenodiscus khoorensis* Krafft and Diener (1909, p. 88), which differs in having a more distinct umbilical wall and shoulder. The densely ribbed variant, GSC 28116, resembles a specimen identified as *Prionolobus plicatus* by Noetling (1905a, Pl. 23, fig. 2).

Etymology. The name commemorates Fritz Frech.

Genus *Gyronites* Waagen, 1895

Type species. Gyronites frequens Waagen.

Gyronites recentis n. sp.

Plate 22, figures 3a, b

Registered material. Holotype GSC 28119 (GSC loc. 56279).

Occurrence. Smithian, Romunderi Zone. Toad Formation, northeastern British Columbia. GSC loc. 56279 (1).

Diagnosis. Gyronites attaining a diameter of about 20 mm, H about 33 per cent, W about 17 per cent, U about 40 per cent of diameter. Umbilical shoulder poorly defined on phragmocone, more distinct on body chamber. Flanks weakly convex. Venter subtabulate, slightly convex, defined by distinct shoulders. Surface smooth.

Remarks. Parts of some suture lines are visible. The last half whorl appears to be body chamber. E has a single point. Several rounded external saddles are visible, but details of the lateral lobes have not been seen. The whorl section and proportions are much the same as in *Gyronites frequens* Waagen (1895, p. 292) but the species from British Columbia is a little more evolute than the lectotype (Spath, 1934, p. 91).

Genus *Prionolobus* Waagen, 1895

Type species. Prionolobus atavus Waagen.

Prionolobus welteri n. sp.

Plate 12, figures 1, 2; Figure 13a, b (p. 372)

Prionolobus sp. cf. *P. indoaustralicus* (Wanner). TOZER, 1967, p. 18, 73.

Registered material. Holotype GSC 28111 (GSC loc. 56182). Paratype GSC 28110 (GSC loc. 56183).

Occurrence. Dienerian, Candidus Zone. Toad Formation, northeastern British Columbia. GSC locs. 56182 (1), 56183 (1).

Diagnosis. Prionolobus attaining a diameter of about 90 mm, H about 40 per cent, W about 20 per cent, U about 33 per cent of diameter. Umbilical shoulder poorly defined, flanks weakly convex. Venter tabulate, with well developed ventral shoulders on most of phragmocone, becoming rounded, with less distinct shoulders, on the body chamber. Surface of venter with spiral lirae, elsewhere merely striate.

Measurements. Holotype GSC 28111 (Pl. 12, fig. 1): at 54, 0.41, 0.20, 0.33. Paratype GSC 28110 (Pl. 12, fig. 2) at 66, 0.38, 0.20, 0.36.

Remarks. The holotype (Pl. 12, fig. 1), as indicated by the extension of the umbilical seam, is the remains of a specimen about 90 mm in diameter. On most of the phragmocone the venter is tabulate, defined by distinct but blunt shoulders. On the last quadrant of the phragmocone, and what is preserved of the body chamber, the ventral shoulders are rounded and the venter arched. The proportions, change in nature of the whorl section, and what is preserved of the suture line, invite comparison with "*Meekoceras*" *indoaustralicum* Wanner (1911, p. 183), but that species lacks the spiral lirae of *Prionolobus welteri.*

Etymology. The name commemorates Otto Welter.

Prionolobus konincki n. sp.

Plate 20, figures 12, 13; Figure 18b (p. 388)

Registered material. Holotype GSC 28118, paratype GSC 28117 (both GSC loc. 56226).

Occurence. Dienerian, Sverdrupi Zone. Toad Formation, northeastern British Columbia. GSC loc. 56226 (2).

Diagnosis. Prionolobus attaining a diameter of about 65 mm, H about 40 per cent, W about 20 per cent, U about 33 per cent of diameter. Umbilical shoulder poorly defined, ventral shoulder well defined, venter flat. Surface of body chamber with faint ribbing.

Measurements. Paratype GSC 28117 (Pl. 20, fig. 12): 26, 0.42, 0.21, 0.33.

Remarks. The tabulate venter is perfectly shown by GSC 28117 (Pl. 20, fig. 12), less perfectly by the holotype (Pl. 20, fig. 13). The phragmocone of the holotype has smooth flanks and faint, low ribs on the body chamber, about eight on the last preserved quadrant. GSC 28117 (Pl. 20, fig. 12), probably an immature specimen, is smooth. In whorl section and proportions this species closely resembles "*Gyronites*" *evolvens* Waagen (1895, p. 295), which differs in having fainter ribbing. Species assigned to *Pleurambites* have more prominent ribbing.

Etymology. The name commemorates L.G. de Koninck.

Prionolobus lucinus n. sp.

Plate 22, figures 4a, b

Registered material. Holotype GSC 28120 (GSC loc. 56170).

Occurrence. Smithian, Romunderi Zone. Toad Formation, northeastern British Columbia. GSC loc. 56170 (1).

Diagnosis. Prionolobus attaining a diameter of about 25 mm, H about 38 per cent, W about 20 per cent, U about 30 per cent of diameter. Umbilical wall inclined, umbilical shoulder well defined. Inner flanks more convex than outer, imparting a slightly bottle-shaped whorl section. Venter tabulate defined by very distinct shoulders. Surface smooth.

Remarks. Suture lines are not clearly seen. Part of the last septum is visible, indicating that the last quarter whorl is body chamber. This species differs from typical representatives of *Prionolobus*, such as *P. atavus* Waagen (1895, p. 306), in having a better defined umbilical wall and shoulder.

Genus *Wyomingites* Hyatt, 1900

Type species. Meekoceras aplanatum White.

Wyomingites scapulatus n. sp.

Plate 20, figures 8, 9

Registered material. Holotype, GSC 28144 (GSC loc. 56228). Paratype GSC 28145 (GSC loc. 56233).

Occurrence. Dienerian, Sverdrupi Subzone 2. Toad Formation, northeastern British Columbia. GSC locs. 56228 (1), 56233 (1).

Diagnosis. Wyomingites with H about 45 per cent, W about 25 per cent, U about 35 per cent of diameter. Umbilical wall perpendicular on inner whorls, inclined on outer; umbilical shoulder prominent; ventral shoulders prominent; venter flat or forming a low arch. Ribs are low, wide, about 12 per whorl, most prominent on inner half of flank. Strigation delicate, present on both flanks and venter.

Measurements. Holotype GSC 28144 (Pl. 20, fig. 8): 27, 0.44, 0.25, 0.30. Paratype GSC 28145 (Pl. 20, fig. 9): at 33, 0.40, 0.35, 0.36.

Remarks. This species evidently attained a diameter of at least 40 mm, judging from GSC 28145 (Pl. 20, fig. 9). This specimen is more evolute than the holotype, probably due to excentrumbilication. Both specimens, on the outer whorl, have a steeply inclined or nearly perpendicular umbilical wall defined by a prominent, angular, umbilical shoulder. On the inner whorls the shoulder is rounded. Ventral shoulders are prominent and angular. The venter of the holotype is slightly arched, that of GSC 28145, flat. Both have blunt ribs, fairly prominent on the inner half of the flank, fading on the outer half. The outer whorl of the holotype has 10 ribs, that of GSC 28145, 13 ribs. Preservation of the test is good and shows delicate strigation on both the flanks and the venter, consisting of spiral lirae spaced about 0.5 mm apart. The holotype shows two ceratitic lateral lobes but no details of the external and suspensive lobes. Compared with *Wyomingites aplanatus* (White) (Smith, 1932, p. 51), *W. scapulatus* has more prominent umbilical and ventral shoulders, is a little more involute and has more distinct ribbing.

Genus *Meekoceras* Hyatt, 1879

Type species. Meekoceras gracilitatis White.

Meekoceras gracilitatis White

Plate 21, figures 2a, b

Meekoceras gracilitatis White. SMITH, 1932, p. 57 (with synonymy); TOZER, 1961, p. 65, Pl. 15, fig. 6; Pl. 17, figs. 1–3; Pl. 18, figs. 4–6; TOZER, 1967, p. 49; NICHOLS and SILBERLING, 1979, p. B3, Pl. 1, figs. 1–4; DAGYS and ERMAKOVA, 1990, p. 35, Pl. 6, figs. 5a, b, Pl. 7, figs. 1a–c, Pl. 8, figs. 1a, b, 2a, b.

not *Meekoceras gracilitatus* White [sic]. KUMMEL and STEELE, 1962, p. 693, Pl. 103, figs. 1–6.

not *Meekoceras gracilitatis* White. KUMMEL and ERBEN, 1968, p. 129, Pl. 20, figs. 1–3, 8–13.

Registered material. Five hypotypes GSC 14052*, GSC 14053*, GSC 14054*, GSC 14058 (Tozer, 1961, Pl. 17, figs. 1a, b), GSC 14061 (ibid., Pl. 18, fig. 4) (all GSC loc. 32371). Three hypotypes GSC 14055*, GSC 14056 (ibid., Pl. 17, figs. 2a, b), GSC 14060 (ibid., Pl. 17, fig. 3) (all GSC loc. 28682). Three hypotypes GSC 14057*, GSC 14062* (ibid., Pl. 18, fig. 5), GSC 14063* (ibid., Pl. 18, fig. 6) (all GSC loc. 28680).

Occurrence. Smithian, Romunderi Zone. Blind Fiord Formation, Ellesmere Island. GSC locs. 28680 (13), 28682 (4), 32371 (8), 48861 (4), 55512 (4).

Remarks. The specimens from Ellesmere Island and those from the type locality in Idaho have broad saddles and a distinctively narrow U2. The specimens excluded from the synonymy, which are from

Afghanistan and Nevada, have a relatively wide U2 and probably represent a different species.

Meekoceras haydeni (Smith)

Plate 22, figures 12a, b; Plate 25, figures 1a–c

Dagnoceras haydeni Smith, 1932, p. 66, Pl. 29, figs. 1–8. *Meekoceras* sp. cf. *M. gracilitatis* White. TOZER, 1967, p. 74.

Registered material. Hypotype GSC 28135 (GSC loc. 56166). Hypotype GSC 70987 (GSC loc. 98863).

Occurrence. Smithian, Romunderi Zone. Toad Formation, Vega-Phroso Member, and Sulphur Mountain Formation, northeastern British Columbia. GSC locs. 56166 (1), 98863 (1).

Remarks. GSC 70987 (Pl. 25, fig. 1), of which about three quarters of a whorl is body chamber, is probably the remains of a complete specimen. The umbilical wall is perpendicular, the umbilical shoulder rounded, flanks are convex and the venter sulcate, bordered by distinct shoulders that almost assume the character of keels. The suture line is incompletely exposed, only the saddles of the last septum being visible. Resemblance to the holotype of "*Dagnoceras*" *haydeni*, particularly regarding the sulcate venter, is very close. GSC 28135 (Pl. 22, fig. 12) was possibly a larger specimen of the same species.

Genus *Neomeekoceras* n. gen.

Type species. Neomeekoceras scalariforme n. sp.

Diagnosis. Discoidal meekoceratid (U about 33 per cent of diameter) with almost concentric coiling, angular ventral shoulders and a tabulate venter crossed by transverse ridges. Flanks smooth. Suture line with delicately indented lobes, non-phylloid saddles about the same width as the lobes; no auxiliary lobe.

Species assigned. Neomeekoceras scalariforme n. sp., probably also "*Svalbardiceras*" *sheldoni* Kummel (1969, p. 453) and "*Gyronites*" *mojsisovicsi* Waagen (1895, p. 297) (="*Xenodiscus*" *schmidti* Mojsisovics, 1886, Pl. 11, figs. 11a–c only).

Occurrence. Spathian. Axel Heiberg Island, probably also northeastern Russia and Idaho.

Remarks. Neomeekoceras is distinguished from *Ambites* and *Meekoceras* by having a ridged venter; and from specimens *Svalbardiceras* with tabulate venters by having smooth inner whorls. Some Prionitidae have ridged venters but they are much more involute than *Neomeekoceras*. A ridged venter is also a character of *Albanites*, but that genus has a distinctive suture line, with phylloid saddles, unlike that of *Neomeekoceras*.

Neomeekoceras scalariforme n. sp.

Plate 37, figures 22–26; Figure 25b (p. 422)

Registered material. Holotype GSC 85762, four paratypes GSC 85763, GSC 85764, GSC 85765, GSC 85766 (all GSC loc. 101891).

Occurrence. Spathian, Pilaticus Zone. Blind Fiord Formation, Axel Heiberg Island. GSC loc. 101891 (5).

Diagnosis. Neomeekoceras with H about 45 per cent, W about 20 per cent, U about 30 per cent of diameter. Umbilical wall narrow, umbilical shoulder rounded, flanks of very low convexity, ventral shoulder angular. Ventral ridges very prominent on body chamber, much less so on phragmocone.

Measurements. Holotype GSC 85762 (Pl. 37, fig. 23): 26, 0.44, 0.19, 0.31.

Remarks. The holotype (Pl. 37, fig. 23) is wholly septate. Ventral ridges are faint, but clearly present. GSC 87565 (Pl. 37, fig. 26), a body chamber fragment, shows the ridges most clearly. "*Svalbardiceras*" *sheldoni* Kummel (1969, p. 453) from the *Columbites* beds of Idaho, has "narrow, shallow, transverse grooves . . ." on the venter and is clearly congeneric with *Neomeekoceras scalariforme* but differs in having less pronounced ventral sculpture.

Family FLEMINGITIDAE Hyatt, 1900

Genus *Flemingites* Waagen, 1892

Type species. Ceratites flemingianus de Koninck.

Flemingites reticulatus n. sp.

Plate 20, figures 5–7

Registered material. Holotype GSC 28137 (GSC loc. 56224). Paratype GSC 28136 (GSC loc. 56206). Paratype GSC 28138 (GSC loc. 56223).

Occurrence. Dienerian, Sverdrupi Zone. Toad Formation, northeastern British Columbia. GSC locs. 56206 (1), 56223 (1), 56224 (1).

Diagnosis. Small *Flemingites*, H about 40 per cent, W about 30 per cent, U about 30 per cent of diameter. Umbilical wall perpendicular, umbilical shoulder abruptly rounded, flanks convex, ventral shoulders rounded, venter arched. Ribbing slightly falcoid, relatively distant and confined to the flank on the inner whorls; relatively dense, and forming ridges extending across the venter, on the outer whorl. Delicate strigation present on both flanks and venter.

Measurements. Holotype GSC 28137 (Pl. 20, fig. 7): 23, 0.45, –, 0.25. Paratype GSC 28138 (Pl. 20, fig. 5): 20, 0.40, 0.30, 0.30. Paratype GSC 28136 (Pl. 20, fig. 6): 23, 0.44, 0.26, 0.28.

Remarks. Suture lines can be seen only on the holotype. E is wide, with four points; the external saddle is narrow; L is narrow with four points. The remainder have not been seen. The strigate sculpture justifies provisional assignment to *Flemingites* but the small umbilicus, dense ribbing and ridged venter distinguish this species from all typical *Flemingites*.

Genus *Euflemingites* Spath, 1934

Type species. Flemingites guyerdetiformis Welter.

Euflemingites cirratus (White)

Plate 22, figures 13a, b; Plate 23, figures 4, 5; Figure 21b, c (p. 394)

Arcestes cirratus White, 1879, p. 116; WHITE 1880, p. 116.

Flemingites cirratus (White). SMITH, 1932, p. 53, Pl. 20, fig. 1; Pl. 26, figs. 1–12.

Euflemingites cirratus (White). NICHOLS and SILBERLING, 1979, p. B3, Pl. 3, figs. 1–3.

Euflemingites sp. cf. *E. cirratus* (White). TOZER, 1967, p. 19, 50, 74; KORCHINSKAYA, 1970, p. 82, Pl. 2, figs. 1a, b; KORCHINSKAYA, 1982, Pl. 5, fig. 1; Pl. 6, fig. 3.

Registered material. Two hypotypes GSC 28146, 28147 (both GSC loc. 47526). Hypotype GSC 28148 (GSC loc. 68183). Hypotype GSC 28149 (GSC loc. 56172).

Occurrence. Smithian, Romunderi Zone. Blind Fiord Formation, Axel Heiberg Island; Toad Formation, northeastern British Columbia; Sulphur Mountain Formation, Vega Siltstone Member, Alberta and northeastern British Columbia. GSC locs. 23849 (2), 36732 (1), 47526 (4), 56166 (1), 56172 (2), 56173 (1), 56279 (1), 64792 (1), 68183 (1), 82608 (1), 98863 (1).

Measurements. Hypotype GSC 28149 (Pl. 22, fig. 13): 43, 0.44, 0.30, 0.27. Hypotype GSC 28146 (Pl. 23, fig. 5): 250, 0.37, 0.25, 0.35.

Remarks. Identified with this species are *Euflemingites* with relatively thin whorls (W 25–30 per cent of diameter), a well rounded umbilical shoulder, no distinct ventral shoulders and an arched venter. Sculpture comprises about 18–25 spiral ridges between the umbilical shoulder and the mid-line of the venter. The two cotypes from Idaho, (both numbered USNM 8192) have never been illustrated. One is a fragment of the flank, probably of the body chamber, about 80 mm high. The other is the remains of a phragmocone about 40 mm in diameter. Examination of plaster casts of these specimens leaves little doubt that the specimens identified by Smith (also from Idaho), are correctly named. GSC 28146 (Pl. 23, fig. 5), with about 18 spiral ridges on each side of the whorl, is a phragmocone with approximated septa followed by a quadrant of body chamber. The complete diameter would have been about 300 mm. It is comparable with what is preserved of the larger of White's cotypes and the large specimen illustrated by Smith (1932, Pl. 20, fig. 1). Most of the specimens from western Canada (e.g., GSC loc. 28148, Pl. 23, fig. 4) are crushed impressions of large individuals, with no suture lines preserved. An exception is GSC 28149 (Pl. 22, fig. 3), a small undistorted phragmocone that shows an arched venter and about 25 ridges on the whorl side. This is comparable with the smaller of White's cotypes and a small specimen illustrated by Smith (1932, Pl. 26, figs. 2–4), although the lateral saddle of both specimens from Idaho is somewhat narrower than that of GSC 28149.

Euflemingites romunderi Tozer

Plate 21, figures 4; Plate 25, figures 4, 5

Euflemingites romunderi Tozer, 1961, p. 51, Pl. 12, figs. 2–5; SILBERLING and PATTON, 1964, p. A 145; TOZER, 1967, p. 19, 49, 50, Pl. 5, figs. 1, 2; TOZER, 1970, Pl. 16, figs. 13a, b.

Euflemingites aff. *romunderi* Tozer. DAGYS and ERMAKOVA, 1990, p. 49, Pl. 11, fig. 1.

Registered material. Holotype GSC 14051, paratype GSC 14049 (Tozer, 1961, Pl. 12, figs. 4a, b) (both GSC loc. 28680). Five paratypes GSC 14050 (ibid., Pl. 12, figs. 2a–c), GSC 14191*, GSC 14192* (ibid. Textfig. 8, p. 51), GSC 14193*, GSC 14194*, (all GSC loc. 28681). Hypotype GSC 28150 (GSC loc. 47801).

Occurrence. Smithian, Romunderi Zone. Blind Fiord Formation, Ellesmere Island. GSC locs. 28680 (10), 28681 (10), 47801 (1), 55512 (1).

Remarks. Compared with *Euflemingites cirratus* (White), this species has relatively thick whorls (W 37–46 per cent of diameter) more abruptly rounded and prominent umbilical and ventral shoulders, a broader venter, and fewer spiral ridges (about 15). Well preserved specimens are known only from the type and nearby localities. GSC 28150 (Pl. 21, fig. 4), a poorly preserved fragment, nevertheless shows the widely spaced ridges that distinguish this species from *E. cirratus*.

Genus *Anaxenaspis* Kiparisova, 1956

Type species. Xenaspis orientalis Diener.

Anaxenaspis dieneri n. sp.

Plate 24, figures, 2, 3; Figure 22 (p. 396)

Paranorites sp. cf. *P. kolymensis costata* Popov. TOZER, 1967, p. 50.

Registered material. Holotype, GSC 28140, paratype GSC 28141 (both GSC loc. 47526).

Occurrence. Smithian, Romunderi Zone. Blind Fiord Formation, Bjarnason Island (Axel Heiberg Island). GSC loc. 47526 (2).

Diagnosis. Anaxenaspis attaining a diameter of about 310 mm; H about 38 per cent, W about 20 per cent, U about 30 per cent of diameter. Umbilical wall inclined, with poorly defined shoulders; flanks convex, venter arched, ventral shoulders poorly defined. Phragmocone with low straight ribs, about five to a quadrant; greater part, if not all, of body chamber is smooth. Suture line with phylloid saddles and a discrete auxiliary lobe.

Measurements. Holotype GSC 28140 (Pl. 24, fig. 3): 312, 0.38, 0.17, 0.30.

Remarks. This species is known only from specimens that are somewhat crushed. The holotype, despite its large size, does not have approximated septa. The phragmocone has low radial ribs, about five on a quadrant. They persist on the initial quadrant of the body chamber. The remainder is smooth. GSC 28141 (Pl. 24, fig. 2) consists of a coiled septate portion, to which a small part of the body chamber adheres. Although much of the specimen is crushed, both the outer and penultimate whorls show the venter to be arched, with poorly defined ventral shoulders. The proportions and suture line are like those of the holotype. GSC 28141 shows, more clearly than the holotype, the contrast between the ribbed inner and smooth outer whorls. The two specimens are not exactly the same, ribbing being absent on the outer septate whorl of GSC 28181, not merely on part of the body chamber, as on the holotype.

Anaxenaspis dieneri is more involute and more prominently ribbed compared with *A. orientalis* (Diener) (1895a, p. 42) but is nevertheless judged to be congeneric with that species, the phylloid saddles being comparable (see Zacharov, 1968, fig. 6, p. 44), although the auxiliary lobe of *A. dieneri* is more individualized. In proportions and ribbing, and probably also whorl section, *A. dieneri* also resembles *Flemingites salya* Diener (1897, p. 96), which differs in having less phylloid saddles and strigate sculpture. *Paranorites kolymensis* Popov (1961a, p. 46) is probably congeneric with the new species, but differs in being more evolute and in having less phylloid saddles. *Paranorites kolymensis* var. *costata* Popov (1961a, p. 47), based on a specimen 50 mm in diameter, resembles the inner whorls of the new species.

Etymology. The name commemorates C. Diener.

Anaxenaspis welteri n. sp.

Plate 24, figure 1

Registered material. Holotype GSC 28142 (GSC loc. 47558).

Occurrence. Smithian, Romunderi Zone. Blind Fiord Formation, Axel Heiberg Island. GSC loc. 47558 (1).

Diagnosis. Anaxenaspis attaining a diameter of about 300 mm, H about 33 per cent, W about 20 per cent, U about 43 per cent of diameter. Whorl section compressed; umbilical and ventral shoulders not defined. Ribbing moderately prominent on inner whorls, becoming less so on outer, penultimate whorl of phragmocone with about seven straight, rectiradiate or slightly rursiradiate ribs to a quadrant. Suture line with moderately developed auxiliary lobe.

Remarks. The holotype is crushed, the proportions given in the diagnosis being rough figures derived at a diameter of 160 mm. The rounded venter is seen only at a whorl height of 45 mm. The diameter of the complete phragmocone was about 225 mm, of the complete specimen about 300 mm.

Specimens of *Anaxenaspis orientalis* (Diener) illustrated by Diener (1895a), Kiparisova (1961) and Zacharov (1968) show a considerable resemblance, although they, like the holotype of *A. welteri*, are not well preserved. It seems that none have the prominent ribs that characterize the inner whorls of the new species. Compared with *Anaxenaspis dieneri* n. sp., *A. welteri* is appreciably more evolute, has less phylloid saddles, and a less developed auxiliary lobe.

Etymology. The name commemorates Otto Welter.

Anaxenaspis kraffti n. sp.

Plate 23, figures 2, 3; Figure 21a (p. 394)

Flemingites? sp. indet.; TOZER, 1961, p. 50, Pl. 12, figs. 1a-c; TOZER, 1967, p. 19, 49.

Registered material. Holotype GSC 28139, paratype GSC 14176 (Tozer, 1961, Pl. 12, figs. 1a-c) (both GSC loc. 28681). Paratype GSC 14177 (GSC loc. 28680).

Occurrence. Smithian, Romunderi Zone. Blind Fiord Formation, Ellesmere Island. GSC locs. 28680 (1), 28681 (2).

Diagnosis. Anaxenaspis attaining a diameter of about 90 mm, H about 40 per cent, W about 30 per cent, U about 33 per cent of diameter. Umbilical and ventral shoulders rounded. Sculpture comprises about 20 ribs per whorl. Suture line with phylloid saddles and a discrete auxiliary lobe.

Measurements. Holotype GSC 28139 (Pl. 23, fig. 3): 85, 0.40, 0.26, 0.33 (approximate).

Remarks. Parts of the test are preserved in these specimens, and it appears that on both the flanks and venter there is no strigation. Except for the absence of strigation, this species has the characters (suture line, ribbing) of *Flemingites.* Ribbing is more prominent compared with that of *Anaxenaspis orientalis* (Diener), *A. dieneri* n. sp. and *A. welteri* n. sp.

Etymology. The name commemorates A. von Krafft.

Anaxenaspis sp. indet.

Plate 22, figure 14

Registered material. GSC 28143 (GSC loc. 56279).

Occurrence. Smithian, Romunderi Zone. Toad Formation, northeastern British Columbia. GSC loc. 56279 (1).

Remarks. GSC 28143 (Pl. 22, fig. 14) appears to be the remains of an *Anaxenaspis* about 200 mm in diameter comparable with *A. welteri* n. sp. The penultimate whorl bears about 30 ribs. The initial part of the outer whorl is ribbed. The adorad quadrant is weathered. As preserved, it is smooth, with an arched venter. No trace of the suture line is preserved.

Family ARCTOCERATIDAE Arthaber, 1911

Genus *Arctoceras* Hyatt, 1900

Type species. Ceratites polaris Mojsisovics.

Arctoceras blomstrandi (Lindstroem)

Plate 26, figures 1-3; Plate 27, figure 1

Arctoceras blomstrandi (Lindstroem). KUMMEL, 1961, p. 500, Pl. 1-7; (with synonymy); TOZER, 1962a, Pl. 2, figs. 6a-c; TOZER, 1967, p. 19, 20, 49; TOZER, 1970, Pl. 16, figs. 8a, b; WEITSCHAT and LEHMANN, 1978, p. 96, Pl. 12, figs. 1a, b; KORCHINSKAYA, 1982, Pl. 6, fig. 1; Pl. 7, fig. 1; DAGYS and ERMAKOVA, 1990, p. 40, Pl. 9, figs. 1, 2; Pl. 10, figs. 1, 2.

Arctoceras sp. cf. *A. blomstrandi* (Lindstroem). TOZER, 1962a, Pl. 3, figs. 4, 5; TOZER, 1963a, p. 26, Pl. 5, fig. 6.

Arctoceras oebergi (Mojsisovics). TOZER, 1961, p. 68, Pl. 15, figs. 1-5; Pl. 16, figs. 2-4.

Registered material. Four hypotypes GSC 14064 (Tozer, 1961, Pl. 15, fig. 1), GSC 14065* (ibid., Pl. 15, fig. 2), GSC 14066* (ibid., Pl. 15, fig. 3); GSC 14068 (ibid., Pl. 15, fig. 4) (all GSC loc. 28680). Hypotype GSC 14069 (ibid., Pl. 15, figs. 5a, b) (32371). Two hypotypes GSC 14070 (ibid., Pl. 16, fig. 4), GSC 14071 (ibid., Pl. 16, fig. 2) (both GSC loc. 28681). Hypotype GSC 14034 (Tozer, 1962a, Pl. 3, fig. 3) (GSC loc. 36732). Hypotype GSC 14294 (Tozer, 1963a, Pl. 5, fig. 6) (GSC loc. 46471). Hypotype GSC 28151 (GSC

loc. 47526). Two hypotypes GSC 28152, GSC 28153* (both GSC loc. 47623). Hypotype GSC 28154 (GSC loc. 51672). Hypotype GSC 28155 (GSC loc. 56169).

Occurrence. Smithian, Romunderi Zone, Tardus Zone(?). Blind Fiord Formation, Ellesmere and Axel Heiberg islands; Toad Formation, northeastern British Columbia; Vega Siltstone Member, and Sulphur Mountain Formation, Alberta. GSC locs. 28680 (15), 28681 (5), 32371 (1), 36732 (1), 46471 (1), 47526 (1), 47623 (5), 51672 (6), 55512 (3), 56169 (1).

Remarks. The material from Canada includes specimens with prominent umbilical tubercles, resembling the type of *Arctoceras oebergi* (Mojsisovics) (1886, p. 33), e.g., the majority from near Smith Creek, described in Tozer (1961), and GSC 28152 (Pl. 26, fig. 2). GSC 28154 (Pl. 27, fig. 1), which is associated with Prionitidae and may be from the Tardus Zone, has relatively strong ribs and barely perceptible umbilical tuberculation. This specimen resembles *Arctoceras lindstroemi* (Mojsisovics) (1886, p. 35) and *A. costatum* (Oeberg) (1877, p. 13) but other specimens from the same locality have weak ribs and distinct tuberculation, like *A. oebergi*. GSC 28151 (Pl. 26, fig. 1), the remains of a specimen that probably attained a diameter of about 175 mm, has about seven indistinct ribs on a quadrant of body chamber. Umbilical tuberculation is not certainly demonstrable but this may be due to imperfect preservation. What is preserved of this specimen invites comparison with *A. lindstroemi*. GSC 28155 (Pl. 26, fig. 3), from British Columbia, has the sculpture of *A. oebergi*. All the species of *Arctoceras* mentioned above are regarded as synonyms of *A. blomstrandi* by Kummel (1961) and the broad interpretation he advocated is accepted here.

Arctoceras gigas n. sp.

Plate 26, figures 4–6

Arctoceras sp. cf. *A. blomstrandi* (Lindstroem). TOZER, 1967, p. 50.

Registered material. Holotype GSC 28156 (GSC loc. 47534). Three paratypes GSC 28157, GSC 28158, GSC 28159* (all GSC loc. 64718). Paratype GSC 28160* (GSC loc. 47559).

Occurrence. Smithian, Tardus Zone? Blind Fiord Formation, Ellesmere and Axel Heiberg islands. GSC locs. 47534 (1), 47559 (1), 47643 (2), 64718 (3).

Diagnosis. Large, evolute *Arctoceras* (H about 38 per cent, W about 20 per cent, U about 33 per cent of diameter). Umbilical wall inclined. Sculptured with distinct umbilical nodes. Suture line with wide, non-phylloid saddles.

Measurements. Holotype GSC 28156 (Pl. 26, fig. 4): 150, 0.38, about 0.27, 0.33. Paratype GSC 28157 (Pl. 26, fig. 5): 227, 0.38, 0.22, 0.33.

Remarks. This species is known only from incomplete, mostly crushed specimens. The holotype (Pl. 26, fig. 4) is entirely septate. There are about 15 umbilical nodes on half of the outer whorl. The suture lines are not well preserved but the saddles are clearly wide, with parallel sides. GSC 28157 (Pl. 26, fig. 5) is the largest known specimen. The original diameter was about 300 mm. As with *Arctoceras blomstrandi* the density of the umbilical tuberculation varies. GSC 28159*, like the holotype, has about 15 nodes on half a whorl. GSC 28158 (Pl. 26, fig. 6) has about nine. On GSC 28157 (Pl. 26, fig. 5) the umbilical shoulder has been abraded but it appears to have been much like that of GSC 28158, which is from the same locality. GSC 28160* has particularly dense tuberculation with about 15 nodes on a quadrant. The sculpture and suture line indicate affinity with *Arctoceras blomstrandi* (Lindstroem) (sensu Kummel, 1961) but representatives of that species differ in having an umbilical width less than 30 per cent of the diameter, commonly about 25 per cent, i.e., they are appreciably more involute than *A. gigas*.

Family USSURIIDAE Spath, 1930

Genus *Oxyussuria* n. gen.

Type species. Oxyussuria canadensis n. sp.

Diagnosis. Very compressed smooth oxycone with relatively large umbilicus. Suture line ammonitic with broad, pyramidal, external and lateral saddles with monophyllic summits. Summit of lateral saddle is at mid- flank. Between the lateral saddles and the venter there are five saddles, interpreted as the external and four adventitious saddles. Of the adventitious saddles, the inner one is broad and pyramidal, like the external saddle. Lateral lobe (L) large, second lateral lobe (U2) much smaller. Suspensive lobe imperfectly known but apparently not divided into discrete auxiliary lobes.

Species assigned. Type species only.

Occurrence. Smithian. Northeastern British Columbia.

Remarks. No other Lower Triassic ammonoid genus is closely comparable. Affinity with representatives of the family Ussuriidae is suggested by the broad and deeply denticulate nature of the principal saddles, but other Ussuriidae differ from *Oxyussuria* in being involute, much more inflated with an arched venter and in having no adventitious elements in the suture line (*Ussuria*, *Parussuria*) or only one such element (*Metussuria*). The monophyllic summit of the external saddle and the broad lateral lobe might indicate affinity with *Lanceolites*, the sole genus of Lanceolitidae, but *Lanceolites* is involute, with a tabulate venter and lacks the well defined adventitious elements of *Oxyussuria*. *Pseudosageceras* (Sageceratacеae), another Lower Triassic oxycone with adventitious elements in the suture line, differs from *Oxyussuria* in being involute with narrow unindented saddles. There are morphological similarities with Middle and Upper Triassic *Pinacocerataceae*, but they are of questionable significance in view of the difference in age. The similarities are not exact. Oxycone Gymnitidae (*Parapinacoceras, Buddhaites*) differ in having bifid adventitious saddles. *Pseudocarnites* and *Carnites* (Carnitidae) differ in having well individualized auxiliary lobes. *Klamathites*, which is now regarded as a member of a new family, differs in being involute and in having fewer discrete adventitious saddles. Pinacoceratidae include evolute, very thin oxycones like *Oxyussuria* but all are distinguished from the new genus by having bifid adventitious saddles.

Oxyussuria canadensis n. sp.

Plate 22, figures 15, 16; Figure 20a, b (p. 392)

New ammonoid genus (oxycone), Tozer, 1967, p. 74.

Registered material. Holotype GSC 28233 (GSC loc. 56279). Paratype GSC 28234 (GSC loc. 56172).

Occurrence. Smithian, Romunderi Zone. Toad Formation, northeastern British Columbia. GSC locs. 56172 (1), 56279 (1), 98863 (1).

Diagnosis. Oxyussuria about 65 mm in diameter, H about 40 per cent, W about 10 per cent, U about 15 per cent of diameter.

Remarks. The holotype (Pl. 22, fig. 15) is preserved as three pieces: natural external impressions of each side showing the surface features; and the internal mould preserving some pieces of test on the venter. The internal mould shows that the phragmocone attained a diameter of about 30 mm with a whorl height of about 20 mm, a maximum width of about 3.5 mm and an umbilical width of about 3.5 mm. The umbilical seam of a further three quarters of a whorl is preserved on the external impression showing that the ammonoid attained an umbilical width of at least 10 mm. The last three quarters was probably body chamber, and the complete ammonoid was probably about 65 mm in diameter. The umbilical wall is narrow and perpendicular, the umbilical shoulder abruptly rounded. Convexity of the flanks is low with the maximum width at mid-flank. The venter is sharp and acute on both the internal mould and the surface of the test. On the outer preserved whorl (i.e., on what was probably the ultimate part of the phragmocone) the thickness of the test, on the venter, is about 1.5 mm, presumably a feature to strengthen a venter that would otherwise have been unusually fragile. Surface markings are shown well on the external impressions. The surface is almost smooth, except for distantly spaced radial lines on the outer third of the flank. The paratype, GSC 28234 (Pl. 22, fig. 16), is preserved only as an internal mould. As a result of imperfect preservation and overlapping, the suture lines are not easily interpreted. However both specimens clearly show the position and character of the largest lateral lobe. Between this lobe and the venter, the holotype shows five progressively smaller lobes. Assuming that the large lobe is L, there are four adventitious saddles. The nature of the second lateral lobe (U2) is not entirely clear, but it is certainly much smaller than L. Exact details of the suspensive lobe are uncertain but the absence of large auxiliary lobes is clearly indicated. Comparisons are given under the discussion of the genus.

Family PARANANNITIDAE Spath, 1934

Genus *Paranannites* Hyatt and Smith

Type species. Paranannites aspenensis Hyatt and Smith.

Paranannites aspenensis Hyatt and Smith

Plate 22, figures 7, 8; Plate 25, figures 2a–c

Paranannites aspenensis Hyatt and Smith, 1905, p. 81, Pl. 8, figs. 1–15, Pl. 73, figs. 1–30; SMITH, 1932, p. 98, Pl. 8, figs. 1–15, Pl. 73, figs. 1–30; SPATH, 1934, p. 190, Pl. 14, figs. 6a–c; KUMMEL and STEELE, 1962, p. 676, Pl. 100, figs. 14–17; NICHOLS and SILBERLING, 1979, p. 3, Pl. 2, figs. 1–10.

Registered material. Hypotype GSC 28165 (GSC loc. 56174). Hypotype GSC 28166 (GSC loc. 56171). Hypotype GSC 70988 (GSC loc. 98863).

Occurrence. Smithian, Romunderi Zone. Toad Formation, northeastern British Columbia. GSC locs. 56171 (1), 56174 (1), 98863 (1).

Remarks. GSC 70988 (Pl. 25, fig. 2) shows the ceratitic L of the last septum indicating a body chamber of three quarters of a whorl.

Paranannites spathi (Frebold)

Plate 36, figures 1, 2

Prosphingites spathi Frebold, 1930, p. 20, Pl. 4, figs. 2, 3, 3a; SPATH, 1934, p. 195, Pl. 13, figs. 1a-e, 2; TOZER, 1961, p. 58, Pl. 13, figs. 1a-c, 2a-e; TOZER, 1967, p. 49; KORCHINSKAYA, 1982, Pl. 5, figs. 2a, b.

Registered material. Two hypotypes, GSC 14085 (Tozer, 1961, Pl. 13, figs. 2a-e), GSC 14086 (ibid., Pl. 13, figs. 1a-c) (both GSC loc. 28680). Three hypotypes, GSC 28169, GSC 28170, GSC 28171* (all GSC loc. 51672).

Occurrence. Smithian, Romunderi Zone, Tardus Zone? Blind Fiord Formation, Ellesmere Island. GSC locs. 28680 (4), 51672 (10).

Measurements. Hypotype GSC 28169 (Pl. 36, fig. 1): 33, 0.36, 0.58, 0.30.

Remarks. Representatives of this species from Spitsbergen, the type locality, characteristically have thick whorls (W 54-60 per cent of diameter). Comparable examples from Canada are GSC 14086 from the Romunderi Zone and GSC 28169 (Pl. 36, fig. 1), which is possibly from the Tardus Zone (GSC loc. 51672). Suture lines of the specimens from GSC locality 51672 are essentially like those of specimens from the Romunderi Zone, with L and U2 placed outside the umbilical shoulder. GSC 14085 (Tozer, 1961, Pl. 13, figs. 2a-e) is the remains of a specimen about 30 mm in diameter. Enough of the body chamber is preserved to show that W was about 43 per cent of the diameter. This specimen, interpreted as a compressed variant of *Paranannites spathi*, closely resembles examples of *Paranannites aspenensis* Hyatt and Smith in external characters (e.g., Kummel and Steele, 1962, Pl. 100, figs. 14-17). There are differences in the suture lines. Compared with *Paranannites spathi,* most specimens of *P. aspenensis* have a relatively shallow U2 on or closer to the umbilical shoulder and a shorter suspensive lobe, with fewer indentations. In spite of these differences "*Prosphingites*" *spathi* is now regarded as congeneric with *Paranannites aspenensis. Prosphingites*, a younger genus, has a different whorl section and a more divided suture line.

Genus *Isculitoides* Spath, 1930

Type species. Isculites originis Arthaber.

Isculitoides minor Tozer

Plate 37, figures 9a, b

Isculitoides minor Tozer, 1965a, p. 20, Pl. 2, figs. 1-3; TOZER, 1967, p. 73; KUMMEL, 1969, p. 418.

Registered material. Holotype GSC 18817 (Tozer, 1965a, Pl. 2, figs. 1a-c). Paratype GSC 18818 (GSC loc. 56243). Paratype GSC 18819 (ibid., Pl. 2, figs. 3a-c).

Occurrence. Spathian, Subrobustus Zone. Toad Formation, northeastern British Columbia. GSC locs. 56243 (1), 56259 (1), 56265 (1).

Genus *Zenoites* Renz and Renz, 1947

Type species. Prosphingites (*Zenoites*) *helenae* Renz and Renz.

Zenoites arcticus Tozer

Plate 37, figures 7a, b

Zenoites arcticus Tozer, 1965a, p. 25, Pl. 2, figs. 6, 7; TOZER, 1967, p. 48; KUMMEL, 1969, p. 411.

Registered material. Holotype GSC 18834, paratype GSC 18835 (Tozer, 1965a, Pl. 2, fig. 6) (both GSC loc. 47544).

Occurrence. Spathian, Subrobustus Zone. Blind Fiord Formation, Ellesmere Island. GSC loc. 47544 (2).

Genus *Popovites* Tozer, 1965a

Type species. Popovites occidentalis Tozer.

Popovites occidentalis Tozer

Plate 37, figures 5a, b

Popovites occidentalis Tozer, 1965a, p. 22, Pl. 3, figs. 2–12; TOZER, 1967, p. 73; KUMMEL, 1969, p. 421; KORCHINSKAYA, 1982, Pl. 13, figs. 2, 3.

Registered material. Holotype GSC 18832 (Tozer, 1965a, Pl. 3, figs. 12 a, b), two paratypes GSC 18820 (ibid., figs. 5a, b), GSC 18822 (ibid., figs. 11a–c) (all GSC loc. 56234). Three paratypes GSC 18821 (ibid., figs. 8a–c), GSC 18828 (ibid., figs. 4a–c), GSC 18829* (all GSC loc. 56240). Paratype GSC 18823 (ibid., figs. 2a–c) (GSC loc. 56265). Paratype GSC 18824 (ibid., figs. 7a, b) (GSC loc. 56262). Paratype GSC 18825 (ibid., figs. 6a–c), hypotype GSC 35319* (both GSC loc. 56259). Paratype GSC 18826* (GSC loc. 56195). Two paratypes GSC 18827 (ibid., figs. 9a–c), GSC 18831 (ibid., figs. 3a, b) (both GSC loc. 56198). Paratype GSC 18830 (ibid., figs. 10a, b) (GSC loc. 56264).

Occurrence. Spathian, Subrobustus Zone. Toad Formation, northeastern British Columbia. GSC locs. 56178 (2), 56195 (1), 56198 (2), 56234 (13), 56240 (7), 56259 (3), 56262 (1), 56264 (1), 56265 (1).

Popovites borealis Tozer

Plate 37, figures 4a, b

Popovites borealis Tozer, 1965a, p. 24, Pl. 3, figs. 1a, b; TOZER, 1967, p. 48; KUMMEL, 1969, p. 422.

Registered material. Holotype GSC 18833 (GSC loc. 47544).

Occurrence. Spathian, Subrobustus Zone. Blind Fiord Formation, Ellesmere Island. GSC loc. 47544 (1).

Family PRIONITIDAE Hyatt, 1900

The taxonomy of the Prionitidae is particularly arbitrary. Instructive is a collection of more than 300 specimens from one bed, 15 cm thick, in the Toad Formation of northeastern British Columbia. Specimens from this bed show great differences in shape, and strength of ribbing and tuberculation. It is hardly an exaggeration to say that no two specimens are exactly alike. Fourteen named species, placed in five genera, are recognized. Many of the species are linked by forms with intermediate morphology. The named taxa are thus probably not species in the biological sense. Many may be morphotypes of a smaller number of unusually variable species. From the British Columbia localities, specimens with body chambers, which are complete, or nearly so, range in diameter from 19 to 85 mm. Incomplete specimens indicate that a diameter of at least 100 mm was attained. None show appreciable approximation of septa. A specimen from Axel Heiberg Island, GSC 14049 (Tozer, 1961, Pl. 19, figs. 1a, b) 107 mm in diameter, now identified as *Wasatchites perrini* Mathews, is the largest prionitid known in Canada.

Genus *Anasibirites* Mojsisovics, 1896

Type species. Sibirites kingianus Waagen.

Anasibirites crickmayi Mathews

Plate 28, figures 1a, b

Anasibirites crickmayi Mathews, 1929, p. 16, Pl. 3, figs. 24–27.

Anasibirites sp. cf. *A. crickmayi* Mathews. TOZER, 1967, p. 74.

Registered material. Hypotype GSC 28172 (GSC loc. 42340). Hypotype GSC 28173* (GSC loc. 85547).

Occurrence. Smithian, Tardus Zone. Toad Formation, Vega-Phroso Member, and Sulphur Mountain Formation, northeastern British Columbia. GSC locs. 42340 (1), 82609 (1), 85547 (1).

Anasibirites robustus Welter

Plate 28, figures 2a, b

Anasibirites robustus Welter, 1922, p. 144, Pl. 171 (17), figs. 15–17.

Wasatchites sp. cf. *W. tardus* McLearn. TOZER, 1967, p. 74.

Registered material. Hypotype GSC 28226 (GSC loc. 68184).

Occurrence. Smithian, Tardus Zone. Toad Formation, northeastern British Columbia. GSC loc. 68184 (1).

Anasibirites kummeli n. sp.

Plate 29, figures 4a, b

Registered material. Holotype GSC 28195 (GSC loc. 42360).

Occurrence. Smithian, Tardus Zone. Toad Formation, northeastern British Columbia. GSC loc. 42360 (1).

Diagnosis. Anasibirites about 65 mm in diameter; H about 45 per cent, W about 40 per cent, U about 30 per cent of diameter. Section of outer whorl broadly trapezoidal with convex flanks, rounded ventral shoulders and convex venter. Sculpture consists of moderately prominent ribs, some branching at the umbilical margin, generally, but not invariably not bullate at the point of branching; some simple, extending from the umbilicus to the venter; some intercalated, arising near mid flank. Inner whorls bear prominent ribs.

Measurements. Holotype GSC 28195 (Pl. 29, fig. 4): 65, 0.43, 0.38, 0.29.

Remarks. This species is known from only one specimen. Although preservation is imperfect, it is clear that bullae are absent on most of the outer whorl, only one rib intersection being slightly bullate. For this reason the species is assigned to *Anasibirites* rather than *Wasatchites*, although the style of ribbing, mode of coiling and whorl section more closely resemble that of *Wasatchites procurvus* McLearn than any species of *Anasibirites*.

Etymology. The name commemorates Bernhard Kummel.

Genus *Prionites* Waagen, 1895

Type species. Prionites tuberculatus Waagen.

Prionites hollandi McLearn

Plate 27, figures 3, 4; Plate 33, figures 1–4

Prionites hollandi McLearn, 1945, Appendix p. 1, Pl. 2, fig. 8.

Registered material. Holotype GSC 9469 (GSC loc. 10657). Three topotypes, GSC 28174, GSC 28175, GSC 28193 (all GSC loc. 42360). Topotype GSC 28176 (GSC loc. 42364). Hypotype GSC 28177 (GSC loc. 51672).

Occurrence. Smithian, Tardus Zone. Toad Formation, northeastern British Columbia; Blind Fiord Formation, Ellesmere Island. GSC locs. 10657 (2), 42360 (5), 42364 (4), 51672 (1).

Measurements. Topotype GSC 28175 (Pl. 33, fig. 3): 85, 0.40, 0.29, 0.27. Topotype GSC 28193 (Pl. 33, fig. 4): 81, 0.46, 0.36, 0.25.

Remarks. Identified with this species are *Prionites* attaining about 80 mm in diameter; H about 45 per cent, W 30–35 per cent, U about 25 per cent of diameter. Section of outer whorl is essentially trapezoidal but with convex flanks. Ventral shoulders distinct but rounded, more distinct on inner than outer whorl. Venter convex. Sculpture comprises prominent bullae and weak ribbing, ribbing on flank being so faint as to be barely perceptible except at the ventral shoulder. Ribbing on venter also faint. Bullae characteristically appear near the umbilical margin at a whorl height of about 20 mm, rise in prominence and then decline near the aperture. In GSC 28174 (Pl. 27, fig. 3) appearance of lateral bullae is at a whorl height of about 25 mm, unlike most specimens, in which they appear at a height of about 20 mm. GSC 28175 (Pl. 33, fig. 3) shows a decline in sculpture near the aperture. GSC 28193 (Pl. 33, fig. 4) has more distinct ventral shoulders and ribbing on the venter compared with the holotype, and thus approaches the form of *Anawasatchites merrilli* McLearn. The near or complete absence of ribbing on the flank and venter justify reference to *Prionites*.

Genus *Wasatchites* Mathews, 1929

Type species. Wasatchites perrini Mathews.

Wasatchites perrini Mathews

Plate 29, figures 5a–c; Plate 35, figures 2–4

Wasatchites perrini Mathews, 1929, p. 40, Pl. 9, figs. 1–9.

Wasatchites tardus (McLearn). TOZER, 1961, p. 71, Pl. 19, figs. 1a, b (only); not *Anawasatchites tardus* McLearn, 1945.

Registered material. Hypotype GSC 14089 (Tozer, 1961, Pl. 19, fig. 1) (GSC loc. 32365). Hypotype GSC 28225 (GSC loc. 42342). Hypotype GSC 28227 (GSC loc. 42360). Hypotype GSC 28228 (GSC loc. 42340). Hypotype GSC 28183 (GSC loc. 42364).

Occurrence. Smithian, Tardus Zone. Toad Formation, northeastern British Columbia; Blind Fiord Formation, Axel Heiberg Island. GSC locs. 32365 (1), 42340 (1), 42342 (1), 42360 (1), 42364 (1).

Remarks. Most of the specimens identified with this species are incomplete, lacking the body chamber. In common with the holotype, they have well developed bullae and ribs on at least one whorl of the phragmocone. GSC 28183 (Pl. 29, fig. 5) has bullae on one and a half whorls, like the holotype.

Wasatchites tridentinus Spath

Plate 28, figures 4, 5, 8, 9

Wasatchites tridentinus Spath, 1934, p. 352, Pl. 15, figs. 2a-c; Pl. 16, figs. 2a, b, 4 (holotype); WEITSCHAT and LEHMANN, 1978, p. 94, Pl. 10, figs. 3-5; KORCHINSKAYA, 1982, Pl. 8, figs. 1a, b.

Wasatchites canadensis McLearn, 1945, Appendix p. 1, Pl. 2, figs. 1-3.

Registered material. Holotype of *Wasatchites canadensis,* GSC 9472, paratype of *Wasatchites canadensis* GSC 9473 (both GSC loc. 10657). Hypotype GSC 28184 (GSC loc. 10657). Hypotype GSC 28185 (GSC loc. 42360).

Occurrence. Smithian, Tardus Zone. Toad Formation, northeastern British Columbia. GSC locs. 10657 (3), 42360 (1).

Remarks. Wasatchites identified with this species have an outer whorl at first broadly trapezoidal, later subhexagonal in section. Ventral shoulders are angular on the phragmocone, becoming somewhat rounded on the body chamber. The venter is tabulate. Sculpture consists of prominent bullae, appearing near the umbilical margin at a whorl height of between 8 mm (GSC 28184, Pl. 28, fig. 4) and 14 mm (GSC 9473, Pl. 28, fig. 5). On the outer whorl (e.g., on GSC 9472, Pl. 28, fig. 8) the bullae become progressively more external in position, eventually being just within the mid-flank. Ribbing is prominent on the flank and venter from a whorl height of 8 mm, two or three ribs stemming from each bulla. The inner whorls have moderately (GSC 28285, Pl. 28, fig. 9) to distinctly (GSC 9472, Pl. 28, fig. 8) prominent sculpture.

GSC 9472 (Pl. 28, fig. 8) closely resembles the holotype from Trehogdene, Spitsbergen. Compared with *Wasatchites perrini* Mathews, strong bullae are developed only on about half a whorl of the phragmocone, instead of a full whorl or more.

Wasatchites deleeni McLearn

Plate 28, figures 3, 6, 7, 10; Plate 32, figures 4a-c

Wasatchites meeki var. *deleeni* McLearn, 1945, Appendix p. 2, Pl. 2, figs. 4-6.

Registered material. Holotype GSC 9474, topotype GSC 28188 (both GSC loc. 10657). Topotype GSC 28187 (GSC loc. 42340). Topotype GSC 28186 (GSC loc. 42360). Topotype GSC 28189 (GSC loc. 42364).

Occurrence. Smithian, Tardus Zone. Toad Formation northeastern British Columbia. GSC locs. 10657 (11), 10658 (2), 42340 (4), 42342 (2), 42360 (19), 42364 (1).

Remarks. Identified with this species are *Wasatchites* with the outer whorl first broadly trapezoidal, later almost subovoid in section, the flanks being distinctly convex. Ventral shoulders are angular, blunt, defining first a nearly flat venter, later a more convex venter. Bullae are low, appearing near the umbilical edge at a whorl height of about 12 mm. Ribbing is relatively prominent on both the flanks and venter with two or more commonly three ribs stemming from each bulla.

This species, like *W. tridentinus* Spath, is distinguished from *W. perrini* Mathews by having relatively few bullae on the phragmocone. Compared with *W. tridentinus* those identified as *W. deleeni* differ in having an outer whorl ovoid rather than hexagonal in section. A closely comparable species is *Wasatchites orientalis* Spath (1934, p. 351) from Timor.

Wasatchites procurvus McLearn

Plate 29, figures 1-3

Wasatchites procurvus McLearn, 1945, Appendix p. 2, Pl. 2, fig. 7.

Registered material. Holotype GSC 9475 (GSC loc. 10657). Topotype GSC 28190 (GSC loc. 42360). Topotype GSC 28191 (GSC loc. 42364).

Occurrence. Smithian, Tardus Zone. Toad Formation, northeastern British Columbia. GSC locs. 10657 (1), 42360 (1), 42364 (1).

Remarks. This species is characterized by a broadly trapezoidal whorl section. Ventral shoulders are prominent but rounded. The venter is weakly convex, nearly flat. Bullae are prominent, appearing at a small diameter. Ribs are prominent on both the flanks and venter from a small diameter and curve adorad on the venter. Two ribs stem from each bulla. On the body chamber both the ribs and bullae decline in prominence. *Wasatchites procurvus* is distinguished from all other representatives of the genus by having adorad curvature of the ribs on the venter.

Wasatchites macconnelli n. sp.

Plate 34, figures 7, 8

Registered material. Holotype GSC 28194 (GSC loc. 42364), paratype GSC 28197 (GSC loc. 42340).

Occurrence. Smithian, Tardus Zone. Toad Formation, northeastern British Columbia. GSC locs. 42340 (6), 42360 (2), 42364 (4).

Diagnosis. Wasatchites at least 65 mm in diameter; H about 45 per cent, W about 30 per cent, U about 25 per cent of diameter. Section of outer whorl narrowly trapezoidal, flanks nearly flat, ventral shoulders angular, venter convex, subtabulate. Inner whorls smooth or weakly ribbed, bullae present near umbilical margin on the outer whorl. Ribbing moderately well defined; on greater part of conch two ribs stem from each bulla; ribs emphasized at ventral shoulder. Prior to acquisition of bullae, venter is almost smooth, thereafter, distinctly ribbed.

Measurements. Holotype GSC 28194 (Pl. 34, fig. 8): 65, 0.43, 0.31, 0.23.

Remarks. This species forms a morphological link between *Wasatchites, Anawasatchites* and *Arctoprionites.* The holotype has bullae on at least half of the penultimate whorl. On account of these bullae it is assigned to *Wasatchites.* The presence of this sculpture distinguishes *W. macconnelli* from *Anawasatchites merrilli* McLearn, which in other characters it closely resembles. *Arctoprionites williamsi* n. sp. differs only in having a flat, instead of weakly convex, venter.

Etymology. The name commemorates R.G. McConnell.

Genus *Anawasatchites* McLearn 1945

Type species. Anawasatchites tardus McLearn.

Anawasatchites tardus McLearn

Plate 30, figures 2, 3; Plate 31, figures 3a–c; Plate 32, figures 5a, b; Plate 35, figures 1a, b; Figure 23b (p. 408)

Anawasatchites tardus McLearn, 1945, Appendix p. 1, Pl. 3, figs. 1, 2.

Wasatchites tardus (McLearn) TOZER, 1961, p. 71, Pl. 19, figs. 2, 3 (only); TOZER, 1967, p. 20, 74, Pl. 5, figs. 3a–c.

Registered material. Holotype GSC 9470 (Tozer, 1967, Pl. 5, figs. 3a–c) (GSC loc. 10657). Two hypotypes GSC 14087 (Tozer, 1961, Pl. 19, figs. 2a, b), GSC 14088 (ibid., figs. 3a–c) (both GSC loc. 32365). Two topotypes GSC 28196, GSC 28224 (both GSC loc. 42360). Topotype GSC 28200 (GSC loc. 42364). Hypotype GSC 28203 (GSC loc. 42369). Topotype GSC 28204 (GSC loc. 47531).

Occurrence. Smithian, Tardus Zone. Toad Formation, northeastern British Columbia; Blind Fiord Formation, Ellesmere and Axel Heiberg islands. GSC locs. 10657 (2), 32365 (2), 42340 (2), 42342 (2), 42360 (6), 42364 (9), 42369 (2), 47531 (1).

Measurements. Holotype GSC 9470: 71, 0.41, 0.34, 0.25. Topotype GSC 28200 (Pl. 30, fig. 3): 75, 0.43, 0.34, 0.26.

Remarks. This is an *Anawasatchites* with a narrowly trapezoidal outer whorl section. Ventral shoulders are angular, blunt; the venter convex, subtabulate. Inner whorls are smooth. Bullae appear at the very end of the phragmocone or at the beginning of the body chamber, generally at a whorl height of about 25 mm. Most of the phragmocone is smooth. On the body chamber, ribbing is faint on the flank, pronounced at the ventral shoulder and on the venter.

Anawasatchites merrilli McLearn

Plate 30, figures 1a–c; Plate 32, figures 1a–c; Figure 23a (p. 408)

Anawasatchites merrilli McLearn, 1945, Appendix p. 1, Pl. 3, figs. 3–5.

Registered material. Holotype GSC 9471 (GSC loc. 10657). Topotype GSC 28199 (GSC loc. 42364).

Occurrence. Smithian, Tardus Zone. Toad Formation, northeastern British Columbia. GSC locs. 10657 (1), 42340 (1), 42342 (2), 42360 (1), 42364 (2).

Measurements. Holotype GSC 9471 (Pl. 30, fig. 1): 73, 0.44, 0.33, 0.24

Remarks. This species has the shape of *Anawasatchites tardus* McLearn but differs in having much less prominent ribs and bullae. GSC 28199 (Pl. 32, fig. 1), which is almost complete, lacks ribs and bullae, but is interpreted as an immature representative of this species. Viewed in isolation it could be regarded as an *Anasibirites* comparable with *Anasibirites multiformis* Welter, Form 8, specimen IV (Welter, 1922, Pl. 171, figs. 8–10).

Anawasatchites kindlei n. sp.

Plate 30, figures 4a, b

Registered material. Holotype GSC 28198 (GSC loc. 42360).

Occurrence. Smithian, Tardus Zone. Toad Formation, northeastern British Columbia. GSC loc. 42360 (1).

Diagnosis. Anawasatchites about 80 mm in diameter; H about 45 per cent, W about 40 per cent, U about 25 per cent of diameter. Section of outer whorl narrowly trapezoidal, flanks flat, ventral shoulders angular, venter tabulate. Sculpture comprises strong bullae at the umbilical margin and ribs that are weak on the flank but form prominent nodes at the ventral shoulder. Ribs moderately prominent on venter.

Measurements. Holotype GSC 28198 (Pl. 30, fig. 4): 80, 0.44, 0.42, 0.25.

Remarks. In shape, this species closely resembles *Anawasatchites tardus* McLearn, from which it differs only in having nodes at the ventral shoulder.

Etymology. The name commemorates E.D. Kindle, who discovered the type locality.

Anawasatchites spathi n. sp.

Plate 31, figures 2a–c; Plate 32, figures 2a–c

Registered material. Holotype GSC 28205, paratype GSC 28207 (both GSC loc. 42360).

Occurrence. Smithian, Tardus Zone. Toad Formation, northeastern British Columbia. GSC locs. 42340 (2), 42360 (3), 42364 (2).

Diagnosis. Anawasatchites at least 66 mm in diameter; H about 45, W about 45 per cent, U about 25 per cent of diameter. Section of outer whorl first trapezoidal, later hexagonal. Ventral shoulders angular, blunt, venter nearly flat, tabulate. Sculpture consists of prominent bullae, appearing near the umbilical margin at, or a little before, the beginning of the outer whorl, adorad they become progressively more external in position, eventually being at mid-flank, imparting a hexagonal whorl section. Ribbing prominent on both flank and venter; three, less commonly two, ribs stem from each bulla. Inner whorls weakly sculptured.

Measurements. Holotype GSC 28205 (Pl. 31, fig. 2): 66, 0.44, 0.47, 0.26. Paratype GSC 28207 (Pl. 32, fig. 2): 42, 0.45, 0.48, 0.18.

Remarks. Paratype GSC 28207 (Pl. 32, fig. 2) is interpreted as an immature individual. The hexagonal whorl is like that of *Wasatchites*, but the relatively smooth inner whorls are taken to justify reference to *Anawasatchites. Anawasatchites merrilli* McLearn, *A. tardus* McLearn, and *A. kindlei* n. sp. differ in having a trapezoidal section on the whole of the outer whorl.

Etymology. The name commemorates L.F. Spath.

Anawasatchites dawsoni n. sp.

Plate 31, figures 1a–c; Plate 32, figures 3, 6

Prionitid indet., Tozer, 1961, p. 72, Pl. 20, figs. 2a, b.

Registered material. Holotype GSC 28208 (GSC loc. 42340). Paratype GSC 28201 (GSC loc. 42364). Paratype GSC 28206 (GSC loc. 42360). Hypotype GSC 14090 (Tozer, 1961, Pl. 20, figs. 2a, b) (GSC loc. 32365).

Occurrence. Smithian, Tardus Zone. Toad Formation, northeastern British Columbia; Blind Fiord Formation, Axel Heiberg Island. GSC locs. 32365 (1), 42340 (1), 42360 (1), 42364 (1).

Diagnosis. Anawasatchites at least 65 mm in diameter; H about 40 per cent, W about 55 per cent, U about 30 per cent of diameter. Section of outer whorl first trapezoidal, later hexagonal, ventral shoulders angular, blunt, venter nearly flat, tabulate. Sculpture consists of prominent bullae appearing near the umbilical margin, a little before the beginning of the outer whorl; on the outer whorl they become progressively more elevated and external in position, eventually being pointed nodes at mid-flank. Ribbing faint on flank and venter.

Measurements. Holotype GSC 28208 (Pl. 31, fig. 1): 65, 0.40, 0.55, 0.29.

Remarks. This species closely resembles *Anawasatchites spathi* n. sp., from which it differs only in having much fainter ribbing, on both the flanks and the venter.

Etymology. The name commemorates G.M. Dawson.

Genus *Arctoprionites* Spath, 1930

Type species. Goniodiscus nodosus Frebold.

Arctoprionites nodosus (Frebold)

Plate 34, figures 5, 6

Goniodiscus nodosus Frebold, 1930, p. 8, Pl. 1, figs. 1–7, (fig. 7, lectotype, Spath, 1934, p. 341); Pl. 2, fig. 2.

Arctoprionites nodosus (Frebold). SPATH, 1934, p. 340, Pl. 16, fig. 5; Pl. 17, fig. 1; WEITSCHAT and LEHMANN, 1978, p. 93, Pl. 10, figs. 1a, b.

Registered material. Two hypotypes, GSC 28181, GSC 28182 (GSC loc. 47547).

Occurrence. Smithian, Tardus Zone. Blind Fiord Formation, Ellesmere Island. GSC loc. 47547 (2).

Remarks. Compared with *Arctoprionites williamsi* n. sp., the lateral bullae in *A. nodosus* are more elevated, and closer to the middle of the flank.

Arctoprionites williamsi n. sp.

Plate 34, figures 1–4

Prionitid indet., Tozer, 1961, Pl. 20, figs. 1a, b.

Registered material. Holotype GSC 28179 (GSC loc. 42340). Paratype GSC 14092 (Tozer, 1961, Pl. 20, figs. 1a, b) (GSC loc. 10657). Three paratypes GSC 28178, GSC 28180, GSC 28202 (all GSC loc. 42364).

Occurrence. Smithian, Tardus Zone. Toad Formation, northeastern British Columbia. GSC locs. 10657 (1), 42340 (4), 42342 (1), 42364 (6).

Diagnosis. Arctoprionites at least 65 mm in diameter; H about 45 per cent, W about 30 per cent, U about 25 per cent of diameter. Section of outer whorl narrowly trapezoidal, flanks nearly flat, ventral shoulders angular, venter tabulate. Sculpture comprises ribs and bullae, inner whorls ribbed. Bullae appear near umbilical margin on outer whorl, but may decline and disappear on last quadrant. Ribbing faint or reduced to a trace; one or two ribs stem from each bulla. Venter with faint ribbing, or smooth.

Measurements. Holotype GSC 28179 (Pl. 34, fig. 2): 44, 0.48, 0.31, 0.18. Paratype GSC 28178 (Pl. 34, fig. 4): 65, 0.43, 0.31, 0.25.

Remarks. The large paratype, GSC 28178 (Pl. 34, fig. 4), is weakly sculptured compared with the holotype. Bullae are present, except on the last quadrant; ribbing is very faint, without branching; the venter is smooth.

The tabulate venter and sharp ventral shoulders justify assignment to *Arctoprionites.* Compared with *Arctoprionites nodosus* (Frebold), the bullae are less elevated and placed closer to the umbilicus. *Arctoprionites tyrrelli* Spath (1934, p. 342) and "*Hemiprionites*" *garwoodi* Spath (op. cit. p. 336) resemble *A. williamsi,* but are probably immature examples of *A. nodosus,* with which they are associated at Trehogdene, Spitsbergen. "*Kashmirites*" *resseri* Mathews (1929, p. 38, Pl. 8, figs. 4–7) is another comparable species, but differs in having less pronounced bullae that are not elevated near the umbilicus.

Etymology. The name commemorates M.Y. Williams.

Superfamily SAGECERATACEAE Hyatt, 1884

Family HEDENSTROEMIIDAE Waagen, 1895

Genus *Pseudosageceras* Diener, 1895

Type species. Pseudosageceras sp. indet. of Diener, 1895.

Pseudosageceras multilobatum Noetling

Plate 18, figures 1a, b; Figure 17 (p. 384)

Pseudosageceras multilobatum Noetling, 1905b, p. 181, Pls. 19–26 (lectotype Pl. 19, figs. 1, 1a; Pl. 24, fig. 12, chosen by Spath, 1934, p. 54).

not *Pseudosageceras multilobatum* Noetling; TOZER, 1961, p. 44 = *P. longilobatum* Kiparisova).

Registered material. Hypotype GSC 28240 (GSC loc. 64731).

Occurrence. Dienerian, Sverdrupi Zone(?). Blind Fiord Formation, Axel Heiberg Island. GSC locs. 32367 (2), 64731 (2), 64764 (2), 64856 (2).

Remarks. GSC 28240 (Pl. 18, fig. 1) has a narrowly tabulate venter at the beginning of the outer whorl, where part of the test is preserved. On the greater part, which apparently nowhere preserves the full thickness of the test, the venter is narrowly rounded. The suture line and character of the umbilicus in this specimen closely resemble those of the lectotype.

Pseudosageceras longilobatum Kiparisova

Plate 21, figures 5a, b; Figure 19a (p. 390)

Pseudosageceras longilobatum Kiparisova, 1954, p. 20, Pl. 11, fig. 3 (not seen); Kiparisova, 1961, p. 29, Pl. 6, figs. 1, 2.

Pseudosageceras multilobatum Noetling. TOZER, 1961, p. 44, Pl. 13, figs. 8, 9 (not of Noetling, 1905b, p. 181).

Registered material. Three hypotypes GSC 14173 (Tozer, 1961, Pl. 13, figs. 9a, b), GSC 14174 (ibid., fig. 8), GSC 14175 (all GSC loc. 28681).

Occurrence. Smithian, Romunderi Zone. Blind Fiord Formation, Ellesmere Island. GSC locs. 28681 (4), 32371 (2).

Remarks. This species is like *Pseudosageceras multilobatum* Noetling, but has more numerous and narrow adventitious elements at a comparable size.

Pseudosageceras plicatum n. sp.

Plate 36, figures 9a, b; Figure 24f, g (p. 420)

Pseudosageceras n. sp., Tozer, 1967, p. 20, 74.

Registered material. Holotype GSC 28243 (GSC loc. 42369).

Occurrence. Smithian, Tardus Zone. Toad Formation, northeastern British Columbia. GSC loc. 42369 (1).

Diagnosis. Pseudosageceras with broad tabulate venter and flanks with low, somewhat bullate, radial ribs with their maximum elevation at mid-flank, about eight ribs on half a whorl. Suture line with three adventitious lobes at a whorl height of 30 mm.

Remarks. Most of the specimen is internal mould, but parts of the test are preserved showing, without much doubt, that the venter, on both the mould and the surface of the test, is tabulate, without keels, attaining a maximum width of about 2 mm. The umbilicus appears to be occluded. The suture line resembles that of some specimens of *Pseudosageceras multilobatum* Noetling (e.g., no. 25, Noetling 1905b, Pl. 22 fig. 9; Pl. 26, fig. 33) but the new species is distinguished by having ribbed, instead of smooth, flanks.

Genus *Hedenstroemia* Waagen, 1895

Type species. Ceratites hedenstroemi Keyserling.

Hedenstroemia hedenstroemi (Keyserling)

Plate 25, figure 3; Plate 27, figures 2a, b

Ceratites hedenstroemi Keyserling, 1845, p. 166, Pl. 2, figs. 5–7.

Hedenstroemia hedenstroemi (Keyserling). KIPARISOVA, 1947, p. 146, Pl. 35, figs. 7a, b; POPOV, 1961a, p. 15, Pl. 8, fig. 3; BYCHKOV et al., 1976, p. 97, Pl. 7, fig. 1; DAGYS et al., 1979, p. 127, Pl. 5, fig. 2; Pl. 6, fig. 1; DAGYS and ERMAKOVA, 1990, p. 70, Pl. 31, fig. 1; Pl. 33, 34.

Meekoceras n.f. ind. ex aff. *M. hedenstroemi* Keyserling. MOJSISOVICS, 1888, p. 10, Pl. 2, figs. 1a, b; Pl. 3, fig. 13.

Hedenstroemia mojsisovicsi Diener, 1897, p. 63; 1915a, p. 148 (holotype, *Meekoceras* n.f. ind. aff. *hedenstroemi* Mojsisovics, 1888, Pl. 2, figs. 1a, b; Pl. 3, fig. 13).

not *Hedenstroemia mojsisovicsi* Diener, 1897, Pl. 20, fig. 1, = "*Anahedenstroemia*" *himalayica* Spath, 1934, p. 218.

Registered material. Hypotype GSC 28244 (GSC loc. 55448). Hypotype GSC 70989 (GSC loc. 89675).

Occurrence. Smithian, Hedenstroemi Zone. Blind Fiord Formation, Axel Heiberg Island; Bjorne Formation, Ellesmere Island. GSC locs. 55448 (1), 89675 (1).

Remarks. Both specimens are steinkerns. On GSC 28244 (Pl. 27, fig. 2) the venter is narrowly tabulate on both the phragmocone and body chamber. The venter of GSC 70989 (Pl. 25, fig. 3) is tabulate, with rounded ventral shoulders.

Genus *Tellerites* Mojsisovics, 1902

Type species. Ceratites furcatus Oeberg.

Tellerites sp. indet.

Plate 20, figures 10a, b; Figure 18d (p. 388)

Registered material. GSC 28241 (GSC loc. 56209).

Occurrence. Dienerian, Sverdrupi Zone. Toad Formation, northeastern British Columbia. GSC loc. 56209 (1).

Genus *Cordillerites* Hyatt and Smith, 1905

Type species. Cordillerites angulatus Hyatt and Smith.

Cordillerites bicarinatus (Tozer)

Plate 37, figures 8a, b

Pseudosageceras bicarinatum Tozer, 1965a, p. 6, 16, Pl. 2, figs. 8a–d; TOZER, 1967, p. 73.

Registered material. Holotype GSC 18814 (GSC loc. 56234).

Occurrence. Spathian, Subrobustus Zone. Toad Formation, northeastern British Columbia. GSC loc. 56234 (1).

Superfamily DINARITACEAE (Mojsisovics, 1882)

Family KHVALYNITIDAE Shevyrev, 1968

Genus *Metadagnoceras* Tozer, 1965a

Type species. Metadagnoceras pulchrum Tozer.

Metadagnoceras pulchrum Tozer

Plate 38, figures 7a, b; Figure 26f–h (p. 424)

Metadagnoceras pulcher Tozer, 1965a, p. 29, Pl. 1, figs. 11a–e; TOZER, 1967, p. 73; KUMMEL, 1969, p. 461.

Registered material. Holotype GSC 18848 (GSC loc. 56196).

Occurrence. Spathian, Subrobustus Zone. Toad Formation, northeastern British Columbia. GSC loc. 56196 (1).

Genus *Alanites* Shevyrev, 1968

Type species. Alanites visendus Shevyrev.

Alanites laevis n. sp.

Plate 51, figures 5a, b; Figure 38h (p. 450)

Ismidites sp., Tozer, 1967, p. 25, 72.

Registered material. Holotype GSC 28245 (GSC loc. 40109).

Occurrence. Middle Anisian, Hagei Zone. Toad Formation, northeastern British Columbia. GSC loc. 40109 (2).

Diagnosis. Alanites about 30 mm in diameter; H about 50 per cent, W about 55 per cent, U about 17 per cent of diameter. Whorl section trapezoidal, whorls being widest at the umbilical shoulder. Umbilical wall high and convex, umbilical shoulder abruptly rounded. Ventral shoulders well rounded, venter convex. Surface without ribs, with sigmoidal growth lines and delicate spiral lirae. Suture line with shallow indentations in the external saddle.

Measurements. Holotype GSC 28245 (Pl. 51, fig. 5): 30, 0.50, 0.55, 0.17.

Remarks. This species is more involute and has a less deeply indented external saddle than *Alanites visendus* Shevyrev (1968, p. 187). *Alanites mulleri* Silberling and Nichols (1982, p. 19) differs in having low, but distinct ribbing; *A. obesus* Silberling and Nichols (ibid.) in having a raised umbilical shoulder.

Superfamily MEGAPHYLLITACEAE Mojsisovics, 1882

Family PROCARNITIDAE Zhao, 1959

Genus *Procarnites* Arthaber, 1911

Type species. Procarnites kokeni Arthaber.

Procarnites modestus Tozer

Plate 38, figures 6a, b; Figure 26e (p. 424)

Procarnites modestus Tozer, 1965a, p. 38, Pl. 1, figs. 1–6; TOZER, 1967, p. 73, 74.

Procarnites immaturus (Kiparisova). KUMMEL, 1969, p. 396 (in part), not of Kiparisova, 1947, p. 130.

Registered material. Holotype GSC 18867, two paratypes GSC 18865 (Tozer, 1965a, Pl. 1, figs 3a, b), GSC 18868 (ibid., fig. 5) (all GSC loc. 56198). Paratype GSC 18864 (ibid., figs. 7a–c) (GSC loc. 56280). Paratype GSC 18863 (ibid., figs. 4a–c) (GSC

loc. 56178). Two paratypes GSC 18869 (ibid., figs. 2a, b) GSC 18870* (both GSC loc. 56242).

Occurrence. Spathian, Subrobustus Zone. Toad Formation, northeastern British Columbia. GSC locs. 56178 (1), 56195 (1), 56198 (3), 56237 (1), 56242 (1), 56254 (2), 56257 (2), 56280 (1).

Family PROSPHINGITIDAE Zacharov, 1978

Genus *Prosphingites* Mojsisovics, 1886

Type species. Prosphingites czekanowskii Mojsisovics.

Prosphingites czekanowskii Mojsisovics

Plate 37, figures 6a, b

Prosphingites czekanowskii Mojsisovics, 1886, p. 64, Pl. 15, figs. 10–12; KIPARISOVA, 1937, p. 140, Pl. 1, fig. 2; POPOV, 1961a, p. 58, Pl. 13, fig. 4; KUMMEL, 1969, p. 405, Pl. 26, fig. 8; ERMAKOVA, 1981, p. 123, Pl. 12, fig. 3; DAGYS and ERMAKOVA, 1981, p. 11, Pl. 1, figs. 1–3.

Prosphingites sp. cf. *P. czekanowskii* Mojsisovics. TOZER, 1965a, p. 19, Pl. 2, figs. 5a–c; Tozer, 1967, p. 73.

Registered material. Hypotype GSC 18816 (GSC loc. 56241).

Occurrence. Spathian, Subrobustus Zone. Toad Formation, northeastern British Columbia. GSC loc. 56241 (1).

Family PARAPOPANOCERATIDAE Tozer, 1971

Genus *Stenopopanoceras* Popov, 1961a

Type species. Stenopopanoceras mirabile Popov.

Stenopopanoceras falcatum n. sp.

Plate 39, figures 13–15; Figure 27b (p. 426)

Stenopopanoceras sp., Tozer, 1967, p. 69.

Registered material. Holotype GSC 28249, two paratypes GSC 28247, GSC 28248 (all GSC loc. 68226).

Occurrence. Lower Anisian, Mulleri Zone. Toad Formation, northeastern British Columbia. GSC loc. 68226 (5).

Diagnosis. Stenopopanoceras attaining a diameter of about 45 mm; H about 33 per cent, W about 25 per cent, U about 32 per cent of diameter. Venter angular on outer whorl, except on last one eighth where it is broad and rounded. Surface with somewhat falcoid growth striae.

Measurements. Holotype GSC 28249 (Pl. 39, fig. 14): 46, 0.33, 0.24, 0.32. Paratype GSC 28248 (Pl. 39, fig. 15): 32, 0.41, 0.28, 0.31.

Remarks. The holotype (Pl. 39, fig. 14) has an angular venter on all of the outer whorl except the last one eighth. It was probably complete and mature. GSC 28248 (Pl. 39, fig. 15) has an angular venter, becoming virtually rounded near the aperture. It was probably complete, possibly not fully mature. GSC 28247 (Pl. 39, fig. 13) had a venter first narrowly rounded becoming bluntly angular adorad. It is mostly septate and evidently indicates the nature of the inner whorls. Suture lines are shown only on GSC 28247 (Fig. 27b). E and L are fairly well preserved, the remainder less so. There were probably at least three auxiliary lobes.

Compared with *S. normale* (McLearn), this species is smaller and a little more involute. It is appreciably more involute than the holotype of *S. mirabile* Popov (1961a).

Stenopopanoceras normale (McLearn)

Plate 46, figures 12a, b

Parapopanoceras normale McLearn, 1948, p. 10, Supplement p. 1, Pl. 8, figs. 7, 8 (only); TOZER, 1967, p. 71.

Parapopanoceras tetsa McLearn. McLEARN, 1969, Pl. 9, figs 8a, b (only).

Registered material. Holotype GSC 9574 (GSC loc. 10732).

Occurrence. Lower Anisian, Caurus Zone. Toad Formation, northeastern British Columbia. GSC loc. 10732 (1).

Measurements. Holotype GSC 9574 (Pl. 46, fig. 12): 68, 0.34, 0.26, 0.35.

Remarks. This species is known only from the holotype; a complete, probably mature specimen. Like *S. falcatum* n. sp. , it has an angular venter on most of the outer whorl, becoming wide and rounded at the aperture. Suture lines are not exposed.

Stenopopanoceras angulatum n. sp.

Plate 57, figures 1–3; Figure 42a (p. 462)

Registered material. Holotype GSC 28250, paratype GSC 28251 (GSC loc. 74736). Paratype GSC 28252 (GSC loc. 42406).

Occurrence. Middle Anisian, Hagei Zone. Toad Formation, northeastern British Columbia. GSC locs. 42406 (1), 74736 (2).

Diagnosis. Stenopopanoceras attaining a diameter of at least 45 mm; H about 33 per cent, W about 25 per cent, U about 33 per cent of diameter. Venter angular on most or all of the outer whorl. Growth striae radial or slightly convex. Suture line with two large and two small auxiliary lobes.

Measurements. Holotype GSC 28250 (Pl. 57, fig. 2): 45, 0.33, 0.24, 0.34. Paratype GSC 28251 (Pl. 57, fig. 1): 33, 0.40, 0.29, 0.33. Paratype GSC 28252 (Pl. 57, fig. 3): 56, 0.35, 0.25, 0.32.

Remarks. The holotype (Pl. 57, fig. 2) has the peristome preserved, and an angular venter on the whole of the outer whorl. It lacks a pre-peristomal constriction and, although complete, may not have been fully mature. The surface bears weakly sigmoidal striae. GSC 28251 (Pl. 57, fig. 1) shows the inner whorls with a rounded venter to a diameter of at least 10 mm. GSC 28252 (Pl. 57, fig. 3) is the remains of a specimen much larger than the holotype. The venter is angular.

In external characters there is a close resemblance to *S. falcatum* n. sp., but that species has different growth striae and is known to acquire a broad venter, a feature unknown in *S. angulatum.*

Stenopopanoceras obesum (McLearn)

Plate 57, figures 4, 5; Figure 42c (p. 462)

Parapopanoceras obesum McLearn, 1948, p. 10, Supplement p. 1, Pl. 8, figs. 5, 6; TOZER, 1967, p. 72.

Parapopanoceras tetsa McLearn. McLEARN, 1969, p. 46, Pl. 9, figs. 9a, b (only).

Registered material. Holotype GSC 9576 (McLearn, 1969, Pl. 9, figs. 9a, b) (GSC loc. 10659). Topotype GSC 22734 (GSC loc. 42406). Topotype GSC 28253 (GSC loc. 42402).

Occurrence. Middle Anisian, Hagei Zone. Toad Formation, northeastern British Columbia. GSC locs. 10659 (1), 42402 (1), 42406 (1).

Measurements. Holotype GSC 9576: 58, 0.31, 0.34, 0.41.

Remarks. The holotype is a complete, mature example with the steinkern of a slightly flared peristome preserved, and a slightly contracted body chamber. The venter of the outer whorl is at first rounded, then bluntly angular before becoming rounded again immediately adjacent to the aperture. In GSC 28253 (Pl. 57, fig. 5) the complete phragmocone is preserved, as well as parts of the body chamber including the peristome (not illustrated). The venter is rounded on the phragmocone, bluntly angular on the body chamber. Enough of the body chamber is preserved to show that the full length was one and a quarter whorls, and that it was virtually identical to that of the holotype. The inner whorls of the holotype are concealed by matrix. Those of GSC 28253 are partly visible, showing that the umbilicus is relatively wide and the coiling virtually concentric, the diagnostic feature of *Stenopopanoceras.* GSC 22734 (Pl. 57, fig. 4), an incomplete specimen, has acquired an angular venter at a smaller diameter than the holotype and GSC 28253. Suture lines are not shown by the holotype. GSC 22734 has three denticulated auxiliary lobes (McLearn, 1969, p. 47, fig. 24f). GSC 28253 (Fig. 42c) has four. The apparently rounded nature of the inner three lobes is probably due to poor preservation. This species is distinguished from all other *Stenopopanoceras* by its very thick whorls.

Stenopopanoceras celere n. sp.

Plate 58, figures 3a–c

Registered material. Holotype GSC 28256 (GSC loc. 68295).

Occurrence. Middle Anisian, Minor Zone. Toad Formation, northeastern British Columbia. GSC loc. 68295 (1).

Diagnosis. *Stenopopanoceras* about 60 mm in diameter; H about 38 per cent, W about 25 per cent, U about 30 per cent of diameter. Venter angular on whole of outer whorl, except immediately adjacent to the aperture. Surface with almost radial growth striae.

Measurements. Holotype GSC 28256 (Pl. 58, fig. 3): 60, 0.38, 0.24, 0.30.

Remarks. The holotype (Pl. 58, fig. 3) is a complete specimen with the peristome preserved. Except at the aperture the venter is angular. The auxiliary lobes of the last septum are visible, showing the length of the body chamber to be one whorl.

Compared with *Stenopopanoceras falcatum* n. sp., the growth lines are essentially radial, not falcoid; with *S. angulatum* n. sp. , the coiling is less excentric; with *S. normale* (McLearn), the umbilical width at maturity is appreciably smaller.

Genus *Amphipopanoceras* Voinova *in* Kiparisova, 1947

Type species. *Popanoceras* (*Amphipopanoceras*) *dzeginense* Voinova *in* Kiparisova, 1947.

Amphipopanoceras medium (McLearn)

Plate 57, figures 6–8; Figure 42b (p. 462)

Parapopanoceras medium McLearn, 1948, p. 10, Supplement p. 1, Pl. 8, figs. 2, 3 (only).

Parapopanoceras tetsa McLearn. McLEARN, 1969, p. 46, Pl. 9, figs. 4a, b (only).

not *Parapopanoceras medium* McLearn; DAGYS and ERMAKOVA, 1981, p. 38, Pl. 5, figs. 1–6.

Registered material. Holotype GSC 9577 (McLearn, 1969, Pl. 9, figs. 4a, b, topotype GSC 22735 (both GSC loc. 10712). Two hypotypes, GSC 28254, GSC 28255 (both GSC loc. 46499).

Occurrence. Middle Anisian, Hayesi Zone. Toad Formation, northeastern British Columbia. GSC locs. 10712 (16), 46499 (12), 89548 (5).

Measurements. Hypotype GSC 28255 (Pl. 57, fig. 8): 43, 0.37, 0.28, 0.30.

Remarks. In GSC 28255 (Pl. 57, fig. 8), the peristome is preserved. It is evidently complete and mature. The venter is rounded on the whole of the outer whorl. Ribbing is absent. Body chamber length is about one whorl. In size and proportions, this specimen closely resembles the holotype. The suggestion of an angular venter shown by the holotype (McLearn, 1969, p. 48) is apparently due to crushing. A topotype (GSC 22735, Pl. 57, fig. 6) shows no angularity. The maximum umbilical width attained on the phragmocone is about 20 per cent of the diameter, as shown in specimens GSC 22735 and GSC 28254 (Pl. 57, fig. 7). The suture line has about four auxiliary lobes. Having a relatively evolute phragmocone, this species forms a link between *Stenopopanoceras* and *Amphipopanoceras*. The specimens from Siberia assigned to this species by Dagys and Ermakova (1981, p. 38) differ in being less excentrically coiled.

Amphipopanoceras selwyni (Mclearn)

Plate 57, figures 9a, b; Plate 58, figures 2, 4, 5, 6; Figure 43a–c (p. 464)

Parapopanoceras selwyni McLearn, 1948, Supplement p. 1, Pl. 9, figs. 7–9; TOZER, 1967, p. 25, 70.

Parapopanoceras sp. cf. *P. selwyni* McLearn. TOZER, 1967, p. 70.

Parapopanoceras tetsa McLearn. McLEARN, 1969, p. 46, Pl. 9, figs. 1, 2 (only).

Registered material. Holotype GSC 9579 (McLearn, 1969, Pl. 9, figs. 1a, b) (GSC loc. no. erased). Paratype GSC 9580 (McLearn, 1969, Pl. 9, figs. 2a, b) (GSC loc. 10706). Three hypotypes GSC 28258*, 28259, 28261 (all GSC loc. 68295). Two hypotypes GSC 28262, 28263 (both GSC loc. 68294). Hypotype GSC 28257 (GSC loc. 74737). Hypotype GSC 85774* (GSC loc. 99565).

Occurrence. Middle Anisian, Hayesi and Minor zones. Toad Formation, northeastern British Columbia; Sulphur Mountain Formation, Whistler Member, northeastern British Columbia. GSC locs. 10706 (1), 16008 (10), 42408 (2), 68204 (5), 68294 (12), 68295 (20), 74722 (6), 74737(3), 85548 (2), 99565 (2).

Measurements. Holotype GSC 9579: 50, 0.42, 0.26, 0.22. Hypotype GSC 28257 (Pl. 57, fig. 9): 58, 0.43, 0.26, 0.21. Hypotype GSC 28259 (Pl. 58, fig. 2): 62, 0.39, 0.27, 0.24. Hypotype GSC 28261 (Pl. 58, fig. 4): 58, 0.43, 0.31, 0.24. Hypotype GSC 85774*: 60, 0.42, 0.33, 0.27.

Remarks. The measurements are of complete specimens with the peristome preserved. This species is

characterized by an outer whorl with a venter that is narrowly rounded or faintly angular, except where rounded on the last quadrant. Body chamber length is about one whorl. At the aperture, the venter is invariably rounded. In the holotype, the venter is somewhat angular on the first quadrant; in GSC 28261 (Pl. 58, fig. 4) and GSC 28257 (Pl. 57, fig. 9) it is somewhat angular on the penultimate quadrant. In GSC 28261 (Pl. 58, fig. 4) and GSC 85774* the outer whorl is rounded, not angular. The phragmocone characteristically has a moderately distinct umbilical shoulder and attains an umbilical width about 15 per cent of the diameter (e.g., GSC 28261, Pl. 58, fig. 5). The suture line has about four auxiliary lobes. The most closely comparable species is *Amphipopanoceras medium* (McLearn), which differs in having a more evolute phragmocone, apparent by comparing GSC 28262 (Pl. 58, fig. 5) with GSC 22735 (Pl. 57, fig. 6).

Amphipopanoceras inconstans (Dagys and Ermakova)

Plate 58, figures 1a, b

Parapopanoceras inconstans DAGYS and ERMAKOVA, 1981, p. 42, Pl. 6, figs. 1, 2; Pl. 7, figs. 1–4.

Registered material. Hypotype, GSC 28260 (GSC loc. 68295).

Occurrence. Middle Anisian, Minor Zone. Toad Formation, northeastern British Columbia. GSC loc. 68295 (1).

Remarks. GSC 28260 (Pl. 58, fig. 1), although incomplete, appears to be comparable with the holotype (Dagys and Ermakova, 1981, Pl. 6, fig. 1). *Amphipopanoceras inconstans* closely resembles *A. selwyni* (McLearn), but has a rounder venter and a larger umbilicus.

Amphipopanoceras acutum Popov

Plate 61, figures 3, 4, Figure 46b (p. 470)

Amphipopanoceras acutum Popov, 1961a, p. 97, Pl. 22, figs. 5a, b.

Parapopanoceras tetsa McLearn. TOZER, 1967, p. 70 (not of McLearn, 1946a).

Registered material. Two hypotypes, GSC 28264, GSC 28265 (both GSC loc. 68228).

Occurrence. Upper Anisian, Deleeni Zone. Toad Formation, northeastern British Columbia. GSC loc. 68228 (20)

Measurements. Hypotype GSC 28625 (Pl. 61, fig. 3): 53, 0.38, 0.30, 0.27.

Remarks. The holotype (Popov, 1961a, Pl. 22, figs. 5a, b) was examined by the writer in 1966. It is slightly crushed but nevertheless shows the venter of the outer whorl to be at first rounded, then angular. The peristome is not preserved, but the venter of the most adorad preserved portion appears to be becoming wider. GSC 28625 (Pl. 61, fig. 3) is complete with the peristome. The angular venter persists to 15 mm of the peristome where it becomes rounded. Septa are not visible in this specimen but are shown in GSC 28264 (Pl. 61, fig. 4), which also has the rounded venter of the inner whorls. There are five auxiliary lobes.

Amphipopanoceras tetsa (McLearn)

Plate 61, figures 5–8; Figure 46c–e (p. 470)

Parapopanoceras tetsa McLearn, 1946a, p. 8, Appendix II, p. 1, Pl. 2, fig. 6; McLEARN, 1948, p. 9, Pl. 2, fig. 6; Pl. 9, fig. 1; TOZER, 1967, p. 26; McLEARN, 1969, p. 46, Pl. 9, figs. 3a, b, 7a, b (only).

Parapopanoceras normale McLearn, 1948, p. 10, Supplement p. 1, Pl. 9, figs. 5, 6 (only).

not *Parapopanoceras tetsa* Mclearn; DAGYS and ERMAKOVA, 1981, p. 66, Pl. 12, figs. 1–5; Pl. 13, figs. 1–5.

Registered material. Holotype GSC 6440 (McLearn, 1969, Pl. 9, figs. 3a, b), hypotype GSC 9575 (paratype of *Parapopanoceras normale)* (ibid., Pl. 9, figs. 7a, b) (both GSC loc. 10695). Four hypotypes GSC 28266, 28267, 28268, 28269* (all GSC loc. 68224). Hypotype GSC 28270 (GSC loc. 74724).

Occurrence. Upper Anisian, Deleeni Zone. Toad Formation, northeastern British Columbia. GSC locs. 10694 (5), 10695 (75), 68224 (10), 68297 (3), 74724 (1), C-90882 (1).

Measurements. Holotype GSC 6440: 62, 0.38, 0.26, 0.27. Hypotype GSC 28270 (Pl. 61, fig. 8): 71, 0.35, 0.24, 0.32. Hypotype GSC 28266 (Pl. 61, fig. 5): 76, 0.37, - , 0.30.

Remarks. Measurements are of complete specimens. On the holotype the septa are not approximated; on GSC 28270, they are; on GSC 28266 they are not visible. These complete examples are characterized by an outer whorl with a venter first bluntly angular (first quadrant), then distinctly angular (second and third quadrants), finally becoming rounded again at the aperture. The length of the body chamber is one and a quarter whorls. Although GSC 28270 (Pl. 61, fig. 8) and GSC 28266 (Pl. 61, fig. 5) are larger and a little more evolute than the holotype, they are otherwise similar. They are more closely comparable with GSC 9575 (McLearn, 1969, Pl. 9, figs. 7a, b), originally described as a paratype of *Parapopanoceras normale.* The phragmocone characteristically has no distinct umbilical shoulder (e.g., GSC 28267, Pl. 61, fig. 7). Judging from the specimens from GSC locality 10695 the maximum umbilical width attained on the phragmocone is about 10 per cent of the diameter. Most specimens are smooth, but GSC 28270 (Pl. 61, fig. 8) has very faint radial ribs. The suture line has five or six auxiliary lobes.

The most closely comparable species is *Amphipopanoceras acutum* Popov, which differs in being slightly smaller, in having an outer whorl more inflated on the first quadrant and with a more angular venter on the second half. Compared with *Amphipopanoceras selwyni* (McLearn) the venter of the outer whorl is angular, the umbilicus is wider at maturity, the phragmocone is more involute, the body chamber is longer, the umbilical shoulder is less distinct, and there are more elements in the suture line with more phylloid saddles. *Amphipopanoceras medium* (McLearn) has an outer whorl with somewhat comparable coiling, but has a rounded venter, a much more evolute phragmocone and a shorter suture line. The specimens from Siberia identified as *Parapopanoceras tetsa* by Dagys and Ermakova (1981, p. 66) differ in having a more evolute phragmocone and a less evolute body chamber.

Genus *Parapopanoceras* Haug, 1894

Type species. Popanoceras verneuili Mojsisovics.

Parapopanoceras malmgreni (Lindstroem)

Plate 65, figures 5, 6; Plate 66, figures 12a, b; Figure 49c (p. 480)

Ceratites malmgreni Lindstroem, 1865, p. 4, Pl. 2, figs. 1, 2; Oeberg, 1877, p. 10, Pl. 2, figs. 1–6.

Popanoceras malmgreni (Lindstroem). MOJSISOVICS, 1886, p. 68, Pl. 15, figs. 1a, b.

Popanoceras verneuili Mojsisovics, 1886, p. 69, Pl. 15, figs. 5–9.

Parapopanoceras verneuili (Mojsisovics). TOZER and PARKER, 1968, p. 536, Pl. 26, figs i–l.

Parapopanoceras malmgreni (Lindstroem). WEITSCHAT and LEHMANN, 1983, p. 44, Pl. 4, figs. 1–4.

Parapopanoceras sp. indet., TOZER, 1967, p. 69.

Registered material. Hypotype GSC 28271 (GSC loc. 83875). Hypotype GSC 28272 (GSC loc. 83890). Hypotype GSC 28273 (GSC loc. 40088).

Occurrence. Upper Anisian, Chischa Zone. Toad Formation, northeastern British Columbia; Sulphur Mountain Formation, Llama Member, northeastern British Columbia. GSC locs. 40088 (1), 83875 (4), 83890 (1).

Remarks. None of the specimens have the body chamber preserved in an uncrushed condition. In GSC 28271 (GSC loc. 65, fig. 5), however, enough of the umbilical seam is preserved to indicate coiling like that of one of the specimens from Spitsbergen (Riksmuseum no. 373, Mojsisovics, 1886, Pl. 15, figs. 9a–d) cited in the foregoing synonymy.

Parapopanoceras? *torelli* (Mojsisovics)

Plate 66, figures 11a, b

Popanoceras torelli Mojsisovics, 1886, p. 67, Pl. 14, figs. 8a–d.

Popanoceras (*Parapopanoceras*) *torelli* Mojsisovics. KIPARISOVA, 1937, p. 141, Pl. 1, figs. 3, 4.

Registered material. Hypotype GSC 28274 (GSC loc. 74726).

Occurrence. Upper Anisian, Chischa Zone. Toad Formation, northeastern British Columbia. GSC loc. 74726 (1).

Remarks. GSC 28274 (Pl. 66, fig. 11) has the characteristic weak folds (10 on half a whorl) and a suture line with three auxiliary lobes, and, although smaller, is comparable to the specimen illustrated by

Mojsisovics. Because the body chamber of this species is unknown, the generic assignment is uncertain.

Family MEGAPHYLLITIDAE Mojsisovics, 1896

Genus *Megaphyllites* Mojsisovics, 1879

Type species. Ammonites jarbas Münster.

Megaphyllites sp. indet.

Plate 147, figures 5a, b

Megaphyllites sp. cf. *M. insectus* (Mojsisovics). TOZER, 1967, p. 79.

Registered material. GSC 28275 (GSC loc. 23374).

Occurrence. Upper Norian, Crickmayi Zone. Sutton Formation, Vancouver Island. GSC loc. 23374 (1).

Remarks. GSC 28275 (Pl. 147, fig. 5) has an occluded umbilicus and is wholly septate. The surface has remains of the internal suture adhering indicating that there was originally a further three quarters of a whorl of phragmocone. The original phragmocone diameter was thus about 25 mm. The external saddle is well preserved, with a monophyllic termination and deep indentations extending over two thirds of its height. The full number of lobes has not been determined. What remains is comparable with the example of *Megaphyllites insectus* illustrated by Mojsisovics (1873, Pl. 20, figs. 6a, b) from the Gastropod beds of Sandling, Austria. It is also comparable to *M. transiens* (Mojsisovics) (ibid., Pl. 19, figs. 1a, b), from the *Sagenites giebeli* beds of Leisling.

Genus *Nitanoceras* McLearn, 1937a

Type species. Arcestes? *selwyni* McLearn.

Nitanoceras selwyni (McLearn)

Plate 74, figures 1–4; Figure 57i–k (p. 496)

Arcestes? *selwyni* McLearn, 1930, p. 5, Pl. 1, fig. 5.

Nitanoceras selwyni (McLearn). McLEARN, 1937a, p. 96; McLEARN, 1947b, p. 17, Pl. 3, figs. 1–5.

Nitanoceras leve McLearn, 1947b, Appendix p. 1, Pl. 3, fig. 6.

Megaphyllites leve (McLearn). TOZER, 1967, p. 67.

Megaphyllites selwyni (McLearn). TOZER, 1967, p. 66, 67.

Registered material. Holotype GSC 9047, topotype GSC 9526, both Beattie Ledge, Peace River. Topotype GSC 9544 (holotype of *Nitanoceras leve*) (GSC loc. 9213). Two topotypes GSC 28276, GSC 28277 (both GSC loc. 9131). Two topotypes GSC 38625*, GSC 38626* (both GSC loc. 9338).

Occurrence. Ladinian, Meginae Subzone 2. Toad Formation, northeastern British Columbia. GSC locs. 9131 (50), 9163 (20), 9213 (8), 9338 (30), 42395 (1), 68243 (2), 68248 (1).

Measurements. Holotype GSC 9047 (Pl. 74, fig. 2): 19, 0.53, 0.53, 0. Topotype GSC 9544 (Pl. 74, fig. 4): 29, 0.55, 0.45, 0.

Remarks. The measured specimens are complete. Assigned to this species are *Nitanoceras* attaining a diameter of about 30 mm but probably also reaching maturity at a smaller size, about 20 mm in diameter. Flanks are convex and the surface almost smooth, with convex growth striae. On the last quadrant the inner surface of the test may have ridges on the flank and venter or on the flank alone. These are indicated by impressions on steinkerns. In steinkerns that also have part of the test preserved (e.g., GSC 38265*, GSC 38626*) the ridges are present only on the inner surface. In the holotype (Pl. 74, fig. 2) and GSC 9526 (Pl. 74, fig. 1) the ridges are on the flanks and venter; in GSC 28276 (Pl. 74, fig. 3a–c) they are on the flank only. In GSC 9544 (Pl. 74, fig. 4), holotype of *Nitanoceras leve,* much of the test is preserved, and is smooth, with convex striae on the flank. In the last quadrant, the test is partly missing, revealing faint impressions of ridges on the venter. In the many specimens available, ridges are present only on the last quadrant. Probably they indicate maturity. If so, the holotype is complete and mature at a small diameter, GSC 9544 at a larger diameter. *Nitanoceras leve* is accordingly regarded as a large variant of *N. selwyni,* a possibility considered by McLearn (1947b, Appendix p. 1). Preservation of suture lines is fair but not perfect (Figs. 57i–k). Probably all the auxiliary lobes were denticulate.

Nitanoceras compressum n. sp.

Plate 77, figures 10a, b; Plate 87, figures 9a–c; Figure 70d (p. 522)

Megaphyllites sp., TOZER, 1967, p. 65.

Registered material. Holotype GSC 28278 (GSC loc. 68234). Paratype GSC 32358 (GSC loc. 68236).

Occurrence. Ladinian, Maclearni and Sutherlandi zones. Toad Formation, northeastern British Columbia. GSC locs. 68234 (16), 68236 (15).

Diagnosis. Nitanoceras about 20 mm in diameter; H about 58 per cent, W about 42 per cent of diameter. Flanks almost flat; ventral shoulders rounded, but distinct. Outer whorl without internal ridges.

Measurements. Holotype GSC 28278 (Pl. 87, fig. 9): 19, 0.58, 0.42, 0.

Remarks. The holotype (Pl. 87, fig. 9) is a complete specimen. The conch is much like that of *Megaphyllites,* but the saddle walls are much less indented, as in *Nitanoceras selwyni* (McLearn) (1937a, p. 96). The new species differs from *N. selwyni* in having flat flanks, distinct ventral shoulders, and in lacking internal ridges.

Superfamily CERATITACEAE Mojsisovics, 1879

Family SIBIRITIDAE Mojsisovics, 1896

Subfamily OLENIKITINAE Tozer, 1971

Genus *Olenikites* Hyatt, 1900

Type species. Dinarites spiniplicatus Mojsisovics.

Olenikites pilaticus Tozer

Plate 37, figures 10a, b

Nordophiceras pilatum (Hyatt and Smith). TOZER, 1965b, p. 2, 5 (not *Meekoceras pilatum* Hyatt and Smith, 1905, p. 144).

Olenikites pilaticus Tozer, 1967, p. 21, 48, 88, Pl. 6, figs. 1–5.

Kazakhstanites pilaticus (Tozer). TOZER, 1971, p. 1014.

Registered material. Holotype GSC 18893, four paratypes GSC 18890 (Tozer, 1967, Pl. 6, figs. 1a, b), GSC 18891 (ibid., figs. 2a, b), GSC 18892 (ibid., figs. 3a, b), GSC 18894 (ibid., figs. 5a–d) (all GSC loc. 64719).

Occurrence. Spathian, Pilaticus Zone. Blind Fiord Formation, Axel Heiberg Island. GSC loc. 64719 (10).

Olenikites subtilis n. sp.

Plate 37, figures 12–19; Figure 25c–f (p. 422)

Registered material. Holotype GSC 72354, six paratypes GSC 72355, GSC 72356, GSC 72357, GSC 72358*, GSC 72359, GSC 72360 (all GSC loc. 101891). Two paratypes GSC 72361, GSC 72362 (both GSC loc. C–134797).

Occurrence. Spathian, Pilaticus Zone. Blind Fiord Formation, Axel Heiberg Island. GSC locs. 101891 (10), C-134797 (2).

Diagnosis. Olenikites ranging in diameter from about 13 to about 25 mm; H about 45 per cent, W about 25 per cent, U about 25 per cent of diameter. Umbilical shoulder rounded, flanks flat, ventral shoulder rounded, venter arched. Phragmocone and initial part of body chamber ribbed, about seven ribs on half a whorl, ribs are nodose at the umbilical shoulder, fading toward the venter, absent outside the mid flank. Last half of body chamber merely striate. Suture line with narrow E, rounded or with one indentation, lateral lobes delicately denticulated, suspensive lobe narrow, with one indentation.

Measurements. Paratype GSC 72355 (Pl. 37, fig. 16): 25.0, 0.50, 0.24, 0.20. Paratype GSC 72356 (Pl. 37, fig. 12): 16.5, 0.42, 0.24, 0.21. Paratype GSC 72357 (Pl. 37, fig. 15): 13.5, 0.44, 0.22, 0.30.

Remarks. The holotype (Pl. 37, fig. 17) and paratypes GSC 72355 (Pl. 37, fig. 16), GSC 72356 (Pl. 37, fig. 12) and GSC 72357 (Pl. 37, fig. 15) have virtually smooth body chambers, are probably mature, and indicate the range in mature size. *Olenikites pilaticus* Tozer is probably the most closely related species, differing only in being larger and more inflated. *Olenikites subtilis* differs from *O. canadensis* Tozer and *O. bombus* n. sp. in having less distinct ventral shoulders, lacking any suggestion of the subtabulate venter that characterizes those species. Compared with *O. spiniplicatus* (Mojsisovics) the nodes are less pointed and the flanks less convex. The suture lines are more similar than might be supposed from the literature, some specimens of *Olenikites* from Taimyr having two ceratitic lateral lobes, like *O. subtilis.*

Olenikites canadensis Tozer

Plate 38, figures 1a, b; Figure 26a (p. 424)

Olenikites canadensis Tozer, 1961, p. 73, Pl. 18, figs. 1, 2 (only). TOZER, 1965a, p. 32, Pl. 4, figs. 1, 2 (only); TOZER, 1967, p. 48; KUMMEL, 1969, p. 489.

Registered material. Holotype, GSC 14094, paratype GSC 14093 (Tozer, 1961, Pl. 18, fig. 2) (both GSC loc. 32363). Topotype GSC 18850 (Tozer, 1965a, Pl. 4, fig. 2) (GSC loc. 47544).

Occurrence. Spathian, Subrobustus Zone. Blind Fiord Formation, Svartfjeld Member, Ellesmere Island. GSC locs. 32363 (2), 47544 (1).

Olenikites bombus n. sp.

Plate 37, figures 2a, b

Olenikites canadensis Tozer, 1961, p. 73, Pl. 18, figs. 3a, b (only); TOZER, 1965a, p. 32, Pl. 4, figs. 3, 4, 6 (only).

Registered material. Holotype GSC 18852, paratype GSC 18851 (Tozer, 1965a, Pl. 4, figs. 3a–c) (both GSC loc. 47544). Paratype GSC 18855 (ibid., figs. 4a–d) (GSC loc. 47545). Paratype GSC 14093 (Tozer, 1961, Pl. 18, figs. 3a, b) (GSC loc. 32363).

Occurrence. Spathian, Subrobustus Zone. Blind Fiord Formation, Svartefjeld Member, Ellesmere Island. GSC locs. 32363 (1), 47544 (2), 47545 (1).

Diagnosis. Olenikites about 25 mm in diameter; H about 40 per cent, W about 35 per cent, U about 30 per cent of diameter. Umbilical shoulder distinct but rounded, flanks weakly convex, ventral shoulder rounded but distinct, venter subtabulate. Phragmocone and initial part of body chamber ribbed; ribbing weak, relatively dense (about 10 ribs per half whorl), ribs form small nodes at the umbilical shoulder, fade toward the venter, being absent outside the mid flank. Suture line with very small denticulations in L; U2 and suspensive lobe apparently without indentation.

Measurements. Holotype GSC 18852 (Pl. 37, fig. 2): 28, 0.36, – , 0.32

Remarks. The tabulate venter indicates affinity with *Olenikites canadensis* Tozer, but compared with that species, the ribbing is much denser and weaker.

Olenikites triton n. sp.

Plate 37, figures 1a, b

Olenikites canadensis Tozer, 1965a, p. 32, Pl. 4, figs. 5, 7, 8 (only).

Registered material. Holotype GSC 18853, paratype GSC 18854 (Tozer, 1965a, Pl. 4, figs. 8a–c) (both GSC loc. 47544). Paratype GSC 18856 (ibid., figs. 5a–c) (GSC loc. 32363).

Occurrence. Spathian, Subrobustus Zone. Blind Fiord Formation, Svartefjeld Member, Ellesmere Island. GSC locs. 32363 (1), 47544 (2).

Diagnosis. Olenikites attaining a diameter of about 30 mm; H about 35 per cent, W about 30 per cent, U about 37 per cent of diameter. Umbilical shoulder distinct but rounded, flanks weakly convex, ventral shoulder rounded but distinct, venter subtabulate. Flanks ribbed, ribs on the inner whorls somewhat nodose at the umbilical shoulder, not appreciably so on the outer; ribbing dense (about 15 per half whorl), fading on outer half of flank. Suture line with very small indentations in L; U2 and suspensive lobe apparently without indentation.

Measurements. Holotype GSC 18853 (Pl. 37, fig. 1): 32, 0.37, 0.28, 0.37

Remarks. The holotype (Pl. 37, fig. 1) is probably complete and mature. This species most closely resembles *Olenikites bombus* n. sp., but differs in being more evolute and densely ribbed. Having only a feeble development of nodes, *O. triton* is not closely similar to *O. spiniplicatus* (Mojsisovics). *Olenikites bombus,* however, serves to link *O. triton* with *O. canadensis* Tozer, in which the characters of *Olenikites* are clearly expressed.

Genus *Svalbardiceras* Frebold 1930

Type species. Lecanites? spitzbergensis Frebold.

Svalbardiceras freboldi Tozer

Plate 38, figures 2a, b; Figure 26c, d (p. 424)

Svalbardiceras freboldi Tozer, 1965a, p. 36, Pl. 4, figs. 12, 13; Pl. 5, fig. 2; TOZER, 1967, p. 48; KUMMEL, 1969, p. 453.

Registered material. Holotype GSC 18857 (Tozer, 1965a, Pl. 4, figs. 13a–c), paratype GSC 18858 (both GSC loc. 47544). Paratype GSC 18859 (ibid., Pl. 5, fig. 2) (GSC loc. 32363).

Occurrence. Spathian, Subrobustus Zone. Blind Fiord Formation, Svartefjeld Member, Ellesmere Island. GSC locs. 32363 (1), 47544 (3).

Svalbardiceras chowadei Tozer

Plate 38, figures 3a, b

Svalbardiceras chowadei Tozer, 1965a, p. 37, Pl. 4, figs. 9–11; TOZER, 1967, p. 73; KUMMEL, 1969, p. 453; KORCHINSKAYA, 1982, p. 46, Pl. 9, fig. 3; Pl. 11, figs. 3, 4.

Registered material. Holotype GSC 18861 (GSC loc. 56263). Paratype GSC 18860 (Tozer, 1965a, Pl. 4, fig. 9) (GSC loc. 56265). Paratype GSC 18862 (ibid., Pl. 4, fig. 11) (GSC loc. 56258).

Occurrence. Spathian, Subrobustus Zone. Toad Formation, northeastern British Columbia. GSC locs. 56258 (1), 56263 (1), 56265 (1).

Subfamily KEYSERLINGITINAE Zacharov, 1970

Genus *Keyserlingites* Hyatt, 1900

Type species. Ceratites subrobustus Mojsisovics.

Keyserlingites subrobustus (Mojsisovics)

Plate 38, figures 8, 9

Ceratites middendorfi Keyserling, 1845, p. 169, Pl. 2, fig. 4 (only).

Ceratites subrobustus Mojsisovics, 1886, p. 44, Pl. 4, fig. 2; Pl. 5; Pl. 6, fig. 1.

Keyserlingites subrobustus (Mojsisovics). POPOV, 1961a, p. 55, Pl. 15, figs. 1a, b; TOZER, 1965a, p. 31, Pl. 5, fig. 1; Pl. 6, figs. 1–3; Pl. 7, figs. 1–3; Pl. 8, figs. 1, 2; TOZER, 1967, p. 21, 48, 73, Pl. 6, figs. 6a, b; TOZER and PARKER, 1968, p. 531, Pl. 25, figs. e–g; KUMMEL, 1969, p. 485, Pl. 26, figs. 6, 7; KORCHINSKAYA, 1970, p. 84, Pl. 5, figs. 1–5; Pl. 6, figs. 1–3; DAGYS et al., 1979, Pl. 7, figs. 1a, b, KORCHINSKAYA, 1982, Pl. 15, figs. 1, 2; DAGYS and ERMAKOVA, 1988, p. 40, Pl. 9, figs. 5, 6; Pl. 10, fig. 5; Pl. 11, fig. 1; Pl. 12, fig. 1; Pl. 13, figs. 1–3.

Keyserlingites sp. cf. *K. subrobustus* (Mojsisovics). FREBOLD, 1929a, p. 12, Pl. 2, figs. 8, 9.

Registered material. Two hypotypes GSC 18841 (Tozer, 1965a, Pl. 5, fig. 1), GSC 18842 (ibid., Pl. 6, figs. 1a, b) (both GSC loc. 51603). Three hypotypes GSC 18843 (ibid., Pl. 6, figs. 2a, b), GSC 18844 (ibid., Pl. 7, fig. 2), GSC 18845 (ibid., Pl. 7, fig. 3) (all GSC loc. 47545). GSC 18846 (ibid., Pl. 7, figs. 1a, b) (GSC loc. 56261). GSC 18847 (ibid., Pl. 8, figs. 2a–h) (GSC loc. 56235).

Occurrence. Spathian, Subrobustus Zone. Blind Fiord Formation, Ellesmere Island; Toad Formation, northeastern British Columbia. GSC locs. 47545 (4), 51599 (3), 51603 (3), 56235 (1), 56261 (1).

Remarks. The presence on the inner whorls of parabolic nodes at the midline of the venter was unknown until recently. They are now known on specimens from Siberia (Dagys and Ermakova, 1988, Pl. 9, fig. 6), Spitsbergen (Tozer and Parker, 1968, Pl. 25, figs. e–g; Korchinskaya, 1970, Pl. 5, figs. 5a, b) and Ellesmere Island (Korchinskaya, 1970, Pl. 5, fig. 3; Pl. 38, fig. 8). They are not certainly known on any specimens from British Columbia. Nodes or spines in this position are exceedingly rare on Triassic ammonoids. It is possibly significant that the nodes of *Keyserlingites* are comparable with those of the contemporary *Monacanthites monoceros* Tozer. This may indicate affinity or dimorphism despite the fact that in other characters *Monacanthites* and *Keyserlingites* are totally different.

Genus *Monacanthites* Tozer, 1965a

Type species. Monacanthites monoceros Tozer.

Monacanthites monoceros Tozer

Plate 37, figures 3a–c

Monacanthites monoceros Tozer, 1965a, p. 27, Pl. 1, figs. 8–10; Pl. 2, fig. 4; TOZER, 1967, p. 73; KUMMEL, 1969, p. 422.

Registered material. Holotype GSC 18838 (GSC loc. 56194). Four paratypes, GSC 18836 (Tozer, 1965a, Pl. 1, figs. 8a, b), GSC 18837 (ibid., figs. 10 a–c), GSC 18839* (ibid., Textfig. 8, p. 27), GSC 18840* (all GSC loc. 56240).

Occurrence. Spathian, Subrobustus Zone. Toad Formation, northeastern British Columbia. GSC locs. 56194 (1), 56240 (10).

Family LONGOBARDITIDAE Spath, 1951

Subfamily GROENLANDITINAE Assereto, 1966

Genus *Groenlandites* Kummel, 1953

Type species. Groenlandites nielseni Kummel.

Groenlandites silberlingi n. sp.

Plate 39, figures 1–12; Plate 45, figures 1a, b; Figure 27a (p. 426)

Pearylandites aff. *P. troelseni* Kummel. TOZER, 1967, p. 69.

Registered material. Holotype GSC 28435, 13 paratypes GSC 28436–28448 (all GSC loc. 68226).

Occurrence. Lower Anisian, Mulleri Zone. Toad Formation, northeastern British Columbia. GSC loc. 68226 (100).

Diagnosis. Groenlandites attaining a diameter of about 45 mm; H about 55 per cent, W about 30 per cent, U about 13 per cent of diameter. Inner whorls are much thicker and evolute, with W up to 55 per cent and U up to 35 per cent of diameter. Inner whorls with rounded flanks and venter; body whorl subtriangular in section with rounded umbilical shoulder and angular or faintly fastigate venter. At mature aperture angularity of venter may be barely perceptible. Radial bullae present on flank of inner whorls, near umbilical margin on penultimate whorl, fading on outer whorl, 10–17 bullae per whorl. Striae on body chamber are generally weakly convex or weakly falcoid, with a shallow sinus on the outer flank. Suture line with two auxiliary lobes.

Measurements. Paratype GSC 28437 (Pl. 39, fig. 3): 25, 0.57, 0.30, 0.13. Paratype GSC 28442 (Pl. 39, fig. 8): 37, 0.54, 0.40, 0.17.

Remarks. The two measured specimens have undistorted body chambers with smooth flanks on the last half whorl, and only a trace of ventral shoulders on the outer whorl. GSC 28442 (Pl. 39, fig. 8) retains an angular venter to the aperture but in GSC 28437 (Pl. 39, fig. 3) the angularity is reduced to a mere thread. These two are probably almost mature. GSC 28445 (Pl. 39, fig. 11), about 45 mm in diameter, is the largest known specimen. GSC 28444 (Pl. 39, fig. 10) has a venter comparable with that of GSC 28437. GSC 28439 (Pl. 39, fig. 5) has 10 bullae per whorl; GSC 28447 (Pl. 45, fig. 1), has 17 per whorl. The phragmocone venter is commonly rounded to a fairly large diameter, as in GSC 28441 (Pl. 39, fig. 7). GSC 28436 (Pl. 39, fig. 2), a highly inflated, prominently sculptured example about 17 mm in diameter, shows unusually early acquisition of an angular, almost carinate venter, with prominent ridges bordering the median line.

This species illustrates the close similarities between representatives of *Groenlandites* and *Pearylandites*. At maturity it is more involute than both *Groenlandites nielseni* Kummel and *Pearylandites troelseni* Kummel. The bullate ribs of *Groenlandites silberlingi* are less nodose and are placed closer to the umbilicus compared with those of *Pearylandites*, although GSC 28436 (Pl. 39, fig. 2), with unusually nodose bullae, could be regarded as a representative of *Pearylandites*. *Groenlandites astachovae* Vavilov (1978, p. 53) appears to be comparable, possibly differing only in being more evolute. *Groenlandites pridaense* Bucher (1989, p. 974) is more evolute, *Groenlandites merriami* Bucher (op. cit., p. 975) has less regular ribbing.

Etymology. The name is for N.J. Silberling.

Groenlandites canadensis n. sp.

Plate 40, figures 6–12; Figure 28a (p. 428)

Registered material. Holotype GSC 28457, three paratypes GSC 28458, GSC 28459, GSC 28460 (all GSC loc. 74732).

Occurrence. Lower Anisian, Caurus Subzone 1. Toad Formation, northeastern British Columbia. GSC locs. 74719 (18), 74732 (8).

Diagnosis. Groenlandites attaining a diameter of about 30 mm; H about 40 per cent, W about 40 per cent, U about 25 per cent of diameter. Inner whorls with W up to 55 per cent, U up to 33 per cent of diameter. Inner whorls with rounded flanks and venter to a diameter of about 10 mm. Outer whorl thickly lanceolate in section with a perpendicular umbilical wall and convex flanks converging gradually to the venter, which has a narrow, raised, rounded keel. Inner whorls bear distant bullate ribs on the flank. Growth lines on the outer whorl convex. Suture line with up to four auxiliary lobes.

Measurements. Paratype GSC 28548 (Pl. 40, fig. 10): 28, 0.41, 0.41, 0.25.

Remarks. In the holotype (Pl. 40, fig. 12) and GSC 28458 (Pl. 40, fig. 10), a body chamber of about three quarters of a whorl is preserved; they may have been mature specimens. The outer whorl of the holotype is weakly carinate, with nine convex ribs on the flank of

the adapical half, replaced, adorally, by convex striae. The last two suture lines are exposed. There is no indication of approximation.The last suture line has four auxiliary lobes, of which the outer three are weakly denticulate. The outer whorl of GSC 28548 has two convex ribs in the adapical part and convex striae, some fasciculate, almost assuming the character of ribs, on the remainder. Smaller specimens are GSC 28459 (Pl. 40, fig. 11), 22 mm in diameter, with a wholly carinate outer whorl, striate except on the last quadrant where there are three prominent ribs; and GSC 28460 (Pl. 40, fig. 9), 15 mm in diameter, with the venter initially rounded, later carinate, and ribs (about five per quadrant) on both the outer and penultimate whorls.

This species closely resembles *Groenlandites nielseni* Kummel (1953, p. 12), differing in being less inflated. The suture line of *G. nielseni* is not known to have more than two auxiliary lobes, but the whole line, at maturity, has not been described. It is possible that the suture lines of *G. nielseni* and *G. canadensis* are essentially similar. Compared with *G. silberlingi* n. sp., *G. canadensis* is more evolute, has less regular and less numerous ribs, which are placed farther from the umbilicus, and has more numerous auxiliary lobes. The whorl sections are also different, *G. canadensis* having a carinate instead of merely angular venter and no suggestion of the ventral shoulders present on some *G. silberlingi*.

Groenlandites kummeli n. sp.

Plate 40, figures 1–5

Groenlandites sp. cf. *G. nielseni* Kummel. TOZER, 1967, p. 23, 69.

Registered material. Holotype GSC 28452, four paratypes GSC 28449, GSC 28450, GSC 28451, GSC 28453 (all GSC loc. 68203).

Occurrence. Lower Anisian, Caurus Subzone 1. Toad Formation, northeastern British Columbia. GSC loc. 68203 (35).

Diagnosis. Groenlandites like *G. nielseni* Kummel and *G. canadensis* n. sp., but more involute.

Measurements. Holotype GSC 28452 (Pl. 40, fig. 4): 27, 0.52, 0.41, 0.17.

Remarks. Only two large specimens are known, the holotype and GSC 28453 (Pl. 40, fig. 5), the remains of a specimen about 30 mm in diameter. It is 14 mm wide, i.e., appreciably more inflated than the holotype. Associated with these two are smaller individuals that closely resemble specimens of *Groenlandites canadensis* n. sp. at a comparable size. GSC 28449 (Pl. 40, fig. 1), 11.5 mm in diameter has an outer whorl at first rounded, becoming very faintly angular on the adoral quadrant. The adoral half has six ribs, the adapical half is striate. GSC 28450 (Pl. 40, fig. 2), about 14 mm in diameter, shows the acquisition of an angular venter. GSC 28451 (Pl. 40, fig. 3) shows the suture line at a whorl height of 5 mm. There is one auxiliary lobe, probably two. L and U2, as preserved, are goniatitic.

Etymology. The name commemorates Bernhard Kummel.

Groenlandites amplus n. sp.

Plate 40, figures 13a–d; Figure 28b (p. 428)

Registered material. Holotype GSC 28461 (GSC loc. 74741).

Occurrence. Lower Anisian, Caurus Subzone 2. Toad Formation, northeastern British Columbia. GSC loc. 74741 (l).

Diagnosis. Large *Groenlandites* (estimated diameter at least 70 mm). Phragmocone proportions: H about 40 per cent, W about 48 per cent, U about 30 per cent of diameter. Phragmocone with strong, convex, bullate ribs, some elevated at inner third of flank, about 15 per whorl. Suture line with two auxiliary lobes.

Remarks. This species is known from one phragmocone. At a diameter of 8 mm the whorl section is ovoid, the venter being arched, without angularity or carination. At a diameter of 12 mm the venter is carinate. The outer whorl has a perpendicular umbilical wall, rounded umbilical shoulder and convex flanks. On the adapical half, the flanks converge, without break in curvature, toward the carinate venter. On the adoral half, rounded ventral shoulders appear, defining a broadly gabled (fastigate) venter, with sloping sides adjacent to the keel. Including the body chamber, this specimen presumably attained a diameter of about 70 mm. The whorl section ontogeny, ribbing and suture line are taken to justify assignment to *Groenlandites,* although this species was much larger than *Groenlandites nielseni* Kummel, *G. silberlingi* n. sp., *G. canadensis* n. sp. and *G. kummeli* n. sp. The convex ribbing is particularly like that of *G. canadensis*. There are other differences in addition to that of size. Compared with *G. amplus, G. canadensis, G. kummeli* and *G. nielseni* lack ventral shoulders; *G. silberlingi* has essentially straight, instead of convex, ribs.

Genus *Pearylandites* Kummel, 1953

Type species. Pearylandites troelseni Kummel.

Pearylandites troelseni Kummel

Plate 43, figures 5, 6; Figure 30d (p. 434)

Pearylandites troelseni Kummel, 1953, p. 8, Pl. 1, figs. 10–22.

Pearylandites sp., TOZER, 1961, p. 33, Pl. 22, figs. 3a, b; TOZER, 1967, p. 47.

Registered material. Three hypotypes GSC 14188 (Tozer, 1961, Pl. 22, figs. 3a, b), GSC 28463, GSC 28464 (all GSC loc. 30339).

Occurrence. Lower Anisian, Caurus Zone. Schei Point Formation, Exmouth Island. GSC loc. 30339 (3).

Remarks. The specimens identified with this species are incomplete, but close similarities with the material from Pearyland are nevertheless demonstrable. GSC 28463 (Pl. 43, fig. 5) and GSC 28464 (Pl. 43, fig. 6) are probably the inner and outer whorls of one specimen originally about 25 mm in diameter. GSC 28463 shows the coronate whorl section, prominent marginal nodes and smooth venter that characterize the inner whorls of this species. GSC 28464 has a dorsum contoured like the venter of GSC 28563 and a compressed, carinate outer whorl. The specimens are comparable with the holotype (Kummel, 1953, Pl. 1, figs. 10, 11) except that the change from coronate to compressed whorls takes place at a smaller diameter. GSC 14188 (Tozer, 1961, Pl. 22, figs. 3a, b), preserved as an external mould, is the remains of a specimen that retained a coronate whorl section to a diameter of about 22 mm. It is closely comparable with a paratype (Kummel, 1953, Pl. 1, figs. 17–19). The suture line of the specimens from Canada, like those from Pearyland, is not known to acquire more than one auxiliary lobe (Fig. 30d).

Pearylandites peregrinus n. sp.

Plate 47, figures 4a–c; Figure 34c (p. 442)

Registered material. Holotype GSC 28462 (GSC loc. 74740).

Occurrence. Lower Anisian, Caurus Zone 2. Toad Formation, northeastern British Columbia. GSC loc. 74740 (1).

Diagnosis. Large *Pearylandites,* attaining a diameter of about 100 mm; relatively involute, U about 20 per cent of diameter. Suture line with two discrete auxiliary lobes.

Remarks. The only known specimen is a complete phragmocone with slightly approximated septa. Including the body chamber, it attained a diameter of at least 100 mm. Parts of the inner whorls are exposed. At a diameter of 18 mm the whorl section is coronate, with a low ridge on the mid line of the venter and prominent bullate marginal nodes, about five per quadrant. The outer whorl, i.e., starting at a diameter of about 30 mm, is subtrigonal in section with a perpendicular umbilical wall and a rounded umbilical shoulder. Adapically the whorls are relatively thick, with convex flanks converging on the acute venter; adorally they are more compressed, with almost flat flanks. The adorad half of the phragmocone has two faint spiral ridges on the outer flank. These fade in prominence toward the last septum and appear to be absent on the small preserved part of the body chamber. The flanks on the adoral half whorl of the phragmocone initially have six low, weakly convex ribs, most prominent at the mid-flank and fading toward the umbilicus and venter. Ribbing is absent on the adoral preserved quadrant. The sculpture and whorl section at a diameter of 18 mm closely resembles that of a paratype of *Pearylandites troelseni* Kummel (1953, Pl. 1, fig. 17). The new species differs in its larger size, more involute outer whorl and in having a faint siphonal ridge on the inner whorls. This ridge is much less prominent than the keel characteristic of *Lenotropites.* From what is known, the suture line of *Pearylandites troelseni* has fewer divisions and is less denticulate, compared with that of *P. peregrinus.* The significance of this difference is uncertain because the suture line of *P. troelseni* is known only at a small diameter, and that of *P. peregrinus* only at maturity.

Genus *Lenotropites* Popov, 1961a

Type species. Lenotropites solitarius Popov.

Lenotropites caurus (McLearn)

Plate 41, figures 1–12, 16; Plate 42, figures 10a–c; Plate 45, figures 10a, b; Figures 29a–c (p. 430)

"Hungarites" caurus McLearn, 1948, p. 22, Supplement p. 1, Pl. 11, figs. 1, 2.

Lenotropites caurus (McLearn). TOZER, 1967, p. 69, 71, Pl. 7, figs. 1a, b; McLEARN, 1969, p. 41, Pl. 8, figs. 4–7; SILBERLING and NICHOLS, 1982,

p. 46, Pl. 29, figs. 14–30; ?KORCHINSKAYA, 1982, p. 63, Pl. 16, figs. 10a, b.

"Hungarites" boreas McLearn, 1948, p. 22, Supplement p. 2, Pl. 11, figs. 3, 4.

Lenotropites boreas (McLearn). TOZER, 1967, p. 71.

"Hungarites" dawsoni McLearn, 1948, p. 23, Supplement p. 2, Pl. 10, figs. 8, 9.

Registered material. Holotype GSC 9585 (McLearn, 1969, Pl. 8, figs. 4a, b), topotype GSC 9586 (Holotype of *"Hungarites" boreas*) (ibid., figs. 6a, b) (both GSC loc. 10660). Two topotypes GSC 21725 (ibid., figs. 5a, b), GSC GSC loc. 28465 (both GSC loc. 42339). Hypotype GSC 9587 (holotype of *"Hungarites" dawsoni* (ibid., figs. 7a, b) (GSC loc. 10736). Hypotype GSC 28466 (GSC loc. 74720). Five hypotypes, GSC 28467–28471 (all GSC loc. 68203). Four hypotypes GSC 28472–28475 (all GSC loc. 42349). Three hypotypes GSC 28476–28478 (all GSC loc. 74735). Hypotype GSC 72206 (GSC loc. 98907). Topotype GSC 85769* (GSC loc. 99581).

Occurrence. Lower Anisian, Caurus Zone. Toad Formation, northeastern British Columbia; Sulphur Mountain Formation, Whistler Member, Alberta. GSC locs. 10660 (2), 10736 (1), 42339 (15), 42349 (24), 52932 (10), 68203 (30), 74720 (3), 74733 (5), 74735 (5), 98907 (1), 99581 (3).

Measurements. Hypotype GSC 28474 (Pl. 41, fig. 9): 20, 0.45, 0.40, 0.31. Hypotype GSC 28468 (Pl. 41, fig. 2): 21, 0.40, 0.33, 0.26. Hypotype GSC 28469 (Pl. 41, fig. 3): 28, 0.50, 0.32, 0.16. Hypotype GSC 28475 (Pl. 41, fig. 12): 32, 0.44, 0.47, 0.31. Hypotype GSC 28478 (Pl. 41, fig. 8): 39, 0.50, 0.42, 0.22. Topotype GSC 85769*: 46, 0.52, 0.33, 0.20. Hypotype GSC 28476 (Pl. 41, fig. 6): 49, 0.53, 0.36, 0.14. Hypotype GSC 72206 (Pl. 42, fig. 10): 61, 0.45, 0.36, 0.24.

Remarks. Following McLearn (1969, p. 41), this species is interpreted as including morphotypes that vary considerably in size, proportions and sculpture. The scope of the species is further enlarged to include forms with thicker whorls and more prominent sculpture than any described by McLearn. Characters of *Lenotropites caurus,* in this broad sense are as follows. The evolute, carinate inner whorls may be relatively compressed or inflated and depressed. They invariably have ribs that are bullate on inflated variants. The most inflated variants have inner whorls with a coronate whorl section and lateral nodes instead of ribs; at a later growth stage these are replaced by ribs. Ribs are generally straight or slightly convex on the flank with concave curvature near the umbilical shoulder. With growth the whorls become more compressed, the keel less prominent and the sculpture is reduced in strength. The outer whorl has a perpendicular umbilical wall, rounded umbilical shoulder, slightly convex flanks, faint to moderately prominent ventro-lateral shoulders defining a gabled (fastigate) venter and a keel that diminishes in prominence adorally. At maturity the aperture is arched, with no keel. On the final quadrant, ribbing may be faint or absent. Some have irregular strigation on the outer flank and venter. The suture line has two discrete auxiliary lobes. The measurements given are of specimens that are complete or nearly so. In GSC 28478 (Pl. 41, fig. 8) and GSC 85769* parts of the peristome are preserved. On these the most adorad part lacks a keel. This is also the case with GSC 72206 (Pl. 42, fig. 10). These three specimens were presumably mature. Variants comparable with the holotype and with the types of *"Hungarites" boreas* and *"H." dawsoni* occur in association at GSC locality 68203 on the Alaska Highway. They include GSC 28467 (Pl. 41, fig. 1) and GSC 28468 (Pl. 41, fig. 2), which are relatively compressed, with non-bullate ribs at a small diameter. These two are comparable with the holotype although somewhat less prominently ribbed. GSC 28470 (Pl. 41, fig. 4) has thicker whorls and somewhat bullate ribs and is comparable with the holotype of *"Hungarites" boreas*, at the same size, and another specimen from the type locality (GSC 28465, Pl. 45, fig. 10). Large specimens from GSC locality 68203 (GSC 28471, Pl. 41, fig. 5; GSC 72206, Pl. 42, fig. 10) are comparable with the holotype of *"Hungarites" dawsoni.* Ribbing visible in the umbilicus and on the adapical part of the outer whorl of GSC 28471 (Pl. 41, fig. 5) show that its inner whorls are like GSC 28470 (Pl. 41, fig. 4). Specimens from GSC locality 68203 are not known to show strigation. In this respect they are like those from the type locality (GSC loc. 10660 = GSC loc. 42339). Specimens interpreted as thick-whorled, prominently sculptured variants are known from two localities: Chischa River (GSC loc. 74735) and Liard River (GSC loc. 42349). At a small diameter (H about 6 mm) this variant has whorls with a coronate section and prominent lateral nodes, most clearly shown by GSC 28472 (Pl. 41, fig. 10) and also visible, in section, in GSC 28478 (Pl. 41, fig. 8). In this variant, ribbing is retained to a diameter of about 30 mm (GSC 28475, Pl. 41, fig. 12). GSC 28473 (Pl. 41, fig. 11) has crescentic bullae near the umbilical shoulder in addition to ribs. GSC 28475 (Pl. 41, fig. 12), GSC 28473 (Pl. 41, fig. 11) and GSC 28478 (Pl. 41, fig. 8) have irregular strigate sculpture on the outer half of the whorl side, a feature also present on the holotype of *"Hungarites" dawsoni* and

GSC 28476 (Pl. 41, fig. 6). GSC 28478 (Pl. 41, fig. 8) is associated with GSC 28476 (Pl. 41, fig. 6), a close counterpart of the holotype of *"Hungarites" dawsoni*. The thick variants from Liard River occur with GSC 28474 (Pl. 41, fig. 9), which closely resembles the holotype. It thus appears that all the variants described above occur in association, at one locality or another.

Lenotropites tardus McLearn

Plate 41, figures 13–15; Plate 42, figures 4–9; Plate 43, figures 8, 9; Figure 29d (p. 430)

Lenotropites tardus McLearn, 1969, p. 39, Pl. 8, figs. 1–3, Textfig. 19; VAVILOV, 1978, p. 53, Pl. 7, figs. 2a, b; DAGYS et al., 1979, Pl. 9, figs. 1, 2.

not *Lenotropites tardus* McLearn. KORCHINSKAYA, 1982, p. 64, Pl. 16, figs. 11a, b; Pl. 18, figs. 1–3 = *L. undulatus* (Spath).

Registered material. Holotype GSC 21723, two paratypes GSC 21722 (McLearn, 1969, Pl. 8, figs. 1a, b), GSC 21724 (ibid., Pl. 8, figs. 3a, b) (all GSC loc. 36446). Hypotype GSC 28482 (GSC loc. 42338). Three hypotypes GSC 28484, GSC 28485, GSC 28486 (all GSC loc. 74719). Hypotype GSC 28487 (GSC loc. 74742). Five hypotypes GSC 28489–28493 (GSC loc. 74732).

Occurrence. Lower Anisian, Caurus Zone. Toad Formation, northeastern British Columbia. GSC locs. 36446 (5), 42338 (1), 74719 (4), 74732 (7), 74742 (7).

Measurements. Holotype GSC 21723 (Pl. 43, fig. 8): 32, 0.59, 0.36, 0.20. Hypotype GSC 28485 (Pl. 41, fig. 14): 37, 0.54, 0.32, 0.12. Hypotype GSC 28486 (Pl. 41, fig. 15): 43, 0.44, 0.37, 0.13. Hypotype GSC 28493 (Pl. 42, fig. 9): 57, 0.46, 0.40, 0.19.

Remarks. Identified with this species are *Lenotropites* like those variants of *L. caurus* (McLearn) that have bullate ribs on the inner whorls, but which differ in having slightly falcoid rather than convex ribbing on the outer whorl. The specimens from the type locality and from GSC localities 74719 and 74732 illustrate the variability. Thickness varies considerably, thick variants being more prominently sculptured than thin. Of those from GSC locality 74719, GSC 28485 (Pl. 41, fig. 14) and GSC 28486 (Pl. 41, fig. 15) are fairly mature examples of thin and thick variants. GSC 28485 has an almost smooth outer whorl, with only falcoid striae. GSC 28486 has a smooth adoral quadrant preceded by one with six falcoid ribs. A sectional view (Pl. 41, fig. 15c) and associated small ribbed specimens (e.g., GSC 28484, Pl. 41, fig. 13) indicate the nature of the inner whorls. GSC 28485 closely resembles a specimen from the type locality (McLearn, 1969, Pl. 8, figs. 3a, b). The specimens from GSC locality 74732 are larger but include three that closely resemble the holotype and paratypes except for the difference in size (GSC 28490, Pl. 42, fig. 6; GSC 28491, Pl. 42, fig. 7; GSC 28493, Pl. 42, fig. 9). These three are probably mature but are not completely preserved. GSC 28489 (Pl. 42, fig. 5), with a coronate whorl section and strong bullae where the whorls are widest shows the characters in a specimen of small diameter; GSC 28492 (Pl. 42, fig. 8) at a somewhat larger diameter. None from this locality show complete suture lines, but GSC 28492 shows the first auxiliary lobe is just below the umbilical shoulder.

Lenotropites undulatus (Spath)

Plate 44, figures 1, 2, 13; Figure 31e (p. 436)

Koptoceras undulatum Spath, 1951, p. 12 (lectotype, now chosen, BMNH C-40583).

Lenotropites sp. cf. *L. caurus* McLearn. TOZER, 1967, p. 47, 48.

Lenotropites tardus McLearn. KORCHINSKAYA, 1982, p. 64, Pl. 16, figs. 11a, b; Pl. 18, figs. 1–3 (not of McLearn, 1969, p. 39).

?*Eutomoceras* aff. *laubei* Meek. FREBOLD, 1929a, p. 25, Pl. 2, fig. 5.

Registered material. Two hypotypes GSC 28479, GSC 28480 (both GSC loc. 47580). Hypotype GSC 28481 (GSC loc. 30339).

Occurrence. Lower Anisian, Caurus Zone. Schei Point Formation, Exmouth Island; Blaa Mountain Formation, Ellesmere Island. GSC locs. 30339 (3), 47580 (4).

Remarks. The keel, convex ribbing and suture lines of these specimens leaves no doubt that they represent a species of *Lenotropites* closely resembling *L. caurus* (McLearn). There is also a close resemblance to the specimens from Edgeoya (Svalbard), to which Spath gave the name *Koptoceras undulatum*. These are crushed impressions but nevertheless show the character of the ribbing. GSC 28479 (Pl. 44, fig. 1) closely resembles the holotype of *Lenotropites caurus* (McLearn), except that it is septate at a larger diameter. The penultimate preserved whorl of this specimen has ribs that are nodose on the outer flank,

somewhat like the ribs of inflated variants of *L. caurus* (e.g., GSC 28472, Pl. 41, fig. 10). GSC 28480 (Pl. 44, fig. 2) has part of the body chamber preserved and shows that the ribbing, at least near the umbilicus, was much less prominent than on the phragmocone. This specimen, when complete was probably comparable to large examples of *L. caurus,* such as GSC 28471 (Pl. 41, fig. 5) and GSC 28476 (Pl. 41, fig. 6), differing only in having more compressed whorls and ribbing retained at a larger diameter.

Lenotropites ellesmerensis n. sp.

Plate 43, figures 1a, b

Registered material. Holotype GSC 28483 (GSC loc. 47550).

Occurrence. Lower Anisian, Caurus Zone. Blaa Mountain Formation, Ellesmere Island. GSC loc. 47550 (1).

Diagnosis. Lenotropites attaining a diameter of about 60 mm; H about 55 per cent, W about 40 per cent, U about 12 per cent of diameter. Inner whorls particularly thick; coronate in section with bullate nodes at the marginal extremity.

Remarks. The only known specimen is the remains of a large *Lenotropites* that thas much of the phragmocone preserved and a small part of the body chamber in the umbilical area. The adapical part of what is preserved of the phragmocone is coronate in section with a carinate venter. The adoral part is subtrigonal in section with nearly flat flanks and a narrowly gabled (fastigate) venter, the acute venter being bordered by low, but distinct ventrolateral ridges. The sculpture on the adapical part is of bullate nodes; on the adoral part of low convex ribs. Much of the suture line is visible at a whorl height of 20 mm, although preservation is imperfect. E is indented; L large and in depth like E; U2 small, placed on the inner flank. Auxiliary lobes are not clearly exposed, but there is not more than one outside the umbilical shoulder. Although incomplete, enough is preserved to show that the specimen closely resembles some examples of *Lenotropites tardus* McLearn and *L. caurus* (McLearn). Compared with typical examples of *L. caurus* the inner whorls of the new species are much more depressed in section, with much more pronounced nodes. Some examples of *L. tardus* have comparable nodes but they are placed closer to the mid-flank than those of *L. ellesmerensis.*

Lenotropites? *tricarinatus* n. sp.

Plate 45, figures 9a, b

Registered material. Holotype GSC 28497 (GSC loc. 68203).

Occurrence. Lower Anisian, Caurus Subzone 1. Toad Formation, northeastern British Columbia. GSC loc. 68203 (1).

Diagnosis. Lenotropites? attaining a diameter of at least 25 mm; H about 45 per cent, W about 55 per cent, U about 25 per cent of diameter. Phragmocone with distant prorsiradiate ribs; body chamber smooth with a bluntly angular venter. Inner surface of the body chamber has thin ventral and marginal sulci, producing a tricarinate steinkern.

Remarks. The outer whorl of the only known specimen has a perpendicular umbilical wall, rounded umbilical shoulder and convex flanks. Where the test is preserved, the flanks converge toward the venter with no suggestion of ventrolateral shoulders. The test at the venter is appreciably thicker than on the flank with the inner surface unlike the outer, the steinkern having a gabled (fastigate) venter with an elevated keel and angular ventrolateral shoulders. On the surface of the test, the ventrolateral shoulders are not present and the venter appears to be bluntly angular, becoming increasingly blunt adorad. The presence of a fastigate venter is demonstrable only in the steinkern of the adoral half of the outer whorl, the adapical half being imperfectly preserved. The flanks of the adapical quadrant bear three prorsiradiate, bullate ribs, thickest at the mid-flank. The remainder of the outer whorl bears convex striae. At the venter, the striae are imperfectly preserved, but appear to be radial. The suture line is imperfectly known. It is ceratitic. E is narrow, external saddle, L, and lateral saddle are large, U2 is small and there is apparently at least one auxiliary lobe. The external saddle lies between the keel and the ventrolateral shoulders, the lateral saddle is on the outer flank, the auxiliary saddle just outside the umbilical shoulder. The lateral lobes are narrow compared with the saddles. The external form, sculpture and suture line suggest affinity with *Groenlandites, Pearylandites* and *Lenotropites*, but the internal form of the venter distinguishes this species from all described representatives of those genera. The tricarinate internal mould forms a venter much like that of *Noetlingites* and *Pronoetlingites* but the angular ventrolateral shoulders of those genera are not merely expressed on the inner surface of the test, as in *Lenotropites*? *tricarinatus.*

Subfamily LONGOBARDITINAE Spath, 1951

Genus *Grambergia* Popov 1961a

Type species. Grambergia taimyrensis Popov.

Grambergia tetsaensis McLearn

Plate 43, figures 3, 4; Plate 44, figures 3, 4, 10; Figure 31c, d (p. 436)

Grambergia tetsaensis McLearn, 1969, p. 36, Pl. 7, figs. 1–5, Textfig. 15.

Registered material. Holotype GSC 21721 (McLearn, 1969, Pl. 7, figs. 5a–c), four paratypes GSC 21717 (ibid., figs. 2a–c), GSC 21718 (ibid., figs. 3a, b), GSC 21719 (ibid., figs. 4a, b), GSC 21720 (ibid., figs. 1a–c) (all GSC loc. 10732). Hypotype GSC 28498 (GSC loc. 68203). Two hypotypes GSC 28499, GSC 28500 (both GSC loc. 68226). Three hypotypes GSC 28501, GSC 28502, GSC 47834* (all GSC loc. 74719).

Occurrence. Lower Anisian, Mulleri and Caurus zones. Toad Formation, northeastern British Columbia. GSC locs. 10732 (60), 42403 (3), 68203 (6), 68226 (2), 74719 (18), 74732 (10).

Remarks. Identified with this species are *Grambergia* attaining a diameter of about 65 mm. The inner whorls are evolute with smooth or very weakly ribbed flanks and a venter that is at first rounded, later keeled. The outer whorl is lanceolate in section with an occluded umbilicus and an acute venter. Growth striae on the outer whorl are weakly biconvex with a shallow sinus on the outer flank. Faint spiral ridges may also be present on the flank. The mature suture line characteristically has L larger than U2, but in some specimens these elements are about the same size. There are at least three auxiliary lobes. No specimens from the type locality show the mature body chamber. The holotype is septate to within 3 mm of the end and is probably a complete phragmocone (cf. McLearn, 1969, p. 36) and thus was the remains of a specimen at least 65 mm in diameter. Relatively smooth inner whorls, similar to those of specimens at the type locality, are shown by GSC 28499 (Pl. 43, fig. 3), unfigured specimens from GSC locality 68203 and GSC 28501 (Pl. 44, fig. 3). The nature of the spiral sculpture varies considerably. GSC 28502 (Pl. 44, fig. 4) and GSC 28498 (Pl. 44, fig. 10) are smooth. The holotype has a trace of one marginal ridge at the beginning of the outer whorl. Paratype GSC 21720 has a distinct ridge, almost a marginal shoulder, near the venter. GSC 28500 (Pl. 43, fig. 4) has a faint ridge in this position. Paratype GSC 21719 has a marginal ridge and two more at mid-flank. The holotype and other specimens from the type locality have L appreciably larger than U2 (McLearn, 1969, fig. 15, p. 36). Some from locality 74719 have L and U2 about the same size (e.g., GSC 28502, Pl. 44, fig. 4), others (e.g., GSC 47834*) resemble the holotype. The suture lines of GSC 28500 (Pl. 43, fig. 4) are imperfectly preserved, but what is visible of L and U2 are similar to those of the holotype.

Grambergia liardensis n. sp.

Plate 45, figures 5–8; Figures 32 a–c (p. 438)

Longobardites nevadanus Hyatt and Smith. McLEARN, 1969, Pl. 6, figs. 7a, b only (not of Hyatt and Smith, 1905, p. 132).

Registered material. Holotype GSC 28510, three paratypes GSC 28511, GSC 28512, GSC 28513 (all GSC loc. 42339). Topotype GSC 21716 (McLearn, 1969, Pl. 6, figs. 7a, b) (GSC loc. 10660).

Occurrence. Lower Anisian, Caurus Subzone 1. Toad Formation, northeastern British Columbia. GSC locs. 10660 (5), 42339 (6), 99581 (1).

Diagnosis. Grambergia at least 80 mm in diameter, on outer whorl H about 60 per cent, W about 25 per cent of diameter. Inner whorls without ribs, with rounded venter. Outer whorl lanceolate in section with an acute venter and with up to seven faint spiral ridges on the flank. Mature suture line with narrow elements; lateral lobes (L and U2) of about the same size.

Measurements. Paratype GSC 28513 (Pl. 45, fig. 8): 82, 0.63, 0.23, 0.

Remarks. The inner whorl of the holotype (Pl. 45, fig. 6b) has a rounded venter. The outer whorl of GSC 28511 (Pl. 45, fig. 5b) has the keeled venter that characterizes a later growth stage. GSC 28512 (Pl. 45, fig. 7) shows the change from a keeled to the mature acute venter. The holotype (Pl. 45, fig. 6) and GSC 28513 (Pl. 45, fig. 8) have an acute venter on the whole of the outer whorl. Seven spiral ridges are clearly shown on the flank of GSC 28512 (Pl. 45, fig. 7); they are more prominent on the internal mould than on the test. The holotype (Pl. 45, fig. 6) and GSC 28513 (Pl. 45, fig. 8), the largest known specimen, have about three less prominent ridges.

This species most closely resembles *Grambergia tetsaensis* McLearn but at a comparable size the suture

lines are different, *G. liardensis* having a relatively large narrow second lateral lobe (U2). Also, numerous spiral ridges are the rule for *G. liardensis,* the exception for *G. tetsaensis.*

Grambergia mackenzii (McLearn)

Plate 43, figures 2a, b, 7; Plate 44, figures 5–9; Plate 47, figures 5, 6; Figure 31f–i (p. 436)

"Hungarites" mackenzii McLearn, 1948, p. 22, Supplement p. 1, Pl. 12, fig. 3.

Grambergia mackenzii (McLearn). TOZER, 1967, p. 23, 71; McLEARN, 1969, p. 38, Pl. 7, figs. 6a, b, Textfig. 17.

"Hungarites" ovinus McLearn, 1948, p. 24, Supplement p. 2, Pl. 12, figs. 1, 2.

Grambergia ovinus (McLearn). TOZER, 1967, p. 23, 71; McLEARN, 1969, p. 37, Pl. 7, figs. 7a, b, Textfig. 16.

Registered material. Holotype GSC 9584 (McLearn, 1969, Pl. 7, figs. 6a, b) (GSC loc. 10736). Hypotype GSC 9591 (=holotype of *"Hungarites" ovinus* (ibid., fig. 7a, b) (GSC loc. 10733). Six topotypes GSC 28496, GSC 28503–GSC 28507 (all GSC loc. 74741). Hypotype GSC 28514 (GSC loc. 74719). Two hypotypes, GSC 70991, GSC 70992 (both GSC loc. 74740).

Occurrence. Lower Anisian, Caurus Zone. Toad Formation, northeastern British Columbia. GSC locs. 10733 (1), 10736 (1), 74719 (1), 74733 (5), 74740 (2), 74741 (20).

Remarks. This species attained a diameter of at least 100 mm. The inner whorls are evolute with a venter at first rounded, later keeled. Inner whorls are ribbed or may be nearly smooth. Ribbing when developed is prominent between diameters of 20 and 30 mm. Ribs (about five to a quadrant) are rectiradiate or convex. At a diameter of about 50 mm the flanks are convex, lanceolate in section or with faint marginal shoulders, which form an acutely fastigate venter. At this size, ribbing is reduced or absent. The outer whorl at maturity is lanceolate in section with an acute venter replacing the raised keel. The umbilicus on the outer whorl, as defined by the steinkern is small, with a narrow perpendicular wall and distinct shoulders. There is apparently no eccentricity. On the surface of the test it is occluded. Growth striae on the inner whorls are convex on the inner flank, concave, with a shallow sinus, on the outer flank, i.e., weakly falcoid or biconvex. The mature suture line has broad elements, with L appreciably larger than U2, and at least four auxiliary lobes. The only specimens available to McLearn were the types of *"Hungarites" mackenzii* and *"Hungarites" ovinus*, both of which are incomplete. These two, and the specimens from GSC localities 74733 and 74741 are all probably from one bed exposed on Chischa River. They form a series that justifies regarding the two taxa as synonyms. When GSC 28507 (Pl. 44, fig. 9), the largest known specimen, was complete, it was at at least 100 mm in diameter. The body chamber is slightly crushed, but the phragmocone, 72 mm in diameter, is undistorted. The outer whorl is lanceolate in section, with an acute venter. In the adapical quadrant there is a faint spiral ridge about 3 mm from the venter. In the adoral quadrant there are four wide, blunt folds. The exact nature of the umbilicus has not been determined, but it is probably occluded. GSC 28505 (Pl. 44, fig. 8) and GSC 28506 (Pl. 43, fig. 2) show the characters of the mature phragmocone, the former being a thin variant, the latter, thick. The thick variant (Pl. 43, fig. 2) has distinct marginal shoulders in pla ce of the mere spiral ridge of GSC 29507 (Pl. 44, fig. 9), producing a narrowly fastigate venter. Adapically, the venter of GSC 28506 (Pl. 43, fig. 2) has a raised keel; adorally it is acute. The surface is merely striate, with irregular strigation on the outer flank of the adapical part. The thin variant [GSC 28505 (Pl. 44, fig. 8)] shows little or no fastigation, the venter, at least on the adoral half, being merely acute. The adapical quadrant has distinct biconvex ribbing on the flank; the adoral part is smooth. At a comparable size, the holotype of *"Hungarites" ovinus* resembles this specimen. GSC 28503 (Pl. 44, fig. 7), thick and ribbed, and GSC 28504 (Pl. 44, fig. 6), thin and nearly smooth, illustrate the extremes encountered at a diameter of about 20 mm. The exposed inner whorl of the holotype (McLearn, 1969, Pl. 7, fig. 6a) has the proportions of GSC 28504 but has ribs approaching in prominence those of GSC 28503. Evolute inner whorls with a rounded venter are seen to attain a diameter of at least 10 mm in GSC 28504 (Pl. 44, fig. 6c). GSC 28496 (Pl. 43, fig. 7) is a crushed specimen with unusually prominent strigate sculpture. Specimens identified with this species from other localities are somewhat different. GSC 28514 (Pl. 44, fig. 5), a relatively small, probably complete phragmocone has a ribbing similar in style, but denser compared with that of specimens from the type locality. GSC 70991 (Pl. 47, fig. 5) has ribs somewhat like those of the holotype, but they are more widely spaced. Most variants of *Grambergia mackenzii* are distinguished from *Grambergia tetsaensis* McLearn and *G. liardensis* n. sp. by having ribbed instead of smooth inner whorls.

Grambergia nahwisi (McLearn)

Plate 43, figures 10, 11; Figure 30b, c (p. 434)

"Hungarites" nahwisi Mclearn, 1948, p. 24, Supplement p. 2, Pl. 12, figs. 4, 5.

Grambergia nahwisi (McLearn). TOZER, 1967, p. 23, 71; McLEARN, 1969, p. 39, Pl. 7, figs. 8a, b, Textfig. 18.

Registered material. Holotype GSC 9590 (McLearn, 1969, Pl. 7, figs. 8a, b) (GSC loc. 10660). Topotype GSC 28508 (GSC loc. 42343). Topotype GSC 28509 (GSC loc. 42338).

Occurrence. Lower Anisian, Caurus Subzone 2. Toad Formation, northeastern British Columbia. GSC locs. 10660 (1), 42338 (1), 42343 (1), 99579 (1).

Remarks. GSC 28508 (Pl. 43, fig. 10) and GSC 28509 (Pl. 43, fig. 11) have outer whorls much like the holotype. Suture lines are also similar in proportion and shape of the principal elements and the first auxiliary lobe, although there are minor differences in the number and size of the smaller auxiliaries. The inner whorls of all three specimens are different. The whorls of the holotype at a diameter of 15 mm are thin (4 mm) and smooth. At the same diameter, those of GSC 28509 (Pl. 43, fig. 11b) are appreciably thicker (7 mm), but the presence or absence of ribs is not demonstrable. The inner whorl of GSC 28508 (Pl. 43, fig. 10b) is visible at a diameter of 7 mm. It is very thick (6 mm), the whorl section is coronate, the venter keeled, and there are large nodes at the whorl side, like those on inflated variants of *Lenotropites tardus.* In both GSC 28508 and GSC 28509 an excentric umbilical spiral is preserved in the steinkern. Having similar outer whorls and coming from the same locality, probably the same bed, it is suggested that the three specimens, despite their different inner whorls, represent one species, comparable in their variability with *Grambergia mackenzii* (McLearn). The holotype of *G. nahwisi* is comparable to smooth variants of *G. mackenzii* (*"Hungarites" ovinus*), but no examples of *G. mackenzii* have the excentric umbilical spiral shown by GSC 28508 and GSC 28509. The prominently sculptured inner whorls of GSC 28508 invite comparison with the inner whorls of sculptured examples of *G. mackenzii* (e.g., GSC 28503, Pl. 44, fig. 7) but differ in having nodes rather than ribs on the flank.

Genus *Azarianites* Dagys, 1987

Type species. Azarianites taimyrensis Dagys.

Azarianites bufonis (McLearn)

Plate 40, figures 14a–c

"Hungarites" bufonis McLearn, 1948, p. 24, Supplement p. 2, Pl. 10, figs. 4–6.

Arctohungarites bufonis (McLearn). TOZER, 1967, p. 71; McLEARN, 1969, p. 45, Pl. 8, figs. 9–11, Textfig. 23.

Registered material. Holotype GSC 9588 (McLearn, 1969, Pl. 8, figs. 11a, b), paratype GSC 9589 (ibid., figs. 10a–c), topotype GSC 21726 (ibid., figs. 9a, b) (all GSC loc. 10660). Four topotypes GSC 28424, GSC 47833*, GSC 72226*, GSC 85770* (all GSC loc. 42339). Hypotype GSC 28425* (GSC loc. 74715).

Occurrence. Lower Anisian, Caurus Subzone 1. Toad Formation, northeastern British Columbia. GSC locs. 10660 (15), 42339 (50), 74715 (1), 99581 (25).

Measurements. Topotype GSC 28424 (Pl. 40, fig. 14): 55, 0.52, 0.31, 0.05.

Remarks. With the exception of GSC 28425*, all the specimens are from one locality on Liard River. McLearn's description was based on incomplete specimens. Topotypes collected in 1960 include three complete examples, 47, 55 and 60 mm in diameter. GSC 28424 (Pl. 40, fig. 14) is the best preserved, retaining part of the peristome, having a body chamber of three quarters of a whorl and showing that on the adorad one eighth of the outer whorl there is no keel, the venter being broad and smooth and defined by rounded shoulders. GSC 72226* is a sectioned specimen showing the umbilicus to be 2 mm wide at a diameter of 40 mm. GSC 47833* and GSC 85770* show the suture line on the umbilical wall, hitherto unknown. GSC 47833 has five auxiliary lobes at a whorl height of 10 mm. They are somewhat weathered and appear to be goniatitic, unlike the two preserved in GSC 9589 (McLearn, 1969, fig. 23, p. 45). GSC 85770 has four auxiliary lobes, the inner two of which appear to be goniatitic. GSC 28425* is poorly preserved and shows no suture lines. It resembles GSC 28424 in shape but is about 95 mm in diameter, i.e., larger than any from the type locality. The shape and suture line of *Azarianites taimyrensis* Dagys are very similar.

Genus *Intornites* Assereto 1966

Type species. Longobardites intornatus McLearn.

Intornites mactaggarti (McLearn)

Plate 47, figures 1, 2; Plate 48, figures 9a, b; Plate 49, figures 1, 2,4; Plate 50, figures 1-6; Figure 34a (p. 442), Figure 36b, c (p. 446), Figure 37a-g (p. 448)

Longobardites mctaggarti McLearn, 1946a, p. 16, Pl. 2, fig. 5.

"Hungarites" mctaggarti (McLearn). McLEARN, 1948, p. 21, Pl. 2, fig. 5; Pl. 10, figs. 1, 2.

Grambergia mctaggarti (McLearn). TOZER, 1967, p. 71; McLEARN, 1969, p. 35, Pl. 8, figs. 8a, b, Textfig. 14.

Intornites mctaggarti (McLearn). SILBERLING and NICHOLS, 1982, p. 48, Pl. 20, figs. 22-35 (only).

Longobardites larvalis McLearn, 1948, p. 20, Pl. 9, figs. 3, 4; TOZER, 1967, p. 25, 70, 72.

Lenotropites larvalis (McLearn). McLEARN, 1969, p. 41, Pl. 6, figs. 8a, b, Textfig. 20.

Registered material. Holotype GSC 6474 (McLearn, 1969, Pl. 8, figs. 8a, b) (labelled GSC loc. 10660, but possibly from GSC loc. 10659). Hypotype (= holotype of *Longobardites larvalis*) GSC 9583 (GSC loc. 10696). Three hypotypes (topotypes?) GSC 28516, GSC 28517, GSC 28518 (all GSC loc. 42400). Two hypotypes (topotypes?) GSC 28519, GSC 28520 (both GSC loc. 42402). Three hypotypes (topotypes?) GSC 28521, GSC 28522, GSC 28523 (all GSC loc. 42406). Hypotype (topotype?) GSC 28524 (GSC loc. 42409). Two hypotypes GSC 28494, GSC 28495 (both GSC loc. 74740).

Occurrence. Middle Anisian, Hagei Zone. Toad Formation, northeastern British Columbia. GSC locs. 10659 or 10660 (1), 10696 (1), 42400 (7), 42402 (4), 42406 (5), 42409 (5), 74740 (2).

Remarks. Identified with this species are *Intornites* that attain a diameter of at least 120 mm. The thick (W = H) inner whorls may attain a diameter of 20 mm. They have crescentic or bullate ribs, and a venter with a raised, rounded keel. At this stage, ventrolateral shoulders are moderately distinct and there may be a shallow sulcus adjacent to the keel. Strigation has been observed on all specimens in which the test is preserved. The suture line at this stage is normal with two or three auxiliary lobes. The outer whorl is smooth with an occluded umbilicus but an eccentric umbilical spiral. The venter is acute and the flanks almost flat except on the last quadrant, where they are somewhat inflated. Growth lines are weakly falcoid. The mature suture line is pseudoadventitious, U2 being a little larger than L. The holotype is an incomplete phragmocone with L and U2 of about the same size. From the character of the suture line, reference to *Grambergia* might be considered but the sulcaticarinate venter of the inner whorl suggests *Intornites*. The material from GSC localities 42400, 42402, 42406 and 42409, which is probably from one bed, provides the present interpretation of the species. As noted previously, these specimens are possibly topotypes. GSC 28518 (Pl. 49, fig. 4), the largest specimen, was originally about 100 mm in diameter. The inner whorls have crescentic lateral nodes, and a raised ventral keel, like the holotype. The outer whorl is smooth with an acute venter. Flanks are nearly flat except in the last quadrant, where they are inflated. The umbilicus is occluded with the steinkern showing eccentricity. The broadening of the whorl section at the aperture suggests that the specimen was mature. The suture line is not completely preserved, E, L and U2 having been destroyed. Most of the mature suture line is shown by GSC 28523 (Pl. 50, fig. 5). It is pseudoadventitious, with U2 larger than L (Fig. 37c). Immature specimens like the inner whorl of the holotype (e.g., GSC 28522, Pl. 50, fig. 3) have crescentic bullate ribs, a sulcaticarinate venter and spiral sculpture. Others (e.g., GSC 28516, Pl. 50, fig. 1 and GSC 28524, Pl. 50, fig. 2) closely resemble the holotype of *"Longobardites" larvalis* (Pl. 48, fig. 9), although that specimen has one large lateral node, more elevated than any on the other specimens. The inner whorl of GSC 28519 (Pl. 50, fig. 6) although incompletely exposed, appears to be more compressed than the others. It seems that the inner whorls vary greatly in thickness and strength of sculpture, a phenomenon also encountered in *Grambergia mackenzii* (McLearn) and *G. nahwisi* (McLearn). Mature suture lines of the *Grambergia* species are normal, with much wider elements, compared with those of *Intornites mactaggarti*.

Intornites intornatus (McLearn)

Plate 49, figures 3a, b; Plate 50, figures 7-12; Plate 51, figures 6-11; Figure 36a (p. 446), Figure 37h-k (p. 448), Figure 38d-g (p. 450)

Longobardites intornatus McLearn, 1946a, p. 15, Pl. 1, fig. 1; McLEARN, 1948, p. 20, Pl. 1, fig. 1; Pl. 11, figs. 7-10.

Longobardites nevadanus Hyatt and Smith. McLEARN, 1969, p. 31, Pl. 6, figs. 4, 5 (only), Textfig. 13a (not of Hyatt and Smith, 1905, p. 132).

Longobardites (*Intornites*) *internatus* McLearn. ASSERETO, 1966, p. 963, Pl. 69, figs. 1, 2, 3 (only).

Registered material. Holotype GSC 6466 (McLearn, 1969, Pl. 6, figs. 4a–c), two topotypes GSC 9582 (ibid., figs. 5a, b), GSC 22722 (Assereto, 1966, Pl. 69, figs. 3a–c) (all GSC loc. 10695). Hypotype GSC 28515 (GSC loc. 42337). Four hypotypes GSC 28525–GSC 28528 (all GSC loc. 40109). Two hypotypes (topotypes?) GSC 28529, GSC 28530 (both GSC loc. 68294). Two hypotypes GSC 28531, GSC 28532 (both GSC loc. 74736). Two hypotypes, GSC 28533, GSC 28534 (both GSC loc. 74737). Hypotype GSC 28535 (GSC loc. 42408). Hypotype GSC 28536 (GSC loc. 58385).

Occurrence. Middle Anisian, Hagei and Hayesi zones. Toad Formation, northeastern British Columbia; Sulphur Mountain Formation, Whistler Member, northeastern British Columbia and Alberta. GSC locs. 10695 (3), 10696 (7), 16008 (1), 40109 (20), 40110 (2), 42408 (1), 46512 (8), 58385 (3), 68294 (4), 74722 (1), 74736 (7), 74737 (4), 89548 (5), 99578 (1).

Remarks. The holotype is wholly septate, but shows the change from thick, carinate, ribbed inner whorls to an oxycone stage of growth. GSC 28535 (Pl. 51, fig. 9) is closely similar. The specimens from GSC locality 40109 are apparently from one bed and reveal great variability at a small diameter. GSC 28525 (Pl. 50, fig. 9) closely resembles the holotype, except for having somewhat stronger ribbing and a more normal suture line. GSC 28527 (Pl. 50, fig. 10) illustrates the the most compressed condition encountered at this size and is comparable with a paratype of *Intornites nevadanus* (Hyatt and Smith) (Silberling and Nichols, 1982, Pl. 21, figs. 1, 2). GSC 28526 (Pl. 50, fig. 11) appears to be the remains of a complete specimen judging from the callus sealing the umbilicus and the excentric umbilical spiral. The test is well preserved with weakly falcoid growth striae but sutures are not visible. The outer whorl is carinate, not merely acute, with spiral ridges on the surface, the most prominent being just inside the keel. Growth lines are falcoid. GSC 28528 (Pl. 50, fig. 12), the largest from this bed, has a quarter whorl of body chamber preserved, shows acquisition of an acute venter, and, in section (Fig. 37k), a thick, carinate inner whorl. L and U2 are about the same size at a whorl height of 25 mm. The largest known specimen, GSC 28515 (Pl. 49, fig. 3) is a phragmocone about 80 mm in diameter with about a quarter whorl of the body chamber. The original diameter was about 100 mm. A thick carinate inner whorl is visible (Pl. 49, fig. 3b). The outer whorl is smooth with an acute venter. The suture line is pseudoadventitious, with U2 larger than L (Fig. 36a). The thickest examples of *I. internatus* are indistinguishable from some specimens (e.g., GSC 28519, Pl. 50, fig. 6), interpreted as examples of *I. mactaggarti* (McLearn) with relatively compressed inner whorls. However the holotype of *I. internatus,* and all specimens identified with that species, have thinner inner whorls than the type of *I. mactaggarti.*

A case has been made by Silberling and Nichols (1982, p. 48) for following McLearn (1969), who treated "*Longobardites*" *internatus* as a synonym of "*L.*" *nevadanus* Hyatt and Smith. Admittedly the two taxa have significant similarities, but they are separated in this report because most variants of *Intornites nevadanus,* as illustrated by Silberling and Nichols (ibid., Pl. 21, figs. 1–16) have inner whorls with nearly smooth flanks, unlike the ribbed flanks of *I. internatus.* One example identified as *I. nevadanus* by Silberling and Nichols (ibid., Pl. 21, figs. 17, 18) is ribbed and carinate but the ribbing is less prominent than on *I. internatus.*

Intornites williamsi n. sp.

Plate 51, figures 12, 13; Figures 38a–c (p. 450)

Longobardites nevadanus Hyatt and Smith. TOZER, 1967, p. 70 (in part).

Intornites nevadanus (Hyatt and Smith). TOZER, 1971, p. 1017.

not *Longobardites nevadanus* Hyatt and Smith, 1905, p. 132.

Registered material. Holotype GSC 28537, two paratypes GSC 28538, GSC 28539* (all GSC loc. 68295). Hypotype GSC 85771* (GSC loc. 83873). Two hypotypes GSC 85772*, GSC 85773* (both GSC loc. 99565).

Occurrence. Middle Anisian, Minor Zone. Toad Formation, northeastern British Columbia; Sulphur Mountain Formation, Whistler Member, northeastern British Columbia. GSC locs. 68295 (17), 83873 (1), 99565 (2).

Diagnosis. Intornites at least 120 mm in diameter. Inner whorls with distant ribs, slightly bullate at mid-flank, venter carinate with no suggestion of sulci bordering the keel. Outer whorl lanceolate in section. Surface with falcoid growth striae. Suture line pseudoadventitious at a whorl height of about 20 mm.

Remarks. Specimens from GSC locality 68295 illustrate the variability at a small diameter. The holotype (Pl. 51, fig. 12) is the thickest most evolute variant known, ribbed and carinate at a diameter of 25 mm. GSC 28539*, at the same diameter, is much more compressed and involute. GSC 28538 (Pl. 51, fig. 13), a complete phragmocone with about a quarter whorl of preserved body chamber, indicates the size attained. The umbilicus is occluded with eccentricity on the inner surface, the extent of which shows that a further quarter whorl of body chamber was originally present. GSC 85771* and GSC 85772* are keeled, ribbed nuclei, about 15 mm in diameter. GSC 85773*, an example 62 mm in diameter, is an oxycone preserving part of the body chamber and the test with falcoid growth lines.

This species includes specimens virtually identical to those identified as compressed variants of *Intornites intornatus* (e.g., GSC 28533, Pl. 51, fig. 11) and GSC 28527 (Pl. 50, fig. 10). The holotype of *I. williamsi,* however, which is the most inflated known variant, is appreciably more compressed than the holotype of *I. intornatus*. Nothing closely comparable with the holotype of *I. intornatus* occurs at GSC locality 68295.

Of the *Intornites* from Canada, *I. williamsi* most closely resembles *I. nevadanus* (Hyatt and Smith) the outer whorls being virtually identical, but no examples of *I. nevadanus* are known to be evolute at the same diameter as the holotype of *I. williamsi.*

Etymology. The name commemorates M.Y. Williams.

Intornites canadensis (McLearn)

Plate 59, figures 1–9; Figure 44 b–h (p. 466)

Longobardites canadensis McLearn, 1946a, p. 14, Pl. 3, fig, 1, 5, 6; McLEARN, 1948, p. 19, Pl. 3, figs. 1, 5, 6; Pl. 10, fig. 3.

Longobardites nevadanus Hyatt and Smith. McLEARN, 1951, p. 13 (in part); TOZER, 1967, p. 26, 69 (in part), p. 70 (in part); McLEARN, 1969, p. 31, Pl. 6, figs. 1, 2, 3, 6 (only), Textfigs. 13b–d.

Longobardites (*Intornites*) *nevadanus* Hyatt and Smith. ASSERETO, 1966, p. 963, fig. 5 (p. 960), Pl. 69, figs. 5, 7; Pl. 70, figs. 1, 3, 4, 6. (not of Hyatt and Smith, 1905, p. 132).

Longobardites (*Intornites*) *intornatus* McLearn. ASSERETO, 1966, p. 963, Pl. 69, fig. 4 (only); Pl. 70, figs. 2, 5, 7, fig. 2 (p. 942) (not of McLearn, 1946a).

Registered material. Holotype GSC 6449 (McLearn, 1969, Pl. 6, figs. 1a–c), paratype GSC 6450 (ibid., figs. 2a, b), topotype GSC 22724 (Assereto, 1966, Pl. 69, figs. 5a–c) (all GSC loc. 10695). Twelve hypotypes (topotypes?), GSC 9581 (McLearn, 1969, Pl. 6, figs. 3a, b), GSC 21715 (ibid., figs. 6a–c), GSC 22720 (Assereto, 1966, fig. 2, p. 942), GSC 22721 (ibid., fig. 5, p. 960); GSC 22725 (ibid., Pl. 69, figs. 7a–c); GSC 22726 (ibid., Pl. 70, figs. 1a–c); GSC 22727 (ibid., figs. 2a–c); GSC 22728 (ibid., figs. 3a–c); GSC 22729 (ibid., figs. 4a–c); GSC 22730 (ibid., figs. 5a–c); GSC 22731 (ibid., figs. 6a–c); GSC 22732 (ibid., figs. 7a–c) (all GSC loc. 10694). Five hypotypes (topotypes?) GSC 28540–GSC 28544 (GSC loc. 68297). Two hypotypes GSC 28545, 28546 (GSC loc. 68228). Two hypotypes GSC 28547, GSC 28548 (both GSC loc. 74724). Hypotype GSC 28549 (GSC loc. 74731).

Occurrence. Upper Anisian, Deleeni Zone. Toad Formation, northeastern British Columbia. GSC locs. 10694 (150), 10693 (10), 10695 (5), 10717 (1), 10726 (1), 68224 (5), 68228 (3), 68297 (20), 74724 (13), 74731 (6).

Remarks. The holotype is wholly septate. It has been broken to show the inner whorls. At a diameter of 8.0 mm, H is 3.0 mm, W, 3.0 mm, U 2.5 mm, and there is a low keel on much, if not all, of the outer whorl. What is visible is much like GSC 28541 (Pl. 59, fig. 2) from GSC locality 68297. This justifies including with this species *Intornites* specimens in which the inner sculptured whorls are more compressed than those of *Intornites williamsi* n. sp. and *I. intornatus* (McLearn) and much more so than in *I. mactaggarti* (McLearn). The ribs of *I. canadensis,* compared with those of *I. williamsi, I. intornatus* and *I. mactaggarti* are not appreciably bullate and are most prominent on the inner flank. Growth striae are falcoid. A pseudoadventitious suture line is commonly developed at a whorl height of about 17 mm.

As with *Intornites mactaggarti, I. intornatus* and *I. williamsi,* the inner whorls are highly variable, but the evolute, sculptured carinate whorls are invariably smaller than in the other *Intornites* species.

Genus *Longobardites* Mojsisovics 1882

Type species. Longobardites breguzzanus Mojsisovics.

Longobardites murrayensis n. sp.

Plate 65, figures 7–12; Plate 66, figures 3, 4; Plate 67, figures 15a–c; Figure 48a–c (p. 478)

Registered material. Holotype GSC 28550, four paratypes GSC 28551–GSC 28554 (GSC loc. 83875). Paratype GSC 28555 (GSC loc. 83890). Two paratypes GSC 28556, GSC 28557 (GSC loc. 74726). Hypotype GSC 28563 (GSC loc. 46484).

Occurrence. Upper Anisian, Chischa Zone; Ladinian, Matutinum Zone. Toad Formation, northeastern British Columbia; Sulphur Mountain Formation, Llama Member, northeastern British Columbia. GSC locs. 46484 (2), 74726 (3), 83875 (10), 83890 (6).

Diagnosis. Longobardites at least 85 mm in diameter. Inner whorls at first evolute, with virtually smooth flanks and a rounded, later angular (but not truly carinate) venter. With growth, as the whorls become compressed, blunt convex ribs appear on the flank. On the outer whorl the flanks are again smooth. Suture line pseudoadventitious at a diameter of about 25 mm.

Remarks. The only specimens known from the Matutinum Zone are small (e.g., GSC 28563, Pl. 67, fig. 15) and might represent another species. *Longobardites murrayensis* resembles *Intornites canadensis* (McLearn) but the inner whorls, at a comparable diameter have an acute, not carinate venter as may be seen by comparing GSC 28554 (Pl. 65, fig. 7) with GSC 28541 (Pl. 59, fig. 2). In this respect *L. murrayensis* forms a morphological link between *Intornites* and *Longobardites.* Also, the convex ribbing is distinctive for *L. murrayensis,* ribbing and growth lines of *I. canadensis,* when present, being falcoid. The convex rib curvature of *L. murrayensis* invites comparison with *L. parvus* (Smith) (see Silberling and Nichols, 1982, p. 50), but that species differs in having weaker and more widely spaced ribs.

Subfamily CZEKANOWSKITINAE new subfamily

Longobarditidae with open umbilici that are characteristically wide (to about half of diameter), but may be much smaller. Flanks generally with simple ribs, but some are nearly smooth. Venter smooth; arched, angular or carinate. Body chamber generally proportionately wider than phragmocone, with distinct ventrolateral shoulders. Suture line with slightly phylloid saddles and two or three auxiliary lobes.

Genera included: *Czekanowskites* Diener (1915a), *Tetsaoceras* n. gen., *Stannakhites* Vavilov (1978), *Arctohungarites* Diener (1916b).

Czekanowskites, by virtue of having an arched instead of angular venter, stands apart from all other Longobarditidae, namely the Noetlingitinae, Silberlingitinae, Groenlanditinae, Longobarditinae (= Neodalmatitinae, Grambergiinae) and Beneckeiinae. The close links between *Czekanowskites,* with a rounded venter, and *Tetsaoceras,* in which the venter is angular, justify treating Czekanowskitinae as Longobarditidae. In the Longobarditinae, the venter is characteristically angular, carinate or acute, unlike that of *Czekanowskites. Arctohungarites* resembles *Azarianites* (Longobarditinae) in some characters, which may indicate a link, but *Azarianites,* like other Longobarditinae lacks the distinctive ribbing of Czekanowskitinae. The inner whorls of some *Czekanowskites* are coronate, resembling those of *Pearylandites.* This may indicate a link between Groenlanditinae and Czekanowskitinae.

The Czekanowskitinae of Canada are assigned to five species placed in *Czekanowskites, Tetsaoceras,* and *Arctohungarites.* All are the same age (Hagei Zone). The differences that characterize these species are mostly in the morphology of the inner whorls. At the mature aperture and in the last quadrant the whorl section of all five may be essentially the same. Possibly this is a case of variability in the young that becomes less extreme at maturity, and all five species are morphotypes of one biological species. The morphological differences are nevertheless best expressed by using a taxonomy that may be typological.

Genus *Czekanowskites* Diener, 1915a

Type species. Ceratites decipiens Mojsisovics.

Czekanowskites pinguis (McLearn)

Plate 52, figures 2, 4

Ceratites? *hayesi* var. *pinguis* McLearn, 1946a, p. 19, Appendix II, p. 2; McLEARN, 1948, p. 35.

Czekanowskites hayesi (McLearn). McLEARN, 1969, p. 43, Pl. 1, figs. 4a, b, 8a–c (only).

Registered material. Holotype GSC 6477 (McLearn, 1969, Pl. 1, figs. 4a, b), east of Mile Post 378, Alaska Highway, GSC loc. no. erased. Hypotype GSC 21699 (ibid., Pl. 1, figs. 8a–c) (GSC loc. 16008). Hypotype GSC 28399* (GSC loc. 68204). Hypotype GSC 28426 (GSC loc. 42408). Hypotype GSC 28432 (GSC loc. 42413). Hypotype GSC 35321* (GSC loc. 68294).

Occurrence. Middle Anisian, Hayesi Zone. Toad Formation, northeastern British Columbia. GSC locs. 16008 (1), 42408 (1), 42413 (1), 68204 (1), 68294 (1).

Remarks. Identified with this species are *Czekanowskites* with a broadly arched venter and relatively strong ribbing on the inner whorls. In the holotype there is a very faint thread-like elevation on the venter of the outer whorl. GSC 28426 (Pl. 52, fig. 2) closely resembles the holotype, except for having a perfectly smooth venter. Ribbing is visible on at least two whorls. This specimen has been broken revealing that the venter is arched from a diameter of 1 mm. GSC 28432 (Pl. 52, fig. 4) is unusually thick. On the outer whorl, four normal ribs are preceded by five that become increasingly nodose, imparting a coronate section to the adapical part.

Czekanowskites acuteplicatus n. sp.

Plate 52, figures 1a, b

Registered material. Holotype GSC 28428 (GSC loc. 42410).

Occurrence. Middle Anisian, Hayesi Zone. Toad Formation, northeastern British Columbia. GSC loc. 42410 (1).

Diagnosis. Czekanowskites with H about 28 per cent, W about 40 per cent, U about 35 per cent of diameter. Venter on body chamber with no trace of angularity and, as far as known, similar situation on phragmocone. Ribbing sharp on both inner and outer whorls; ribs have pronounced curvature at the ventrolateral margin. Venter is crossed by low transverse ridges, stemming from the ribs.

Measurements. Holotype GSC 28428 (Pl. 52, fig. 1): 28, 0.41, 0.43, 0.36

Remarks. The unique holotype does not show the venter of the inner whorls but at the end of the phragmocone there is no suggestion of angularity, as in *Tetsaoceras hayesi* (McLearn). Distinct ribbing is present on the body chamber and on at least one and a half whorls of the phragmocone. Of the *Czekanowskites* from Canada, the ribbing most closely resembles that of *C. pinguis* (McLearn). Compared with ribs of that species, those of *C. acuteplicatus* are sharper and more curved.

Genus *Tetsaoceras* n. gen.

Type species. Ceratites? *hayesi* var. *angulatus* McLearn.

Diagnosis. Czekanowskitin with acute or carinate venter on the inner whorls. Outer whorl with quadrangular whorl section, well defined ventrolateral shoulders and a smooth venter at the mature aperture. Ribs strong on the outer whorls, almost radial on the flank, projected or fading abruptly at the ventrolateral margin. Inner whorls ribbed or smooth.

Species assigned. Ceratites? *hayesi* var. *angulatus* McLearn, *Ceratites*? *hayesi* McLearn.

Remarks. The style of ribbing and form of the body chamber indicate close affinity with *Czekanowskites* Diener (1915a), which differs in having a rounded venter on the inner whorls. *Stannakhites* Vavilov (1978) differs in having inner whorls with a more blunt keel and more prominent ribs.

Tetsaoceras hayesi (McLearn)

Plate 52, figures 3, 5–7; Figure 39c, d (p. 452)

Ceratites? *hayesi* McLearn, 1946a, p. 18, Appendix II, p. 2, Pl. 1, fig. 2; McLEARN, 1948, p. 35, Pl. 1, fig. 2; TOZER, 1962a, Pl. 5, figs. 1a–c.

Czekanowskites hayesi (McLearn). TOZER, 1967, p. 25, 69, 71, 72; McLearn, 1969, p. 43, Pl. 1, figs. 7a–c (only).

Registered material. Holotype GSC 6478 (McLearn, 1969, Pl. 1, figs. 7a–c), east of Mile Post 378, Alaska Highway, GSC loc. no. erased. Hypotype GSC 14232 (GSC loc. 42410). Two hypotypes, GSC 28429, GSC 28430 (GSC loc. 74737). Hypotype GSC 28431 (GSC loc. 58385).

Occurrence. Middle Anisian, Hayesi Zone. Toad Formation, northeastern British Columbia; Sulphur Mountain Formation, Whistler Member, northeastern British Columbia and Alberta. GSC locs. 10698 (6), 42410 (3), 58385 (3), 74737 (3), 89548 (15).

Measurements. Hypotype GSC 14232 (Pl. 52, fig. 3): 40, 0.38, 0.30, 0.30

Remarks. The measured specimen (Pl. 52, fig. 3) is the largest known and is probably virtually complete. The phragmocone has a venter that is distinctly angular at the mid-line, although it does not have a raised keel. Angularity is abruptly reduced at the start of the body chamber and the adorad quadrant has a broad, tabulate venter defined by angular shoulders; the venter itself is smooth except for a median thread preserved on the steinkern. Ribbing is present on the last one and a half whorls. The preceding whorls are smooth. This specimen resembles the holotype, except for being larger, thinner and a little more densely

ribbed. The whorl section and ribbing of GSC 28429 (Pl. 52, fig. 5) is particularly close to that of the holotype.

This species differs from *Czekanowskites pinguis* (McLearn) and *C. acuteplicatus* n. sp., and is excluded from *Czekanowskites,* because of the angular venter on the phragmocone. Also, the inner whorls have less prominent ribs.

Tetsaoceras angulatum (McLearn)

Plate 52, figures 8a–c; Figure 39b (p. 452)

Ceratites hayesi var. *angulatus* McLearn, 1946a, p. 19, Appendix II, p. 2; McLEARN, 1948, p. 35.

Czekanowskites hayesi (McLearn). McLEARN, 1969, p. 43, Pl. 1, figs. 5, 6 (only).

Registered material. Holotype GSC 6476 (McLearn, 1969, Pl. 1, figs. 5a, b) Cameron Hill, Alaska Highway. Hypotype GSC 21698 (ibid., figs. 6a–c) (GSC loc. 10706). Hypotype 28427 (GSC loc. 42408).

Occurrence. Middle Anisian, Hayesi Zone. Toad Formation, northeastern British Columbia. GSC locs. 10706 (1), 42408 (1).

Remarks. The ribbing of this species closely resembles that of *Tetsaoceras hayesi* (McLearn), but it differs in having a phragmocone with a distinctly raised keel instead of a merely angular venter.

Genus *Arctohungarites* Diener, 1916b

Type species. Hungarites triformis Mojsisovics.

Arctohungarites liardensis n. sp.

Plate 48, figures 5a–c; Plate 52, figures 9, 10; Figure 39a (p. 452)

Registered material. Holotype GSC 28434 (GSC loc. 42407). Paratype GSC 28433 (GSC loc. 42413). Paratype GSC 70994 (GSC loc. 42410).

Occurrence. Middle Anisian, Hayesi Zone. Toad Formation, northeastern British Columbia. GSC locs. 42407 (1), 42410 (1), 42413 (1).

Diagnosis. Arctohungarites with H about 45 per cent, W about 35 per cent, U about 20–30 per cent, of diameter. Ribbing weak, confined to body chamber.

Measurements. Paratype GSC 28433 (Pl. 52, fig. 10): 30, 0.43, 0.37, 0.20. Holotype GSC 28434 (Pl. 52, fig. 9): 24, 0.40, 0.33, 0.29. Paratype GSC 70994 (Pl. 48, fig. 5): 22, 0.51, 0.36, 0.20.

Remarks. The holotype (Pl. 52, fig. 9) and GSC 70994 (Pl. 48, fig. 5) show the phragmocone to be smooth, with an acute venter. Ribbing appears on the body chamber of the holotype (Pl. 52, fig. 9a) and faintly on GSC 70994 (Pl. 48, fig. 5). GSC 28433 (Pl. 52, fig. 10) is probably an example of mature morphology, with the body chamber initially narrow, with an angular venter, acquiring increasingly strong ribs, and a broad venter toward the aperture. The phragmocone of this specimen is poorly preserved. The suture lines of the holotype and GSC 70994 have two auxiliary lobes.

This species closely resembles *Arctohungarites triformis* (Mojsisovics) but it is a little more evolute and has less prominent ribbing. It also resembles *Tetsaoceras angulatum* (McLearn), which is more evolute, has distinct marginal shoulders on the body chamber, and more prominent ribs. The resemblance illustrates the close link between *Tetsaoceras* and *Arctohungarites.*

Family DANUBITIDAE Spath, 1951

Genus *Paradanubites* Shevyrev, 1968

Type species. Danubites kansa Diener.

Paradanubites shevyrevi n. sp.

Plate 45, figures 4, 12; Figure 32e (p. 438)

Registered material. Holotype GSC 28423, questionably assigned: specimen GSC 35320 (both GSC loc. 68226).

Occurrence. Lower Anisian, Mulleri Zone. Toad Formation, northeastern British Columbia. GSC loc. 68226 (1, ?2).

Diagnosis. Paradanubites with H about 30 per cent, W about 35 per cent, U about 45 per cent of diameter. Whorl section depressed, almost coronate, umbilical wall not defined. Ribs strong, confined to flank, about eight to a quadrant, some straight, some slightly concave, fading at the umbilical slope and the ventrolateral margin. On last quadrant, some ribs converge, but do not actually merge, toward the umbilicus. Venter almost smooth, crossed by essentially radial growth lines and faint depressions aligned with the rib interspaces.

Remarks. The suture line of the holotype, although incompletely preserved, clearly shows that the external saddle is phylloid and that the indentations in L are large. GSC 35320 (Pl. 45, fig. 12), judging from the style of the ribbing, possibly represents an immature example. Compared with the holotype, the venter is less smooth, being crossed by extensions of some ribs and depressions aligned with the interspaces. Because of the nature of the venter, it is possible that the specimen is an immature *Paracrochordiceras.*

The phylloid external saddle and the character of the ribbing invite comparison with *Paradanubites kansa* (Diener) (Diener, 1895b, p. 103), which differs in having thinner whorls, denser ribbing and in having the lateral saddle placed higher in relation to the external saddle.

Family APLOCOCERATIDAE Spath, 1951

Genus *Epiceratites* Diener, 1915a

Type species. Ammonites (Clydonites) elevatus Dittmar.

Epiceratites yukonensis n. sp.

Plate 103, figures 2a–c

Registered material. Holotype GSC 72181 (GSC loc. 97561).

Occurrence. Upper Carnian. Otuk Formation. Northern Yukon. GSC loc. 97561 (1).

Diagnosis. Epiceratites about 10 mm in diameter, H about 45 per cent, W about 40 per cent, U about 25 per cent of diameter. Whorl section quadrangular, venter broadly arched, ventral shoulders rounded, umbilical shoulder rounded. Flanks with simple, dense prorsiradiate riblets, stronger on inner than on outer flank, reduced to growth striae on venter, which they cross in the form of a rounded rostrum. Suture line goniatitic.

Measurements. Holotype GSC 72181 (Pl. 103, fig. 2): 11.0, 0.45, 0.40, 0.27

Remarks. In the holotype, a body chamber of seven eighths of a whorl is preserved, and it is probably complete. The external saddle and L1 of the last septum are visible. Both are rounded.

This rather featureless ammonoid is regarded as congeneric with *Epiceratites elevatus* (Dittmar) (Mojsisovics, 1893, p. 404), although it differs in having denser ribbing and an entire instead of weakly indented L.

Family ACROCHORDICERATIDAE Arthaber, 1911

Genus *Paracrochordiceras* Spath, 1934

Type species. Acrochordiceras anodosum Welter.

Paracrochordiceras benderi n. sp.

Plate 45, figures 2, 3; Figure 32d (p. 438)

Acrochordiceras americanum McLearn. TOZER, 1967, p. 69 (only), not of McLearn, 1946a, p. 16.

Registered material. Holotype GSC 28280, paratype GSC 28281 (GSC loc. 68226).

Occurrence. Lower Anisian, Mulleri Zone. Toad Formation, northeastern British Columbia. GSC loc. 68226 (2).

Diagnosis. Paracrochordiceras attaining a diameter of at least 44 mm; H about 38 per cent, W about 30 per cent, U about 37 per cent of diameter. Inner whorls rounded in section, with simple ribs on the flank and a smooth venter. Outer whorl section initially rounded, later quadrangular, the flanks becoming flat, ventral shoulders distinct and the venter flat; at this stage the ribs cross the venter; most are simple but there is some branching and intercalation near the umbilicus.

Measurements. Holotype GSC 28280 (Pl. 45, fig. 2): 44, 0.38, 0.31, 0.37. Paratype GSC 28281 (Pl. 45, fig. 3): 30, 0.33, 0.34, 0.43.

Remarks. Both the holotype (Pl. 45, fig. 2) and paratype (Pl. 45, fig. 3) are virtually complete, having body chambers of about three quarters of a whorl. A quadrangular whorl section is seen only in the holotype. The absence of this feature on the paratype is attributed to immaturity. The venter of the whole of the outer whorl of the holotype is ribbed. The suture line is ceratitic, but details are not clearly exposed. On the paratype, the venter is initially smooth, becoming ribbed adorad. It shows the suture line (Fig. 32d).

Compared with *Paracrochodiceras anodosum* (Welter) (1915, p. 111), *P. americanum* McLearn, *P. pandya* (Diener) (1895b, p. 104), *P. asseretoi* Fantini-Sestini (1981, p. 48), *P. denseplicatum* Fantini-Sestini (1981, p. 49), *P. silberlingi* Bucher (1989, p. 471), *P. maclearni* Bucher (1989, p. 973) and *P. plicatus* Bucher (1989, p. 974) the ribbing of the new species most

closely resembles that of *P. denseplicatum*. That species and all the others differ in that they are not known to acquire the quadrangular body chamber of *P. benderi*.

Etymology. The name is for Hans Bender.

Paracrochordiceras americanum McLearn

Plate 42, figures 1–3

Acrochordiceras (*Paracrochordiceras*) *americanum* McLearn, 1946a, p. 16; McLEARN, 1946b, p. 3, Pl. 5, fig. 1; McLEARN, 1948, p. 25, Pl. 5, fig. 1; McLEARN, 1969, p. 12, Pl. 1, figs. 1–3.

Acrochordiceras americanum McLearn. TOZER, 1967, p. 23, 71, (only).

not *Paracrochordiceras americanum* McLearn. SILBERLING and NICHOLS, 1982, p. 21, Pl. 29, figs. 1–9 (= *Paracrochordiceras plicatum* Bucher (1989, p. 974).

Registered material. Holotype GSC 6475, two topotypes GSC 21696, GSC 28279 (all GSC loc. 10732). Hypotype GSC 21697 (McLearn, 1969, Pl. 1, figs. 3a, b) (GSC loc. 10660).

Occurrence. Lower Anisian, Caurus Zone. Toad Formation, northeastern British Columbia. GSC locs. 10660 (1), 10732 (7).

Remarks. Of the specimens described by McLearn, none show the suture line. The outer whorl of the holotype is probably partly body chamber. The venter, at the beginning of the outer whorl is not perfectly preserved but appears to be nearly smooth, certainly less strongly ribbed than the adorad half, a feature in common with *Paracrochordiceras anodosum* (Welter) (Spath, 1934, p. 401). The large topotype (Pl. 42, fig. 2) and GSC 21697 (McLearn, 1969, Pl. 1, figs. 3a, b) appear to be parts of the body chamber. Branching of the ribs is infrequent. On the holotype, some ribs merge near the umbilicus on the last quadrant. On the large topotype (Pl. 42, fig. 2), one rib branches at the umbilical shoulder. GSC 28279 (Pl. 42, fig. 3) is interpreted as an immature example. The outer whorl has four coalescing ribs forming crescentic nodes on the flank and a nearly smooth venter. The saddles but not the lobes of the last septum are visible.

Compared with *Paracrochordiceras benderi* n. sp., *P. americanum* is more inflated and there is no evidence that it acquired ventral shoulders on the body chamber. Also, branching of the ribs is less frequent and, when present, the branching takes place closer to the umbilicus. The "transitional mouth borders" of "*Sibirites*" *pandya* Diener (1895b, p. 104), already mentioned as a representative of *Paracrochordiceras,* evidently resemble the coalescing ribs of GSC 28279.

Family CERATITIDAE Mojsisovics, 1879

Subfamily BEYRICHITINAE (Spath, 1934)

Genus *Hollandites* Diener, 1905

Type species. Ammonites voiti Oppel.

Hollandites dieneri n. sp.

Plate 55, figures 5, 6; Figure 40a (p. 458)

Registered material. Holotype GSC 28282 (GSC loc. 74739), hypotype GSC 28283 (GSC loc. 74736).

Occurrence. Middle Anisian, Hagei Zone. Toad Formation, northeastern British Columbia. GSC loc. 74739 (1).

Diagnosis. Hollandites about 100 mm in diameter; H about 40 per cent, W about 30 per cent, U about 23 per cent of diameter. Ventral shoulders prominent, venter subtabulate and smooth, with little or no projection of growth lines. Ribs on phragmocone faint, some bifurcating near mid-flank, becoming stronger and simple, with slight convex curvature, on the body chamber, about six on last quadrant. Tuberculation absent.

Measurements. Holotype GSC 28282 (Pl. 55, fig. 6): 102, 0.42, 0.29, 0.23.

Remarks. The holotype is the remains of a complete specimen, preserving the peristome. Septa are not approximated. This species resembles *Hollandites visvakarma* (Diener) (1895b, p. 16) and *H. roxburghii* Diener (1907, p. 64), but is distinguished by having slightly convex instead of straight ribs and in lacking bullae at the mid-flank.

Etymology. The name commemorates Carl Diener.

Hollandites liardensis n. sp.

Plate 55, figures 4a, b; Figure 40b (p. 458)

Registered material. Holotype GSC 28284 (GSC loc. 42402).

Occurrence. Middle Anisian, Hagei Zone. Toad Formation, northeastern British Columbia. GSC loc. 42402 (1).

Diagnosis. Hollandites about 70 mm in diameter; H about 40 per cent, W about 30 per cent, U about 25 per cent of diameter. Ventral shoulders prominent, venter subtabulate and smooth, with little or no projection of growth lines. Ribs simple and straight on whole of the outer whorl, about six on last quadrant. Tuberculation absent.

Measurements. Holotype GSC 28284 (Pl. 55, fig. 4): 68, 0.40, 0.31, 0.26.

Remarks. The holotype is probably nearly complete. Septa are not approximated. Like *Hollandites dieneri* n. sp. this species is distinguished from *H. visvakarma* (Diener) and *H. roxburghii* Diener by the absence of bullae on the flank. Compared with *H. dieneri* there are no branched ribs on the outer whorl and the ribs are straight, not convex.

Hollandites pelletieri McLearn

Plate 52, figures 11–13, 15; Plate 53, figures 4–9

Hollandites pelletieri McLearn, 1969, p. 13, Pl. 2, figs. 3–7, Textfig. 2.

Hollandites sp. cf. *H. pelletieri* McLearn; McLEARN, 1969, p. 15, Pl. 2, figs. 2a, b.

Hollandites n. sp., Tozer, 1967, p. 25, 72.

Anagymnotoceras sp. cf. *A. columbianum* (McLearn); TOZER, 1967, p. 72.

Registered material. Holotype GSC 21704 (McLearn, 1969, Pl. 2, figs. 7a–c), four paratypes GSC 21700 (ibid., figs. 4a, b), GSC 21701 (ibid., figs. 5a, b), GSC 21702 (ibid., figs. 6a–c), GSC 21703 (ibid., figs. 3a, b), eleven topotypes GSC 21772 (ibid., figs. 2a, b), GSC 28285–GSC 28294 (all GSC loc. 40109).

Occurrence. Middle Anisian, Hagei Zone. Toad Formation, northeastern British Columbia. GSC loc. 40109 (72).

Measurements. Topotype GSC 28293 (Pl. 53, fig. 8): 56, 0.42, 0.31, 0.26. Holotype GSC 21704: 65, 0.43, 0.27, 0.28. Topotype GSC 28292 (Pl. 53, fig. 7): 48, 0.44, 0.29, 0.30. Topotype GSC 28294 (Pl. 53, fig. 9): 61, 0.37, 0.26, 0.36.

Remarks. This species varies greatly in proportions, strength of ribbing and in the development of bullae on the flank. GSC 28293 (Pl. 53, fig. 8) is the most involute variant; GSC 28294 (Pl. 53, fig. 9) the most evolute. All variants have rounded ventrolateral shoulders and an arched venter crossed by growth lines or faint ribs with moderate projection. Bifurcating ribs, with bullae at the point of bifurcation, prevail on the phragmocone; simple ribs on the mature body chamber. Strong bullae, like those of *Anagymnotoceras,* appear to be a feature of immature specimens, e.g., GSC 28285, GSC 28286 and GSC 28287 (Pl. 52, figs. 11–13). Comparable bullae are visible on the inner whorls of GSC 28288 (Pl. 52, fig. 15) and GSC 28289 (Pl. 53, fig. 4). Examples on which bullate ribs are present at a large diameter are GSC 28291 (Pl. 53, fig. 6) and GSC 21772 (McLearn, 1969, Pl. 2, figs. 2a, b). GSC 28285 (Pl. 52, fig. 11) has three parabolic nodes on the outer whorl, a feature not shown by the others. The most evolute variant (GSC 28294, Pl. 53, fig. 9) also has unique sculpture, with simple non-bullate ribs on the outer and penultimate whorls. All variants of *Hollandites pelletieri* are distinguished from *H. dieneri* n. sp. and *H. liardensis* n. sp. by having prominent curvature of the ribs at the ventrolateral shoulder, and projected growth lines on the venter.

Hollandites macconnelli McLearn

Plate 54, figures 2a–c

Hollandites? mcconnelli McLearn, 1946b, p. 3, Pl. 4, fig. 2; McLEARN, 1948, p. 27, Pl. 4, fig. 2.

Hollandites mcconnelli McLearn; McLEARN, 1969, p. 16, Pl. 1, figs. 10a, b, Textfig. 4.

Registered material. Holotype GSC 9481, "300 yards west of Mile Post 375" (GSC locality no. erased) (McLearn, 1969, Pl. 1, figs. 10a, b). Hypotype (topotype?) GSC 28299 (GSC loc. 68294).

Occurrence. Middle Anisian, Hayesi Zone. Toad Formation, northeastern British Columbia. GSC loc. 68294 (1).

Remarks. GSC 28299 (Pl. 54, fig. 2) closely resembles the holotype, except for being slightly more involute and in having more prominent ribs. There is a resemblance to some variants of *Hollandites pelletieri* McLearn but the inner whorls of *H. macconnelli* appear to have less bullate flanks than the outer, the reverse of the condition commonly found in *H. pelletieri.*

Hollandites minor n. sp.

Plate 55, figures 1–3

Registered material. Holotype GSC 28296, two paratypes GSC 28295, GSC 28297, (all GSC loc. 68295).

Occurrence. Middle Anisian, Minor Zone. Toad Formation, northeastern British Columbia. GSC loc. 68295 (3).

Diagnosis. Hollandites about 40 mm in diameter; H about 30 per cent, W about 45 per cent, U about 35 per cent of diameter. Whorl section on body chamber subovoid, umbilical wall perpendicular, the umbilical shoulder rounded, flanks weakly convex, ventral shoulders indistinct. Venter arched on the outer whorl. Ribs are strong, slightly falcoid, convex on the flank, fading abruptly at the ventral shoulder. Simple and bifurcating ribs alternate, except near aperture, where all ribs are simple; bifurcation is at inner flank, without bullae; about eight ribs on last quadrant. Rib terminations and growth lines strongly projected on the venter, meeting on the median line at an angle of about 90 degrees.

Measurements. Holotype GSC 28296 (Pl. 55, fig. 2): 31, 0.45, 0.32, 0.35.

Remarks. Paratype GSC 28297 (Pl. 55, fig. 3) is a fragment with a maximum whorl height of 18 mm, evidently the remains of a specimen that attained a diameter of about 40 mm. All ribs on the last quadrant are simple. Paratype GSC 28295 (Pl. 55, fig. 1), 23 mm in diameter, probably indicates the character of the inner whorls. The venter has a distinct, blunt keel. Suture lines are not well preserved, but saddles with small indentations are visible on GSC 28295 and GSC 28297. Strong projection of sculpture on the venter distinguishes this species from *Hollandites dieneri* n. sp., *H. liardensis* n. sp., *H. pelletieri* McLearn and *H. macconnelli* McLearn. The style of ribbing and the venter of the holotype of *H. spivaki* McLearn is similar, but that specimen has distinct bullae where the ribs bifurcate on the inner flank, unlike those identified as *H. minor*. Also, the holotype of *H. spivaki* lacks single ribs on the outer whorl, but this difference is not necessarily significant because only one quadrant of the body chamber is preserved. It is possible that *H. spivaki* and *H. minor* are conspecific, the former being a large, prominently sculptured variant, the latter, a small, weakly sculptured variant.

Hollandites spivaki McLearn

Plate 55, figures 7a, b

Hollandites? *spivaki* McLearn, 1946b, p. 3, Pl. 5, fig. 2; McLEARN, 1948, p. 28, Pl. 5, fig. 2.

Hollandites spivaki McLearn; TOZER, 1967, p. 25, 70; McLEARN, 1969, p. 17, Pl. 1, figs. 11a, b.

Registered material. Holotype GSC 9483 (McLearn, 1969, Pl. 1, figs. 11a, b), talus, Cameron Hill, Alaska Highway (GSC locality number erased). Hypotype GSC 32367 (GSC loc. 68295).

Occurrence. Middle Anisian, Minor Zone. Toad Formation, northeastern British Columbia. GSC loc. 68295 (2).

Remarks. Strong peripheral projection of the growth lines, which meet on the venter at an acute angle, is taken to be the principal character for this species. This feature is clearly shown on the holotype and on GSC 32367 (Pl. 55, fig. 7). The projection is more pronounced than on *Hollandites macconnelli* McLearn and much more so than on *H. pelletieri* McLearn, *H. liardensis* n. sp. and *H. dieneri* n. sp. Bullate ribs are also a feature of the species and one that distinguishes it from *H. minor* n. sp. As already mentioned, *H. spivaki* may be a strongly sculptured variant of *H. minor*.

Genus *Anagymnotoceras* McLearn, 1966

Type species. Gymnotoceras varium McLearn.

Anagymnotoceras tozeri McLearn

Plate 54, figures 1a, b

Anagymnotoceras n. sp., Tozer, 1967, p. 47.

Anagymnotoceras tozeri McLearn, 1969, p. 19, Pl. 5, figs. 8, 9.

Registered material. Holotype GSC 21809 (McLearn, 1969, Pl. 5, figs. 8a, b), paratype GSC 21810 (ibid., Pl. 5, figs. 9a, b) (both GSC loc. 51677). Two hypotypes GSC 28304, 28305* (both GSC loc. 42400).

Occurrence. Middle Anisian, Hagei Zone. Blaa Mountain Formation, Lower Shale Member, Ellesmere Island; Toad Formation northeastern British Columbia. GSC locs. 42400 (3), 51676 (6), 51677 (10).

Remarks. No complete specimens are known. The holotype (McLearn, 1969, Pl. 5, figs. 8a, b) is the remains of a specimen that attained a diameter of about 80 mm. The body chamber bears blunt, rectiradiate simple ribs (about six to a quadrant), which are not appreciably bullate. This feature is shown on what is preserved of the body chamber of the paratype and by other specimens from Ellesmere

Island, most of which are fragments of body chambers. GSC 28304 (Pl. 54, fig. 1) from British Columbia is comparable with the material from the type locality, the small part of the body chamber that is preserved having simple non-bullate ribs on the adoral portion and the phragmocone showing ribs stemming from umbilical bullae, the characteristic sculpture of *Anagymnotoceras*.

Anagymnotoceras varium (McLearn)

Plate 53, figures 1, 2; Plate 54, figures 7a, b

Gymnotoceras varium McLearn, 1948, p. 33, Supplement p. 2, Pl. 11, figs. 5, 6.

Anagymnotoceras varium (McLearn); McLEARN, 1966, Pl. 1, figs. 11–13; TOZER, 1967, p. 24, 25, 70, Pl. 7, figs. 2a–c, 3a, b; McLEARN, 1969, p. 18, Pl. 3, figs. 7a–c, Textfig. 6.

Gymnotoceras helle McLearn, 1948, p. 32, Supplement p. 2, Pl. 10, fig. 7; TOZER, 1962a, Pl. 5, figs. 3a–c.

Anagymnotoceras helle (McLearn); McLEARN, 1966, Pl. 1, figs. 3–5; TOZER, 1967, p. 25, 70; McLEARN, 1969, p. 21, Pl. 3, figs. 4a–c, 5, Textfig. 7; Tozer, 1970, Pl. 17, figs. 3a, b.

Registered material. Holotype GSC 9595 (McLearn, 1969, Pl. 3, figs. 7a–c), topotype (paratype *Gymnotoceras helle*) GSC 9592 (ibid., Pl. 3, figs. 4a–c), topotype GSC 14233 (all GSC loc. 10696). Hypotype (holotype *Gymnotoceras helle*) GSC 9593 (ibid., Pl. 3, fig. 5) (GSC loc. 10697). Topotype GSC 18899 (Tozer, 1967, Pl. 7, figs. 2a–c) (GSC loc. 68294). Hypotype GSC 28298 (GSC loc. 74737).

Occurrence. Middle Anisian, Hayesi Zone. Toad Formation, northeastern British Columbia; Sulphur Mountain Formation, Whistler Member, northeastern British Columbia. GSC locs. 10696 (9), 10697 (1), 16008 (4), 68294 (8), 74722 (1), 74737 (2), 85548 (5), 89548 (1).

Measurements. Holotype GSC 9595: 70, 0.43, 0.35, 0.32.

Remarks. The holotype (Tozer, 1967, Pl. 7, figs 3a, b; McLearn, 1969, Pl. 3, figs. 7a–c) is the remains of a nearly complete, probably mature specimen. For this species, the characteristic body chamber sculpture consists of blunt rectiradiate ribs (about five to a quadrant), most of which are bullate initially at the inner flank, later at mid-flank, and, approaching the aperture, outside the mid-flank. Ribs immediately adjacent to the aperture may be without bullae. The sculpture on much of the mature body chamber is seen in the holotype. Comparable sculpture is seen in one topotype (Pl. 53, fig. 1). On what is preserved of the body chamber, there are six ribs. The first five are bullate with the bullae on each successive rib progressively closer to the venter. The last rib is not bullate. The phragmocone of this specimen has bullae more prominent than those of the holotype, more comparable with those of the specimens identified as *Anagymnotoceras helle* by McLearn. GSC 28298 (Pl. 53, fig. 2) is another example with prominent bullae. The variation in the strength of bullae among specimens that evidently came from the same bed justifies treating *Anagymnotoceras helle* as a synonym of *A. varium*. GSC 14233 (Pl. 54, fig. 7) is a topotype phragmocone showing inner whorls with simple ribs and acquisition of branched ribs and bullae on the adorad quadrant. Illustrations of the suture line are in McLearn (1969, figs. 6, 7). This species closely resembles *Anagymnotoceras tozeri* McLearn, but the simple ribs on the body chamber of that species differ in being without bullae.

Anagymnotoceras columbianum (McLearn)

Plate 54, figures 6a–c

Gymnotoceras columbianum McLearn, 1946a, p. 17, Appendix II, p. 2, Pl. 3, fig. 7; McLEARN, 1948, p. 31, Pl. 3, fig. 7.

Anagymnotoceras columbianum (McLearn); McLEARN, 1966, Pl. 1, figs. 6, 7; TOZER, 1967, p. 24, 70 (only); McLEARN, 1969, p. 23, Pl. 3, figs. 2a, b.

Registered material. Holotype GSC 6691 (McLearn, 1969, Pl. 3, figs. 2a, b) (GSC loc. 10696). Hypotype GSC 28203 (GSC loc. 46512).

Occurrence. Middle Anisian, Hayesi Zone. Toad Formation, northeastern British Columbia. GSC locs. 10696 (1), 46512 (1).

Remarks. The outer whorl of the holotype and of GSC 28303 (Pl. 54, fig. 6) have rounded umbilical and ventrolateral shoulders, strong bullate nodes on the inner flank, from which stem three or four ribs, and intercalated ribs between the nodes. In both, the body chamber is preserved and they are virtually complete specimens. They may be immature, being comparable to the complete phragmocone of *Anagymnotoceras varium* (McLearn) (e.g., of GSC 18899, Pl. 53, fig. 1),

although more inflated, with the intercalated ribs more prominent and regular. The specimens identified as *A. columbianum* are thus probably immature, unusually thick variants of *A. varium*.

Anagymnotoceras ino (McLearn)

Gymnotoceras ino McLearn, 1948, p. 33, Supplement p. 2.

Anagymnotoceras ino (McLearn); McLEARN, 1966, Pl. 1, figs. 9, 10; TOZER, 1967, p. 25, 72; McLEARN, 1969, p. 23, Pl. 3, figs. 3a, b.

Registered material. Holotype GSC 9594 (McLearn, 1969, Pl. 3, figs. 3a, b) (GSC loc. 10698).

Occurrence. Middle Anisian, Hayesi Zone. Toad Formation, northeastern British Columbia. GSC loc. 10698 (1).

Remarks. The unique holotype consists of the remains of the phragmocone and a relatively well preserved body chamber. Nodes are high, ribbing is weak, becoming increasingly so adorally, but the characteristic *Anagymnotoceras* sculpture, of ribs stemming from the nodes, is discernible at the beginning of the body chamber. At the aperture, the nodes are at mid-flank, imparting a hexagonal whorl section. The strong nodes in conjunction with weak ribbing distinguish this species from *Anagymnotoceras tozeri* McLearn, *A. varium* (McLearn) and *A. columbianum* (McLearn). The specimen might be interpreted as immature but this cannot be established because at a comparable size it has much weaker ribbing than the other species.

Anagymnotoceras wrighti (McLearn)

Plate 54, figures 3–5; Plate 55, figures 8a, b

Gymnotoceras wrighti McLearn, 1946b, p. 4, Pl. 5, fig. 4; McLEARN, 1948, p. 32, Pl. 5, fig. 4.

Anagymnotoceras wrighti (McLearn); McLEARN, 1966, Pl. 1, figs. 1, 2; TOZER, 1967, p. 25, 72; McLEARN, 1969, p. 22, Pl. 3, figs. 1a, b.

Registered material. Holotype GSC 9484 (GSC loc. 10702) (McLearn, 1969, Pl. 3, figs. 1a, b). Three hypotypes GSC 28300–GSC 28302 (all GSC loc. 58385). Hypotype GSC 32366 (GSC loc. 68295).

Occurrence. Middle Anisian, Hayesi? and Minor zones. Toad Formation, northeastern British Columbia; Sulphur Mountain Formation, Whistler Member, Alberta. GSC locs. 10702 (1), 58385 (3), 68295 (1).

Remarks. GSC 32366 (Pl. 55, fig. 8), a wholly septate specimen, has a trapezoidal whorl section, perpendicular umbilical wall, rounded umbilical shoulder, indistinct ventral shoulders and a smooth arched venter. There are five bullate nodes on the inner flank of what is preserved of the outer whorl. Three ribs stem from four bullae; two from one. Suture lines are not well preserved but the saddles are seen to be denticulate. This specimen resembles the holotype. GSC 28300 (Pl. 54, fig. 3) also resembles the holotype and this justifies assigning the associated specimens, GSC 28302 (Pl. 54, fig. 5) and GSC 28301 (Pl. 54, fig. 4) to *A. wrighti*. GSC 28302 (Pl. 54, fig. 5) is a body chamber with nodes but no ribs. GSC 28301 (Pl. 54, fig. 4) is interpreted as indicating the character of the inner whorls. Compared with *Anagymnotoceras tozeri* McLearn, *A. varium* McLearn and *A. columbianum* McLearn, the whorl section of the mature phragmocone of this species is more trapezoidal in section. The body chamber (GSC 28302, Pl. 54, fig. 5) resembles that of *A. ino* (McLearn), although it is much larger.

Genus *Nicomedites* Toula, 1896

Type species. Ceratites (Nicomedites) osmani Toula.

Nicomedites moderatus (McLearn)

Plate 52, figure 14; Plate 53, figures 3a, b; Plate 56, figures 3a, b; Figures 41b, c (p. 460)

Gymnotoceras moderatum McLearn, 1948, p. 34, Supplement p. 3, Pl. 10, fig. 10.

Anagymnotoceras moderatum (McLearn); McLEARN, 1966, Pl. 1, fig. 8; TOZER, 1967, p. 25, 70; McLEARN, 1969, p. 20, Pl. 3, fig. 6.

Registered material. Holotype GSC 9596 (McLearn, 1969, Pl. 3, fig. 6) (GSC loc. 10696). Two topotypes GSC 28306, GSC 28308 (both GSC loc. 68294). Hypotype GSC 28307 (GSC loc. 74738).

Occurrence. Middle Anisian, Hayesi Zone. Toad Formation, northeastern British Columbia. GSC locs. 10696 (3), 16008 (1), 40110 (6), 68294 (3), 74738 (1), 89548 (1).

Remarks. This species is interpreted as including *Nicomedites* with a phragmocone much like that of *Anagymnotoceras*, with moderately convex flanks and bullate ribs near the umbilical shoulder. The body chamber is more like that of *Nicomedites*: relatively compressed with faint simple ribs and ventrolateral tuberculation. The holotype, although only 40 mm in diameter, is nearly complete and possibly mature. GSC 28306 (Pl. 52, fig. 14), evidently a topotype, is the remains of a specimen, which, when complete, was about 80 mm in diameter. Apart from the difference in size, it is comparable with the holotype, the phragmocone whorl section being narrowly ovoid, with low bullate nodes at the umbilical shoulder from which stem two or three ribs. The body chamber has faint, slightly falcoid ribs, slightly tuberculate at the ventrolateral margin. Some, at least, are simple. GSC 28307 (Pl. 53, fig. 3) closely resembles GSC 28306, except for being a little more evolute. GSC 28308 (Pl. 56, fig. 3), another probable topotype, is more involute than the others, has a more compressed phragmocone, with nearly flat flanks, and lacks umbilical bullae. The outer whorl is like that of GSC 28306 (Pl. 52, fig. 14), with which it is associated. Because of this and the association, it is regarded as a compressed variant of *Nicomedites moderatus*. GSC 28299 (Pl. 54, fig. 2), identified as *Hollandites macconnelli* McLearn has a phragmocone much like that of GSC 28306 (Pl. 52, fig. 14) and GSC 28307 (Pl. 53, fig. 3). What is preserved of the body chamber, however, is different, bearing branched ribs.

Nicomedites arthaberi n. sp.

Plate 56, figures 1, 2, 4; Figure 41a (p. 460)

Gymnotoceras sp., Tozer, 1967, p. 70.

Registered material. Holotype GSC 28310, three paratypes GSC 28311, 44397*, 44398* (all GSC loc. 68295). Paratype GSC 28309 (GSC loc. 10692).

Occurrence. Middle Anisian, Minor Zone. Toad Formation, northeastern British Columbia. GSC locs. 10692 (1), 68295 (6), 99565 (5).

Diagnosis. Nicomedites about 100 mm in diameter; H about 55 per cent, W about 25 per cent, U about 15 per cent of diameter. Phragmocone with faint but distinct ribs, some simple, some bifurcating, some intercalated. Body chamber nearly smooth, sculptured with little more than faint crescents at the margin, about six to a quadrant.

Measurements. Paratype GSC 44397*: 100, 0.57, 0.26, 0.15. Paratype GSC 28309 (Pl. 56, fig. 4): 92, 0.51, 0.29, 0.15.

Remarks. The holotype (Pl. 56, fig. 2) is the remains of a complete, probably mature example that attained a diameter of about 100 mm. The peristome is preserved near the umbilicus. The outer whorl is slightly crushed. It is missing on one side, revealing much of the penultimate whorl. What is visible of the penultimate whorl has simple and bifurcating ribs and one very low bullate swelling at the umbilical edge. GSC 28311 (Pl. 56, fig. 1), 30 mm in diameter, is taken to indicate the character of the inner whorls. The apical half of the outer whorl is smooth, adorally there are low falcoid ribs. Most are simple, one bifurcates near the umbilicus. They are not bullate. All specimens have an arched venter, with no trace of a keel, and moderately projected growth lines. The suture line of the holotype (Fig. 41a) has deeply indented lobes and saddles. There are at least two auxiliary lobes. GSC 44397* is a specimen like the holotype, but with an uncrushed outer whorl. GSC 28309 (Pl. 56, fig. 4) is probably a mature example, in that rounded but distinct ventral shoulders are acquired on the last quadrant and the umbilical spiral is slightly excentric. What can be seen of the phragmocone resembles that of the holotype and GSC 28308 (Pl. 56, fig. 3) except that most ribs are simple and relatively faint.

This species is congeneric with *Nicomedites moderatus* (McLearn), but has more compressed inner whorls, with relatively flat flanks, and lacks well developed lateral bullae compared with the holotype of that species. There is, however, a very close resemblance to GSC 28308 (Pl. 56, fig. 3), described above as a compressed variant of *N. moderatus* because of its associates. The discoidal shape, weak sculpture, absence of carination and deeply indented saddles justify reference to *Nicomedites*.

Etymology. The name commemorates G. von Arthaber.

Genus *Eogymnotoceras* Bucher, 1988

Type species. Eogymnotoceras thompsoni Bucher.

Eogymnotoceras beachi (McLearn)

Plate 60, figures 1–3

Gymnotoceras beachi McLearn, 1946a, p. 18; McLEARN, 1946b, p. 4, Pl. 5, fig. 5; McLEARN, 1948, p. 29, Pl. 5, fig. 5; TOZER, 1967, p. 26, 73; McLEARN, 1969, p. 30, Pl. 5, figs. 1a–d.

Gymnotoceras deleeni (McLearn), TOZER, 1967, p. 70 (in part).

Registered material. Holotype GSC 6692 (McLearn, 1969, Pl. 5, figs. 1a–d) (GSC loc. 10727). Three hypotypes GSC 28313–GSC 28315 (all GSC loc. 68228).

Occurrence. Upper Anisian, Deleeni Zone. Toad Formation, northeastern British Columbia. GSC locs. 10727 (1), 68228 (4), 99566 (1).

Remarks. The holotype of this species is clearly an *Eogymnotoceras* resembling *E. deleeni* (McLearn) and *E. liardense* (McLearn), having the keel, oblique bullae and auriculoids that characterize *Eogymnotoceras.* The outer whorl, half of which is body chamber, initially has rounded ventral shoulders; toward the aperture they become bluntly angular. Ribbing remains strong to the end and is present at a larger diameter, compared with *E. deleeni* and *E. liardense.* The specimen may be immature, or may indicate a species of *Eogymnotoceras* distinguished from *E. deleeni* and *E. liardense* by having a ribbed instead of smooth body chamber. Provisionally assigned to this species are GSC 28313, GSC 28314 and GSC 28315. GSC 28314 (Pl. 60, fig. 2), although crushed, shows the oblique bullae, auriculoids and low keel of *Eogymnotoceras.* GSC 28313 (Pl. 60, fig. 3) shows an early stage with simple ribs, comparable with GSC 28312 (Pl. 60, fig. 12), a topotype of *E. deleeni* (McLearn). GSC 28315 (Pl. 60, fig. 1) is interpreted as an example of *Eogymnotoceras* because of its association with GSC 28313 and GSC 28314, despite the fact that the outer whorl shows no keel and auriculoids. The ribbing, however, is somewhat like that on the body chamber of the holotype of *E. beachi.* For this reason these specimens are identified as *Eogymnotoceras beachi* rather than *E. deleeni.*

Eogymnotoceras deleeni (McLearn)

Plate 59, figures 10, 11; Plate 60, figures 10–12

Beyrichites deleeni McLearn, 1946a, p. 16, Appendix II, p. 2, Pl. 1, fig. 5; Pl. 2, fig. 3; McLEARN, 1948, p. 26, Pl. 1, fig. 5; Pl. 2, fig. 3.

Gymnotoceras deleeni (McLearn); TOZER, 1967, p. 69, 70 (in part), Pl. 7, figs. 4, 5; McLEARN, 1969, p. 24, Pl. 4, figs. 2, 3, 4, 5, 7 (only); not Pl. 4, figs. 1, 6; Pl. 5, figs. 5a, b, = *Gymnotoceras smithi* n. sp.

Registered material. Holotype GSC 6479 (McLearn, 1969, Pl. 4, figs. 2a–c), paratype GSC 6480 (ibid., figs. 4a, b), four topotypes GSC 21707 (ibid., figs. 5a, b), GSC 21709 (ibid., figs. 3a–c), GSC 21710 (ibid., fig. 7), GSC 28312 (all GSC loc. 10694). Hypotype GSC 28316 (GSC loc. 68224). Three hypotypes (topotypes?) GSC 28317–GSC 28319 (all GSC loc. 68297).

Occurrence. Upper Anisian, Deleeni Zone. Toad Formation, northeastern British Columbia; Sulphur Mountain Formation, Llama Member, Alberta. GSC locs. 10693 (10), 10694 (200), 10695 (25), 14841 (1), 25118 (5), 55007 (5), 68224 (10), 68297 (20), C-90882 (1).

Remarks. At maturity, a diameter of about 90 mm is attained, and the body chamber is almost smooth, with a broadly arched venter and indistinct ventral shoulders, which are without tubercles, or have only a trace of tuberculation. Measurements at maturity are H about 55 per cent, W about 30 per cent, U about 15 per cent of diameter. The inner whorls are much more evolute and are ribbed and tuberculate. The phragmocone has a an almost fastigate (gabled) venter defined by moderately distinct ventrolateral shoulders and a low blunt keel. Phragmocone flanks initially have simple ribs, later branched and intercalated falcoid ribs. Parabolic ribbing (oblique lateral bullae and marginal auriculoids) is present at a diameter of about 30 mm. The prominent growth lines (transitional peristomes), which define the parabolic ribbing, form a sinus on the inner flank, a lappet at mid-flank, a small rounded sinus embracing the auriculoid at the margin, and a distinct, rounded rostrum on the ventral keel. The holotype and most of the other specimens described by McLearn are from a talus collection (GSC loc. 10694). Preservation of these specimens and of the matrix is similar, suggesting that all are from the same bed. The specimens from GSC locality 68297 are from a nearby locality and are of similar preservation. They are probably topotypes. In the holotype, only the phragmocone is preserved. The characters of the body chamber are shown by GSC 6840 (McLearn, 1969, Pl. 4, figs. 4a–c) and GSC 21710 (ibid., fig. 7). Of those collected in place GSC 28318 (Pl. 59, fig. 11) closely resembles the holotype in proportions, whorl section and sculpture. GSC 28317 (Pl. 59, fig. 10) has lateral sculpture like the holotype but somewhat more pronounced ventral shoulders. These specimens, and also GSC 28319 (Pl. 60, fig. 11) show the parabolic ribbing and growth lines with a lappet at mid-flank. In GSC 28319, just over half a whorl of crushed body chamber is preserved, in addition to the part illustrated (Pl. 60, fig. 11a). The flanks are smooth. The first quadrant has marginal tuberculation, which is

apparently absent on the adorad part, as in GSC 21710, mentioned above. Suture lines are fairly well preserved on GSC 28318 (Pl. 59, fig. 11). The external and first lateral saddles are subammonitic; the second lateral and auxiliary saddles subceratitic. There are two auxiliary lobes outside the umbilical shoulder.

Eogymnotoceras liardense (McLearn)

Plate 60, figures 4–9; Figure 45 (p. 468)

Gymnotoceras liardense McLearn, 1946b, p. 4, Pl. 5, fig. 3; McLEARN, 1948, p. 30, Pl. 5, fig. 3; TOZER, 1967, p. 26, 73.

Gymnotoceras deleeni var. *liardense* McLearn, 1969, p. 28, Pl. 5, figs. 3, 4, Textfig. 10.

Gymnotoceras deleeni (McLearn); TOZER, 1967, p. 69 (in part).

Registered material. Holotype GSC 9485 (McLearn, 1969, Pl. 5, figs. 3a, b), topotype GSC 21712 (ibid., Pl. 5, figs. 4a, b) (both GSC loc. 10726). Six hypotypes GSC 28320–GSC 28325 (all GSC loc. 74724).

Occurrence. Upper Anisian, Deleeni Zone. Toad Formation, northeastern British Columbia. GSC locs. 10726 (9), 74724 (40), 74731 (10).

Measurements. Hypotype GSC 28325 (Pl. 60, fig. 9): 74, 0.50, 0.27, 0.18. Hypotype GSC 28323 (Pl. 60, fig. 7): 44, 0.52, 0.23, 0.17.

Remarks. Identified with this species are *Eogymnotoceras* specimens like *E. deleeni* (McLearn) but differing in that the keel is more pronounced, the fastigate form of the venter on the phragmocone commonly has a steeper pitch, the ventral shoulders are more conspicuous and on some variants the mature body chamber is weakly ribbed rather than smooth. The collection from GSC locality 74724 illustrates the variability. At a diameter of 25–30 mm, specimens may be highly inflated with about nine prominent lateral bullae per whorl (GSC 28322, Pl. 60, fig. 6); specimens maybe of moderate inflation, with about 12 (GSC 28321, Pl. 60, fig. 5); or be compressed, with about eight low bullae on the first half of the outer whorl replaced by barely bullate ribs on the ultimate half (GSC 28320, Pl. 60, fig. 4). Of these, GSC 28322 (Pl. 60, fig. 6) has a close counterpart in the inner whorl of a topotype (McLearn, 1969, Pl. 5, fig. 4b); GSC 28321 (Pl. 60, fig. 5) of the holotype (ibid., Pl. 5, figs. 3a, b). Parabolic ribbing like that of *Eogymnotoceras deleeni,* is clearly shown by the holotype and GSC 28322 (Pl. 60, fig. 6). GSC 28325 (Pl. 60, fig. 9) is a complete specimen showing replacement of branched ribs by simple ribs on the last quadrant. The external elements of the last five septa are in contact. The specimen was probably mature. GSC 28323 (Pl. 60, fig. 7) is at a comparable stage at a diameter of 44 mm. What is visible of their inner whorls indicates that these two are weakly bullate variants, comparable with GSC 28320 (Pl. 60, fig. 4). The outer whorl of these specimens is much like that of the large topotype (McLearn, 1969, Pl. 5, figs. 4a, b) but, as mentioned above, it differs in having prominent bullae on the inner whorls.

Genus *Gymnotoceras* Hyatt, *in* Meek, 1877

Type species. Ammonites blakei Gabb.

Gymnotoceras smithi n. sp.

Plate 59, figures 12, 13; Figure 44a (p. 466)

Gymnotoceras sp. aff. *G. rotelliformis* Smith [sic]; TOZER, 1967, p. 26.

Gymnotoceras deleeni McLearn; McLEARN, 1969, Pl. 4, figs. 1, 6; Pl. 5, figs. 5a, b (only).

Registered material. Holotype GSC 28326, two paratypes GSC 28327, GSC 44399* (all GSC loc. 74724). Hypotype GSC 21705 (McLearn, 1969, Pl. 4, figs. 1a, b) (GSC loc. 10694). Hypotype GSC 21708 (ibid., Pl. 4, figs. 6a, b) (GSC loc. 14841). Hypotype GSC 21706 (ibid., Pl. 5, figs. 5a, b) (GSC loc. 10717).

Occurrence. Upper Anisian, Deleeni Zone. Toad Formation, northeastern British Columbia. GSC locs. 10694 (1), 10717 (6), 14841 (1), 74724 (14).

Diagnosis. Gymnotoceras about 35 to at least 60 mm in diameter; H about 55 per cent, W about 27 per cent, U about 15 per cent of diameter. Body chamber virtually smooth, with very indistinct ventral shoulders. Venter with very blunt keel on both the outer whorl of the phragmocone and on much of the body chamber, flat at the mature aperture. Phragmocone with weakly bullate ribs on the inner flank (8–10 on half a whorl); ribbing faint on outer flank but stronger at the margin, where low crescentic tubercles appear on a moderately distinct shoulder defining a fastigate (gabled) venter.

Measurements. Holotype GSC 28326 (Pl. 59, fig. 13): 59, 0.54, 0.27, 0.14. Paratype GSC 28327 (Pl. 59, fig. 12): 33, 0.47, 0.29, 0.23.

Remarks. The holotype is almost complete. The venter remains angular to the end. The last eight septa are visible. They show slight approximation but are not in contact. Probably the specimen was not fully mature. Most of the ribs visible are simple and somewhat falcoid. Initially bullate on the inner flank, later they become barely perceptible, mainly expressed as crescents on the outer flank. The last half whorl has eight faint ribs; the preceding half has 10. Among the topotypes there are some with nearly smooth body chambers, like the holotype, but appreciably smaller in size. One of these, GSC 44399*, the remains of a specimen about 35 mm in diameter, has the last quarter whorl of body chamber preserving the peristome and rostrum. To within 4 mm of the peristome margin the venter is angular, but immediately adjacent to the margin it is flat. This specimen, despite its small size compared with the holotype, probably indicates the mature nature of the aperture. The growth stage at which there are some bifurcating and intercalated ribs is shown by paratype GSC 28327 (Pl. 59, fig. 12). Suture lines are well preserved. Saddles are weakly denticulate.

The most closely comparable species is *Gymnotoceras rotelliformis* (Meek) as interpreted by Silberling and Nichols (1982, p. 26). The main difference seems to be in the form of the venter, examples of *G. rotelliformis* having venters that are a trifle blunter than that of *G. smithi*. Most examples of *G. rotelliformis* are also somewhat more inflated compared with *G. smithi*. *"Beyrichites" migayi* Kiparisova (1968, p. 302), type species of *Frechitoides* Konstantinov (1987), has an outer whorl with flanks much like those of *Gymnotoceras smithi* and *G. rotelliformis*, but is not known to have a stage with prominent ribs.

Etymology. The name commemorates James Perrin Smith.

Genus *Frechites* Smith, 1932

Type species. Ceratites humboldtensis Hyatt and Smith.

Frechites chischa (Tozer)

Plate 65, figures 1a, b; Plate 66, figures 16, 17

Gymnotoceras chischa Tozer, 1967, p. 26, 69, 90, Pl. 7, figs. 6, 7, Textfig. 22.

?*Gymnotoceras* sp., TOZER, 1967, p. 69; McLEARN, 1969, p. 11, Pl. 5, figs. 6, 7.

Registered material. Holotype GSC 18885 (Tozer, 1967, Pl. 7, figs. 7a, b), paratype GSC 18886 (ibid., figs. 6a, b) (both GSC loc. 40088). Two topotypes GSC 28346, 28347 (GSC loc. 74726). Hypotype GSC 28348 (GSC loc. 83875). Hypotype GSC 85775* (GSC loc. 83852). Questionably assigned specimens, GSC 21713 (McLearn, 1969, Pl. 5, figs. 6a, b), GSC 21714 (ibid., figs. 7a, b) (both GSC loc. 10719).

Occurrence. Upper Anisian, Chischa Zone. Toad Formation northeastern British Columbia; Sulphur Mountain Formation, Llama Member, northeastern British Columbia. GSC locs. 10719 (?2), 40088 (5), 74726 (20), 83852 (4), 83875 (1), 83890 (2), 85550 (1).

Remarks. This species attained a diameter of at least 45 mm with H about 45 per cent, W about 35 per cent, U about 30 per cent of the diameter. The phragmocone has a quadrangular whorl section with a tabulate venter defined by angular ventral shoulders and falcoid ribs branching from bullae on the inner flank. Parabolic sculpture defining marginal auriculoids and oblique bullae is present to a diameter of about 20 mm. The body chamber initially has low bullae near the umbilical shoulder, a smooth outer flank and marginal tuberculation. Adorally the low bullae fade, leaving only the marginal tuberculation. The venter is at first sulcaticarinate, on the later septate whorls and part of the body chamber it is carinate, ultimately it is smooth. The suture line has moderately denticulate saddles. Complete specimens are unknown. The largest well preserved specimen (Tozer, 1967, Pl. 7, figs. 6a, b), which originally attained a diameter of about 45 mm, retains a keel on what is preserved of the body chamber. A topotype (GSC 28347, Pl. 66, fig. 16) indicates that the venter was eventually smooth. GSC 28348 (Pl. 65, fig. 1) closely resembles the holotype. Preservation of the inner whorls is inadequate for determining the presence of parabolic sculpture. GSC 85775*, another comparable specimen, about 25 mm in diameter, has auriculoids at a diameter of about 20 mm. GSC 21713 and GSC 21714 (McLearn, 1969, Pl. 5, figs. 6, 7) resemble *Frechites chischa* more closely than any other species. GSC 21713 has auriculoids at the beginning of the outer whorl. GSC 21714 is more robustly sculptured than any typical example. These specimens possibly represent another species. The parabolic sculpture on the phragmocone and the style of ribbing indicates affinity with the older species now assigned to *Eogymnotoceras* (*E. deleeni* (McLearn) etc.). The phragmocone whorl section is different, however, the venter of *F. chischa* being tabulate and sulcaticarinate; that of the *Eogymnotoceras* species gabled and carinate. As noted previously (Tozer, 1967, p. 90; Tozer and Parker, 1968, p. 537), this species closely resembles *Frechites laqueatus* (Lindstroem).

Frechites laqueatus (Lindstroem)

Plate 66, figures 13–15

Ceratites laqueatus Lindstroem, 1865, p. 5, Pl. 2, figs. 3, 4; OEBERG, 1877, p. 8, Pl. 2, figs. 7, 8; MOJSISOVICS, 1886, p. 51, Pl. 9, figs. 1, 2.

Gymnotoceras laqueatum (Lindstroem); TOZER and PARKER, 1968, p. 536, Pl. 26, figs. e–h.

Frechites sp., TOZER, 1961, Pl. 22, figs. 4a, b.

Halilucites sp., TOZER, 1961, p. 15.

Frechites laqueatus (Lindstroem); KORCHINSKAYA, 1982, p. 26, Pl. 21, figs. 3, 4; WEITSCHAT and LEHMANN, 1983, p. 46, Pl. 4, figs. 5–6.

Registered material. Three hypotypes, GSC 14189, GSC 28349, GSC 28350 (all GSC loc. 30341).

Occurrence. Upper Anisian, Chischa Zone. Schei Point Formation, Exmouth Island. GSC loc. 30341 (3).

Remarks. GSC 28349 (Pl. 66, fig. 13) has lateral bullae and marginal auriculoids preserved. The venter of GSC 28350 (Pl. 66, fig. 15) is distinctly carinate. GSC 14189 (Pl. 66, fig. 14) is the remains of a strongly ribbed body chamber with only the suggestion of a keel. GSC 28350 was formerly identified as *Halilucites* sp. because of the resemblance to *Halilucites intermedius* (Hauer, 1896, p. 259). These specimens probably represent *Frechites laqueatus*, although they have stronger ribbing than typical examples.

Frechites hamatus n. sp.

Plate 64, figures 9–11

Registered material. Holotype GSC 28330, paratype GSC 28329 (both GSC loc. 45655). Paratype GSC 28328 (GSC loc. 83882).

Occurrence. Upper Anisian, Chischa Zone. Sulphur Mountain Formation, Llama Member, northeastern British Columbia. GSC locs. 45655 (2), 83882 (2).

Diagnosis. Frechites attaining a diameter of about 85 mm; H about 47 per cent, W about 45 per cent, U about 25 per cent of diameter. Section of outer whorl trapezoidal with distinct ventral shoulders. Venter tabulate, without a keel, on the body chamber and much or all of the phragmocone. Body chamber with strong ribs and high bullate lateral nodes.

Measurements. Holotype GSC 28330 (Pl. 64, fig. 11): at 85, 0.47, 0.46, 0.26.

Remarks. Few septa are visible on the holotype but one quarter of the outer whorl appears to be body chamber. Sculpture of the outer whorl consists of high bullate nodes on the inner flank replaced adorad by low, bullate ribs. On the first half of the outer whorl there are five bullate nodes and about 12 ribs, terminating, with adorad curvature, as low tubercles at the ventral shoulder. Rib increase is mostly through bifurcation at the nodes with some intercalation on the outer flank. On the adorad half there is one high bullate node, then a bullate rib, followed by four ribs with bullae of diminishing elevation. Two ribs stem from the bullate node and the earlier formed ribs. The last three or four ribs appear to be simple. The flanks of the penultimate whorl have been exposed; they have low bullae where the ribs branch on the inner flank. The venter is nearly smooth with a trace of projected ribbing but no suggestion of carination. GSC 28328 (Pl. 64, fig. 9) is identical with the holotype except for having a phragmocone, which is somewhat smaller. GSC 28329 (Pl. 64, fig. 10) interpreted as indicative of the nature of the inner whorls, has well defined ventral shoulders and a tabulate venter at a diameter of 20 mm. At this diameter, some ribs cross the venter with moderate projection; at a larger diameter most are interrupted at the siphonal line. There is no suggestion of carination. These specimens do not show parabolic sculpture, nor do they show details of the suture line.

The ribbing and tuberculation of this species is much like that of *Frechites nevadanus* (Mojsisovics), as interpreted by Silberling and Nichols (1982, p. 29), from which *F. hamatus* is distinguished by the absence of a keel. Possibly also related is *Frechites kindlei* McLearn (McLearn, 1969, p. 29) judging from similarities in whorl section, in particular the presence of distinct ventral shoulders and the absence of a keel. The unique holotype of *F. kindlei* is wholly septate and shows adorad decline in the strength of tuberculation on the phragmocone, and is thus distinguished from *F. hamatus*.

Genus *Pleurofrechites* n. gen.

Type species. Frechites johnstoni Silberling and Nichols.

Diagnosis. Moderately involute, compressed beyrichitin (umbilicus 20–25 per cent of diameter). Whorl section narrowly trapezoidal, ventral shoulders distinct, venter subtabulate. Inner and outer whorls ribbed; ribbing on outer whorl commonly weaker than

on inner. Bifurcating ribs, branching at mid-flank or near umbilicus, prevail on the phragmocone; bullae may, or may not, be present at the point of branching. Branched ribs without bullae, and eventually simple ribs, characterize the body chamber. Phragmocone characteristically, but not invariably keeled. Venter of body chamber smooth. Suture line subammonitic.

Species assigned. *Frechites johnstoni* Silberling and Nichols, *Ceratites arcticus* Mojsisovics, *Pleurofrechites subsidens* n. sp., *P. lineatus* n. sp., *P. fellersi* n. sp.

Age. Upper Anisian, Ladinian (Subasperum Zone).

Remarks. The style of ribbing is much like that of *Parafrechites*, but that genus has different ventral shoulders which are rounded, producing a suboval whorl section, unlike the trapezoidal whorl section of *Pleurofrechites*. *Eogymnotoceras liardense* (McLearn) has moderately distinct ventral shoulders but they define a venter which is gabled, not subtabulate, as in *Pleurofrechites*. Species of *Pleurofrechites* with lateral bullae invite comparison with *Frechites*, but in that genus, unlike *Pleurofrechites*, bullae are characteristically more nodose and are retained on the body chamber.

Pleurofrechites lineatus n. sp.

Plate 64, figures 1–8

Registered material. Holotype GSC 28333, two paratypes GSC 28334, GSC 28335 (all GSC loc. 83889). Paratype GSC 28331 (GSC loc. 83883). Paratype GSC 28332 (GSC loc. 83882). Paratype GSC 28336 (GSC loc. 83874).Two paratypes GSC 28337, GSC 28338 (GSC loc. 83867).

Occurrence. Upper Anisian, Chischa Zone. Sulphur Mountain Formation, Llama Member, northeastern British Columbia. GSC locs. 83867 (2), 83874 (25), 83882 (6), 83883 (4), 83884 (43), 83889 (15).

Diagnosis. *Pleurofrechites* attaining a diameter of at least 50 mm; H about 50 per cent, W about 30 per cent, U about 20 per cent of diameter. Mature body chamber without a keel, ribbed but not bullate, ribbing being essentially uniform from the umbilicus to the margin. Phragmocone venter virtually tabulate, with distinct ventral shoulders, without a keel. Lateral bullae weak or absent.

Measurements. Holotype GSC 28333 (Pl. 64, fig. 1): 47, 0.51, 0.30, 0.19.

Remarks. This species is represented by more than 80 specimens. From a diameter of about 20 mm the whorl section is at first broadly, later narrowly, trapezoidal with a high perpendicular umbilical wall, an abruptly rounded umbilical shoulder, weakly inflated flanks, distinct ventral shoulders and a broad, virtually tabulate venter. Ribbing is prominent on both the inner and outer whorls. Ribs are simple at small diameter (less than 12 mm). Increase at larger diameters is by bifurcation at low, weak to barely perceptible bullae on the inner flank, with a ratio, on half a whorl, of about 10 ribs at the umbilicus to 18 at the margin. Rib terminations at the margin are prominent, almost tuberculate, with adorad projection. Ultimately, on the outer whorl, bullae are absent and increase is by intercalation or bifurcation just inside the mid-flank. There is no keel. Projected growth lines cross the venter. None show parabolic sculpture. The size attained, about 50 mm, is indicated by GSC 28336 (Pl. 64, fig. 7). The last four ribs of this specimen are simple, suggesting maturity. GSC 28334 (Pl. 64, fig. 2) is a relatively thick variant. GSC 28335 (Pl. 64, fig. 3), 22 mm in diameter, illustrates the evolute inner whorls, with simple ribs replaced by alternating simple and branched ribs. No specimens show a well preserved complete suture line but both GSC 28334 and GSC 28336 show a denticulate, subammonitic external saddle. The inner whorls of *Pleurofrechites lineatus* closely resemble those of the contemporary *Frechites hamatus* n. sp., but the body chamber is entirely different, being devoid of the prominent bullae that characterize *F. hamatus*. There is a close resemblance to *Pleurofrechites johnstoni* (Silberling and Nichols) (1982, p. 31), which differs only in having a keel on the phragmocone.

Pleurofrechites subsidens n. sp.

Plate 65, figures 2a–c; Plate 66, figures 5–10; Figure 49a (p. 480)

Registered material. Holotype GSC 28339, four paratypes GSC 28340–GSC 28343 (all GSC loc. 40088). Paratype GSC 28344 (GSC loc. 74726). Paratype GSC 28345 (GSC loc. 83875).

Occurrence. Upper Anisian, Chischa Zone. Toad Formation, northeastern British Columbia; Sulphur Mountain Formation, Llama Member, northeastern British Columbia. GSC locs. 40088 (6), 74726 (2), 83875 (1).

Diagnosis. Specimens of *Pleurofrechites* that are like *P. lineatus* n. sp., but with perceptible, although not very distinct, keel on phragmocone. Parabolic

sculpture commonly present to a diameter of about 15 mm.

Remarks. Large, complete specimens are unknown. GSC 28342 (Pl. 66, fig. 10) and GSC 28343 (Pl. 66, fig. 9) are fragmentary, but show that a size of about 50 mm was attained and that the appearance, at this diameter, was much like that of *Pleurofrechites lineatus*. GSC 28343 shows the venter near the aperture to be smooth, without a keel (Pl. 66, fig. 9b). The outer whorl of the holotype (Pl. 66, fig. 5) is initially subquadrangular in whorl section, ultimately high and compressed. Ventral shoulders are distinct, the venter broad. Sculpture is of simple and branched ribs. Increase is by bifurcation at low bullae on the inner flank of the phragmocone; by branching or intercalation just inside the mid-flank on the body chamber. Two parabolic lines and marginal auriculoids are present on the phragmocone. Ribs are very slightly tuberculate at the margin. A low but distinct rounded keel is present on both the phragmocone and the body chamber. The presence of the keel suggests that this specimen, although complete, was probably not fully mature. The holotype of *Pleurofrechites subsidens* closely resembles *Ceratites arcticus* Mojsisovics (1886, p. 55). Both have parabolic sculpture. Positive identification is not possible because that species is not known to attain the size indicated by GSC 28343 and GSC 28342. Both *Pleurofrechites lineatus* n. sp. and *P. johnstoni* (Silberling and Nichols) (1982, p. 31) are closely comparable, but differ in lacking parabolic sculpture.

Pleurofrechites fellersi n. sp.

Plate 67, figures 7–14; Figure 50c (p. 482)

Gymnotoceras spp., TOZER, 1967, p. 27, 68.

Registered material. Holotype, GSC 28351, five paratypes GSC 28352–GSC 28356 (all GSC loc. 83862). Two paratypes GSC 28357, GSC 28358 (GSC loc. 46484).

Occurrence. Ladinian, Matutinum Zone. Sulphur Mountain Formation, Llama Member, northeastern British Columbia and Alberta. GSC locs. 46484 (15), 83862 (14), 85533 (6).

Diagnosis. Pleurofrechites attaining a diameter of about 65 mm; H about 50 per cent, W about 30 per cent, U about 20 per cent of diameter. Mature body chamber without a keel, ribbed but not bullate, ribbing being essentially uniform from the umbilicus to the margin. Phragmocone with distinct keel and lateral bullae. Inflated variants have parabolic sculpture in the form of oblique bullae and marginal auriculoids to a diameter of about 25 mm.

Measurements. Holotype GSC 28351 (Pl. 67, fig. 10): 39.5, 0.52, 0.34, 0.23. Paratype GSC 28352 (Pl. 67, fig. 14): 63.5, 0.47, 0.30, 0.23.

Remarks. The holotype (Pl. 67, fig. 10), judging from the change in whorl section and sculpture on the outer whorl, was probably approaching maturity. The adapical half of the outer whorl is distinctly sculptured, initially with ribs that bifurcate at moderately prominent bullae on the inner flank, latterly with increase by bifurcation or intercalation just inside the mid-flank. Marginal tuberculation is distinct and the venter is keeled. There are eight bullae at the umbilicus; 16 tubercles at the margin. On the adoral half, the sculpture is much reduced in strength. Where well preserved, on the adorad quadrant, sculpture is of falcoid ribs, apparently simple, relatively strong and slightly bullate on the inner flank, barely perceptible on the outer. Marginal tuberculation is retained. The venter is smooth, not keeled. GSC 28352 (Pl. 67, fig. 14), the largest known specimen (originally about 70 mm in diameter) has a more prominently ribbed body chamber than the holotype. The last 3 ribs are simple, suggesting maturity. GSC 28354 (Pl. 67, fig. 8) and GSC 28356 (Pl. 67, fig. 9) are thick, relatively evolute examples, with very well defined keels. They are presumably immature. GSC 28356 has oblique bullae and auriculoids.

All variants of *Pleurofrechites fellersi* are distinguished from *P. subsidens* n. sp. by having a more pronounced keel. Thick variants of *P. fellersi* closely resemble *Frechites chischa* (Tozer), but this resemblance probably applies only to the inner whorls, the body chamber of *P. fellersi* being ribbed on the flank, that of *F. chischa* being nearly smooth, with only marginal tuberculation. *Pleurofrechites fellersi* is also comparable with some variants of *Frechites occidentalis* (Smith), as interpreted by Silberling and Nichols (1982, p. 30). *Frechites occidentalis*, thus interpreted, includes variants with stronger, more pointed, bullae than any *Pleurofrechites fellersi*. *Frechites occidentalis* seems to represent a morphological link between typical *Frechites* and typical *Pleurofrechites*.

Genus *Tuchodiceras* n. gen.

Type species. Progonoceratites poseidon Tozer.

Diagnosis. Discoidal beyrichitin with a subtabulate, unkeeled venter. Inner whorls bituberculate (lateral,

marginal) with falcoid branched ribs. Outer whorls characteristically smooth, but may be ribbed; when smooth they have falcoid striae emphasized to form crescents on the outer flank. Suture line subammonitic with at least three auxiliary lobes.

Species assigned. *Progonoceratites poseidon* Tozer, *Tuchodiceras costatum* n. sp.

Age. Ladinian.

Remarks. The ribbed whorls of *Tuchodiceras*, coupled with the blunt venter and subammonitic suture line, invite comparison with *Progonoceratites*. The body chamber of *Progonoceratites* retains tuberculation, unlike that of the type species of *Tuchodiceras*. *Tuchodiceras costatus* n. sp. may retain ribbing and tuberculation on the body chamber but does not closely resemble *Progonoceratites*, the ribbing being much more pronounced. The body chamber of *Tuchodiceras* is characteristically smooth and much like that of *Beyrichites* but the inner whorls are different, *Beyrichites* being devoid of tuberculation. *Nicomedites* is somewhat similar in shape and suture line, but also differs in being devoid of tuberculation. Other discoidal Beyrichitinae such as *Gymnotoceras*, *Frechitoides* and *Eogymnotoceras* may have bituberculate inner whorls, but differ from *Tuchodiceras* in having venters that are keeled to varying degrees.

Tuchodiceras poseidon (Tozer)

Plate 68, figures 5–7; Plate 69, figures 1, 2

Progonoceratites poseidon Tozer, 1967, p. 28, 67, 91, Pl. 8, fig. 3–5.

Registered material. Holotype GSC 18888 (Tozer, 1967, Pl. 8, figs. 4a–c), two paratypes GSC 18887 (ibid., Pl. 8, figs. 3a, b), GSC 18889 (ibid., Pl. 8, figs, 5a–c), topotype GSC 28363 (all GSC loc. 68286). Hypotype GSC 28360 (GSC loc. 74757). Hypotype GSC 28362 (GSC loc. 68289). Two hypotypes GSC 28364, GSC 28365 (both GSC loc. 83861). Hypotype GSC 28366 (GSC loc. 83860).

Occurrence. Ladinian, Poseidon Zone. Toad Formation, northeastern British Columbia; Sulphur Mountain Formation, Llama Member, northeastern British Columbia. GSC locs. 68284 (5), 68285 (5), 68286 (30), 68288 (6), 68289 (2), 74757 (1), 83860 (7), 83861 (7), 84220 (3), 84247 (1), 84250 (20).

Measurements. Hypotype GSC 28366 (Pl. 68, fig. 7): 80, 0.56, 0.25, 0.10.

Remarks. In this species, specimens with sculptured whorls do not attain a diameter of more than about 20 mm. Large complete specimens are unrepresented in the collection from the type locality but are known from Mount Withrow and north of Wapiti Lake (GSC 28360, Pl. 69, fig. 1; GSC 28366, Pl. 68, fig. 7). GSC 28366 (Pl. 68, fig. 7) indicates the size attained. In this specimen, the peristome near the umbilicus is preserved. Only the last septum is exposed. Approximation is not demonstrable. The outer whorl is sculptured with falcoid growth lines, emphasized to form crescents on the outer quarter of the flank. Small ribbed binodose specimens (GSC 28364, Pl. 68, fig. 5; GSC 28365, Pl. 68, fig. 6) occur in association.

Tuchodiceras costatum n. sp.

Plate 69, figures 3, 4

Registered material. Holotype GSC 28367 (GSC loc. 68284). Paratype GSC 28361 (GSC loc. 68289).

Occurrence. Ladinian, Poseidon Zone. Toad Formation, northeastern British Columbia. GSC locs. 68284 (2), 68289 (1).

Diagnosis. *Tuchodiceras* attaining a diameter of about 45 mm, H about 45 per cent, W about 25 per cent, U about 25 per cent of diameter. Falcoid ribbing and bituberculation present on both phragmocone and body chamber.

Remarks. The holotype indicates that a diameter of about 45 mm was attained. Sutures are not visible. Most of the specimen is probably body chamber. Ribbing is sharp and well defined on the flank and moderately so also on the venter, which is defined by distinct shoulders. In GSC 28361 (Pl. 69, fig. 4), although it is only 20 mm in diameter, half a whorl of body chamber is preserved following a phragmocone preserved in crystalline carbonate. The venter is nearly smooth. The sculpture indicates close affinity with the contemporary *Tuchodiceras poseidon* (Tozer). The specimens identified as *T. costatus* differ in retaining strong sculpture and a wide umbilicus to a larger diameter than any *T. poseidon*. The available evidence suggests that *T. costatus* may have had ribbing and tuberculation on the mature body chamber, unlike *T. poseidon*, which becomes smooth. It is possible, however, that the specimens of *T. costatus* are immature variants of individuals of *T. poseidon* that would have attained a very large size.

Subfamily NEVADITINAE new subfamily

Strongly ribbed Ceratitidae. Venter smooth and flat or very slightly depressed but not sulcate or carinate. External tuberculation is characteristic; some also have umbilical, lateral and marginal tubercles. Suture line ceratitic.

Genera included. Nevadites Smith (1914), *Paranevadites* n. gen., *Chieseiceras* Brack and Rieber (1986), probably also *Xenoprotrachyceras* Wang (1983).

This subfamily forms a link between Paraceratitinae and Trachyceratidae. The tuberculation anticipates that of Trachyceratidae but members of that family differ in having a sulcate venter. Paraceratitinae differ in having a carinate venter.

Genus *Paranevadites* n. gen.

Type species. Trachyceras (*Anolcites*) *furlongi* Smith.

Diagnosis. Like *Nevadites* but whorls are less quadrate in section, the venter is more narrow and the sculpture is quadrituberculate instead of trituberculate, with spirals of umbilical, lateral, ventrolateral (marginal) and external rounded tubercles. Suture line ceratitic.

Species assigned. Trachyceras (*Anolcites*) *gabbi* Smith, *Trachyceras* (*Anolcites*) *furlongi* Smith.

Age. Late Upper Anisian.

Remarks. The style of tuberculation is somewhat like that of *Anolcites* but the marginal and external tubercles in that genus are clavate instead of rounded, imparting a distinctly different appearance. *Anolcites* is Ladinian and thus appreciably younger than *Paranevadites*. Any resemblance probably does not indicate close affinity. Closest affinity is with *Nevadites*, the immediate predecessor of *Paranevadites* in the Upper Anisian of Nevada (Silberling and Nichols, 1982, p. 8).

Paranevadites sp. indet.

Plate 65, figures 3a–c

Registered material. GSC 28359 (GSC loc. 83890).

Occurrence. Upper Anisian, Chischa Zone. Sulphur Mountain Formation, Llama Member, northeastern British Columbia. GSC loc. 83890 (1).

Remarks. The outer whorl of GSC 28359 (Pl. 65, fig. 3) shows the acquisition of tuberculation, being initially nearly smooth but quadrituberculate, with umbilical, lateral, marginal and external tubercles, at the aperture. At mid-flank on the last half whorl there are two auriculoids. The suture line is not visible. Except for being a little more inflated, this specimen closely resembles one of *Paranevadites gabbi* (Smith) (USNM 74398, Smith, 1914, Pl. 11, figs. 4, 5) at a comparable diameter. The outer whorl of USNM 74398 has auriculoids like those of GSC 28359. They do not show on Smith's illustration but show on the plaster cast.

Family HUNGARITIDAE Waagen, 1895

Genus *Hungarites* Mojsisovics, 1879

Type species. Ceratites mojsisovicsi Roth = *Ceratites zalaensis* Boeckh.

Hungarites inermis n. sp.

Plate 80, figures 1, 2; Figure 63d (p. 508)

Hungarites sp., TOZER, 1967, p. 30, 65.

Registered material. Holotype GSC 28368, paratype GSC 28369 (both GSC loc. 68236).

Occurrence. Ladinian, Maclearni Subzone 3. Toad Formation, northeastern British Columbia; Sulphur Mountain Formation, Llama Member, northeastern British Columbia. GSC locs. 68236 (2), 84219 (1).

Diagnosis. Hungarites at least 55 mm in diameter, H about 55 per cent, W about 20 per cent, U about 8 per cent of diameter. Venter fastigate in the form of a gable with very low pitch, nearly flat. Flanks smooth except for falcoid striae, some of which are emphasized on the outer half of the flank. Suture line with slightly phylloid saddles; three auxiliary lobes outside the umbilical shoulder.

Measurements. Holotype GSC 28368 (Pl. 80, fig. 1): 27, 0.54, 0.19, 0.09.

Remarks. Complete specimens are unknown. GSC 28369 (Pl. 80, fig. 2), an incomplete example, shows that a diameter of at least 55 mm was attained. The surface of the holotype is smooth except for falcoid striae. GSC 28369, in which about half a whorl of body chamber is preserved, has some striae (about four on the last quadrant) emphasized on the outer half of the flank. The most closely comparable species is

Hungarites mojsisovicsi (Roth) (Mojsisovics, 1882, p. 222), which differs in having a venter formed of a more steeply pitched gable.

Family BADIOTITIDAE Hyatt, 1900

Genus *Badiotites* Mojsisovics, 1879

Type species. Ammonites eryx Muenster.

Badiotites scapulatus n. sp.

Plate 89, figures 2, 3; Figure 72a (p. 526)

Registered material. Holotype GSC 28561, paratype GSC 28562 (both GSC loc. 84267).

Occurrence. Lower Carnian, Desatoyense Zone. Liard Formation, northeastern British Columbia. GSC loc. 84267 (2).

Diagnosis. Badiotites about 20 mm in diameter; H about 35 per cent, W about 27 per cent U about 43 per cent of diameter. The simple ribs are straight and radial on the flank and abruptly projected at the angular ventral shoulder, which defines a flat smooth venter.

Remarks. In the holotype (Pl. 89, fig. 2), about half a whorl of body chamber is preserved. The original diameter was about 17 mm. The style of ribbing, smooth venter and goniatitic suture line indicate affinity with *Badiotites eryx* (Muenster) (Mojsisovics, 1882, p. 91), which differs in being more involute and in having rounded ventral shoulders. "*Lecanites*" *trauthi* Johnston (1941, p. 455), which is probably a species of *Badiotites*, differs from *B. scapulatus* in having more delicate ribbing and a rounded venter.

Genus *Orthoceltites* Spath, 1951

Type species. Goniatites buchi Klipstein.

Orthoceltites belcheri n. sp.

Plate 103, figures 1a, b; Figure 82b (p. 554)

Registered material. Holotype GSC 72182 (GSC loc. 30369).

Occurrence. Upper Carnian, Welleri Zone. Schei Point Formation, Table Island. GSC loc. 30369 (1).

Diagnosis. Serpenticone ribbed ammonoid attaining a diameter of at least 25 mm; H about 40 per cent, W about 35 per cent, U about 33 per cent of diameter. Whorl section ovoid, both umbilical margin and venter being rounded. Phragmocone has about 15 strong, straight ribs per whorl, arising just outside the umbilicus, rising to maximum height near mid-flank, and fading on the outer third of the flank. Near end of phragmocone, ribs are bluntly tuberculate where highest at mid-flank. Suture line weakly ammonitic.

Remarks. This species is known only from one well preserved phragmocone, partly steinkern, partly preserved test. The tuberculate nature of the ribs is only visible near the end of the outer preserved whorl. Owing to the involution, only the inner part of the ribs of the inner whorls are exposed. They are well preserved and show no tuberculation. The external suture line is partly exposed. E is narrow with a blunt single point. The external saddle is weakly wrinkled. L has about four deep indentations. No ammonoids comparable with this species are known. It probably represents a new genus.

Etymology. The name commemorates Sir Edward Belcher.

Superfamily PINACOCERATACEAE (Mojsisovics, 1879)

Family GYMNITIDAE Waagen, 1895

Subfamily JAPONITINAE Tozer, 1971

Genus *Caucasites* Shevyrev, 1968

Type species. Caucasites evolutus Shevyrev.

Caucasites mulleri n. sp.

Plate 44, figures 11, 12; Figure 31a, b (p. 436)

Registered material. Holotype GSC 28371, paratype GSC 28372 (both GSC loc. 68226).

Occurrence. Lower Anisian, Mulleri Zone. Toad Formation, northeastern British Columbia. GSC loc. 68226 (4)

Diagnosis. Caucasites at least 50 mm in diameter, H about 30 per cent, W about 35 per cent, U about 45 per cent of diameter. Whorl section ovoid, with rounded umbilical shoulder, convex flanks widest near the umbilicus, converging on a bluntly rounded venter. Suture line with external and lateral saddles of about the same size.

Measurements. Holotype GSC 28371 (Pl. 44, fig. 12): at 29, 0.33, 0.36, 0.43.

Remarks. The outer whorl of the holotype is partly body chamber, which has a less elevated umbilical wall compared with that of the phragmocone. This suggests that the whorl section of the mature body chamber was more compressed than that of the phragmocone. The venter of the body chamber is not preserved. *Caucasites evolutus* Shevyrev (1968, p. 222) and *C. inflatus* Shevyrev (ibid., p. 223) differ from the new species in being more inflated. "*Japonites*" *chandra* Diener (1895b, p. 33) is probably a representative of *Caucasites*, but compared with *C. mulleri* is more evolute, has an acute venter and an external saddle appreciably smaller than the lateral saddle.

Etymology. The name commemorates Siemon W. Muller.

Genus *Japonites* Mojsisovics, 1893

Type species. Ceratites ?planiplicatus Mojsisovics.

Japonites wrighti n. sp.

Plate 47, figures 7a, b; Figure 34b (p. 442)

Registered material. Holotype GSC 28370 (GSC loc. 74740).

Occurrence. Lower or Middle Anisian, Caurus Zone? Toad Formation, northeastern British Columbia. GSC loc. 74740 (1).

Diagnosis. Japonites with phragmocone attaining a diameter of at least 115 mm; H about 40 per cent, W about 20 per cent, U about 35 per cent of diameter. Whorl section ovoid. Surface smooth.

Measurements. Holotype GSC 28370 (Pl. 47, fig. 7): at 75, 0.37, 0.20, 0.35.

Remarks. The body chamber is not preserved.

The most closely comparable species is *Japonites subacutus* Welter (1915, p. 125), from which the new species differs only in being more compressed and involute.

Japonites readi n. sp.

Plate 63, figures 1a–c

Registered material. Holotype GSC 72299 (GSC loc. C-90882).

Occurrence. Upper Anisian, Deleeni Zone. Toad Formation, northeastern British Columbia. GSC loc. C-90882 (1).

Diagnosis. Japonites attaining a diameter of more than 250 mm, H about 25 per cent, W about 20 per cent, U about 60 per cent of diameter. Whorl section ovoid, surface with very faint radial ribs, about eight to a quadrant.

Measurements. Holotype GSC 72299 (Pl. 63, fig. 1): at 204, 0.25, 0.18, 0.61.

Remarks. "*Gymnites*" *vastesellatus* Welter (1915, p. 118) is evidently congeneric and comparable with the new species. Both have suture lines with the depressed auxiliaries characteristic of *Japonites* rather than the retracted suspensive lobe of *Gymnites*. Compared with Welter's species, *Japonites readi* has less prominent ribbing, which is radial, not rursiradiate. Compared with *Japonites wrighti* n. sp., *J. readi* is much more evolute.

Etymology. The name is for Peter B. Read.

Genus *Tropigymnites* Spath, 1951

Type species. Sibyllites planorbis Hauer.

Tropigymnites haueri n. sp.

Plate 61, figures 1, 2; Figure 46a (p. 470)

Tropigymnites sp. cf. *T. planorbis* (Hauer); TOZER, 1967, p. 26, 69.

Registered material. Holotype GSC 28375, paratype GSC 28374 (both GSC loc. 74724).

Occurrence. Upper Anisian, Deleeni Zone. Toad Formation, northeastern British Columbia. GSC loc. 74724 (4).

Diagnosis. Tropigymnites attaining a diameter of about 30 mm, H about 30 per cent, W about 23 per cent, U about 45 per cent of diameter. Venter rounded on inner whorls, acute on outer. Sculpture consists of faint lateral ribs, about seven to a quadrant on the outer whorl. Suture line with external and lateral saddles of about the same size.

Measurements. Holotype GSC 28375 (Pl. 61, fig. 2): 30, 0.30, 0.23, 0.45.

Remarks. The holotype (Pl. 61, fig. 2), a nearly complete specimen, has an acute venter on the whole of the outer whorl. It is almost smooth, with faint ribs on the inner half of the flank. Ribs and growth lines are slightly convex on the flank and the growth lines are slightly projected on the venter. GSC 28374 (Pl. 61, fig. 1), is a broken specimen 20 mm in diameter showing the inner whorls in section. The outer whorl has an angular venter; the inner whorls have a rounded venter up to a diameter of 12 mm. Ribbing is more pronounced than on the holotype, with about 12 on the inner flank on the outer half whorl.

Remarks. Compared with *Tropigymnites planorbis* (Hauer) (1896, p. 271), *T. haueri* is smaller and acquires an acute venter at a smaller diameter; it is also a little more involute. The suture line of the new species lacks the discrete auxiliary lobe shown on Hauer's figure for *T. planorbis*, but otherwise there is a close resemblance. Specimens from the Rotelliformis Zone of Nevada identified as *Gymnites* (*Anagymnites*) *acutus* Hauer by Smith (1914, p. 54) and as *Tropigymnites*(?) sp. cf. *T. planorbis* (Hauer) by Silberling and Nichols (1982, p. 39) are more involute than *T. haueri*.

Etymology. The name commemorates Franz Ritter von Hauer.

Subfamily GYMNITINAE Waagen, 1895

Genus *Gymnites* Mojsisovics, 1882

Type species. Ammonites incultus Beyrich.

Gymnites procerus n. sp.

Plate 46, figures 7, 8; Figure 33b (p. 440)

Registered material. Holotype GSC 28376, paratype GSC 28377 (both GSC loc. 68226).

Occurrence. Lower Anisian, Mulleri Zone. Toad Formation, northeastern British Columbia. GSC loc. 68226 (3).

Diagnosis. Gymnites attaining a diameter of about 50 mm, H about 35 per cent, W about 17 per cent, U about 40 per cent of diameter. Whorl section narrowly ovoid with a low perpendicular umbilical wall, rounded umbilical shoulder and weakly convex flanks converging, with no suggestion of shoulders on a narrowly rounded, almost bluntly acute venter. Surface with slightly sinuous striae; no ribs. Suture line with relatively simple indentations and with a deep indentation in the outer side of the external saddle; suspensive lobe without individualized auxiliary lobes.

Measurements. Holotype GSC 28376 (Pl. 46, fig. 7): 27, 0.34, 0.17, 0.41.

Remarks. GSC 28377 (Pl. 46, fig. 8), a crushed, probably nearly complete specimen, 50 mm in diameter, with half a whorl of body chamber, indicates the size attained. *Gymnites procerus* is much smaller and more compressed, and has a less elaborately indented suture line compared with typical representatives of *Gymnites,* such as *G. incultus* (Beyrich) (Mojsisovics, 1882, p. 233). The relatively deep indentations in the lateral saddle are taken to justify assignment to *Gymnites* rather than to *Anagymnites*, in which they are characteristically shallow.

Gymnites compressus n. sp.

Plate 51, figures 1–3; Figure 32i, j (p. 438)

Registered material. Holotype GSC 28378 (GSC loc. 42400). Two paratypes GSC 28379, GSC 28380 (both GSC loc. 46512).

Occurrence. Middle Anisian, Hagei and Hayesi zones. Toad Formation, northeastern British Columbia. GSC locs. 42400 (1), 46512 (2).

Diagnosis. Gymnites attaining a diameter of about 70 mm, H about 35 per cent, W about 15 per cent, U about 33 per cent of diameter. Whorl section narrowly ovoid with a barely perceptible umbilical wall and shoulder, weakly convex flanks converging on a venter, which is acute at a small diameter, becoming narrowly rounded adorad. Surface with convex growth striae; no ribs. Suture line with a deep indentation on the outer side of the external saddle; suspensive lobe with three moderately discrete auxiliary lobes.

Remarks. The holotype (Pl. 51, fig. 3) is an incomplete phragmocone estimated to have been about 50 mm in diameter. The complete specimen presumably attained a diameter of about 70 mm. Parts of two whorls are preserved. The venter of the inner whorl is bluntly angular; of the outer, narrowly rounded. GSC 28380 (Pl. 51, fig. 1) is also estimated to have been about 70 mm in diameter. This specimen has

parts of three whorls preserved, the outer as steinkern, the inner with the test. The outer is body chamber with a flared aperture probably indicating the peristome. The whorl section is compressed with a barely perceptible umbilical wall and shoulder. Flanks are convex. The venter on the outer whorl is rounded; on the penultimate whorl, acute. On the outer quarter of the flank there are six raised ridges on the last 20 mm measured at the venter. Suture lines are not visible. GSC 28373 (Pl. 51, fig. 2) has a bluntly acute venter. The flank, at the outer third, is marked by a break in the curvature, a feature not discernible in the other specimens. Growth lines are well preserved. They are slightly convex on the inner flank and radial on the outer, outside the break in curvature.

Comparably compressed *Gymnites* include *G. procerus* n. sp. and "*Pinacoceras*" *delorenzoi* Martelli (1906, p. 128). *G. procerus* differs in having a rounded, not acute, venter at a comparable diameter; *G. delorenzoi* retains an acute venter to a larger diameter. *Gymnites*? *perplanus* Meek (Silberling and Nichols, 1982, p. 40) differs from both *G. procerus* and *G. compressus* in being more involute and in having a broader venter.

Gymnites(?) *perplanus* (Meek)

Plate 48, figures 8a, b; Figure 35f (p. 444)

Arcestes(?) *perplanus* Meek, 1877, p. 120, Pl. 1, figs. 7, 7a.

Gymnites perplanus (Meek); SMITH, 1914, p. 54, Pl. 15, figs. 7, 7a; SILBERLING and NICHOLS, 1982, p. 40, Pl. 30, figs. 11–16, Textfig. 21.

Registered material. Hypotype GSC 32369 (GSC loc. 89548).

Occurrence. Middle Anisian, Hayesi Zone. Toad Formation, northeastern British Columbia. GSC loc. 89548 (1).

Remarks. GSC 32369 (Pl. 48, fig. 8) is almost wholly septate and is probably a complete phragmocone. The whorls are compressed with an inclined umbilical wall, rounded umbilical shoulder, weakly convex flanks and an arched venter defined by rounded ventral shoulders. The surface is smooth except for faint, slightly convex ribs on the inner two thirds of the flank at the beginning of the outer whorl. Growth lines are not prominent but appear to be nearly radial. Agreement with the holotype in whorl section and proportions is close, except that the ventral shoulders of GSC 32369 are a little more distinct. Also, as far as is known, the specimens from the type locality (Nevada) do not have the faint ribs of GSC 32369. The suture line (Fig. 35f) resembles that of a specimen from Nevada (Silberling and Nichols, 1982, p. 40) but the Nevada specimen has more deeply indented elements and a more symmetrically indented external saddle. The differences in the indentation may reflect only a difference in size, the suture line of the Nevada specimen being larger than that of GSC 32369.

This species is more involute and has a broader venter compared with *Gymnites procerus* n. sp. and *G. compressus* n. sp. The body chamber has not yet been described. Although the species is undoubtedly a gymnitin, the exact generic reference is uncertain without knowledge of the body chamber.

Gymnites(?) sp. indet.

Plate 71, figure 1; Figure 54c (p. 490)

Registered material. GSC 28381 (GSC loc. 68284).

Occurrence. Ladinian, Poseidon Zone. Toad Formation, northeastern British Columbia. GSC loc. 68284 (1).

Remarks. GSC 28381 (Pl. 71, fig. 1) is a septate fragment, the remains of a large, evolute, compressed apparently smooth ammonoid. At a whorl height of 48 mm, W is about 10 mm and the venter is narrowly rounded. The suture line is only partly preserved (Fig. 54c). The external saddle is very wide with a deep indentation on the outer side. The suture line is more like that of *Buddhaites* or *Parapinacoceras* than *Gymnites*, but the wide umbilicus of the specimen precludes reference to either of these genera.

Genus *Discogymnites* n. gen.

Type species. Gymnites hollandi McLearn.

Diagnosis. Oxycone gymnitid. At a small diameter (less than 10 mm) coiled like *Gymnites* with an open umbilicus. Umbilicus occluded on the outer whorl. Venter narrowly rounded. Surface essentially smooth although there may be traces of radial sculpture on the phragmocone. Suture line with weakly indented saddles (unindented part about half of saddle width), external saddle almost symmetrical, suspensive lobe with at least seven auxiliary lobes.

Species assigned. Gymnites hollandi McLearn.

Age. Lower Anisian.

Remarks. The principal saddles are indented in the style of *Anagymnites* rather than *Gymnites* but *Discogymnites* is distinguished from *Anagymnites* by being involute at maturity and in consequence having a much longer suspensive lobe. *Parapinacoceras* and *Buddhaites* are coiled and have a whorl section much like *Discogymnites*, but both differ in having an external saddle that is deeply indented and assymmetrical. They also differ in having more distinct sculpture.

Discogymnites hollandi (McLearn)

Plate 43, figure 12; Plate 46, figures 9, 10; Plate 47, figure 3; Figures 30a (p. 434), 33h, i (p. 440)

Gymnites hollandi McLearn, 1946a, p. 14; McLEARN, 1946b, p. 3, Pl. 6, fig. 1; McLEARN, 1948, p. 16, Pl. 6, fig. 1.

Anagymnites hollandi (McLearn); TOZER, 1967, p. 71; McLEARN, 1969, p. 52, Pl. 12, figs. 1a, b; VAVILOV, 1978, p. 62, Pl. 7, fig. 7, Textfig. 2.

Registered material. Holotype GSC 6448 (GSC loc. 10660). Topotype GSC 28382 (GSC loc. 42338). Topotype GSC 85776* (GSC loc. C-90877). Hypotype GSC 28383 (GSC loc. 74733). Hypotype GSC 70990 (GSC loc. 74740).

Occurrence. Lower Anisian, Caurus Subzone 2. Toad Formation, northeastern British Columbia. GSC locs. 10660 (1), 42338 (1), 74733 (1), 74740 (1).

Remarks. This is a large species, the phragmocone attaining a diameter of about 210 mm. The phragmocone of the holotype, as shown on the side illustrated by McLearn (1969, Pl. 12, fig. 1b), has an occluded umbilicus. The other side (Pl. 43, fig. 12) shows that the umbilicus on the steinkern is open at the beginning of the body chamber, with a perpendicular umbilical wall and an abruptly rounded umbilical shoulder. A similar umbilical wall is shown by a topotype, GSC 28382 (Pl. 46, fig. 9). GSC 85776*, another topotype, shows low, rather rough, radial ribs or folds, about five to a quadrant, at a whorl height of 30 mm. GSC 28383 (Pl. 46, fig. 10), the remains of a specimen about 55 mm in diameter shows the evolute inner whorls. At a diameter of 7.2 mm, U is 2.2 mm; at 17.5 mm, U is 4 mm, becoming increasingly narrow on the two succeeding whorls. Because this specimen is so much smaller than the specimens from the type locality, exact comparisons are impossible, but the suture line (Fig. 33h) leaves no doubt that it is at least closely related. The small umbilicus, narrow venter and suture line of GSC 70990 (Pl. 47, fig. 3) are also comparable.

Genus *Anagymnites* Hyatt, 1900

Type species. Ammonites lamarcki Oppel.

Anagymnites via alaska McLearn

Plate 63, figures 2, 3

Anagymnites involutus var. *via alaska* McLearn, 1946a, p. 14; McLEARN, 1946b, p. 3, Pl. 7, fig. 1.

Anagymnites via alaska McLearn; McLEARN, 1948, p. 16, Pl. 7, fig. 1; McLEARN, 1969, p. 51, Pl. 11, figs. 2, 3, Textfig. 26.

Anagymnites via-alaskae [sic] McLearn; TOZER, 1967, p. 26, 72.

Registered material. Holotype GSC 6446 (GSC loc. 10693). Hypotype GSC 21730 (McLearn, 1969, Pl. 11, figs. 3a, b) (GSC loc. 10694).

Occurrence. Upper Anisian, Deleeni Zone. Toad Formation, northeastern British Columbia. GSC locs. 10693 (1), 10694 (1), 10695 (1).

Remarks. This species is known only from the specimens described by McLearn (1969).

Genus *Buddhaites* Diener, 1895b

Type species. Gymnites (*Buddhaites*) *rama* Diener.

Buddhaites hagei (McLearn)

Plate 48, figures 6, 7; Plate 49, figures 5-7; Figure 35a-c (p. 444), Figure 36d-g (p. 446)

Gymnites hagi McLearn, 1946a, p. 13, Appendix II, p. 1, Pl. 1, fig. 4; McLEARN, 1948, p. 15, Pl. 1, fig. 4.

Parapinacoceras hagi (McLearn); McLEARN, 1953a, p. 7.

Parapinacoceras hagei (McLearn); TOZER, 1967, p. 25, 72; McLEARN, 1969, p. 49, Pl. 10, figs. 2-5.

Registered material. Holotype GSC 6447 (McLearn, 1969, Pl. 10, figs. 5a, b), west of Mile Post 375, Alaska

Highway. Hypotype GSC 21727 (ibid., figs. 2a, b) (GSC loc. 36657). Hypotype GSC 21728 (ibid., figs. 3a, b) (GSC loc. 10713). Hypotype 21729 (ibid., figs. 4a, b) (GSC loc. 10659). Hypotype GSC 28384 (GSC loc. 40109). Hypotype GSC 28385 (GSC loc. 42337). Hypotype GSC 28386 (GSC loc. 74739). Four hypotypes GSC 28387, GSC 28388, GSC 28389, GSC 28390* (all GSC loc. 74736). Hypotype GSC 28391* (GSC loc. 58385).

Occurrence. Middle Anisian, Hagei Zone. Toad Formation, northeastern British Columbia; Sulphur Mountain Formation, Whistler Member, Alberta. GSC locs. 10659 (1), 10713 (1), 36657 (1), 40109 (1), 42337 (1), 42409 (2), 58385 (2), 74736 (6), 74739 (2), 99578 (1).

Remarks. Specific characters determined from the relatively large collection are as follows. The phragmocone attains a diameter of at least 125 mm (GSC 28390*); H is about 60 per cent, W about 20 per cent of the diameter. At this size the umbilicus is very small or occluded, the surface is without ribs and the venter is acute. At a diameter of 20–45 mm, the venter is bluntly acute or narrowly rounded and the inner two thirds of the flank bear blunt radial folds terminating abruptly at a poorly defined discontinuous spiral ridge. On the inner flank, these folds may coalesce in the form of bifurcating ribs. There are 12–14 folds at mid-flank on half a whorl. At a diameter of 25–30 mm the umbilicus is open with a width of about one fifth of the diameter. The suture line varies in details, but at a large diameter there are generally two deep indentations (adventitious lobes) on the outer side of the external saddle; the outer of these is the larger. The radial sculpture is taken to indicate affinity with *Buddhaites rama* (Diener) (1895b, p. 59), although in that species the umbilicus is larger, the ribbing denser and the pattern of adventitious lobes different, with the larger being on the inner side. *Parapinacoceras aspidoides* (Diener) (1900, p. 19) has a suture line like *B. hagei*, but differs in having spiral instead of radial sculpture.

Subfamily PLACITINAE Wang and He, 1976

Genus *Paragymnites* Hyatt, 1900

Type species. Placites sakuntala Mojsisovics.

Paragymnites symmetricus (Mojsisovics)

Plate 129, figures 5a, b; Plate 144, figures 13a, c; Figures 117h, i (p. 636)

Pinacoceras symmetricum Mojsisovics, 1873, p. 56, Pl. 22, figs. 2a–c.

Placites symmetricus (Mojsisovics), MOJSISOVICS, 1902, p. 302.

Placites sp., McLEARN, 1960a, p. 111, Pl. 18, fig. 8; TOZER, 1967, p. 39, 57, 58, 59.

Registered material. Hypotype GSC 12610 (McLearn, 1960a, Pl. 18, fig. 8) (GSC loc. 9741). Hypotype GSC 28392 (GSC loc. 9841). Hypotype GSC 28393* (GSC loc. 64638). Hypotype GSC 28394 (GSC loc. 68304).

Occurrence. Middle Norian, Rutherfordi and Columbianus zones; Upper Norian, Cordilleranus Zone. Pardonet Formation, northeastern British Columbia. GSC locs. 9741 (25), 9841 (2), 64638 (10), 68304 (7).

Remarks. Identified with this species are placitins with flat flanks and an arched venter, like *Placites*, but with a symmetrical external saddle. Compared with *P. sakuntala* (Mojsisovics) this species has flatter flanks and a less indented suture line.

Genus *Placites* Mojsisovics, 1896

Type species. Pinacoceras platyphyllum Mojsisovics.

Placites polydactylus (Mojsisovics)

Plate 147, figures 24a, b; Figure 120f, h (p. 644)

Pinacoceras polydactylum Mojsisovics, 1873, p. 52, Pl. 21, figs. 3–6; BRANCO, 1879, p. 43, Pl. 7, figs. 5g–i.

Placites polydactylus (Mojsisovics); MOJSISOVICS, 1902, p. 301; ARTHABER, 1905, Pl. 46, fig. 8; SIMIONESCU, 1913, Pl. 8, fig. 7; SHEVYREV, 1968, p. 227, Pl. 21, figs. 3, 4.

Placites sp., TOZER, 1967, p. 55, 77, 79.

Registered material. Hypotype GSC 28395 (GSC loc. 10141). Hypotype GSC 28396 (GSC loc. 64595). Hypotype GSC 28397* (GSC loc. 23374). Hypotype GSC 72300* (GSC loc. 98501).

Occurrence. Upper Norian, Amoenum Zone, Crickmayi Zone. Pardonet Formation, northeastern British Columbia; Tyaughton Group, Taseko Lakes area, British Columbia; Sutton Formation, Vancouver Island. GSC locs. 10141 (1), 23374 (1), 64595 (1), 98500 (1), 98501 (2), 98886 (1).

Remarks. Placitins identified with this species are distinguished from *Paragymnites symmetricus* (Mojsisovics) by having an asymmetrically divided external saddle with a single deep indentation in the outer side. GSC 72300* is a phragmocone 90 mm in diameter.

Family PINACOCERATIDAE Mojsisovics, 1879

Genus *Pinacoceras* Mojsisovics, 1873

Type species. Ammonites metternichi Hauer.

Pinacoceras sp. indet.

Plate 110, figures 4a, b; Figure 88a (p. 568)

Registered material. GSC 28422 (GSC loc. 83826).

Occurrence. Lower Norian, Kerri Zone. Pardonet Formation, northeastern British Columbia. GSC locs. 83826 (1), 98901 (1).

Remarks. Suture lines of GSC 28422 (Pl. 110, fig. 4, Fig. 88a) are moderately well preserved, the outerpart on one side, the inner on the other. The principal divisions of the external saddle are four bifid adventitious saddles, adjacent to two pyramidal lateral saddles.

The most closely comparable species appears to be *Pinacoceras verkhojanicum* Archipov (1974, p. 250). The coiling is similar, but *P. verkhoyjanicum* differs in having a pyramidal instead of bifid inner adventitious saddle flanked by four bifid outer adventitious saddles.

Pinacoceras parma Mojsisovics

Ammonites metternichi Hauer, 1846, p. 1, Pl. 1, fig. 1; Pl. 2, figs. 1, 2; Pl. 3, fig. 1 (only).

Pinacoceras parma Mojsisovics, 1873, p. 60, Pl. 26, fig. 2; MOJSISOVICS, 1896, p. 659, Pl. 18, figs. 7, 8; MOJSISOVICS, 1899, p. 105, Pl. 18, fig. 7, 8; DIENER, 1906, p. 161, Pl. 14, figs. 11a-c; MOJSISOVICS, 1902, p. 294, Pl. 18, fig. 1.

Pinacoceras subparma Mojsisovics, 1873, p. 61, Pl. 26, fig. 3.

Pinacoceras sp., McLEARN, 1960a, p. 111, Pl. 21, fig. 1; TOZER, 1967, p. 58, 81.

Registered material. Four hypotypes GSC 13495 (McLearn, 1960a, Pl. 21, figs. 1), GSC 33139*, GSC 33140*, GSC 33141* (all GSC loc. 9781). Hypotype GSC 32370* (GSC loc. 19678). Hypotype GSC 85777* (GSC loc. 98886).

Occurrence. Middle Norian, Columbianus Zone; Upper Norian, Amoenum Zone. Pardonet Formation, northeastern British Columbia; Parson Bay Formation, Vancouver Island, British Columbia. GSC locs. 9781 (6), 19678 (1), 98886 (1).

Remarks. None of the specimens from Canada are complete or well preserved. GSC 33139*, a whorl fragment about 50 mm high preserved as steinkern, has an acute venter and shows a bifid instead of pyramidal inner adventitious saddle, the character taken by Diener (1906, p. 162) to distinguish *Pinacoceras parma* from the otherwise similar *P. metternichi* (Hauer). According to Zapfe (1967, p. 26) these two taxa are possibly conspecific. GSC 33140*, a septate whorl fragment 65 mm in height, 16 mm wide, also has an acute venter and shows that proportions are much the same as for typical examples of *P. parma*. GSC 33141*, another septate fragment, attained a width of 30 mm. GSC 32370* is the remains of a phragmocone about 300 mm in diameter. The suture line is not well preserved, but is apparently like that of *P. parma*.

Family KLAMATHITIDAE new family

Oxycone, with very narrow tabulate or slightly sulcate venter. Surface smooth or with falcoid striae. Suture line with very large, wide L, small U2 and a suspensive lobe of feebly to moderately discrete auxiliary lobes. Deep indentations are present in the suture line all the way from the siphuncle to the base of L; these include one adventitious lobe and deep indentations on the outer side of L.

Genera included. Parahauerites Diener (1916b) (=*Fremontites* Smith, 1927), ?*Dieneria* Hyatt and Smith (1905), *Klamathites* Smith (1927).

Remarks. Klamathididae are possibly related to Carnitidae, but the differences in the suture lines are too profound to consider a relationship established. In the Carnitidae, L is clearly differentiated, narrow and symmetrically indented; in the Klamathitidae, it is wide and much more indented on the outer than on the inner side. In the Carnitidae, auxiliary lobes are discrete; in the Klamathitidae, they are not. The very broad L of the Klamathitidae resembles that of *Lanceolites* and some Khvalynitidae. However, there are differences, in the details and it is unlikely that any similarites between *Klamathites* and the much older *Lanceolites* and the Khvalynitidae have any phylogenetic significance.

Genus *Parahauerites* Diener, 1916b

Type species. Hauerites ashleyi Hyatt and Smith.

Parahauerites sp. indet.

Plate 92, figures 2a, b

Registered material. GSC 28419 (GSC loc. 68208).

Occurrence. Upper Carnian, Dilleri Zone. Ludington Formation, northeastern British Columbia. GSC loc. 68208 (1).

Remarks. GSC 28419 (Pl. 92, fig. 2) has a large E, a small U2 and a small auxiliary lobe below the umbilical shoulder. The saddles are ammonitic. The suture line resembles that of *P. ashleyi* (Hyatt and Smith) but compared with that species, GSC 28419 has a more deeply sulcate venter.

Genus *Klamathites* Smith, 1927

Type species. Klamathites schucherti Smith.

Klamathites sp. indet.

Plate 99, figs. 5, 6; Figure 78d (p. 546)

Klamathites sp. indet. TOZER, 1967, p. 62.

Registered material. GSC 28420, GSC 28421 (both GSC loc. 42389).

Occurrence. Upper Carnian, Welleri Subzone 2. Pardonet Formation, northeastern British Columbia. GSC loc. 42389 (2).

Remarks. The suture line of GSC 28420 (Pl. 99, fig. 5; Fig. 78d) is much like that of the types of *Klamathites schucherti* Smith (1927, p. 74), *K. kellyi* Smith (1927, p. 74) and *K. macrolobatus* Silberling (1959, p. 38), but does not correspond exactly with any of them. There is less resemblance to the suture lines of specimens from Nevada identified as *K. schucherti* by Silberling (1959, p. 38), in which the summit of the external saddle is more depressed in relation to the lateral saddle, compared with GSC 28420 and the type specimens mentioned above.

Superfamily PTYCHITACEAE Mojsisovics, 1882

Family STURIIDAE Kiparisova, 1958

Genus *Sturia* Mojsisovics, 1882

Type species. Amaltheus sansovinii Mojsisovics.

Sturia sansovinii (Mojsisovics)

Plate 46, figures 11a, b; Figure 33a (p. 440)

Amaltheus sansovinii Mojsisovics, 1869, p. 580, Pl. 18, figs. 1, 2.

Sturia sansovinii (Mojsisovics); MOJSISOVICS, 1882, p. 241, Pl. 49, figs. 6, 7 (?not 5); Pl. 50, fig. 1; DIENER, 1895b, p. 61, Pl. 15, figs. 1a, b; MARTELLI, 1904, p. 102, Pl. 6, fig. 5; ARTHABER, 1905, Pl. 36, figs. 3a, b; SIMIONESCU, 1913, p. 338, Pl. 7, fig. 8, Textfig. 69; SHEVRYEV, 1968, p. 216, Pl. 18, fig. 5, Textfig. 85.

Sturia sp. cf. *S. sansovinii* (Mojsisovics); WELTER, 1915, p. 99, Textfig. 7; ONUKI and BANDO, 1959, p. 101, Pl. 8, figs. 3, 4.

Sturia sp. KINDLE, 1946, p. 21; TOZER, 1967, p. 71; McLEARN, 1969, p. 8, Pl. 12, figs. 2a, b.

Registered material. Two hypotypes, GSC 21732 (McLearn, 1969, Pl. 12, figs. 2a, b; Tozer, 1984, p. 96), GSC 28398 (both GSC loc. 10660 = 42338).

Occurrence. Lower Anisian, Caurus Subzone 2. Toad Formation, northeastern British Columbia. GSC loc. 10660 (= GSC locs. 42338), 99579 (2).

Remarks. This species is characterized by having the spiral ridges sharpest and most closely spaced at the venter, broader and less sharp on the outer flank, and broadest and blunt on the inner flank. GSC 21732 (Tozer, 1984, p. 96) is a phragmocone 345 mm in diameter. At a diameter of 240 mm there are about 40 spiral ridges between the umbilicus and the venter. The contrast between the spiral sculpture on the inner and the outer flank is apparently less marked that on specimens from the type locality (Schreyer Alps, Austria), but in other characters agreement is close.

Although known only from the Lower Anisian in Canada, evidence from other parts of the world indicates that this species ranges into younger Anisian strata.

Family ISCULITIDAE Spath, 1951

Genus *Columbisculites* n. gen.

Type species. Columbisculites maclearni n. sp.

Diagnosis. Isculitid differing from *Isculites* Mojsisovics (= *Smithoceras* Diener, *Spitisculites* Diener, *Alloptychites* Spath) and *Nevadisculites* Bucher in having an occluded instead of open umbilicus.

Species included. Columbisculites maclearni n. sp.

Columbisculites maclearni n. sp.

Plate 45, figures 11a, b; Figure 32f (p. 438)

Registered material. Holotype GSC 33283, paratype GSC 33284* (both GSC loc. 10732).

Occurrence. Lower Anisian, Caurus Zone. Toad Formation, northeastern British Columbia. GSC loc. 10732 (3).

Diagnosis. Columbisculites about 27 mm in diameter, H and W about 50 per cent of diameter. Flanks and venter convex; ventral shoulders indistinct. Growth lines convex on flank, forming a sinus on the venter. Suture line with a narrow external saddle.

Measurements. Holotype GSC 33283 (Pl. 45, fig. 11): 27, 0.52, 0.50, 0.

Remarks. The holotype, although incomplete, shows a body chamber of one and three eighths of a whorl and part of the peristome at the venter, with a pre-peristomal constriction on the steinkern. It is probably the remains of a complete, mature example. The paratype, GSC 33284*, is similar, but the whole of the outer whorl is preserved.

Representatives of *Isculites* Mojsisovics differ from *Columbisculites maclearni* in having an open umbilicus. Representatives of *Nevadisculites* Bucher have a phragmocone with a small or occluded umbilicus, but differ in having an egressive body chamber.

Etymology. This species is named in memory of F.H. McLearn.

Family PTYCHITIDAE Mojsisovics, 1882

Genus *Ptychites* Mojsisovics, 1875b

Type species. Ammonites rugifer Oppel, here designated.

Designation of *Ammonites eusomus* Beyrich as type species by Diener (1915a, p. 667) is invalid because that species was not among those originally considered by Mojsisovics. It seems that no other formal designation has been made. *Ammonites rugifer*, one of the six species originally included in the genus by Mojsisovics (*in* Neumayr, 1875, p. 883) was regarded as the type species by Kummel (1957, p. L 180) with the statement that it had been designated by Spath. Spath (1951, p. 147) discussed the problem, but did not designate a type species. On the contrary, he assumed that Diener's selection had priority. Kiparisova (1958, p. 50) and Tozer (1961, p. 92) followed Diener; Shevyrev (1968, p. 212) followed Kummel.

Ptychites guloensis n. sp.

Plate 48, figures 1, 2; Figure 35d, e (p. 444)

Registered material. Holotype, GSC 70993 (GSC loc. 83873). Paratypes GSC 35315, GSC 35316*, GSC 35317* (all GSC loc. 68295). GSC 72303* (GSC loc. 99565).

Occurrence. Middle Anisian, Minor Zone. Toad Formation, northeastern British Columbia; Sulphur Mountain Formation, Whistler Member, northeastern British Columbia. GSC locs. 68295 (3), 83873 (1), 99565 (10).

Diagnosis. Ptychites attaining a diameter of at least 70 mm; H about 50 per cent, W 60–70 per cent, U about 15 per cent of diameter. Whorl section ovoid, the flanks and venter merging to form a perfect arch. Distinct ribbing absent, growth striae nearly or perfectly radial. Suture line with four lateral saddles, the outer two large and the inner two small. The inner two are depressed in relation to the large saddles. The outer large saddles are not bifid; the inner small saddles weakly bifid.

Measurements. Holotype GSC 70993 (Pl. 48, fig. 1): at 58, 0.49, 0.60, approx. 0.15.

Remarks. The holotype is incomplete, preserving only a quarter whorl of body chamber. When complete, it was presumably at least 70 mm in diameter. The suture line is well displayed only by the holotype (Fig. 35e). GSC 35315 (Pl. 48, fig. 2) shows no sutures but GSC 36316* and GSC 35317* show suture lines at a diameter of about 6 mm with a small external saddle (S1) and larger, rounded lateral saddles (S2, S3) (Fig. 35d). This species resembles *Ptychites domatus* (Hauer) (1851, p. 115), but differs in being less evolute.

Ptychites wrighti McLearn

Plate 48, figures 3, 4

Ptychites wrighti McLearn, 1946a, p. 9; McLEARN, 1946b, p. 3, Pl. 4, fig. 5; McLEARN, 1948, p. 12, Pl. 4, fig. 5; TOZER, 1967, p. 25, 73; McLEARN, 1969, p. 56, Pl. 10, figs. 1a–c, Textfig. 31.

Registered material. Holotype GSC 6442, topotype GSC 35318 (both GSC loc. 10731).

Occurrence. Middle Anisian, Minor Zone? Toad Formation, northeastern British Columbia. GSC loc. 10731 (3).

Remarks. This species differs from *Ptychites guloensis* n. sp. in having a symmetrically bifid second lateral saddle.

Ptychites trochleaeformis (Lindstroem)

Plate 62, figures 1a, b

Nautilus trochleaeformis Lindstroem, 1865, p. 3, Pl. 1, fig. 2.

Ammonites trochleaeformis (Lindstroem); OEBERG, 1877, p. 4, Pl. 1, fig. 1.

Ptychites trochleaeformis (Lindstroem); MOJSISOVICS, 1886, p. 89, Pl. 12, figs. 1, 2; Pl. 13, figs. 1a, b; KORCHINSKAYA, 1982, Pl. 21, figs. 1a, b.

Ptychites sp. cf. *P. trochlaeformis* (Lindstroem) [sic]; TOZER, 1961, p. 15, 93, Pl. 22, figs. 1, 2; TOZER, 1967, p. 27, 47, 72.

Aristoptychites trochleaeformis (Lindstroem); WEITSCHAT and LEHMANN, 1983, p. 39, Pl. 1, figs. 1a, b.

Registered material. Two hypotypes, GSC 14186 (Tozer, 1961, Pl. 22, figs. 1a, b), GSC 14187 (ibid., figs. 2a, b) (both GSC loc. 30341). Hypotype GSC 28400 (GSC loc. 55007). Hypotype GSC 72304* (GSC loc. C-90882).

Occurrence. Upper Anisian, Deleeni and Chischa zones. Schei Point Formation, Exmouth Island; Toad Formation, northeastern British Columbia; Sulphur Mountain Formation, Llama Member, Alberta. GSC locs. 25118 (2), 30341 (3), 55007 (7), C-90882 (1).

Remarks. Following Weitschat and Lehmann (1983, p. 40), specimens identified with this species have three large lateral saddles inside the small external saddle. In this way they differ from *Ptychites guloensis* n. sp. The two outer lateral saddles are rounded, the third is bifid. Of the specimens from Canada, a specimen from Exmouth Island exhibits this arrangement best (Tozer, 1961, Pl. 22, fig. 2b). GSC 28400 (Pl. 62, fig. 1) and GSC 72304* have two outer lateral saddles that are rounded, but the nature of the third saddle is not clear.

Ptychites hamatus n. sp.

Plate 65, figures 13, 14; Plate 67, figures 1–4; Plate 71, figures 2a, b; Figure 48d (p. 478), Figure 50a (p. 482), Figure 54b (p. 490)

Registered material. Holotype GSC 28401, paratype GSC 28402 (both GSC loc. 83875). Four hypotypes, GSC 28403, GSC 28405, GSC 28406, GSC 72341 (all GSC loc. 46484). Hypotype GSC 28408 (GSC loc. 74758).

Occurrence. Upper Anisian, Chischa Zone; Ladinian, Matutinum and Poseidon zones. Toad Formation, northeastern British Columbia; Sulphur Mountain Formation, Llama Member, northeastern British Columbia. GSC locs. 46484 (20), 74758 (6), 83852 (1), 83867 (4), 83875 (3), 83878 (4).

Diagnosis. Smooth *Ptychites* like *P. guloensis* n. sp., but having a suture line with three large non-bifid lateral saddles, of which the inner is not depressed in relation to the outer two.

Measurements. Paratype GSC 28402 (Pl. 65, fig. 14): 76, 0.51, 0.43, 0.12.

Remarks. The holotype (Pl. 65, fig. 13) is about the same size as the paratype (Pl. 65, fig. 14), but lacks a well preserved outer whorl. However, the suture line is evident (Fig. 48d). In the paratype, the suture line is seen only in the umbilicus; the length of the body chamber was 10 degrees more than one whorl.

The specimens from the Matutinum Zone (Pl. 67) do not appear to differ significantly from the type specimens, which are from the Chischa Zone. Those from the Poseidon Zone (e.g., Pl. 71, fig. 2) have a similar suture line, but have slightly projected instead of radial growth striae.

This species, like most or all of the *Ptychites* from the Deleeni, Chischa and Matutinum zones (Upper Anisian, Ladinian) of British Columbia, has three

large, lateral saddles on the flank with concordant summits, unlike *P. guloensis,* an older species, in which the inner saddle is depressed. The arrangement of the saddles in *P. hamatus* is much like that in *P. trochleaeformis* (Lindstroem) (1865, p. 3), which is also similar in whorl section. The suture line of *P. trochleaeformis* differs from that of *P. hamatus* in having a bifid inner large saddle. Most specimens of *P. trochleaeformis* also differ in having distinct ribbing. These differences may not be of great significance and it is possible that *P. hamatus* is no more than a variety of *P. trochleaeformis.*

Genus *Arctoptychites* Archipov, Korchinskaya and Tozer, *in* Archipov, 1974

Type species. Arctoptychites kruzini Bychkov.

Arctoptychites lingulatus n. sp.

Plate 69, figures 5, 6; Figure 52 (p. 486)

Ptychites n. sp. TOZER, 1967, p. 28, 67.

Registered material. Holotype GSC 28409 (GSC loc. 68285). Paratype GSC 28410 (GSC loc. 68289).

Occurrence. Ladinian, Poseidon Zone. Toad Formation, northeastern British Columbia. GSC locs. 68285 (1), 68289 (2).

Diagnosis. Arctoptychites with a rounded ventral ridge on the phragmocone. Growth lines strongly projected at about 20 degrees adjacent to the ridge, curving abruptly and aligned transversely where they cross the ridge in the form of a rounded rostrum. Flanks with moderately prominent ribs, about seven to a quadrant. Suture line has three large, lateral saddles with concordant summits on the flank; the outer two saddles are rounded, the inner is bifid.

Measurements. Holotype GSC 28409 (Pl. 69, fig. 5): 39, 0.44, 0.67, 0.20. Paratype GSC 28410 (Pl. 69, fig. 6): 72, 0.47, 0.50, 0.15.

Remarks. In the holotype (Pl. 69, fig. 5), the body chamber is not preserved. In GSC 28410 (Pl. 69, fig. 6) no sutures are seen. The outer whorl is probably wholly body chamber. The venter is arched, not ridged like that of the holotype. The venter is crossed by moderately projected growth lines. Despite the fact that GSC 28410 apparently does not have the distinctive ventral ridge of *Arctoptychites,* it is interpreted as having the morphology of a mature conch of this species on account of the similarity in lateral ribbing and its occurrence at the same locality as the holotype.

The projected ribbing and the course of the growth lines indicate that this species is congeneric with *Arctoptychites kruzini* Bychkov (*in* Bychkov et al., 1976, p. 143), *A. omolojensis* Archipov (1974, p. 248) and *A. popowi* Korchinskaya (1982, p. 57). All three differ in lacking the raised ventral ridge of *A. lingulatus* and also in having two bifid lateral saddles instead of one.

Genus *Istreites* Simionescu, 1913

Type species. Joannites (*Istreites*) *ptychitiformis* Simionescu.

Istreites nanuk (Tozer)

Plate 68, figures 3a, b

Ptychites nanuk Tozer, 1961, p. 93, Pl. 21, figs. 2–10, Textfig. 10; TOZER, 1967, p. 28, 45.

Registered material. Holotype GSC 14099 (Tozer, 1961, Pl. 21, figs. 9a, b), three paratypes GSC 14100 (ibid., Pl. 21, figs. 7a, b), GSC 14101 (ibid., Pl. 21, fig. 10); GSC 14105 (ibid., Pl. 21, figs. 8a, b, Textfig. 10) (all GSC loc. 26110). Paratype GSC 14102 (ibid., Textfig. 10a) (GSC loc. 26112). Four paratypes GSC 14097 (ibid., Pl. 21, figs. 4a, b), GSC 14098 (ibid., Pl. 21, figs. 6a, b), GSC 14103 (ibid., Textfig. 10c); GSC 14104 (ibid., Pl. 21, figs. 5a, b) (all GSC loc. 26111). Paratype GSC 14106 (ibid., Pl. 21, figs. 3a, b). Paratype GSC 14096 (ibid., Pl. 21, figs. 2a, b) (GSC loc. 26114).

Occurrence. Ladinian, Poseidon Zone? Schei Point Formation, Ellesmere Island. GSC locs. 26110 (10), 26111 (5), 26112 (1), 26113 (2), 26114 (1), 26115 (1), 51616 (10).

Remarks. Compared with this species, *Istreites ptychitiformis* Simionescu (1913, p. 318) has more convergent flanks, a more elaborately indented external saddle and more deeply indented lobes, but the basic similarities in the suture lines indicate that they are congeneric.

Family EOSAGENITIDAE new family

Diagnosis. Concentrically coiled, thick-whorled sphaerocones with an arched or broadly subtabulate venter. Sculptured with ribs or nodes on the inner

flank. Suture line with formula E, L, U2, U3, U1, I; external saddle large and narrow; saddles weakly to moderately indented.

Genera included. Eosagenites Tozer (1971), *Girthiceras* Diener (1909).

Rough similarity in shape, the presence of sculpture on the inner flank, and the large size of the external saddle suggest that *Eosagenites* and *Girthiceras* may be related. Both have no obvious relatives. The Isculitidae are somewhat comparable, but differ in their mode of coiling and in details of the suture line.

Genus *Eosagenites* Tozer, 1971

Type species. Sagenites gethingi McLearn.

Eosagenites gethingi (McLearn)

Plate 74, figures 10–14; Figure 57f, g (p. 496)

Sagenites gethingi McLearn, 1937a, p. 98, Pl. 1, fig. 12; McLEARN, 1947b, p. 12, Pl. 3, figs. 13–16; Pl. 4, fig. 5; TOZER, 1967, p. 29, 67.

Eosagenites gethingi (McLearn); TOZER, 1971, p. 1029.

Registered material. Holotype GSC 8806, topotypes GSC 9529, GSC 9530 (all Beattie Ledge, Peace River). Topotype GSC 28411 (GSC loc. 9131). Topotype GSC 28412 (GSC loc. 9340).

Occurrence. Ladinian, Meginae Zone. Toad Formation, northeastern British Columbia; Sulphur Mountain Formation, Llama Member, northeastern British Columbia. GSC locs. 9131 (9), 9163 (3), 9338 (12), 9340 (1), 45651 (1), 85588 (1).

Measurements. Holotype GSC 8806 (Pl. 74, fig. 12): 26, 0.46, 0.57, 0.22. Topotype GSC 28412 (Pl. 74, fig. 10): 37, 0.41, 0.51, 0.22.

Remarks. GSC 9530 (Pl. 74, fig. 13), a body chamber fragment, indicates the maxiumum size attained. When complete it was about 40 mm in diameter. GSC 28412 (Pl. 74, fig. 10) is a variant with thinner whorls than the holotype. The whorl section is oval with a perpendicular umbilical wall, rounded umbilical shoulder, convex flanks and an arched venter. Radial sculpture consists of growth lines of irregular strength. Some on the flank assume the form of low ribs, spaced at about five on half a whorl. These ribs are most clearly shown on the holotype (Pl. 74, fig. 12) and GSC 28412 (Pl. 74, fig. 10). Growth striae are radial or slightly prorsiradiate and may be slightly projected on the venter, as in GSC 28412 (Pl. 74, fig. 10). Strigate sculpture is also present. Much of the holotype (Pl. 74, fig. 12) has the test preserved. Most of GSC 9530 (Pl. 74, fig. 13) is steinkern. Both show radial and strigate sculpture. Details of the suture line are shown only by GSC 28411 (Pl. 74, fig. 14, Figs. 57f, g). Preservation is not perfect, but the essential morphological details are clear. E is deep, the external saddle is high, probably with a small, shallow indentation at the summit, although some suture lines apparently have a rounded summit. L and U2 have deep, simple denticulations. The summit of the lateral saddle is apparently rounded. Auxiliary lobes appear to be absent.

No closely comparable ammonoids are known. True Sagenitidae differ in having numerous deep complex indentations in the saddles.

Family SAGENITIDAE Spath, 1951

Genus *Sagenites* Mojsisovics, 1879

Type species. Ammonites reticulatus Hauer.

Sagenites spp. indet.

Plate 141, figure 5; Plate 144, figures 9a–c; Plate 145, figure 5; Plate 147, figures 23 a, b

Sagenites sp. indet., McLEARN, 1960a, p. 106, Pl. 19, figs. 5a, b; TOZER, 1967, p. 38, 39, 58, 80.

Registered material. GSC 13487 (McLearn, 1960a, Pl. 19, figs. 5a, b) (GSC loc. 9471). GSC 28415 (GSC loc. 64634). GSC 28416 (GSC loc. 6897). GSC 28417 (GSC loc. 68304). GSC 28418 (GSC loc. 82974).

Occurrence. Middle and Upper Norian, Columbianus, Cordilleranus and Amoenum zones. Pardonet Formation, northeastern British Columbia; Parson Bay Formation, Vancouver Island, British Columbia. GSC locs. 6897 (1), 9471 (1), 64634 (1), 68304 (1), 82974 (1).

Remarks. The *Sagenites* known from Canada are indeterminable, being either very small or imperfectly preserved. Lateral nodes are present only in GSC 13487 (McLearn, 1960a, p. 106). GSC 13487, GSC 28417 (Pl. 144, fig. 9) and GSC 28418 (Pl. 147, fig. 23) show parts of the suture line. On all three specimens, the external saddle is deeply indented.

Superfamily NATHORSTITACEAE (Spath, 1951)

Family PROTEUSITIDAE Spath, 1951

Genus *Tropigastrites* Smith, 1914

Type species. Tropigastrites trojanus Smith.

Tropigastrites(?) *costatus* n. sp.

Plate 51, figures 4a, b; Figure 38k (p. 450)

Registered material. Holotype GSC 28373 (GSC loc. 10706).

Occurrence. Middle Anisian, Hayesi Zone? Toad Formation, northeastern British Columbia. GSC loc. 10706 (1).

Diagnosis. Tropigastrites with H about 27 per cent, W about 25 per cent, U about 50 per cent of diameter. Venter subangular. Flanks with strong ribs (about 32 per whorl), straight and radial on inner two thirds of flank, fading abruptly, with slight adorad projection, near the venter. Suture line with external and lateral saddles of about the same size; external saddle distinctly denticulate, lateral saddles faintly so.

Measurements. Holotype GSC 28373 (Pl. 51, fig. 4): 27, 0.28, 0.24, 0.52.

Remarks. The holotype is wholly septate. The umbilical wall is narrow and perpendicular, the umbilical shoulder rounded, the flanks nearly flat and the venter very bluntly angular.

The generic affinity of this species is uncertain. The whorl section and ribbing invite comparison with *Danubites dritarashtra* Diener (1895b, p. 30), type of *Pseudodanubites,* but the suture line of that species is ceratitic, unlike that of the new species. Provisionally the species is assigned to *Tropigastrites* because that genus includes species with both ceratitic and weakly ammonitic suture lines, but the ribs of typical *Tropigastrites* are different, being projected in a distinctive fashion on the flank.

Genus *Tozerites* Silberling and Nichols, 1982

Type species. Columbites humboldtensis Smith.

Tozerites polygyratus (Smith)

Plate 65, figures 4a, b; Plate 66, figures 1, 2; Figure 49b (p. 480)

Celtites polygyratus Smith, 1914, p. 35, Pl. 20, figs. 1–4, 5–8 (?).

Celtites? *polygyratus* Smith. TOZER, 1967, p. 26, 69.

Tozerites polygyratus (Smith). SILBERLING and NICHOLS, 1982, p. 56, Pl. 27, figs. 24–29.

Registered material. Three hypotypes, GSC 28564, GSC 28565, GSC 28566* (all GSC loc. 40088). Hypotype GSC GSC loc. 28567 (GSC loc. 83875).

Occurrence. Upper Anisian, Chischa Zone. Toad Formation, northeastern British Columbia; Sulphur Mountain Formation, Llama Member, northeastern British Columbia. GSC locs. 40088 (3), 74726 (5), 83875 (1).

Measurements. Hypotype GSC 28564 (Pl. 66, fig. 1): 21.5, 0.23, 0.26, 0.56.

Family NATHORSTITIDAE Spath, 1951

Genus *Eonathorstites* n. gen.

Type species. Eonathorstites dieneri n. sp.

Diagnosis. Nathorstitid with a compressed outer whorl. Inner whorls serpenticone, first with a rounded venter, then with a low keel before becoming an acute ventered oxycone. Flanks on inner whorls with blunt ribs. Suture line with about four auxiliary lobes.

Species assigned. Eonathorstites dieneri n. sp.

Age. Ladinian.

Remarks. This genus is distinguished from other *Nathorstitidae* (*Indigirites, Nathorstites, Stolleyites*) by having serpenticone instead of globose inner whorls. There are also similarities between *Eonathorstites* and *Longobardites,* but they are probably superficial, *Longobardites* having a short, and *Eonathorstites* a long body chamber. *Longobardites* also differs in having a pseudoadventitious suture line at maturity.

Eonathorstites dieneri n. sp.

Plate 70, figures 1–6; Figure 53d–f

Registered material. Holotype GSC 28568, six paratypes GSC 28569–GSC 28574 (all GSC loc. 74758).

Occurrence. Ladinian, Poseidon Zone. Toad Formation, northeastern British Columbia. GSC loc. 74758 (20).

Diagnosis. Eonathorstites attaining a diameter of about 40 mm; W about 25 per cent of diameter and the umbilicus occluded. Inner whorls attain a width of about 40 per cent of diameter, and are evolute with a rounded venter and low radial ribs (10–14 per whorl) on the flank at a diameter of 10 mm; acquiring a low keel at a diameter of about 13 mm. Growth lines convex on inner whorls, falcoid on outer with a sinus on the outer flank. Suture line with weakly phylloid saddles.

Remarks. The holotype (Pl. 70, fig. 4) is a complete phragmocone preserving umbilicus callus showing that the body chamber was one whorl. This length is also seen in GSC 28574, sectioned vertically. These specimens, and also GSC 28573 (Pl. 70, fig. 6) indicate that a diameter of about 40 mm was attained. GSC 28569 (Pl. 70, fig. 1) shows a rounded venter at a diameter of 7 mm and at 10 mm the trace of a keel. GSC 28570 (Pl. 70, fig. 2), 11.5 mm in diameter, has a well defined keel. Replacement of low by high whorls at a diameter of about 13 mm, is illustrated by GSC 28571 (Pl. 70, fig. 3). Flanks of the outer whorl of GSC 28570 (Pl. 70, fig. 2) are sculptured with about 10 low crescentic ribs; outer whorl flanks of GSC 28571 (Pl. 70, fig. 3) with about 14 ribs. At a diameter of more than 13 mm, the specimens have only growth lines. On the holotype (Pl. 70, fig. 4), these are convex at a whorl height of 10 mm. On GSC 28572 (Pl. 70, fig. 5) and GSC 28573 (Pl. 70, fig. 6) at a height of 13 mm, they are falcoid, with a sinus on the outer half of the flank. GSC 28572 (Pl. 70, fig. 5) is broken and shows the serpenticone inner whorls, followed by an outer whorl with a lanceolate section. The venters of GSC 28571 (Pl. 70, fig. 3), GSC 28572 (Pl. 70, fig. 5) and the holotype (Pl. 70, fig. 4) have a distinctly raised keel. GSC 28573 (Pl. 70, fig. 6) is preserved to a diameter of 25 mm with an umbilicus that shows a further half whorl was originally present. This, the largest known specimen, has a raised keel at the beginning of the outer whorl, replaced, adorad, by an acute venter, presumably indicating the mature condition.

It is possible that compressed oxycones such as *Paraindigirites vaskovskii* Popov (1946, p. 55), and *Longobardites oleshkoi* Archipov (1974, p. 239) are related to *Eonathorstites dieneri,* but their inner whorls have not been described, making detailed comparisons impossible.

Etymology. The name commemorates Carl Diener.

Genus *Indigirites* Popov, 1946

Type species. Indigirites krugi Popov.

Indigirites freboldi n. sp.

Plate 70, figures 7–18, Figure 53a–c, g (p. 488)

Registered material. Holotype GSC 28576, seven paratypes GSC 28577–GSC 28583 (all GSC loc. 68286). Two paratypes GSC 28584, GSC 28585 (both GSC loc. 68284). Two paratypes GSC 28586, GSC 28587 (both GSC loc. 68289). Two paratypes GSC 28588, GSC 28589 (both GSC loc. 74755).

Occurrence. Ladinian, Poseidon Zone. Toad Formation, northeastern British Columbia. GSC locs. 68284 (17), 68285 (1), 68286 (160), 68289 (25), 74755 (2).

Diagnosis. Indigirites attaining a diameter of about 65 mm; W about 30 per cent of diameter and the umbilicus occluded. Examples with inflated whorls (W more than 50 per cent of diameter) attain a diameter of 10–20 mm. Inner whorls have blunt radial bullate ribs (up to about 14 per whorl) on the inner flank. Early whorls with rounded venter, penultimate whorl with raised keel, venter of outer whorl acute. Growth lines convex. Suture line with phylloid saddles; about six auxiliary lobes.

Remarks. That this species attained a diameter of about 65 mm is indicated by the holotype (Pl. 70, fig. 11), a complete phragmocone with umbilical callus showing that the body chamber extended one whorl beyond the last septum. Specimens of small diameter are highly variable: compressed and smooth or inflated and sculptured with bullate ribs. Compressed variants are exemplified by GSC 28583*, a phragmocone 16.5 mm in diameter, with a wholly smooth outer whorl and a width 30 per cent of the diameter. GSC 28580 (Pl. 70, fig. 10) at a comparable size, is more inflated, but nevertheless smooth. Examples with inflated sculptured whorls are GSC 28577 (Pl. 70, fig. 7), GSC 28578 (Pl. 70, fig. 8), GSC 28584 (Pl. 70, fig. 13), GSC 28586 (Pl. 70, fig. 16) and GSC 28587 (Pl. 70, fig. 15). The change from inflated sculptured whorls to smooth whorls is shown by GSC 28586 (Pl. 70, fig. 16). The diameter for this change is about 10 mm in GSC 28577 (Pl. 70, fig. 7), about 13 mm in GSC 28578 (Pl. 70, fig. 8). GSC 28587 (Pl. 70, fig. 15) is the largest known specimen with inflated sculptured whorls. In GSC 28577 (Pl. 70, fig. 7) and GSC 28587 (Pl. 70, fig. 15), the most dense arrangement of ribs is illustrated. GSC 28579 (Pl. 70, fig. 9) has an outer whorl with the venter at first rounded, later keeled.

GSC 28585 (Pl. 70, fig. 14) shows the stage with a raised, rounded keel. The holotype (Pl. 70, fig. 11) and GSC 28588 (Pl. 70, fig. 17) show that, on the adoral part of the complete phragmocone, the venter is acute and the growth lines are convex.

Tsvetkovites dolioliformis Vavilov and Korchinskaya (1973, p. 126) closely resembles some variants of *Indigirites freboldi* at a diameter of 10 mm, but at larger diameters *T. dolioliformis* develops large, distant, nodose ribs, unlike *I. freboldi. Tsvetkovites varius* Weitschat and Lehmann (1983, p. 48) is also somewhat similar, but has a more blunt keel than any example of *I. freboldi.* It is also not only more evolute, but apparently retains an open umbilicus at maturity. *Tsvetkovites* is provisionally regarded as a junior synonym of *Indigirites.*

Etymology. The name commemorates Hans Frebold.

Indigirites stolleyi n. sp.

Plate 72, figures 11, 12

Nathorstites sp., TOZER, 1967, p. 67.

Registered material. Holotype GSC 28605, two paratypes GSC 33142*, 33143* (both GSC loc. 10790). Paratype GSC 72207 (GSC loc. 98902).

Occurrence. Ladinian, Meginae Zone. Toad Formation, northeastern British Columbia; Liard Formation, northeastern British Columbia. GSC locs. 10790 (5), 42535 (?3), 98902 (4).

Diagnosis. Indigirites attaining a diameter of about 60 mm; at which W is about 33 per cent of diameter, and the umbilicus is occluded. Examples with inflated whorls (W more than 50 per cent of diameter) attain a diameter of more than 20 mm. Inner whorls subpentagonal in section with radial bullae on the inner flank, at the point of maximum whorl width. Raised, rounded keel present prior to the acquisition of high compressed whorls with an acute venter. Some have irregular spiral striae on test. Suture line with phylloid saddles; about four auxiliary lobes.

Remarks. GSC 72207 (Pl. 72, fig. 12), 62 mm in diameter, is the largest known specimen. The peristome is preserved on the flank and the body chamber is a little less than one whorl. The outer whorl of the holotype (Pl. 72, fig. 11) is initially inflated, with four slightly convex bullate nodes on the inner flank. The smooth, compressed, adorad half has an acute venter; the adapical part has a distinct, raised, rounded keel. The characteristic convex growth lines of *Indigirites* are clear. The test appears to be devoid of spiral sculpture. GSC 33142*, in contrast, has faint irregular spiral sculpture adjacent to the venter. GSC 33143* is the body chamber fragment of an individual that attained a diameter of about 60 mm.

The inner whorls of this species are like those of *Tsvetkovites* the outer whorl like that of *Indigirites.* This is taken to justify regarding these taxa as synonyms, despite the fact that the inner whorls of *Indigirites krugi* Popov (1946, p. 53) (type species of *Indigirites*) have not been described. *Indigirites stolleyi,* compared with *I. freboldi* n. sp., has thick, robustly sculptured whorls that attain a larger diameter; the mature shell is larger and thicker.

Etymology. The name commemorates E. Stolley.

Indigirites boehmi n. sp.

Plate 76, figures 1–17; Figure 59a–d (p. 500)

Nathorstites sp. cf. *N. lenticularis* (Whiteaves). McLEARN, 1930, p. 2.

Nathorstites sp. cf. *N. mcconnelli* (Whiteaves). McLEARN, 1930, p. 2; McLEARN, 1937a, p. 95; McLEARN, 1940a, p. 47; McLEARN, 1940b, p. 81 (in part).

Nathorstites sp. cf. *N. mcconnelli* var. (?) *lenticularis* (Whiteaves). McLEARN, 1937a, p. 95.

Nathorstites sp. cf. *N. mcconnelli* var. *lenticularis* (Whiteaves). McLEARN, 1940a, p. 47; McLEARN, 1940b, p. 81 (in part).

Nathorstites mcconnelli (Whiteaves). McLEARN, 1947b, p. 5, Pl. 2, figs. 4–6; SPATH, 1951, p. 145. (not *Popanoceras mcconnelli* Whiteaves, 1889, p. 138).

Nathorstites mcconnelli var. *lenticularis* (Whiteaves). McLEARN, 1947b, p. 5, Pl. 2, figs. 1–3. (not *Popanoceras mcconnelli* var. *lenticulare* Whiteaves, 1889, p. 140).

Nathorstites lenticularis (Whiteaves). SPATH, 1951, p. 145.

Nathorstites sp., TOZER, 1967, p. 29.

Nathorstites sp. aff. *N. mcconnelli* (Whiteaves). TOZER, 1967, p. 66 (in part).

Registered material. Holotype GSC 28590, four paratypes GSC 28591–GSC 28594 (all GSC loc. 68248). Six paratypes, GSC 28595–GSC 28598, GSC 28599*, GSC 28600 (all GSC loc. 68243). Three paratypes GSC 28601–GSC 28603 (all GSC loc. 9338). Paratype GSC 28604 (GSC loc. 9131). Four paratypes GSC 9520–GSC 9523 (Beattie Ledge, Peace River).

Occurrence. Ladinian, Meginae Zone. Toad Formation, northeastern British Columbia; Liard Formation, northeastern British Columbia. GSC locs. 9131 (80), 9163 (30), 9197 (35), 9213 (35), 9338 (175), 9340 (10), 10781 (10), 42300 (10), 42393 (2), 42394 (2), 42395 (3), 50043 (30), 50045 (40), 68243 (40), 68248 (10), 68351 (1), 74765 (20), 74766 (20), 74767 (20), 74768 (3), 98906 (3).

Diagnosis. Indigirites attaining a diameter of about 80 mm; W about 35 per cent of diameter and the umbilicus occluded. Examples with inflated whorls (W more than 50 per cent of diameter) may attain a diameter of about 40 mm. Inner whorls with blunt, radial bullate ribs (about 10 per whorl) on inner flank. Venter of inner whorls angular but without a raised keel. Umbilical wall, as defined by internal mould, undercut. Strigate sculpture may be present on both test and internal mould. Suture line with phylloid saddles; about four auxiliary lobes.

Remarks. GSC 28602 (Pl. 76, fig. 16) is the largest known specimen. Assuming a body chamber length of one whorl, the original diameter was about 80 mm. The largest specimens known at the type locality have a diameter of about 60 mm. Specimens of small diameter are highly variable, being compressed and smooth, or inflated and sculptured. Sculpture of inflated forms comprises convex bullate ribs, less commonly nodes, on the inner flank. Smooth compressed variants are exemplified by GSC 28593 (Pl. 76, fig. 5) and GSC 28603 (Pl. 76, fig. 10). Examples with inflated, sculptured whorls are GSC 28595 (Pl. 76, fig. 2) with seven bullate ribs on the outer whorl; GSC 28597 (Pl. 76, fig. 6) with seven nodes; GSC 28604 (Pl. 76, fig. 12) with 10 bullate ribs and GSC 28591 (Pl. 76, fig. 1) with 12 bullate ribs. GSC 28596 (Pl. 76, fig. 3) with the outer whorl at first smooth and with six ribs on the adorad half, forms a link between the smooth and sculptured forms. The change from sculptured to smooth whorls takes place at a diameter of about 15 mm in GSC 28594 (Pl. 76, fig. 8), about 20 mm on GSC 28601 (Pl. 76, fig. 13), and at about 28 mm (the maximum) on GSC 9523 (Pl. 76, fig. 11). The venter at a diameter of about 7 mm is generally rounded as in GSC 28595 (Pl. 76, fig. 2) and GSC 28596 (Pl. 76, fig. 3). At larger diameters, it is bluntly acute, ultimately sharp and truly acute. Curvature of the growth lines is distinctly convex. Irregular spiral sculpture is common, as in the holotype (Pl. 76, fig. 7), and GSC 28602 (Pl. 76, fig. 16). GSC 28597 (Pl. 76, fig. 6), the most inflated nucleus known, has two spiral ridges adjacent to the ventral ridge. Suture lines have the phylloid saddles characteristic of *Indigirites* (Figs. 59a–c). GSC 28597 (Pl. 76, fig. 6) has only one auxiliary lobe at a diameter of 12 mm.

Compared with *Indigirites freboldi* n. sp. and *I. stolleyi* n. sp., *I. boehmi* has different inner whorls, with a bluntly acute venter instead of a raised, rounded keel. *Indigirites freboldi* also differs in having a more compressed outer whorl. The outer whorls of *Indigirites krugi* Popov (1946, p. 53) and *I. tozeri* Weitschat and Lehmann (1983, p. 49) are like those of *I. boehmi.* The inner whorls of those species have not been described in detail, making further comparisons impossible.

Etymology. The name commemorates J. Boehm.

Genus *Nathorstites* Boehm, 1903

Type species. Popanoceras mcconnelli Whiteaves.

Nathorstites maclearni n. sp.

Plate 81, figures 1–8; Figure 64a–c (p. 510)

Popanoceras mcconnelli Whiteaves, 1889, p. 140 (in part).

Nathorstites sp., TOZER, 1963b, p. 32.

Nathorstites sp. aff. *N. mcconnelli* (Whiteaves). TOZER, 1967, p. 65, 66 (in part).

Registered material. Holotype GSC 28606, four paratypes GSC 28607–GSC 28610 (all GSC loc. 42355). Four paratypes GSC 28611–GSC 28614 (all GSC loc. 68242). Hypotype GSC 4720, "Liard River about 25 miles below Devil's Portage", collected by R.G. McConnell, 1887.

Occurrence. Ladinian, Maclearni Zone. Toad Formation, northeastern British Columbia; Liard Formation, northeastern British Columbia. GSC locs. 36420 (5), 42355 (16), 47486 (25), 50042 (25), 68236 (6), 68242 (27), 68252 (4), 68271 (4), 68292 (14).

Diagnosis. Nathorstites attaining a diameter of about 80 mm; at which W is about 33 per cent of diameter and the umbilicus occluded. Examples with inflated whorls (W more than 50 per cent of diameter) may

attain a diameter of about 40 mm. Inner whorls smooth or with very faint ribbing on the inner flank. Venter angular from a small diameter but without a raised keel at any stage. Growth lines convex on the inner whorls, falcoid, with a shallow sinus on the outer third of the flank, on the outer whorl. Irregular strigate sculpture present on the test. Umbilical wall, when not filled by callus, perpendicular. Suture line with moderately phylloid saddles, about four auxiliary lobes.

Remarks. GSC 28610 (Pl. 81, fig. 7), 80 mm in diameter is the largest known specimen. It has one whorl of body chamber and preserves the peristome. Specimens less than 22 mm in diameter (e.g., GSC 28607, Pl. 81, fig. 8) have very faint ribs on the inner flank. At larger diameters, ribbing is absent. GSC 28608 (Pl. 81, fig. 2), 35 mm in diameter, preserves much of the test with strigate sculpture. At diameters greater than about 7 mm, the venter is bluntly acute, ultimately truly acute. Curvature of growth lines is convex at a diameter of about 38 mm in GSC 28607 (Pl. 81, fig. 8), falcoid near the aperture of the largest known specimen (Pl. 81, fig. 7). A perpendicular umbilical wall is shown by immature specimens (e.g., GSC 28608, Pl. 81, fig. 2, 32 mm in diameter), which have not acquired the callus that seals the umbilicus at maturity. This callus is shown by the holotype (Pl. 81, fig. 6) and GSC 28610 (Pl. 81, fig. 7).

The outer whorl is much like that of species assigned to *Indigirites,* but *Nathorstites maclearni* differs in lacking the bullae or distinct ribs that characterize the inner whorls of *Indigirites freboldi* n. sp., *I. stolleyi* n. sp. and *I. boehmi* n. sp. *Nathorstites maclearni* also differs in acquiring falcoid striae on the outer whorl.

Etymology. The name commemorates F.H. McLearn.

Nathorstites macconnelli (Whiteaves)

Plate 86, figures 1–7; Plate 87, figures 1–8;
Figure 69a–c (p. 520), Figure 70a–b (p. 522)

Popanoceras mcconnelli Whiteaves, 1889, p. 138, Pl. 18, figs. 2, 2a, 2b.

Popanoceras mcconnelli var. *lenticulare* Whiteaves, 1889, p. 140, Pl. 18, figs. 3, 3a.

Nathorstites mcconnelli (Whiteaves). SMITH, 1927, p. 67, Pl. 107, figs. 3–5; McLEARN, 1947b, Pl. 8, figs. 7, 8 (only); TOZER, 1961, p. 91, Pl. 22, figs. 7a–c, 8a, b (only); TOZER 1967, p. 30, 65; TOZER, 1970, Pl. 17, figs. 20a, b.

Nathorstites lenticularis (Whiteaves). SMITH, 1927, p. 67, Pl. 107, figs. 6, 7; McLEARN, 1947b, Pl. 8, figs. 4, 5 (only).

Nathorstites macconnelli (Whiteaves). TOZER, 1972, Pl. 124, figs. 1–7; Pl. 125, figs. 1–4, Textfig. 1.

Nathorstites macconnelli has been recorded from Svalbard and Siberia, *N. lenticularis* from Svalbard, Siberia and Kotelny Island (Boehm, 1903; Diener, 1916a; Frebold, 1929a; Spath, 1951; Popov, 1961a; Vozin and Tikhomirova, 1964; Korchinskaya, 1972; Archipov, 1974; Bychkov et al., 1976; Dagys et al., 1979; Bychkov, 1982a). Some of these identifications are certainly incorrect, the others are doubtful. A complete synonymy cannot be compiled from the literature alone.

Registered material. Holotype GSC 4716, paratype GSC 4721 (holotype of *Popanoceras mcconnelli* var. *lenticulare),* paratype GSC 4716a, all three from Liard River "about 30 miles below Devil's Portage" collected by R.G. McConnell, 1887. Most or all of those collected "about 25 miles" below the portage are *Nathorstites maclearni* n. sp. (cf. Smith, 1927, p. 67). Hypotype GSC 14169 (Tozer, 1961, Pl. 22, figs. 7a–c). Hypotype GSC 14170 (Tozer, 1961, Pl. 22, figs. 8a, b) from Halfway River, about 4 miles (6.4 km) west of Mount Stearns, collected by Shell Oil Company, 1946. Eight topotypes GSC 21769 (Tozer, 1970, Pl. 17, figs. 20a, b), GSC 28014, GSC 28230 (Tozer, 1972, Pl. 124, figs. 7, 8) GSC 28615–GSC 28619 (all GSC loc. 42351). Hypotype GSC 28027 (ibid., Textfig. 1a, p. 638) (GSC loc. 42333). Two hypotypes GSC 28232 (ibid., Pl. 124, figs. 5, 6), GSC 28620 (both GSC loc. 42334). Two hypotypes GSC 28028 (ibid., Pl. 124, fig. 1, Textfig. 1b, p. 638), GSC 28231 (ibid., Pl. 124, figs. 3, 4) (both GSC loc. 68264). Five hypotypes GSC 28015, GSC 28016 (ibid., Pl. 125, figs. 3, 4) GSC 28026 (ibid., Pl. 124, fig. 2), GSC 28621, GSC 28622 (all GSC loc. 42335).

Occurrence. Ladinian, Sutherlandi Zone. Toad Formation, northeastern British Columbia; Liard Formation, northeastern British Columbia; Schei Point Formation, Table Island. GSC locs. 9797 (20), 30353 (5), 42297 (50), 42333 (5), 42334 (17), 42335 (35), 42350 (8), 42351 (60), 49998 (10), 68229 (60), 68231 (25), 68260 (1), 68261 (45), 68263 (1), 68264 (68), 68265 (5), 68266 (20), 68269 (2), 68279 (3), 68280 (10), 68363 (2), 74772 (1), 74773 (5), 74774 (3), 82645 (1), 84265 (4).

Diagnosis. Nathorstites attaining a diameter of about 100 mm, at which W is at least 30 per cent of diameter and umbilicus is occluded. Examples with inflated whorls (W more than 50 per cent of diameter) may

attain a diameter of at least 65 mm. Inner whorls virtually smooth at a diameter greater than 10 mm. Some, at least have blunt nodes at the umbilical margin at smaller diameter. Venter without a raised keel at any stage. Growth lines falcoid with a deep sinus on the outer third of the flank. Strigation faint or absent. Umbilical wall, where not filled by callus, undercut. Suture line with parallel sided or weakly phylloid saddles and about six auxiliary lobes.

Remarks. GSC 28619, a topotype (Pl. 86, fig. 7) 100 mm in diameter with more than one whorl of body chamber, is the largest known specimen. This specimen has the proportions of the holotype of Whiteaves' var. *lenticulare* (Pl. 86, fig. 1) with W 30 per cent of the diameter. The holotype (Pl. 86, fig. 2), 65 mm in diameter, is thicker (W 55 per cent). Topotypes GSC 28618 (Pl. 86, fig. 5, W 53 per cent) and GSC 28014 (Pl. 86, fig. 6) (W 43 per cent) are large specimens with inflation intermediate between that of the holotype and var. *lenticulare.* There seems to be no doubt that Whiteaves was correct in treating "*lenticulare*" as a variant of the same species as the holotype. GSC 28232 (Pl. 86, fig. 3), although only 26 mm in diameter is complete. The body chamber is one and one eighth of a whorl and the peristome, with a blunt rostrum, is preserved. Specimens of small diameter range in width from 30 to more than 70 per cent of the diameter. At a small diameter (about 10 mm), the whorls are weakly sculptured or smooth. The outer whorl of GSC 28621 (Pl. 87, fig. 2), with seven blunt nodes on the inner flank, is a sculptured example. GSC 28622 (Pl. 87, fig. 3) shows a trace of similar sculpture. GSC 28620 (Pl. 87, fig. 5) is smooth at the same size. At larger diameters, all specimens are smooth. Small specimens (e.g., GSC 28620, Pl. 87, fig. 5) have a rounded venter at a diameter of about 7 mm. At larger diameters the venter is at first bluntly, ultimately truly acute. Curvature of growth lines is falcoid at an early stage. GSC 28622 (Pl. 87, fig. 3) has a falcoid constriction at a diameter of 10 mm. Growth striae may almost assume the prominence of constrictions at larger diameters as in GSC 28616 (Pl. 87, fig. 4). Well preserved specimens commonly show at least a trace of irregular spiral ridges on the flank. They are most clearly shown on both the test surface and steinkern of the holotype (Pl. 86, fig. 2), GSC 28014 (Pl. 86, fig. 6) and GSC 4716a (Pl. 87, fig. 7). The umbilical wall as defined by the steinkern is rounded and undercut (Fig. 69c). The suture line is characterized by saddles that have parallel sides or are weakly phylloid (Figs. 69a, b, 70a, b). GSC 28621 (Pl. 87, fig. 2) already has three auxiliary lobes at a diameter of 9 mm.

Of the specimens from the Arctic Islands GSC 14169 (Tozer, 1961, Pl. 22, figs. 7a–c) has falcoid growth striae and probably represents this species.

Like *Nathorstites maclearni* n. sp., *N. macconnelli* differs from the species of *Indigirites* in having relatively smooth inner whorls, the whorls being entirely smooth at diameters greater than 10 mm. *Nathorstites macconnelli* differs from *N. maclearni* in having more pronounced falcoid curvature of the growth lines developed at a smaller diameter. There are also differences in whorl section apparent at both a small diameter and maturity, *N. macconnelli* having a more rounded umbilical shoulder and an undercut instead of perpendicular umbilical wall. The flanks are also different, those of *N. maclearni* being relatively flat on the inner two thirds, before sloping abruptly to the venter; those of *N. macconnelli* having a more regular curvature all the way from the inner flank to the venter. The whorl section of *N. maclearni* approaches the form of a gothic arch; that of *N. macconnelli,* by comparison, is heart shaped.

Genus *Stolleyites* Archipov, 1974

Type species. Nathorstites gibbosus Stolley.

Stolleyites intermedius (Frebold)

Plate 68, figures 9a, b

Nathorstites gibbosus var. *intermedia,* Frebold, 1929b, p. 305, Pl. 2, figs. 4–6.

Nathorstites gibbosus Stolley. TOZER, *in* FORTIER et al., 1963, p. 385; KORCHINSKAYA, 1972, p. 66, Pl. 2, figs. 11a, b (only?); not *Nathorstites gibbosus* Stolley, 1911, p. 119).

Nathorstites mcconnelli (Whiteaves). TOZER, 1961, p. 91, Pl. 22, figs. 5, 6 (only); not *Popanoceras mcconnelli* Whiteaves, 1889, p.138.

Registered material. Hypotype GSC 28624 (GSC loc. 26107). Two hypotypes GSC 14167, GSC 14168 (Tozer, 1961, Pl. 22, figs. 5, 6) (both GSC loc. 28442).

Occurrence. Ladinian or Lower Carnian. Blaa Mountain Formation, Ellesmere Island. GSC locs. 26107 (1), 28442 (4).

Remarks. GSC 28624 (Pl. 68, fig. 9) has four blunt radial folds on the last half whorl. Of the specimens described from Svalbard it most closely resembles figures 5, 5a, Pl. 2 of Frebold (1929b). GSC 14168

(Tozer, 1961, Pl. 22, figs. 6a, b) more closely resembles Frebold's var. *globosa* (op. cit. figs. 7, 7a, 8). Like the specimens from Svalbard those from Canada have non-phylloid saddles. They closely resemble *Stolleyites gibbosus* (Stolley, 1911, p. 119), but typical examples of that species are more compressed.

Stolleyites sp. indet.

Plate 88, figures 12a, b; Figure 71b (p. 524)

Registered material. GSC 28623 (GSC loc. 83824).

Occurrence. Lower Carnian, Desatoyense Zone. Liard Formation, northeastern British Columbia. GSC loc. 83824 (1).

Remarks. The acute venter, occluded umbilicus and suture line of GSC 28623 (Pl. 88, fig. 12) leave no doubt that it is a nathorstitid. It is not well preserved but apparently has one radial pleat, suggesting reference to *Stolleyites* rather than *Nathorstites*.

Family THANAMITIDAE Tozer, 1971

Genus *Thanamites* Diener, 1908

Type species. Thanamites bicuspidatus Diener.

Thanamites schooleri (McLearn)

Plate 75, figures 1–3; Figure 58b–d (p. 498)

Isculites schooleri McLearn, 1930, p. 5, Pl. 1, fig. 6; McLEARN, 1937b, p. 128; McLEARN, 1947b, p. 17, Pl. 3, figs. 10–12.

Thanamites schooleri (McLearn). McLEARN, 1953a, p. 6.

Thanamites schoolerensis (McLearn) [sic]. TOZER, 1967, p. 29, 67.

Registered material. Holotype GSC 9046, two topotypes GSC 9528, GSC 28625 (all Beattie Ledge, Peace River). Topotype GSC 85778* (GSC loc. 9197).

Occurrence. Ladinian, Meginae Subzone 2. Toad Formation, northeastern British Columbia. GSC locs. 9131 (25), 9197 (25), 9338 (14), 42395 (1).

Measurements. Holotype GSC 9046 (Pl. 75, fig. 1): 36, 0.33, 0.42, 0.33.

Remarks. The holotype is a complete specimen with a contracted body chamber. GSC 28625 (Pl. 75, fig. 3), which also preserves the mature peristome, is somewhat smaller. In GSC 9528 (Pl. 75, fig. 2), the complete phragmocone is involute. Suture lines are fairly well preserved in GSC 9528 and GSC 28625 (Figs. 58b–d). L appears to be goniatitic. GSC 85778* is a phragmocone 17 mm in diameter showing the septal surface. Lobe formula is E, L, U2, U3, U1, I.

The shape and suture plan suggest affinity with *Thanamites bicuspidatus* Diener (1908, p. 31) and *T. ladinus* (Welter) (1915, p. 80), despite the fact that those species apparently have an indentation in L, unlike *T. schooleri*. *Thanamites bicuspidatus* also differs in being smaller, with a less excentric umbilicus. The coiling of *T. ladinus* is more similar, but it differs in acquiring a somewhat angular venter on the outer whorl. "*Nannites*" *bittneri* Mojsisovics (1882, p. 210) and "*N.*" *fugax* Mojsisovics (ibid., p. 211) have suture lines like *T. schooleri* and are probably congeneric. More detailed comparison with "*N.*" *fugax* is impossible because it is known only from the phragmocone. "*Nannites*" *bittneri* is much smaller and has a much smaller umbilicus than *T. schooleri*.

Thanamites parvus (McLearn)

Plate 75, figures 4, 5; Figure 58h (p. 498)

Isculites schooleri var. *parvus* McLearn, 1937a, p. 98, Pl. 1, fig. 7; McLEARN, 1947b, Pl. 3, figs. 7–9.

Thanamites schoolerensis parvus (McLearn) [sic]. TOZER, 1967, p. 67.

Registered material. Holotype GSC 8793, topotype GSC 9527, (both Beattie Ledge, Peace River). Topotype GSC 35356* (GSC loc. 9131).

Occurrence. Ladinian, Meginae Subzone 2. Toad Formation, northeastern British Columbia. GSC locs. 9131 (1), 9197 (2), 9213 (2), 9338 (8), 42393 (1).

Measurements. Topotype GSC 9527 (Pl. 75, fig. 4): 23, 0.35, 0.37, 0.33.

Remarks. GSC 9527 (Pl. 75, fig. 4) is a complete specimen, the holotype (Pl. 75, fig. 5) is incomplete. In this species at least half a whorl of the phragmocone as well as the body chamber has an open umbilicus. The holotype (Pl. 75, fig. 5a) has one deep constriction on the phragmocone. No constrictions are visible on the topotype (Pl. 75, fig. 4). Slight contraction in the width of the body chamber is seen on the holotype but not

the topotype. In these specimens the body chamber is concealed by the suture line. GSC 35356*, an incomplete specimen 17 mm in diameter, shows much of the external suture line. L appears to be rounded (Fig. 52h).

This species differs from *T. schooleri* (McLearn) in having an umbilicus, which is open on part of the phragmocone.

Genus *Indoceltites* Diener, 1919

Type species. Celtites trigonalis Diener.

Indoceltites transiens n. sp.

Plate 75, figures 6a–c; Figure 58a (p. 498)

Thanamites schoolerensis (McLearn) [sic]. TOZER, 1967, p. 66 (only).

Registered material. Holotype GSC 28626 (GSC loc. 68351).

Occurrence. Ladinian, Meginae Subzone 2. Toad Formation, northeastern British Columbia. GSC loc. 68351 (1).

Diagnosis. Indoceltites about 20 mm in diameter; H about 27 per cent, W about 35 per cent, U about 45 per cent of diameter. Geniculation weak, initiated at start of body chamber. Phragmocone with open umbilicus for at least one whorl. Surface mostly smooth except for weak prorsiradiate ribbing on the body chamber, and one prorsiradiate constriction on the phragmocone. Suture line with a goniatitic lateral lobe.

Measurements. Holotype GSC 28626 (Pl. 75, fig. 6): 18.5, 0.27, 0.36, 0.44.

Remarks. In the holotype, the inner whorls are preserved by the test, the outer whorl is steinkern. Remains of the peristome are preserved showing the body chamber length to be one eighth less than a full whorl. The ribbing on the body chamber is irregular. Five ribs are discernible on the adapical quadrant. Near the aperture they are more closely spaced. The last two septa are approximated.

This species occupies a position linking *Thanamites* and *Indoceltites*. Resemblance to *Thanamites parvus* (McLearn) is close, but *I. transiens* differs in being more evolute, on both phragmocone and body chamber, and not appreciably excentrumbilicate; also, no *Thanamites* are geniculate. The geniculation of the outer whorl, evolute mode of coiling and the goniatitic suture line all indicate affinity with *Indoceltites trigonalis* (Diener) (1908, p. 29) and *I. contractiformis* (Diener) (1909, p. 18). *Indoceltites contractiformis* has constricted whorls, like *I. transiens*. Both *I. trigonalis* and *I. contractiformis* differ from *I. transiens* in having parabolic sculpture (auriculoids) near the aperture. Another related species is probably "*Lobites*?" *aberrans* Mojsisovics (1882, p. 178). The suture line of that species is unknown, but the external similarities leave little doubt that it is congeneric with *Indoceltites transiens*.

Genus *Drumoceras* Wang and He, 1976

Type species. Drumoceras minor Wang and He.

Drumoceras tuberculatum n. sp.

Plate 75, figures 7–10; Figure 58e, f (p. 498)

Registered material. Holotype GSC 28627 (GSC loc. 74768). Two paratypes GSC 28628, GSC 28629 (both GSC loc. 50045). Paratype GSC 28630 (GSC loc. 74766).

Occurrence. Ladinian, Meginae Subzone 2. Toad Formation, northeastern British Columbia. GSC locs. 50045 (6), 74766 (4), 74768 (1).

Diagnosis. Drumoceras about 33 mm in diameter; H about 30 per cent, W about 38 per cent, U about 45 per cent of diameter. Body chamber contracted, phragmocone being wider than the body chamber. Phragmocone cadicone, with an angular, tuberculate umbilical shoulder to within half a whorl of the aperture, where it becomes rounded and smooth. Umbilical tubercles are slightly bullate; from stem, delicate ribs extend a short distance across the flank. Outer flank and venter smooth.

Measurements. Holotype GSC 28627 (Pl. 75, fig. 9): 32.5, 0.29, 0.38, 0.44.

Remarks. The holotype (Pl. 75, fig. 9) is a complete mature specimen. Maximum width, on the phragmocone, is 12.5 mm; width at the aperture, 10 mm. Suture lines are tolerably well preserved on GSC 28629 (Pl. 75, fig. 10), a phragmocone. On what appears to be the best preserved line, L is goniatitic, but other lobes have a suggestion of one or two small indentations.

The cadicone phragmocone and umbilical tuberculation indicate close affinity with *Drumoceras*

minor Wang and He (1976, p. 339). The suture line of *D. minor* is described as goniatitic, probably another point of resemblance. The septate whorls of *D. minor* appear to be more depressed than those of *D. tuberculatum*. The body chamber of *D. minor* is not known, making more detailed comparisons impossible.

Drumoceras anodosum n. sp.

Plate 75, figures 11a-c

Registered material. Holotype GSC 28631 (GSC loc. 74765).

Occurrence. Ladinian, Meginae Subzone 2. Toad Formation, northeastern British Columbia. GSC loc. 74765 (1).

Diagnosis. Drumoceras like *D. tuberculatum* n. sp. but without tuberculation at the umbilical shoulder.

Measurements. Holotype GSC 28631 (Pl. 75, fig. 11): 28.5, 0.33, 0.42, 0.36.

Remarks. Most of the suture line is invisible, because it is covered by the last whorl. What appears to be the last septum is visible in the umbilicus, indicating a body chamber length of one and a quarter whorls.

Superfamily CLYDONITACEAE Hyatt, 1877

Family TRACHYCERATIDAE Haug, 1894

Subfamily PROTRACHYCERATINAE Tozer, 1971

Genus *Eoprotrachyceras* Tozer, 1980a

Type species. Eoprotrachyceras matutinum Tozer.

Eoprotrachyceras matutinum Tozer

Plate 67, figures 5, 6; Figure 50b (p. 482)

Protrachyceras sp. cf. *P. meeki* Mojsisovics. TOZER, 1967, p. 27, 68, Pl. 8, figs. 1, 2.

Eoprotrachyceras matutinum Tozer, 1980a, p. 107, Pl. 17.1, figs. 1-7.

Registered material. Holotype GSC 28632, paratype GSC 28633 (both GSC loc. 83862). Two topotypes, GSC 18900 (Tozer, 1967, Pl. 8, figs. 1a, b), GSC 18901 (ibid., figs. 2a, b) (both GSC loc. 46484).

Occurrence. Ladinian, Matutinum Zone. Sulphur Mountain Formation, Llama Member, northeastern British Columbia. GSC locs. 46484 (2), 83862 (2).

Diagnosis. Eoprotrachyceras at least 40 mm in diameter; H about 40 per cent, W about 30 per cent, U about 35 per cent of diameter. Outer whorl with up to six spirals of tubercles, one weak umbilical, two or three lateral, one marginal and one external.

Remarks. The holotype (Pl. 67, fig. 6), the remains of an example that attained a diameter of more than 40 mm, has umbilical, two lateral, marginal and external tubercle-spirals. It is preserved as an internal mould and the tuberculation is subdued, reflecting the development of the preseptal layer. GSC 28633 (Pl. 67, fig. 5) and GSC 18901 (Tozer, 1967, Pl. 8, figs. 2a, b) do not have the umbilical shoulder preserved. They, unlike the holotype, have three lateral spirals. In GSC 18901 the inner spiral is of larger tubercles than the outer two. This specimen is the remains of an individual appreciably larger than the holotype. GSC 18900 (ibid., Pl.8, figs. 1a, b) has two lateral spirals like the holotype, but barely perceptible umbilical tuberculation. The ceratitic suture line characteristic of *Eoprotrachyceras* is shown only in the holotype (Fig. 50b). Although the four specimens assigned to this species differ from one another in the details of tuberculation, they are interpreted as representing one species because they occur in the same bed.

Eoprotrachyceras gibsoni n. sp.

Plate 68, figures 8, 10

Registered material. Holotype GSC 28634, paratype GSC 28635 (both GSC loc. 85533).

Occurrence. Ladinian, Matutinum Zone. Sulphur Mountain Formation, Llama Member, Alberta. GSC loc. 85533 (2).

Diagnosis. Eoprotrachyceras at least 50 mm in diameter, H about 50 per cent, W about 25 per cent, U about 17 per cent of diameter. Outer whorl with six spirals of tubercles: umbilical, three faint lateral, marginal and external. Lateral tuberculation absent on adoral part of the outer whorl.

Measurements. Holotype GSC 28634 (Pl. 68, fig. 8): 51, 0.51, 0.25, 0.17.

Remarks. The holotype (Pl. 68, fig. 8), mostly preserved as an internal mould, has elevated, clavate

external tubercles on the last half whorl. On the preceding segment these tubercles are low and smooth, with an abrupt boundary between the two kinds of tuberculation. This abrupt change evidently indicates the extent of the preseptal layer. No septa are visible, most or all of the specimen apparently being body chamber. GSC 28635 (Pl. 68, fig. 10), has tuberculation like the holotype. It has a rounded, unindented external saddle at a whorl height of 7 mm. The suture line and tuberculation indicate affinity with *Eoprotrachyceras matutinum* Tozer, which differs in being more evolute and in having more conspicuous lateral tuberculation.

Etymology. The name is for D.W. Gibson.

Genus *Protrachyceras* Mojsisovics, 1893

Type species. Trachyceras archelaus Laube.

Protrachyceras sikanianum McLearn

Plate 71, figures 6–8; Plate 75, figures 12, 13; Plate 77, figures 6a–c; Plate 79, figures 14, 15; Figure 54e (p. 490), Figure 58g (p. 498), Figure 60d (p. 502)

Protrachyceras sikanianus McLearn, 1930, p. 4, Pl. 1, fig. 1.

Protrachyceras sikanianum McLearn McLEARN, 1943, p. 53, Pl. 1, figs. 1–16; McLEARN, 1947b, p. 20, Pl. 1, figs. 2–5; TOZER, 1967, p. 29, 66, 67.

Protrachyceras sikanianus var. *zauwae* McLearn, 1930, p. 5, Pl. 1, fig. 4.

Protrachyceras sikanianum var. *zauwae* McLearn. McLEARN, 1943, p. 56, Pl. 2, figs. 1–4.

Protrachyceras zauwae McLearn. McLEARN, 1947b, p. 21, Pl. 1, fig. 1.

Protrachyceras sp. cf. *P. archelaus* (Laube). TOZER, 1963b, p. 32.

Protrachyceras sp. cf. *P. sikanianum* McLearn. TOZER, 1967, p. 28, 67.

Protrachyceras sp. aff. *P. sikanianum* McLearn. TOZER, 1967, p. 30, 65, 66.

Registered material. Holotype GSC 9044, holotype var. *zauwae,* GSC 9045, four topotypes, GSC 1491 (McLearn, 1943, Pl. 1, figs. 1–3), GSC 1492 (ibid., figs. 7–9), GSC 1493 (ibid., figs. 13, 14), GSC 1494 (ibid., figs. 15, 16), all from Beattie Ledge, Peace River. Hypotype GSC 28636 (GSC loc. 74758). Hypotype GSC 28637 (GSC loc. 68286). Hypotype GSC 28638 (GSC loc. 68289). Two hypotypes GSC 28639, 28640 (both GSC loc. 42355). Hypotype GSC 28861 (GSC loc. 68237).

Occurrence. Ladinian, Poseidon, Meginae and Maclearni zones. Toad and Liard Formations, northeastern British Columbia. GSC locs. 9131 (25), 9163 (20), 9197 (10), 9338 (25), 9340 (5), 9341 (8), 42355 (3), 42393 (3), 42394 (1), 42395 (1), 42535 (2), 68236 (1), 68237 (5), 68243 (1), 68248 (1), 68286 (7), 68289 (1), 68292 (1), 74748 (1), 74758 (1), 83861 (1), 84246 (1), 84264 (4), 85588 (3).

Remarks. This species is interpreted in a broad sense and includes *Protrachyceras* with six to eight spirals of tubercles on the outer whorl: umbilical; three, four or five lateral; marginal and external. Evolute, thick variants (e.g., the holotype of var. *zauwae,* Pl. 75, fig. 13) and GSC 28640 (Pl. 79, fig. 15) have three lateral spirals. Involute, compressed variants have four, e.g., GSC 28637 (Pl. 71, fig. 6), GSC 28639 (Pl. 79, fig. 14) or five, e.g., the holotype (Pl. 75, fig. 12). All retain tuberculation to a large diameter, probably to maturity. Significant differences between specimens from the Poseidon, Meginae and Maclearni zones are not apparent. Evolute thick variants are comparable to *P. archelaus* (Laube), compressed variants to *P. longobardicum* Mojsisovics.

Protrachyceras sp. indet.

Plate 68, figures 4a, b

Protrachyceras sp. indet., TOZER, 1961, p. 14, 75, Pl. 21, figs. 1a, b.

Registered material. GSC 14190 (GSC loc. 26110).

Occurrence. Ladinian, Poseidon Zone? Schei Point Formation, Ellesmere Island. GSC loc. 26110 (1).

Remarks. The poorly preserved specimen is part phragmocone, part body chamber. External and marginal tuberculation is clearly shown. Lateral tuberculation consists of two or three spirals. Umbilical tuberculation is apparently absent. The lateral saddle is indented indicating reference to *Protrachyceras,* not *Eoprotrachyceras.*

Genus *Spirogmoceras* Silberling, 1956

Type species. Trachyceras (Protrachyceras) shastense Smith.

Spirogmoceras shastense (Smith)

Plate 92, figures 13a, b

Trachyceras (*Protrachyceras*) *shastense* Smith, 1904, p. 391, Pl. 46, figs. 9, 9a, Pl. 48, figs. 3, 4; SMITH, 1927, p. 81, Pl. 5, figs. 1–19.

Trachyceras (*Protrachyceras*) *lecontei* Hyatt and Smith, 1905, p. 194, Pl. 44, figs. 1, 2; Pl. 45, figs. 1–9; Pl. 46, figs. 1–15; SMITH, 1927, p. 78, Pl. 6, fig. 1; Pl. 44, figs. 1, 2; Pl. 45, figs. 1–9; Pl. 46, figs. 1–15.

Trachyceras (*Protrachyceras*) *beckeri* Smith, 1927, p. 79, Pl. 4, figs. 1–8.

Trachyceras (*Protrachyceras*) *californicum* Smith, 1927, p. 79, Pl. 1, figs. 1, 2; Pl. 2, figs. 1–7.

Trachyceras (*Protrachyceras*) *lindgreni* Smith, 1927, p. 80, Pl. 3, figs. 1–6.

Trachyceras (*Protrachyceras*) *madisonense* Smith, 1927, p. 80, Pl. 6, figs. 2–14.

Spirogmoceras shastense (Smith); SILBERLING, 1956, p. 1152; SILBERLING, 1961, p. 539, Pl. 74, figs. 16, 17; TOZER, 1967, p. 33, 64.

Spirogmoceras sp., CARLISLE and SUSUKI, 1965, p. 474, Pl. 4, figs. 24–27; SOUTHER, 1971, p. 78.

Registered material. Hypotype GSC 28642 (GSC loc. 68208). Hypotype GSC 28643* (GSC loc. 43695). Two hypotypes GSC 18002 (Carlisle and Susuki, 1965, Pl. 4, figs. 26, 27), GSC 18003 (ibid., figs. 24, 25).

Occurrence. Upper Carnian, Dilleri Zone. Ludington Formation, northeastern British Columbnia; Nicola Group southwestern British Columbia; King Salmon Group, northwestern British Columbia; Open Bay Formation, Quadra Island, British Columbia. GSC locs. 18667 (1), 43695 (1), 68208 (2), 91897 (1).

Remarks. The specimens from Canadian localities are not well preserved. GSC 28642 (Pl. 92, fig. 13) and GSC 28643* nevertheless show the characteristic spiral sculpture of "*Trachyceras* (*Protrachyceras*) *lecontei*".

Subfamily ARPADITINAE Hyatt, 1900

Genus *Meginoceras* McLearn, 1930

Type species. Steinmannites (*Meginoceras*) *meginae* McLearn.

Meginoceras triviale n. sp.

Plate 73, figures 1–12; Figure 56a (p. 494)

Arpadites sp. aff. *A. toldyi* Mojsisovics. TOZER, 1967, p. 29, 67, 68.

Registered material. Holotype GSC 28646, seven paratypes GSC 28647–28653 (all GSC loc. 50006). Two paratypes GSC 28654, GSC 28655 (both GSC loc. 74769). Three paratypes GSC 28656–GSC 28558 (all GSC loc. 45651).

Occurrence. Ladinian, Meginae Subzone 1. Toad Formation, northeastern British Columbia; Sulphur Mountain Formation, Llama Member, northeastern British Columbia. GSC locs. 45651 (4), 50006 (15), 68277 (6), 74769 (6), 85588 (2).

Diagnosis. Meginoceras attaining a diameter of about 50 mm; H about 40 per cent, W about 25 per cent, U about 25 per cent of diameter. Ribs branch commonly near the umbilicus, uncommonly at the mid-flank. Ribs smooth on phragmocone, striate on the body chamber. Venter of inner whorls has high tuberculate keels. On the outer whorl, keels are barely elevated, finely serrated or weakly tuberculate, tubercles being most elevated on the outer side of the keel.

Remarks. The holotype (Pl. 73, fig. 3) consists of a well preserved phragmocone and a crushed body chamber. On the phragmocone there are about 14 ribs per half whorl at the umbilicus; about 22 at the margin, with bifurcation frequent at the umbilical edge. Where notches on the keel are well preserved they correspond in number to the ribs at the margin and are arranged spirally, not obliquely. Branching of ribs at the mid-flank is not shown by the holotype but occurs, sporadically, in GSC 28649 (Pl. 73, fig. 6) and GSC 28652 (Pl. 73, fig. 1). Keels may be high and tuberculate (GSC 28647, Pl. 73, fig. 4) although on internal moulds they may be nearly smooth (GSC 28652, Pl. 73, fig. 1; GSC 28653, Pl. 73, fig. 2). On the outer whorl, keels are not appreciably elevated. They may be finely serrated (GSC 28650, Pl. 73, fig. 7; GSC 28657, Pl. 73, fig. 11) or weakly tuberculate (GSC 28649, Pl. 73, fig. 6). Ceratitic suture lines are seen in the holotype, GSC 28647, GSC 28652 and GSC 28653.

The collection from near Mount Stearns (GSC loc. 50006) indicates the variation. The close resemblance between GSC 28657 (Pl. 73, fig. 11) from Hook Lake and GSC 28646 (Pl. 73, fig. 3) justifies placing the Hook Lake specimens in this species, despite the fact that small specimens from Hook Lake (GSC 28656, Pl. 73, fig. 10; GSC 28658, Pl. 73, fig. 12) have denser ribbing and more prominently tuberculate keels than those of comparable size from near Mount Stearns.

The style of ribbing, ventral sculpture and ceratitic suture line justify reference to *Meginoceras*. Compared with that of *Meginoceras tetsa* (McLearn), ribbing is much less falcoid and ventral tuberculation is much less prominent on the outer whorl. The holotype of *Meginoceras aylardi* (McLearn) has more distantly spaced ribs. Some variants of that species have lateral ribbing much like that of *M. triviale,* but the tuberculation at the venter is different, with the external tubercles being more numerous than the ribs at the margin. *Meginoceras meginae* McLearn differs in having keels that are more elevated with more prominent tubercles that are obliquely arranged, producing a braided, rather than serrated, keel. *Meginoceras meginae* also differs in lacking branched ribs.

Meginoceras tetsa (McLearn)

Plate 72, figures 1–4

Paratrachyceras tetsa McLearn, 1947b. p. 23, Appendix p. 1, Pl. 4, figs. 3, 4; Pl. 8, fig. 3; TOZER, 1967, p. 29, 67.

Registered material. Holotype GSC 9545 (GSC loc. 10781). Paratype GSC 9546 (GSC loc. 10790). Hypotype GSC 28644 (GSC loc. 74748). Hypotype GSC 28645 (GSC loc. 42535).

Occurrence. Ladinian, Meginae Zone, Subzone 1? Toad Formation, northeastern British Columbia; Liard Formation, northeastern British Columbia. GSC locs. 10781 (1), 10790 (1), 42535 (1), 74748 (1), 98903 (1). Doubts about the exact locality for the holotype were expressed previously (Tozer, 1967, p. 67) but they can now be dismissed because the occurrence on the Alaska Highway has now been confirmed at GSC locality 98903.

Diagnosis. Meginoceras attaining a diameter of about 50 mm; H about 40 per cent, W about 27 per cent, U about 25 per cent of diameter. Ribs falcoid, rather wide on the phragmocone, increasing by branching and intercalation near mid-flank. Sculpture changes to striae on body chamber. Venter with blunt keels with well defined, regular tuberculation on the outer side.

Measurements. Holotype GSC 9545 (Pl. 72, fig. 2): 40, 0.40, 0.27, 0.25.

Remarks. The largest known specimen is GSC 28645 (Pl. 72, fig. 3). Acquisition of simple falcoid striae on the body chamber is best shown by GSC 9546 (Pl. 72, fig. 4). The external tubercles of this species are distinctive, being somewhat oblique and more elevated on the outer side than on the inner side of the keel. Suture lines of the holotype (Pl. 72, fig. 2) and GSC 28644 (Pl. 72, fig. 1) have rounded external and lateral saddles, but no details for the lobes.

This species most closely resembles *Meginoceras triviale* n. sp. differing only in having more falcoid sculpture, more common branching of ribs, and more prominent external tuberculation on the outer whorl.

Meginoceras meginae (McLearn)

Plate 73, figures 13–15; Figure 56b, c (p. 494)

Steinmannites (*Meginoceras*) *meginae* McLearn, 1930, p. 4, Pl. 1, figs. 7, 8.

Paratrachyceras meginae (McLearn). McLEARN, 1931, p. 7; SPATH, 1951, p. 42; McLEARN, 1953a, p. 3.

Sirenites (*Meginoceras*) *meginae* (McLearn). McLEARN, 1937b, p. 128, Pl. 1, figs. 8–11.

Meginoceras meginae (McLearn). TOZER, 1967, p. 29, 66, 67, Pl. 8, figs. 6, 7; TOZER, 1970, Pl. 17, figs. 11a, b.

Sirenites meginae (McLearn). McLEARN, 1947b, p. 24, Pl. 5, figs. 1–4.

Registered material. Holotype GSC 9042 (McLearn, 1930, Pl. 1, fig. 7; McLearn, 1937b, Pl. 1, fig. 11; Tozer, 1967, Pl. 8, figs. 6a, b), paratype GSC 9049 (McLearn, 1930, Pl. 1, fig. 8), topotype GSC 8841 (McLearn, 1937b, Pl. 1, fig. 9); topotype GSC 8842 (ibid., fig. 8), topotype GSC 9531, all from Beattie Ledge, Peace River. Topotype GSC 8811 (Tozer, 1967, Pl. 8, figs. 7a, b) (GSC loc. 9163). Hypotype GSC 28659 (GSC loc. 68244). Hypotype GSC 28660 (GSC loc. 74766).

Occurrence. Ladinian, Meginae Subzone 2. Toad Formation, northeastern British Columbia. GSC locs.

9131 (25), 9163 (4), 9213 (4), 9338 (8), 42394 (2), 42395 (3), 68243 (2), 68244 (1), 68248 (3), 68251 (2), 74766 (2).

Diagnosis. Meginoceras attaining a diameter of about 45 mm; H about 48 per cent, W about 30 per cent, U about 22 per cent of diameter. Most ribs are simple, some are fasciculate on the inner flank near the aperture but branching is very uncommon. Ribbing on body chamber is essentially as on the phragmocone. Venter has elevated, tuberculate keels. On the outer whorl, the external tubercles are oblique and their number may slightly exceed that of the ribs at the margin.

Measurements. Holotype GSC 9042: 37, 0.48, 0.32, 0.21. Hypotype GSC 28659 (Pl. 73, fig. 13): 42, 0.48, 0.27 0.23. Topotype GSC 9531 (Pl. 73, fig. 15): 30, 0.43, 0.30, 0.27.

Remarks. Meginoceras tetsa (McLearn) and *M. triviale* n. sp. differ in having common branching of ribs. The external tubercles are also different, those of *M. meginae* being oblique and extending across the whole keel instead of being more prominent on the outer side. The keels of *M. meginae* thus have a braided appearance compared with those of *M. tetsa* and *M. triviale,* which are notched. Also, ribbing on the body chamber of *M. meginae* is like that on the phragmocone. In the other two species, ribs are replaced by striae.

Meginoceras aylardi (McLearn)

Plate 73, figures 16–20

Paratrachyceras aylardi McLearn, 1947b, p. 22, Appendix p. 2, Pl. 8, figs. 1, 2.

Registered material. Holotype GSC 9549 (GSC loc. 10781). Topotype (?) GSC 28661 (GSC loc. 42300). Hypotype GSC 28662 (GSC loc. 50043). Two hypotypes GSC 28663, GSC 28664 (both GSC loc. 74767).

Occurrence. Ladinian, Meginae Subzone 3. Toad Formation, northeastern British Columbia; Liard Formation, northeastern British Columbia. GSC locs. 10781 (1), 42300 (6), 50043 (6), 74767 (7).

Diagnosis. Meginoceras attaining a diameter of about 45 mm; H about 40 per cent, W about 30 per cent, U about 35 per cent of diameter. Most ribs are straight and simple with sporadic branching near mid-flank. Ribbing on body chamber essentially as on phragmocone. Ventral sulcus not bordered by raised keels but by tuberculate bands on which the number of tubercles exceeds that of ribs at the margin.

Remarks. GSC 28661 (Pl. 73, fig. 16), which is probably a topotype, closely resembles specimens from Mount Withrow, e.g., GSC 28663 (Pl. 73, fig. 18). This resemblance justifies an interpretation of *M. aylardi* according to which the holotype (Pl. 73, fig. 20) is a distantly ribbed variant, with GSC 28661 (Pl. 73, fig. 16) and GSC 28663 (Pl. 73, fig. 18) being densely ribbed forms. None show the suture lines clearly, but GSC 28663 has what appears to be a rounded external saddle.

Densely ribbed variants resemble *Meginoceras meginae* (McLearn), but are distinguished by lacking truly raised keels and by having more external tubercles in relation to the marginal ribs.

Meginoceras effervescens n. sp.

Plate 78, figures 4a–c; Figure 61f (p. 504)

Paratrachyceras caurinum McLearn. TOZER, 1967, p. 66 (not of McLearn, 1947b, p. 23).

Registered material. Holotype GSC 28665, paratype GSC 28666* (both GSC loc. 68242).

Occurrence. Ladinian, Maclearni Subzone 1. Toad Formation, northeastern British Columbia. GSC loc. 68242 (2).

Diagnosis. Meginoceras attaining a diameter of about 35 mm; H about 45 per cent, W about 28 per cent, U about 25 per cent of diameter. Ribs are simple. Venter has deep sulcus bordered by keels with low tubercles, nearly all of which are attached to ribs. Tubercles arranged obliquely, not much more elevated than the adjoining ribs, not on truly raised keels.

Measurements. Holotype GSC 28665 (Pl. 78, fig. 4): 36, 0.44, 0.28, 0.26.

Remarks. In the holotype (Pl. 78, fig. 4), about half a whorl of body chamber is preserved. Nearly all the external tubercles are attached to ribs, but in one place, near the aperture, there are two opposite one rib. The lateral ribbing is much like that of *Meginoceras meginae* McLearn, but the venter of *M. effervescens* is different, with the external tubercles being much less elevated. *Meginoceras aylardi* (McLearn) is also comparable, but has a relatively shallow ventral sulcus and denser external tuberculation, with more external tubercles than ribs at the margin.

Meginoceras caurinum (McLearn)

Plate 77, figures 3a, b; Plate 78, figures 5a, b

Paratrachyceras caurinum McLearn, 1947b, p. 23, Appendix p. 1, Pl. 7, fig. 13; TOZER, 1967, p. 66 (in part).

Registered material. Holotype GSC 9548, Beattie Ledge, Peace River, coll. H.H. Beach. (?)Topotype, GSC 28667 (GSC loc. 9276).

Occurrence. Ladinian, (?)Maclearni Zone, Liard Formation, northeastern British Columbia. GSC loc. 9276 (2).

Diagnosis. Meginoceras about 40 mm in diameter; H about 40 per cent, W about 27 per cent, U about 30 per cent of diameter. Ribs are slightly curved on the flank with some branching near the umbilical shoulder and strong adorad projection at the margin. Venter deeply sulcate. Keels low, apparently with clavate nodes.

Remarks. In the holotype (Pl. 78, fig. 5), the small part of the venter preserved is mostly internal mould showing a deep sulcus bordered by nearly smooth keels. GSC 28667 (Pl. 77, fig. 3) has ribs that are strongly projected like those of the holotype. These ribs end as low clavate nodes. The holotype shows part of the suture line. The external and lateral saddles are rounded. The lobes are not preserved.

Although known only from two incomplete, poorly preserved specimens, the species clearly differs from all other *Meginoceras* in having very strong projection of the ribs at the margin.

Genus *Silenticeras* McLearn, 1930

Type species. Daphnites (*Silenticeras*) *hatae* McLearn.

Silenticeras gibsoni n. sp.

Plate 75, figures 14a, b

Registered material. Holotype GSC 35313 (GSC loc. 85588).

Occurrence. Ladinian, Meginae Subzone 1. Sulphur Mountain Formation, Llama Member, northeastern British Columbia. GSC loc. 85588 (1).

Diagnosis. Silenticeras attaining a diameter of about 40 mm; H about 45 per cent, W about 25 per cent, U about 18 per cent of diameter. Ventrolateral shoulders well defined on outer whorl. Ventral sulcus broad, bordered by raised keels. Surface merely striate.

Remarks. This species is known from one slightly crushed specimen (Pl. 75, fig. 14). The suture line is not preserved. The distinct ventral shoulders are like those of *Silenticeras bamberi* n. sp., from which *S. gibsoni* differs in having a much wider ventral sulcus, and in having raised keels.

Etymology. The name is for D.W. Gibson.

Silenticeras bamberi n. sp.

Plate 72, figures 6–10; Figure 55 (p. 492)

Silenticeras n. sp.; TOZER, 1967, p. 67.

Registered material. Holotype GSC 28680, three paratypes GSC 28681, 28682, 28683 (all GSC loc. 42535). Paratype GSC 28684 (GSC loc. 89782).

Occurrence. Ladinian, Meginae Zone, Subzone 1? Toad Formation, northeastern British Columbia; Sulphur Mountain Formation, Llama Member, northeastern British Columbia. GSC locs. 10790 (1), 42535 (10), 74748 (1), 84246 (2), 84264 (2), 89782 (2), 98902 (1), 98903 (1).

Diagnosis. Silenticeras attaining a diameter of about 55 mm; H about 40 per cent, W about 30 per cent, U about 25 per cent of diameter. Ventrolateral shoulders well defined on outer whorl. Inner whorls appreciably thicker than the outer, with less distinct shoulders. Ventral sulcus narrow, not bordered by raised keels. Surface striate. On inner whorls low, short, blunt ribs or sulci may be present at the umbilical edge.

Measurements. Holotype GSC 28680 (Pl. 72, fig. 7): 48, 0.39, 0.31, 0.28. Paratype GSC 28684 (Pl. 72, fig. 9): 45, 0.46, 0.34, 0.22. Paratype GSC 28683 (Pl. 72, fig. 6): 26, 0.46, 0.49, 0.21.

Remarks. The holotype (Pl. 72, fig. 7) has a body chamber a little more than three quarters of a whorl in length. GSC 28681 (Pl. 72, fig. 10), is the remains of a specimen about 55 mm in diameter. It has much of the aperture preserved, with a rounded rostrum. GSC 28683 (Pl. 72, fig. 6) is a small thick example. Crude ribs and sulci are present at the umbilical edge. The holotype shows parts of the last suture line. The summits of the external and lateral saddles are rounded. GSC 28684 (Pl. 72, fig. 9, Fig. 55) has a ceratitic suture line with small wrinkles on the sides of some saddles.

In common with *Silenticeras hatae* McLearn, this species lacks raised keels bordering the sulcus. *Silenticeras bamberi* is distinguished from *S. hatae* by having much thicker inner whorls and by having distinct ventrolateral shoulders on the outer whorl.

Etymology. The name is for E.W. Bamber.

Silenticeras hatae McLearn

Plate 74, figures 6–9; Figure 57a–e (p. 496)

Daphnites (*Silenticeras*) *hatae* McLearn, 1930, p. 4, Pl. 1, fig. 3.

Silenticeras hatae McLearn. McLEARN, 1937b, p. 128, Pl. 1, fig. 12; McLEARN, 1947b, p. 25, Pl. 5, figs. 5–8; SPATH, 1951, p. 59; TOZER, 1967, p. 25, 67.

Registered material. Holotype GSC 9043, topotype GSC 9532, both from Beattie Ledge, Peace River. Topotype GSC 28676 (GSC loc. 9163). Hypotype GSC 28677 (GSC loc. 68245).

Occurrence. Ladinian, Meginae Subzone 2. Toad Formation, northeastern British Columbia. GSC locs. 9131 (40), 9163 (10), 9197 (50), 9213 (10), 9338 (12), 42395 (3), 68245 (2).

Diagnosis. Silenticeras attaining a diameter of about 45 mm; H about 45 per cent, W about 30 per cent, U about 25 per cent of diameter. Marginal shoulders rounded on both inner and outer whorls. Inner whorls not appreciably proportionately thicker than the outer. Ventral sulcus narrow, not bordered by raised keels.

Measurements. Holotype GSC 9043 (Pl. 74, fig. 6): 39, 0.46, 0.31, 0.28. Hypotype GSC 28677 (Pl. 74, fig. 9): 30, 0.47, 0.27, 0.20.

Remarks. The suture lines may have slightly indented saddles (Figs. 57a–e).

Both *Silenticeras gibsoni* n. sp. and *S. bamberi* n. sp. have well defined marginal shoulders and are thus distinguished from *S. hatae. Silenticeras gibsoni* also differs in having a broader ventral sulcus and raised keels, *S. bamberi* by being proportionately much thicker at a small than at a large diameter.

Silenticeras liardense n. sp.

Plate 74, figures 5a–c

Registered material. Holotype GSC 28678, paratype GSC 28679* (both GSC loc. 68244).

Occurrence. Ladinian, Meginae Subzone 2. Toad Formation, northeastern British Columbia. GSC locs. 68243 (25), 68244 (6).

Diagnosis. Silenticeras at least 24 mm in diameter; H about 50 per cent, W about 30 per cent, U about 20 per cent of diameter, inner whorls not appreciably thicker. Ventrolateral shoulders moderately well defined. Ventral sulcus narrow, bordered by raised keels. Surface merely striate.

Measurements. Holotype GSC 28678 (Pl. 74, fig. 5): 23.5, 0.47, 0.30, 0.21. Paratype GSC 28679: 16.0, 0.50, 0.31, 0.19.

Remarks. The holotype (Pl. 74, fig. 5) has a body chamber one whorl in length. The last two septa are visible. No approximation is apparent. Moderately well preserved suture lines are shown by GSC 28679*. Saddles are nearly, if not perfectly rounded and the lobes weakly indented.

The proportions and projected growth striae are almost exactly as in *Silenticeras hatae* McLearn, that species differing in lacking keels adjacent to the ventral sulcus and also in lacking ventrolateral shoulders. *Silenticeras bamberi* n. sp. and *S. gibsoni* n. sp. have shoulders somewhat like those of *S. liardense,* but the former differs in lacking keels and having inflated inner whorls; the latter in having a broad instead of a narrow ventral sulcus.

Silenticeras involutum n. sp.

Plate 88, figures 9a, b (p. 568)

Registered material. Holotype GSC 28685 (GSC loc. 83870).

Occurrence. Lower Carnian, Desatoyense Zone? Liard Formation, northeastern British Columbia. GSC loc. 83870 (1).

Diagnosis. Silenticeras with H about 55 per cent, W about 50 per cent of diameter; U small, less than 10 per cent of diameter. Ventral sulcus narrow, bordered by slightly raised keels. Marginal shoulders absent.

Remarks. The unique holotype (Pl. 88, fig. 9) is entirely septate and mostly steinkern, with some shell. Enough shell is preserved to show that the surface was striate, not ribbed. Suture lines are fairly well

preserved. The saddles are unindented, the lobes very weakly indented.

This species is much more involute and probably also more inflated than all the Ladinian species of *Silenticeras*. The combination of slightly raised keels and the absence of marginal shoulders may indicate affinity with *Arpadites schencki* Johnston (1941, p. 458), but that species has thinner whorls and a larger umbilicus compared with *Silenticeras involutum*.

Genus *Liardites* Tozer, 1963b

Type species. Liardites whiteavesi Tozer.

Liardites whiteavesi Tozer

Plate 77, figures 4, 5; Figures 60b, c (p. 502)

Liardites whiteavesi Tozer, 1963b, p. 34, Pl. 6, figs. 6–8; TOZER, 1967, p. 30, 66.

Registered material. Holotype GSC 14302, paratypes GSC 14300 (Tozer, 1963b, Pl. 6, figs. 7a, b), GSC 14301 (ibid., figs. 8a, b) (all GSC loc. 42355). Hypotype GSC 28686 (GSC loc. 47486).

Occurrence. Ladinian, Maclearni Subzone 2. Liard Formation, northeastern British Columbia. GSC locs. 42355 (7), 47486 (1).

Genus *Otoarpadites* n. gen.

Type species. Otoarpadites auritus n. sp.

Diagnosis. Ribbed arpaditid; ribs mostly simple; some branch near umbilicus. Most of phragmocone with tuberculate keels and without marginal tuberculation; tubercles on keels small, virtually equal in number to ribs at the margin. On adoral part of phragmocone and on body chamber, ribs are stronger and more distantly spaced than on phragmocone, and each rib ends at a prominent marginal tubercle; each marginal tubercle is aligned with a clavate, subtriangular, external tubercle, obliquely placed in relation to the deep ventral furrow. Suture line ceratitic.

Species assigned. Type species only.

Age. Ladinian.

Remarks. The sculpture of the phragmocone is like that of some *Meginoceras* but the bituberculate body chamber of *Otoarpadites* is entirely different. The bituberculate sculpture is somewhat like that of "*Ceratites*" *reitzi* Boeckh (Mojsisovics, 1882, p. 113), but that species, as far as known, lacks the finely tuberculate keels and deep ventral sulcus that characterizes *Otoarpadites*. Wang (1983, p. 162) has suggested that "*Ceratites*" *reitzi* is a representative of *Xenoprotrachyceras,* but the type species of that genus, *X. primum* Wang, differs from both "*Ceratites*" *reitzi* and *Otoarpadites auritus* in having denticulated saddles.

Otoarpadites auritus n. sp.

Plate 79, figures 6–13; Figure 62c (p. 506)

"*Protrachyceras*" n. sp. aff. "*P. reitzi*" (Boeckh). TOZER, 1967, p. 65.

Registered material. Holotype GSC 28668, seven paratypes GSC 28669–28675 (all GSC loc. 68236).

Occurrence. Ladinian, Maclearni Subzone 3. Toad Formation, northeastern British Columbia. GSC loc. 68236 (8).

Diagnosis. Otoarpadites attaining a diameter of about 45 mm, H about 40 per cent, W about 35 per cent, U about 35 per cent of diameter. Nearly all ribs are simple and falcoid to a varying degree; a few ribs merge at the umbilical edge. Ribbing on phragmocone variable in density (9–18 ribs per quadrant), denser than on body chamber. Outer whorl has strong ribs linked with marginal pointed nodes and external oblique clavi, 7–10 per quadrant. Clavi of each side are opposite one another.

Remarks. Preservation is not perfect. The specimens assigned to the species vary considerably in the density of the ribbing. The holotype (Pl. 79, fig. 12) is the crushed remains of a specimen about 45 mm in diameter. The inner coil lacks marginal tuberculation. The tuberculate keels of the phragmocone are clearly shown in several specimens, notably GSC 28669 (Pl. 79, fig. 11) and GSC 28674 (Pl. 79, fig. 10). In GSC 28671 (Pl. 79, fig. 7) and GSC 28673 (Pl. 79, fig. 8), the appearance of marginal tubercles and external clavi corresponds with the beginning of the body chamber. In GSC 28670 (Pl. 79, fig. 9), which has one particularly well preserved external clavus, large marginal and external tubercles are present on the adorad part of the phragmocone. On the outer whorl of the holotype (Pl. 79, fig. 12), there are about ten ribs per quadrant; on GSC 28669 (Pl. 79, fig. 11), about seven. Variation in density of ribbing on the phragmocone is illustrated by GSC 28674 (Pl. 79,

fig. 10), with nine ribs per quadrant, GSC 28669 (Pl. 79, fig. 11) with 14, and GSC 28672 (Pl. 79, fig. 6) with 18. GSC 28675 (Pl. 79, fig. 13), although large and with part of the body chamber preserved, has no modification of sculpture on the adoral part, but because it is sculptured like the septate part of GSC 28671 (Pl. 79, fig. 7) it is interpreted as the remains of a large immature individual of this species. GSC 28672 (Pl. 79, fig. 6), another specimen with a body chamber without modified sculpture, is also interpreted as an immature example.

As mentioned in the diagnosis of the genus, there are other Middle Triassic ammonoids, e.g., "*Ceratites*" *reitzi* Boeckh, which have bituberculate body chambers somewhat comparable to that of *Otoarpadites auritus*. The detailed morphology of the phragmocone of "*Ceratites*" *reitzi* is not known. There is no evidence that it has tuberculate keels like *Otoarpadites auritus*.

Genus *Trachystenoceras* Johnston, 1941

Type species. Arpadites gabbi Hyatt and Smith.

Trachystenoceras gabbi (Hyatt and Smith)

Plate 92, figures 1a, b; Figure 74a (p. 532)

Arpadites gabbi Hyatt and Smith, 1905, p. 175, Pl. 39, figs. 1–17; Pl. 83, figs. 1–13; SMITH, 1927, p. 93, Pl. 39, figs. 1–17; Pl. 83, figs. 1–13.

Trachystenoceras gabbi (Hyatt and Smith). KUMMEL, 1957, p. L 162, fig. 193.

Trachystenoceras sp. aff. *T. gabbi* (Hyatt and Smith). TOZER, 1967, p. 33, 64.

Registered material. Hypotype GSC 28687 (GSC loc. 68208).

Occurrence. Upper Carnian, Dilleri Zone. Ludington Formation, northeastern British Columbia. GSC loc. 68208 (1).

Remarks. GSC 28687 (Pl. 92, fig. 1), a poorly preserved phragmocone, shows umbilical tuberculation, external tuberculation, virtually smooth flanks with ribs adjacent to the external tubercles, and a ceratitic suture line. Attainment of the growth stage in which the keels are nearly smooth is not demonstrable. However, the specimens do correspond closely with specimens of comparable size from the type locality (California).

Genus *Hisnitites* n. gen.

Type species. Hisnitites janmulleri n. sp.

Diagnosis. Discoidal arpaditin, umbilical width about 15 per cent of diameter. Phragmocone has a narrow venter with a shallow sulcus, and flanks with low ribs branching at bullae on the mid-flank, ending at slightly clavate marginal tubercles. Marginal tubercles divide on the venter forming notched keels adjacent to the sulcus. The body chamber has a broad venter on which the keels become low, with finer notching and the sulcus shallow, compared with the phragmocone. Adorad part of body chamber has indistinct ribbing, strong marginal and lateral tuberculation, indistinct ribbing and a broad venter without keels and sulcus. Umbilical shoulder of both phragmocone and body chamber rounded, without tuberculation. Suture line ceratitic.

Species assigned. Type species only.

Age. Upper Carnian, Dilleri Zone.

Remarks. The ceratitic suture line and notched keels on the phragmocone suggest affinity with the Arpaditinae (e.g., *Trachystenoceras*), but *Hisnitites* is distinguished from that genus, and all others of the subfamily, by having a laterally tuberculate, broad body chamber. The suture line and the nature of the lateral and marginal tuberculation are much like that of *Nairites armenius* Kiparisova and Azaryan (1963, p. 54), which was described as a representative of the Noridiscitidae. *Nairites* differs in having smooth, not notched keels, but the other similarities may be significant and it may be wrong to place *Hisnitites* and *Nairites* in different families. There is no resemblance between *Hisnites* and *Noridiscites*.

Hisnitites janmulleri n. sp.

Plate 93, figures 11, 14; Figure 75 (p. 534)

Registered material. Holotype GSC 32364 (GSC loc. 82852). Paratype GSC 35358 (GSC loc. 23939).

Occurrence. Upper Carnian, Dilleri Zone. Quatsino Limestone or limestone within Karmutsen Group, Vancouver Island, British Columbia. GSC locs. 23147 (1), 23939 (3), 82852 (3).

Diagnosis. Hisnites attaining a diameter of about 70 mm; H about 50 per cent, W about 25 per cent, U about 15 per cent of diameter. Genus monotypic, see generic diagnosis.

Remarks. This species is known only from poorly preserved specimens. In the holotype (Pl. 93, fig. 11), a quarter whorl of body chamber is preserved. The last 15 septa are visible. They are closely spaced (14 per quadrant), presumably approximated. The sculpture is tolerably well shown. The extent of the umbilical seam shows that the original diameter was about 70 mm. The keels are present to within one eighth of a whorl of the preserved aperture. On the last one eighth they are barely perceptible. This appears to be natural, not due to malpreservation. At the beginning of the outer whorl, marginal and ventral tuberculation is fairly well preserved, with about 10 ventral tubercles and about five marginal in 10 mm. On what is preserved of the body chamber there are six well preserved marginal tubercles. Lateral tubercles are poorly preserved; the number was probably three. GSC 35358 (Pl. 93, fig. 14), a somewhat distorted fragment, shows the style of the ribs and their abrupt termination at the marginal tubercles.

With the exception of *Nairites armenius* Kiparisova and Azaryan, already mentioned, no closely comparable ammonoids are known.

Etymology. The name is for J.E. Muller.

Genus *Arctoarpadites* n. gen.

Type species. Sirenites costatus Tozer.

Diagnosis. Moderately evolute arpaditin with bifurcating, narrow, somewhat falcoid ribs. A faint suggestion of tuberculation may be present on the umbilical shoulder, but the ribs are smooth on the flank. Venter with well defined sulcus, bordered by tuberculate keels. External tubercles more numerous than ribs at the margin. Suture line weakly ammonitic.

Species assigned. Type species only.

Age. Upper Carnian, probably Welleri Zone.

Remarks. The wide umbilicus and delicate tuberculation on the keels are taken to indicate closer affinity with the Arpaditinae than the Sirenitinae. The most closely related genus is probably *Dittmarites,* but the notching on the keels of that genus is much less distinct compared with that of *Arctoarpadites. Arpadites, Meginoceras* and *Liardites* show some similarities, but all differ in having ceratitic sutures. *Meginoceras* and *Liardites* also differ in have less dense external tuberculation and in being more involute.

Arctoarpadites costatus (Tozer)

Plate 102, figures 11a, b

Sirenites costatus Tozer, 1961, p. 80, Pl. 24, figs. 10, 11.

Registered material. Holotype GSC 14143, four paratypes GSC 14144*, GSC 14145 (Tozer, 1961, Pl. 24, fig. 10), GSC 14146*, GSC 14147* (all GSC loc. 28454).

Occurrence. Upper Carnian, ?Welleri Zone. Blaa Mountain Formation, Axel Heiberg Island. GSC loc. 28454 (10).

Genus *Arctosirenites* Tozer 1961

Type species. Arctosirenites canadensis Tozer.

Arctosirenites canadensis Tozer

Plate 102, figures 13–15; Figure 81a, b (p. 552)

Arctosirenites canadensis Tozer, 1961, p. 82, Pl. 24, figs. 1–5; Pl. 25. figs. 1–11; TOZER, 1967, p. 34 (in part), p. 44, not p. 62.

Striatosirenites seimkanensis Bychkov, 1973, p. 37, figs. 9, 9a; BYCHKOV et al., 1976, p. 131, Pl. 38, figs. 1, 2.

Yanosirenites seimkanensis (Bychkov). BYCHKOV, 1982b, p. 73, Pl. 4, figs. 7–9.

not *Arctosirenites canadensis* Tozer, TOZER, 1962a, Pl. 7, figs. 2, 3 (= *A. columbianus* n. sp.)

Registered material. Holotype GSC 14136 (Tozer, 1961, Pl. 25, figs. 8a, b), 19 paratypes, GSC 14119 (ibid., Pl. 24, figs. 1a, b), GSC 14120 (ibid., Pl. 24, figs. 2a, b), GSC 14121 (ibid., Pl. 24, figs. 3a, b), GSC 14122*, GSC 14123 (ibid., Pl.24, figs. 5a–c), GSC 14124 (ibid., Pl. 25, figs. 1a, b), GSC 14125 (ibid., Pl. 25, figs. 2a, b), GSC 14126 (ibid., Pl. 25, figs. 3a–c), GSC 14127*, GSC 14128 (ibid., Pl. 24, figs. 4a, b). GSC 14129 (ibid., Pl. 25, figs. 6a, b), GSC 14130 (ibid., Pl. 25, fig. 5), GSC 14131*, GSC 14132*, GSC 14133 (ibid., Pl. 25, figs. 4a, b), GSC 14134 (ibid., Pl. 25, figs. 11a, b), GSC 14135 (ibid., Pl. 25, figs. 7a, b), GSC 14137*, GSC 14138 (ibid., Pl. 25, figs. 10a, b). GSC 14139 (ibid., Pl. 25, figs. 9a, b), GSC 14140* (all GSC loc. 28436). Hypotype GSC 72184 (GSC loc. 47619). Two hypotypes GSC 72185, GSC 72186 (both GSC loc. 89714).

Occurrence. Upper Carnian, Welleri Zone, ?Subzone 1. Blaa Mountain Formation, Axel Heiberg Island. GSC locs. 28436 (50), 47619 (1), 89714 (2).

Remarks. The sculpture of this species is highly variable. All variants have three prominent tubercle-spirals on the inner flank and a fairly prominent spiral of closely spaced tubercles at the margin. The outer flank may also have one (rarely), two (commonly) or three (rarely) less prominent spirals, making a maximum total of seven between the umbilicus and the external keels. *"Yanosirenites" seimkanensis* (Bychkov) closely resembles weakly sculptured variants of *A. canadensis,* e.g., GSC 14139 (Tozer, 1961, Pl. 25, figs. 9a, b), and is accordingly interpreted as a species of *Arctosirenites.*

Arctosirenites columbianus n. sp.

Plate 97, figures 1, 2

Arctosirenites canadensis Tozer. TOZER, 1962a, Pl. 7, figs. 2, 3, not of TOZER, 1961, p. 82.

Registered material. Holotype GSC 14313, hypotype GSC 14312 (both GSC loc. 42306).

Occurrence. Upper Carnian, Welleri Subzone 1. Pardonet Formation or Ludington Formation, northeastern British Columbia. GSC loc. 42306 (2).

Diagnosis. Arctosirenites with H about 38 per cent, W about 36 per cent, U about 35 per cent of diameter. Sculptured with four spirals of small tubercles between the umbilicus and external keels, one at the umbilical shoulder, two on the inner flank and one at the margin.

Remarks. The outer whorl of the holotype (Pl. 97, fig. 1) has more numerous tubercles at the margin than on the external keels, about 20 marginal tubercles being adjacent to about 13 at the venter. This is the sculpture characteristic of *Arctosirenites.* Ribbing is slightly falcoid, very delicate and faint. Most ribs appear to be simple. GSC 14312 (Pl. 97, fig. 2) has strong ribs, mostly bifurcating on the inner flank. Ribs end at marginal tubercles, which match those at the venter, as in *Protrachyceras.* In common with the holotype it has three tubercle-spirals on the inner flank. In spite of the differences from the holotype, GSC 14312 is interpreted as a variant of *Arctosirenites columbianus,* because this kind of variation is well documented in *Arctosirenites canadensis* Tozer, which closely resembles *Arctosirenites columbianus.* The outer flank of *Arctosirenites canadensis* differs from that of *Arctosirenites columbianus* in having one or more tubercle-spirals in addition to the three that characterize the inner flanks of both species.

Arctosirenites southeri n. sp.

Plate 102, figures 3a, b

Sirenites sp., SOUTHER, 1963, p. 432.

Arctosirenites sp. indet., TOZER, 1961, p. 84, Pl. 24, figs. 6a, b.

Registered material. Holotype GSC 14141 (GSC loc. 26167). Hypotype GSC 14142* (GSC loc. 26124).

Occurrence. Upper Carnian, ?Welleri Zone. Blaa Mountain Formation, Axel Heiberg Island; Schei Point Formation, Ellesmere Island. GSC locs. 26124 (1), 26167 (1).

Diagnosis. Arctosirenites with H about 50 per cent, W about 25 per cent, U about 15 per cent of diameter. Sculptured with three spirals of tubercles between the umbilicus and ventral keels, one on the umbilical shoulder, one on the inner flank and one at the margin, on the outer flank.

Remarks. The last quadrant of the holotype (Pl. 102, fig. 3) has 8 umbilical, 10 inner lateral, 25 marginal and 20 external tubercles. Ribbing is very faint. Growth lines are falcoid. The relationship of the marginal to the external tuberculation indicates reference to *Arctosirenites.* Compared with *Arctosirenites canadensis* Tozer and *A. columbianus* n. sp., *A. southeri* is much more involute, has weaker ribbing, and fewer spirals of tubercles.

Etymology. The name is for J.G. Souther.

Arctosirenites? *sverdrupi* (Kittl)

Plate 102, figure 12

Protrachyceras sverdrupi Kittl, 1907, p. 38, Pl. 3, fig. 8 (and ?7).

Registered material. Palaeontologisk Museum, Oslo, Per Schei Collection, no. 65774. Example with tuberculate ribs, to the right in Plate 101, fig. 12, now selected as lectotype.

Occurrence. Upper Carnian. Ammonite Mountain, Bjorne Peninsula, Ellesmere Island, collected by Per

Schei, 1900. Presumably from the Schei Point Formation.

Remarks. The illustrated specimen (Pl. 102, fig. 12) is a plaster cast of the best examples figured by Kittl (1907, Pl. 3, fig. 8). Kittl considered that the two examples on the slab represented one species, with lateral tuberculation preserved on the external impression (example on the right), but not on the steinkern (left example). The tuberculate example is now selected as the lectotype. An interpretation alternative to that of Kittl is that there are two species on the slab, the specimen without tuberculation being an *Arctoarpadites* related to *A. costatus* (Tozer) and the other (now the lectotype) an *Arctosirenites* related to *Arctosirenites canadensis* Tozer. This question cannot be resolved because the specimens are flattened and the venters are incompletely preserved.

Genus *Yakutosirenites* n. gen.

Type species. Sirenites pentastichus Vozin.

Diagnosis. Relatively involute arpaditin, sculptured like *Arctosirenites* in that tuberculation at the margin is finer than at the venter. Distinguished from *Arctosirenites* by having much larger external tubercles in the form of pointed clavate ears. Suture line ammonitic.

Species assigned. Type species only.

Age. Upper Carnian.

Remarks. This genus is classed with the Arpaditinae because of the resemblance to *Arctosirenites.* Genera with large external tubercles comparable with those of *Yakutosirenites* include some *Nevadites, Otoarpadites* and *Pterosirenites. Nevadites* Smith (1914) and *Otoarpadites* n. gen. differ in having ceratitic suture lines. *Pterosirenites* Tozer (1980a) has a differently sculptured phragmocone, with much less dense marginal tuberculation compared with *Yakutosirenites. Neosirenites* Popov (1961a) is somewhat comparable, but differs in having alternating clavi and spines bordering the ventral sulcus, instead of merely clavi as in *Yakutosirenites* and the other genera mentioned above.

Yakutosirenites pentastichus (Vozin)

Plate 102, figures 1a, b

Sirenites pentastichus Vozin, *in* Vozin and Tikhomirova, 1964, p. 78, Pl. 43, figs. 3, 4.

Neosirenites pentastichus (Vozin). DAGYS, ARCHIPOV and BYCHKOV, 1979, Pl. 14, figs. 2, 3.

Registered material. Hypotype GSC 72173 (GSC loc. 28429).

Occurrence. Upper Carnian, Welleri Zone. Blaa Mountain Formation, Axel Heiberg Island. GSC loc. 28429 (1).

Remarks. GSC 72173 (Pl. 102, fig. 1), a wholly septate steinkern, has umbilical, lateral (two spirals) and marginal tuberculation. The external ears are preserved as internal moulds, some of which are broken. They are arranged en echelon. Six external tubercles are aligned with ten at the margin, a ratio encountered in specimens from the type locality, in Siberia. The suture line is ammonitic, with narrow, indented saddles like those of *Sirenites nanseni* Tozer.

Subfamily TRACHYCERATINAE (Haug, 1894)

Genus *Anolcites* Mojsisovics, 1893

Type species. Ammonites (Trachyceras) doleriticus Mojsisovics.

Anolcites impolitus n. sp.

Plate 77, figures 8, 9; Plate 78, figures 10, 11

Registered material. Holotype GSC 28759, paratype GSC 28760 (both GSC loc. 68242). Paratype, GSC 28763 (GSC loc. 68347). Paratype GSC 28764 (GSC loc. 50042).

Occurrence. Ladinian, Maclearni Subzone 1. Toad Formation, northeastern British Columbia. GSC locs. 50042 (1), 68242 (6), 68292 (1), 68347 (1).

Diagnosis. Anolcites attaining a diameter of at least 80 mm; H about 35 per cent, W about 25 per cent, U about 40 per cent of diameter. Tuberculation consists of six or seven spirals between the umbilicus and median line (umbilical, three or four lateral, marginal and external). Tubercles of umbilical spiral separated by depressions in the umbilical wall; those of the lateral spirals virtually rounded; marginal and external tubercles distinctly clavate. Umbilical and lateral spirals fade on the outer whorl, where the marginal and external spirals remain with undiminished prominence.

Measurements. Holotype GSC 28759 (Pl. 78, fig. 11): 62, 0.36, 0.27, 0.41.

Remarks. In the holotype (Pl. 78, fig. 11), probably at least half a whorl of body chamber is preserved, but septa are not visible. There are four spirals of lateral tubercles, well expressed except on the last half whorl, where they fade. GSC 28763 (Pl. 77, fig. 8), the remains of a specimen that attained a diameter of about 80 mm, has three lateral spirals.

There is a close resemblance between this species and a specimen of *Anolcites julius* (Mojsisovics) from Prezzo, Italy (Mojsisovics, 1882, Pl. 13, fig. 2), which may differ only in being a little less evolute. Examples of *Anolcites julius* from Mount Clapsavon (Mojsisovics, 1882, Pl. 37, fig. 3; Pisa, 1966, Pl. 73, figs. 4a, b; Pl. 74, figs. 3, 4) differ in having only two lateral spirals.

Anolcites politus n. sp.

Plate 78, figures 8, 9; Figure 61a, b (p. 504)

Anolcites sp. cf. *A. doleriticum* (Mojsisovics). Tozer, 1967, p. 30, 66.

Registered material. Holotype GSC 28762, paratype GSC 28761 (both GSC loc. 68242).

Occurrence. Ladinian, Maclearni Subzone 1. Toad Formation, northeastern British Columbia. GSC loc. 68242 (6).

Diagnosis. Anolcites about 40 mm in diameter; H about 37 per cent, W about 30 per cent, U about 34 per cent of diameter. Umbilical, marginal and external tuberculation well developed, but lateral tuberculation is absent or very faint.

Measurements. Holotype GSC 28762 (Pl. 78, fig. 8): 35, 0.37, 0.29, 0.34.

Remarks. In the holotype (Pl. 78, fig. 8), of which half a whorl is body chamber, much of the test is preserved and is devoid of lateral tuberculation. The paratype (Pl. 78, fig. 9), the remains of an individual that attained a diameter of about 40 mm, has a very faint trace of lateral tuberculation, suggesting that this species may be a weakly sculptured, less evolute variant of *Anolcites impolitus* n. sp. The last septum of this specimen is slightly approximated. The ceratitic suture lines are well preserved (Figs. 61a, b).

This species seems to resemble closely the holotype of *Anolcites doleriticus* (Mojsisovics) (1882, p. 103), and it is possible that the two taxa are identical. The holotype of *A. doleriticus* is preserved as a steinkern and the nature of the test surface is unknown. Exact comparisons are thus impossible.

Anolcites angustus n. sp.

Plate 78, figures 2, 3; Figure 61d, e (p. 504)

Anolcites sp. cf. *A. doleriticum* Mojsisovics. TOZER, 1967, p. 30, 65, 66 (in part).

Registered material. Holotype GSC 28765 (GSC loc. 68237). Hypotype GSC 28767 (GSC loc. 42355).

Occurrence. Ladinian, Maclearni Subzone 2. Toad Formation, Liard Formation, northeastern British Columbia. GSC locs. 42355 (1), 68237 (3).

Diagnosis. Anolcites about 40 mm in diameter; H about 38 per cent, W about 27 per cent, U about 35 per cent of diameter. Tuberculation present on both phragmocone and body chamber with six spirals between the umbilicus and the median line (umbilical, three lateral, marginal and external). Umbilical tubercles low, slightly bullate; lateral tubercles rounded; marginal and external tubercles distinctly clavate.

Measurements. Holotype GSC 28765 (Pl. 78, fig. 2): 40.5, 0.38, 0.27, 0.35.

Remarks. The holotype (Pl. 78, fig. 2), has seven eighths of a whorl of body chamber preserved. The ceratitic suture lines are well preserved (Figs. 61d, e). The last septum is partly preserved, but the penultimate is not. Marginal and external tuberculation persists to the end. The umbilical and lateral spirals remain discernible but fade in prominence.

Compared with *Anolcites impolitus* n. sp., *A. angustus* is more involute, has three instead of four lateral spirals, and a less indented umbilical wall. The proportions are close to those of *A. politus* n. sp., but that species differs in being devoid of lateral tuberculation.

Anolcites rasilis n. sp.

Plate 78, figures 1a–c

Registered material. Holotype GSC 28766 (GSC loc. 68237).

Occurrence. Ladinian, Maclearni Subzone 2. Toad Formation, northeastern British Columbia. GSC loc. 68237 (3).

Diagnosis. Anolcites about 25 mm in diameter; H about 39 per cent, W about 28 per cent, U about 33 per cent of diameter. Ribs thickened, but not truly tuberculate on umbilical shoulder of phragmocone. Lateral tuberculation absent, at least on the outer whorl. Marginal tuberculation well defined on phragmocone, weak on body chamber. External tubercles, alone, retain their strength to the aperture.

Measurements. Holotype GSC 28766 (Pl. 78, fig. 1): 23, 0.39, 0.28, 0.32.

Remarks. The holotype (Pl. 78, fig. 1) is preserved mostly as steinkern with some test. The body chamber is between seven eighths and three quarters of a whorl in length. The ceratitic suture line is well preserved. The weakening of the sculpture on the body whorl suggests that the specimen is complete and mature, although the septa show no approximation.

The whorl section, marginal and external tuberculation are like that of *A. angustus* n. sp., with which *A. rasilis* is associated. *Anotites rasilis* differs in lacking lateral tuberculation and ribbing on the body chamber. The absence of lateral tuberculation invites comparison with *A. politus* n. sp., but that species differs in having more prominent umbilical tuberculation and a ribbed, instead of smooth, body chamber.

Anolcites papillatus n. sp.

Plate 78, figures 6a–c

Registered material. Holotype, GSC 28769 (GSC loc. 36420).

Occurrence. Ladinian, Maclearni Zone. Liard Formation, northeastern British Columbia. GSC loc. 36420 (1).

Diagnosis. Anolcites about 50 mm in diameter; H about 37 per cent, W about 35 per cent, U about 40 per cent of diameter. Ribs are radial or slightly rursiradiate where they cross the venter. Tuberculation comprises seven spirals of tubercles between the umbilicus and the median line (umbilical, four lateral, marginal, external). Umbilical and two inner spirals are of rounded tubercles; the outer spirals become increasingly clavate.

Measurements. Holotype GSC 28769 (Pl. 78, fig. 6): 49, 0.37, 0.35, 0.41.

Remarks. The illustrations of the holotype (Pl. 78, fig. 6) are mostly of the steinkern. The impression with some shell adhering, is also preserved. The last septum may be seen, indicating a body chamber length of three quarters of a whorl, but the details of the suture line are not shown. For the phragmocone and part of the body chamber, the steinkern has smooth ribs, without tubercles preserved. On the adorad quadrant, tubercles are preserved on the steinkern. The presence or absence of tubercles on the steinkern demonstrably relates to the distribution of the preseptal layer, tubercles being obliterated where this layer is present, but preserved where it is absent. Pieces of test are preserved at the start of the outer whorl. They show tubercles on the outer surface of the test arranged like those on the steinkern of the adoral quadrant.

The numerous tubercle-spirals of this species invite comparison with *Anolcites impolitus* n. sp. from which *A. papillatus* differs in having appreciably thicker whorls, no projection of ribs where they cross the venter and in having a thick, preseptal layer.

Anolcites gemmatus n. sp.

Plate 78, figures 7a–d; Figure 61c (p. 504)

Anolcites sp., TOZER, 1963b, p. 32.

Registered material. Holotype, GSC 28768 (GSC loc. 42355).

Occurrence. Ladinian, Maclearni Subzone 2. Liard Formation, northeastern British Columbia. GSC loc. 42355 (1).

Diagnosis. Anolcites about 35 mm in diameter; H about 38 per cent, W about 35 per cent, U about 35 per cent of diameter. Ribs are radial where they cross the venter. Phragmocone tuberculation comprises five or six spirals between the umbilicus and the median line (umbilical, two or three lateral, marginal and external). On body chamber, ribs are devoid of lateral tuberculation, only clavate marginal and external tubercles being present.

Measurements. Holotype GSC 28768 (Pl. 78, fig. 7): 34, 0.38, 0.35, 0.35.

Remarks. In the holotype (Pl. 78, fig. 7), a body chamber of three quarters of a whorl is preserved. The ceratitic suture lines are well preserved, with the last

septum approximated. The nature of both the inner and outer test surface is demonstrable, the former from the steinkern, the latter from the external impression and small pieces of test adhering to the steinkern. At the beginning of the outer whorl there are umbilical tubercles and two (or possibly three) spirals of lateral tubercles and also marginal and external spirals. On the phragmocone and the first quadrant of the body chamber, the impressions of the ribs preserved on the steinkern are without tubercles, the consequence of the presence of the preseptal layer. The impression of the body chamber indicates the absence of lateral tuberculation.

In the style of the tuberculation on the phragmocone and the thick preseptal layer this species resembles *Anolcites papillatus* n. sp. more than any other, but it differs in having fewer lateral spirals and in the absence of tuberculation on the body chamber.

Anolcites anguinus n. sp.

Plate 80, figures 7, 8, 10

Registered material. Holotype GSC 35362, paratypes GSC 28771, 28772 (all GSC loc. 68236).

Occurrence. Ladinian, Maclearni Subzone 3. Toad Formation, northeastern British Columbia; Sulphur Mountain Formation, Llama Member, northeastern British Columbia. GSC locs. 68236 (11), 84219 (1).

Diagnosis. Anolcites about 40 mm in diameter; H about 33 per cent, W 30 to nearly 50 per cent, U about 42 per cent of diameter. Ribs thick, simple. Tuberculation absent on the umbilical shoulder and flank; marginal and external clavate tubercles present, external tubercles weak, marginal tubercles very weak.

Measurements. Paratype GSC 28771 (Pl. 80, fig. 7): 37, 0.35, 0.30, 0.42. Holotype GSC 35362 (Pl. 80, fig. 10): 42, 0.33, 0.30, 0.44.

Remarks. At least half a whorl of the holotype (Pl. 80, fig. 10) is body chamber, but suture lines are not clearly visible. This specimen has low external and very low marginal clavate tubercles at both the beginning and the end of the outer whorl. At the beginning, the tubercles are present only on the outer surface of the test, but not on the steinkern; at the end, their presence is also indicated on the steinkern. As with *Anolcites gemmatus* n. sp. and *A. papillatus* n. sp., a thick preseptal layer is indicated. The test of GSC 28772 (Pl. 80, fig. 8), interpreted as an inflated variant, has low marginal and external clavi, but they are barely expressed in the steinkern. The venter of GSC 28771 (Pl. 80, fig. 7) is mostly preserved as steinkern; tuberculation is not demonstrable. Ceratitic suture lines are shown by GSC 28771 and GSC 28772.

The presence of external and marginal clavate tuberculation, albeit faint, indicates affinity with *Anolcites gemmatus* n. sp., but the simple ribbing and large umbilicus distinguish *A. anguinum* from that species and all other *Anolcites.*

Genus *Zestoceras* n. gen.

Type species. Zestoceras cerastes n. sp.

Diagnosis. Evolute ribbed trachyceratin without a ventral sulcus. Ribs simple or bifurcating; they may be thickened, but are not truly tuberculate at the umbilical shoulder. Venter crossed by ribs that have external tuberculation on the phragmocone, but are smooth on the body chamber. Lateral and marginal tuberculation absent. Suture line ceratitic.

Species assigned. Zestoceras cerastes n. sp., *Zestoceras enode* (Tozer), *Zestoceras nitidum* n. sp., probably also "*Trachyceras*" *armatum* Münster of Mojsisovics (1882, Pl. 34, figs. 2), non *Goniatites armatus* Münster (1841, p. 127).

Age. Ladinian.

Remarks. The absence of a ventral sulcus indicates affinity with *Anolcites* Mojsisovics (1893) and *Maclearnoceras* Tozer (1963), both of which have venters much like that of *Zestoceras.* Suture lines are also similar. *Anolcites* differs in having marginal as well as external tuberculation; some species of *Anolcites* also differ in having lateral tuberculation. *Maclearnoceras* differs in having lateral tuberculation on the inner whorls. *Anolcites anguinum* n. sp., which has only very faint marginal tuberculation, forms a morphological link between *Anolcites* and *Zestoceras.*

Zestoceras nitidum n. sp.

Plate 80, figures 9a, b; Figure 63e (p. 508)

Registered material. Holotype GSC 28770 (GSC loc. 68236).

Occurrence. Ladinian, Maclearni Subzone 3. Toad Formation, northeastern British Columbia. GSC loc. 68236 (1).

Diagnosis. Zestoceras about 45 mm in diameter; H about 35 per cent, W about 37 per cent, U about 40 per cent of diameter. Ribs simple on phragmocone; mostly simple, some bifurcating on body chamber, bifurcation taking place near umbilical edge or at inner third of flank.

Measurements. Holotype GSC 28770 (Pl. 80, fig. 9): 43, 0.35, 0.37, 0.40.

Remarks. In the holotype (Pl. 80, fig. 9), three quarters of a whorl of body chamber is preserved. The ceratitic suture line is well preserved. The last two septa show slight approximation. On the last half whorl there are 20 ribs at the umbilicus, 27 at the venter. Most of the venter is preserved as steinkern. The ribs are nearly smooth with a faint suggestion of bituberculation. The test is partly preserved at one rib, and there, tuberculation at the venter is definite, but the pattern is not clear.

Although the venter is not perfectly preserved, this species appears to be congeneric with *Zestoceras cerastes* n. sp., and *Zestoceras enode* (Tozer), which differ in having bifurcating ribs on the phragmocone. The phragmocone of *Anolcites anguinum* n. sp. is much like that of *Z. nitidum,* but that species has simple ribs on the body chamber, and more distinct tuberculation. It is possible that *Zestoceras nitidum* is a species of *Maclearnoceras,* but without data regarding the morphology of the inner whorls this cannot be established. The simple ribbing of the phragmocone distinguishes *Zestoceras nitidum* from all known species of *Maclearnoceras.*

Zestoceras cerastes n. sp.

Plate 82, figures 4a–e; Figure 65d (p. 512)

Registered material. Holotype GSC 28773 (GSC loc. 68363).

Occurrence. Ladinian, Sutherlandi Subzone 2. Toad Formation, northeastern British Columbia. GSC loc. 68363 (1).

Diagnosis. Zestoceras at least 45 mm in diameter; H about 27 per cent, W about 20 per cent, U about 50 per cent of diameter. Venter of phragmocone with a row of slightly clavate external tubercles on each side of the median line, venter of body chamber without tuberculation. Outer whorl with relatively distant ribs most of which bifurcate at the mid-flank.

Measurements. Holotype GSC 28773 (Pl. 82, fig. 4): 40, 0.27, 0.21, 0.50.

Remarks. The holotype (Pl. 82, fig. 4) is incomplete, with only one quarter whorl of body chamber preserved. The ceratitic suture lines are well preserved (Fig. 65d). They are not approximated. The bituberculate venter is visible from a diameter of about 5 mm to the end of the phragmocone (diameter about 32 mm). This tuberculation is not suppressed on the steinkern, presumably indicating that the preseptal layer was thin or absent. At a diameter of 12 mm there are 15 external tubercles on half a whorl. Toward the end of the phragmocone these tubercles become increasingly blunt and on the body chamber the ribs cross the venter without any appreciable tuberculation.

The most closely comparable ammonoid is *"Trachyceras" armatum* (Münster) of Mojsisovics (1882, p. 100, Pl. 34, fig. 2) from Bukowina (Rumania). The only specimen described from this locality is apparently lost. The small, typical examples of Münster's species from the St. Cassian beds (e.g., Mojsisovics, ibid., Pl. 24, figs. 35, 36) do not resemble *Zestoceras cerastes. Zestoceras nitidum* n. sp. differs in having denser ribbing and also in having simple, not bifurcating ribs on the phragmocone.

Zestoceras enode (Tozer)

Plate 82, figures 2, 3, 5; Figure 65f (p. 512)

Maclearnoceras enode Tozer, 1972, p. 653, Pl. 128, figs. 3, 4.

Registered material. Holotype GSC 28024 (GSC loc. 68364). Hypotype GSC 28775 (GSC loc. 89784). Hypotype 28774 (GSC loc. 42351).

Occurrence. Ladinian, Sutherlandi Subzone 2. Toad Formation, northeastern British Columbia; Liard Formation, northeastern British Columbia. GSC locs. 42351 (1), 68364 (1), 89784 (1).

Diagnosis. Zestoceras at least 40 mm in diameter; H about 30 per cent, W about 32 per cent, U about 40 per cent of diameter. Venter of phragmocone with a spiral of rounded external tubercles on each side of the median line; tuberculation becomes faint or absent on the outer whorl. Ribbing dense with simple and bifurcating ribs on both the phragmocone and body chamber. Bifurcation is on the inner flank on the phragmocone, sporadically on the outer flank of the body chamber.

Measurements. Holotype (Pl. 82, fig. 2): 36, 0.30, 0.32, 0.40.

Remarks. The holotype (Pl. 82, fig. 2) has a thick preseptal layer suppressing all traces of ribbing on the steinkern of the phragmocone and the initial part of the body chamber. External tuberculation on ribs crossing the venter is indicated at a diameter of about 10 mm by impressions on the dorsum of the succeeding whorl. At the beginning of the outer whorl there is a very shallow sulcus on the ribs where they cross the venter. Thereafter there is no sulcation or tuberculation. The blunt spiral ridge near the aperture at the margin of one side (Pl. 82, fig. 2a) is probably the result of injury. GSC 28775 (Pl. 82, fig. 5) shows faint external tuberculation at the venter at the beginning of what is preserved of the outer whorl. External tuberculation is not discernible on GSC 28774 (Pl. 82, fig. 3), which is preserved as an external impression.

Compared with *Zestoceras cerastes* n. sp., *Zestoceras enode* is more involute, has weaker external tuberculation, and simple, in addition to bifurcating, ribs. *Zestoceras nitidum* n. sp. differs in having a phragmocone with simple ribs.

Genus *Maclearnoceras* Tozer, 1963b

Type species. Maclearnoceras maclearni Tozer.

Maclearnoceras maclearni Tozer

Plate 77, figures 1, 2; Figure 60a (p. 502)

Maclearnoceras maclearni Tozer, 1963b, p. 35, Pl. 6, figs. 1–5; TOZER, 1967, p. 29, 66, Pl. 8, figs. 8a, b; TOZER, 1970, Pl. 17, figs. 16a, b.

Registered material. Holotype GSC 14297, four paratypes GSC 14295 (Tozer, 1963b, Pl. 6, figs. 3a, b), GSC 14296 (ibid., figs. 4a, b), GSC 14298 (ibid., figs. 5a, b), GSC 14299 (ibid., figs. 2a, b) (all GSC loc. 42355).

Occurrence. Ladinian, Maclearni Subzone 2. Liard Formation, northeastern British Columbia. GSC loc. 42355 (8).

Maclearnoceras ensio n. sp.

Plate 79, figures 2–5; Figure 62a (p. 506)

Maclearnoceras n. sp. aff. *M. maclearni* Tozer; TOZER, 1967, p. 65.

Registered material. Holotype GSC 28794, three paratypes GSC 28795, 28796, 28797 (GSC loc. 68236).

Occurrence. Ladinian, Maclearni Subzone 3. Toad Formation, northeastern British Columbia. GSC loc. 68236 (15).

Diagnosis. Maclearnoceras attaining a diameter of about 30 mm, H about 50 per cent, W 33–40 per cent, U about 20 per cent of diameter. Ribbing dense, nearly all ribs merge at the umbilical shoulder, many bifurcate on the inner third of the flank. Ribs strongly projected where they cross the venter.

Measurements. Holotype GSC 28794 (Pl. 79, fig. 3): 19, 0.53, 0.33, 0.18. Paratype GSC 28795 (Pl. 79, fig. 4): 20, 0.49, 0.40, 0.20.

Remarks. The ceratitic suture line is seen in the holotype (Pl. 79, fig. 3, Fig. 62a). The last four septa are irregularly spaced, but are not certainly approximated. The tuberculate inner whorls that characterize *Maclearnoceras* are well preserved. At a diameter of about 5 mm there are three lateral spirals, one marginal spiral and one external spiral. The umbilical shoulder is not visible. On the outer whorl of the holotype, which is preserved as steinkern, tuberculation is absent. In GSC 28795 (Pl. 79, fig. 4), some of the test is preserved. It shows a trace of tuberculation at the beginning of the outer whorl, none latterly. GSC 28796 (Pl. 79, fig. 2), a somewhat crushed specimen about 30 mm in diameter, is the largest known. On half of the outer whorl there are 37 ribs at the venter, 11 at the umbilical shoulder. In this specimen, and also GSC 28797 (Pl. 79, fig. 5), enough of the test is preserved to show that on the outer surface the ribs are smooth, and depressed where they cross the venter. The steinkern of GSC 28797 (Pl. 79, fig. 5) shows a smooth venter, indicating the presence of a preseptal layer.

The tuberculate inner whorls and style of ribbing indicate close affinity with *Maclearnoceras maclearni* Tozer, which differs only in being more evolute and in having much less pronounced projection of ribs where they cross the venter.

Genus *Asklepioceras* Renz, 1911

Type species. Arpadites (Dittmarites) segmentatus Mojsisovics.

Asklepioceras exilis n. sp.

Plate 80, figures 3a–c; Figure 63a (p. 508)

Asklepioceras n. sp. TOZER, 1967, p. 30, 65 (in part).

Registered material. Holotype GSC 28776 (GSC loc. 68236).

Occurrence. Ladinian, Maclearni Subzone 3. Toad Formation, northeastern British Columbia. GSC loc. 68236 (2).

Diagnosis. Thick whorled *Asklepioceras,* diameter about 28 mm, H about 35 per cent, W about 55 per cent, U about 35 per cent of diameter. Excentrumbilicate, body chamber not contracted. Ribs smooth, without lateral or external tuberculation, somewhat tuberculate at the umbilical shoulder, appreciably thinner on body chamber than on phragmocone. Venter arched, without a sulcus on the surface of the test, but with a shallow sulcus impressed on the steinkern, at least until the margin of the body chamber.

Measurements. Holotype GSC 28776 (Pl. 80, fig. 3): 27, 0.35, 0.55, 0.35.

Remarks. In the holotype (Pl. 80, fig. 3), three quarters of a whorl of body chamber is preserved. In the outer whorl, the cross-section changes, the whorls becoming proportionately higher in relation to their width, with the acquisition of moderately distinct ventrolateral shoulders on the last half whorl. This modification, and the thinning of the ribs, suggests that the specimen was complete and mature. The last three septa are visible. They are not approximated.

In lacking a ventral sulcus, *A. exilis* might be regarded as too unlike *A. segmentatum* (Mojsisovics) to be treated as a representative of the same genus. There is, however, a distinct resemblance in shape and lateral sculpture, to *Asklepioceras laurenci* McLearn. *Asklepioceras laurenci,* differs from *A. exilis,* and resembles *A. segmentatum,* in having a truly sulcate venter.

Asklepioceras altilis n. sp.

Plate 80, figures 4–6; Figure 63b, c (p. 508)

Asklepioceras n. sp. TOZER, 1967, p. 30, 65, (in part).

Registered material. Holotype GSC 28777, two paratypes GSC 28778, GSC 28779 (all GSC loc. 68236).

Occurrence. Ladinian, Maclearni Subzone 3. Toad Formation, northeastern British Columbia. GSC loc. 68236 (13).

Diagnosis. Thick-whorled *Asklepioceras,* like *A. exilis* n. sp., but thicker (W about 70 per cent of diameter) and with a contracted body chamber, the width of the phragmocone being more than that of the body chamber.

Measurements. Holotype GSC 28777 (Pl. 80, fig. 5): 24, 0.42, 0.71, 0.29.

Remarks. The holotype (Pl. 80, fig. 5), with about three quarters of a whorl of body chamber, which is distinctly contracted in width, was probably complete and mature. The last three septa are visible; they show no approximation. GSC 28779 (Pl. 80, fig. 4) is the remains of a specimen—the largest known—that attained a diameter of about 30 mm.

Asklepioceras laurenci McLearn

Plate 82, figures 11–13; Plate 83, figures 1–7; Figure 65a, b (p. 512)

Asklepioceras laurenci McLearn, 1940a, p. 51, Pl. 2, figs. 1, 2; McLEARN, 1941b, p. 98; McLEARN, 1947b, Pl. 6, figs. 4–9; TOZER, 1967, p. 30, 66.

Asklepioceras sp. cf. *A. laurenci* McLearn. TOZER, 1967, p. 65.

Aklepioceras mahaffii McLearn, 1947b, p. 26, Appendix 2, Pl. 6, figs. 1–3; TOZER, 1967, p. 30, 66.

Registered material. Holotype GSC 8805, topotype GSC 9533 (both GSC loc. 9806). Holotype *Asklepioceras mahaffii* GSC 9551, topotype GSC 9534 (both GSC loc. 9797). Paratype *Asklepioceras mahaffii* GSC 9552, topotype GSC 9535 (both GSC loc. 9800). Hypotype GSC 28780 (GSC loc. 46960). Hypotype GSC 28782 (GSC loc. 68231). Hypotype GSC2 28781 (GSC loc. 82612). Hypotype GSC 28783 (GSC loc. 82645).

Occurrence. Ladinian, Sutherlandi Subzone 2. Toad Formation, northeastern British Columbia; Liard Formation, northeastern British Columbia. GSC locs. 9797 (6), 9800 (2), 9806 (4), 46960 (1), 68231 (2), 82612 (1), 82645 (1).

Diagnosis. Asklepioceras with mature diameter of about 28 mm to more than 38 mm, H about 40 per cent, W about 45 per cent, U about 25 per cent of diameter. Excentrumbilicate, body chamber not contracted. Ribbing on adoral part of body chamber much denser than on phragmocone. Phragmocone ribs

smooth, except at small diameter (about 10 mm), where there are two spiral ridges on the flank. Venter of inner whorls with a discontinuous external ridge on each side of the median line. With increase in size these ridges fade with the appearance of a well defined sulcus between them. Sulcus retained on the outer whorl, impressed on both the surface of the test and the steinkern.

Measurements. Holotype GSC 8805 (Pl. 83, fig. 7): 30, 0.40, 0.47, 0.25. Hypotype GSC 28781 (Pl. 82, fig. 13): 27, 0.40, 0.44, 0.25. Hypotype GSC 28783 (Pl. 82, fig. 12): 32, 0.45, 0.37, 0.23.

Remarks. Spiral ridges on the flank are seen only in GSC 28780 (Pl. 83, fig. 4) and GSC 28782 (Pl. 82, fig. 11). GSC 28781 (Pl. 82, fig. 13) contributes most to the diagnosis showing that dense ribbing, as on the holotype of *Asklepioceras mahaffii* (Pl. 83, fig. 1), may replace broad smooth ribs, like those of the holotype of *A. laurenci* (Pl. 83, fig. 7). In this interpretation the two taxa are synonyms, with the holotype of *Asklepioceras mahaffi* being a small mature form. The holotype of *Asklepioceras laurenci* (Pl. 83, fig. 7), which lacks dense ribbing, is interpreted as immature, despite its large size.

This species is distinguished from *Asklepioceras exilis* n. sp. and *A. altilis* n. sp. by having a ventral sulcus. *Asklepioceras squamatum* Arthaber (1914, p. 140) resembles *A. laurenci,* but seemingly differs because it is not known to have lateral spiral ridges.

Genus *Muensterites* Mojsisovics, 1893

Type species. Arpadites (Muensterites) ectodus Mojsisovics.

Muensterites helenae (Renz)

Plate 82, figures 8a–e

Arpadites (Asklepioceras) helenae Renz, 1911, Pl. 72, Pl. 4, figs. 4, 5; ARTHABER, 1914, p. 139, Pl. 16, figs. 7a–c (only).

not *Arpadites helenae* Mojsisovics, 1882, p. 62.

Muensterites helenae (Renz). TOZER, 1971, p. 1018.

Registered material. Hypotype GSC 28793 (GSC loc. 68279).

Occurrence. Ladinian, Sutherlandi Subzone 2. Toad Formation, northeastern British Columbia. GSC loc. 68279 (1).

Measurements. Hypotype GSC 28793 (Pl. 82, fig. 8): 20.5, 0.49, 0.68, 0.22.

Remarks. GSC 28793 (Pl. 82, fig. 8) shows loss of sculpture on the outer whorl and was probably mature. Initially there are three tubercle-spirals between the umbilical shoulder and the median line (lateral, marginal, external). Adorad the lateral and marginal spirals disappear, and the external spiral is replaced by low clavate ridges bordering a shallow ventral sulcus. The ribs are thickened and almost tuberculate at the umbilical shoulder on the whole of the outer whorl. Preservation is partly steinkern, partly with the test. Sculpture of the test surface is essentially as on the steinkern, except near the aperture where fine growth striae are preserved on the test, but not on the steinkern. Suture lines are not visible. The specimen very closely resembles those described by Renz and Arthaber.

Muensterites glaciensis (McLearn)

Plate 84, figures 1–11; Figure 67 (p. 516)

Asklepioceras glaciense McLearn, 1940a, p. 51, Pl. 2, fig. 11; McLEARN, 1941b, p. 98; McLEARN, 1947b, p. 26, Pl. 6, figs. 10–13; TOZER, 1967, p. 30, 66.

Muensterites glaciensis (McLearn). TOZER, 1971, p. 1018; TOZER 1972a, p. 641, Pl. 127, fig. 6.

Registered material. Holotype GSC 8808, topotype GSC 9536 (both GSC loc. 9797). Eight hypotypes, GSC 28784 – GSC 28791 (all GSC loc. 68279). Hypotype GSC 28792 (GSC loc. 79383).

Occurrence. Ladinian, Sutherlandi Subzone 2. Toad Formation, northeastern British Columbia; Liard Formation, northeastern British Columbia. GSC locs. 9797 (8), 9799 (1), 68279 (22), 79383 (1).

Measurements. Hypotype GSC 28792 (Pl. 84, fig. 11): 71, 0.48, 0.51, 0.20.

Remarks. GSC 28792 (Pl. 84, fig. 11) has approximated septa and was probably mature. Lateral tuberculation is retained as far as the aperture. The tuberculation in this species varies considerably, with three to nine tubercle-spirals between the umbilical shoulder and the median line (one to seven lateral, marginal, external). GSC 28790 (Pl. 84, fig. 10) has only one lateral spiral; GSC 28792 (Pl. 84, fig. 11), two; GSC 28791 (Pl. 84, fig. 3), three; the holotype (Pl. 84, fig. 2), three or four; GSC 9536 (Pl. 84, fig. 1),

seven. On the inner whorls most or all of the tubercles are rounded and pointed. On the outer whorl at least some of the external tubercles are clavate, with two points (as on *Trachyceras*), the outer more elevated than the inner. These are shown by the holotype (Pl. 84, fig. 2), GSC 9536 (Pl. 84, fig. 1), GSC 28790 (Pl. 84, fig. 10) and GSC 28791 (Pl. 84, fig. 3). Some ribs join at the umbilical shoulder, forming prominent spines. The preseptal layer may be thick, resulting in suppression of the tuberculation on the steinkern (Pl. 84, fig. 11).

The inner whorls are much like those of *Muensterites helenae* (Renz), but most individuals of *M. glaciensis* have more spirals of lateral tubercles. They also differ in attaining a larger size and in retaining lateral tuberculation on much or all of the body whorl. The style of ribbing and form of the venter indicate affinity with *Muensterites ectodus* Mojsisovics (1893, p. 464), but that species differs from both *M. helenae* and *M. glaciensis* in having only marginal and external tuberculation.

Muensterites delicatulus (McLearn)

Plate 82, figures 9a, b

Asklepioceras delicatulum McLearn, 1947b, p. 26, Appendix p. 2, Pl. 4, figs. 6, 7; TOZER, 1967, p. 66 (?).

Registered material. Holotype GSC 9550, Sikanni Chief River, six miles (10 km) west of Mount Withrow, probably from the Toad Formation, collected by Shell Oil Company, 1946.

Occurrence. Ladinian, Sutherlandi Zone. Toad Formation, northeastern British Columbia; Liard Formation, northeastern British Columbia? GSC loc. 42354 (?3).

Remarks. The holotype (Pl. 82, fig. 9) is part of the body chamber and has much of the test preserved. Ribs are somewhat flat. There are about ten spirals of tubercles between the umbilicus and the ventral sulcus: one umbilical, four closely spaced inner lateral, three or four outer lateral, and two closely spaced spirals adjacent to the sulcus. Between the inner and outer lateral spirals there is a smooth band, without tubercles. None of the tubercles are clavate.

The species, which is certainly known only from the holotype (Pl. 82, fig. 9), has sculpture somewhat like that of *Muensterites glaciensis* (McLearn), but has more spirals of tubercles, none of which are clavate. The absence of clavate tubercles places this species as a morphological link between *Muensterites glaciensis* and *Daxatina canadensis* (Whiteaves). All species placed in *Daxatina* differ in their ribbing and tuberculation, ribs being less flattened and the lateral tuberculation more uniform.

Genus *Frankites* Tozer, 1971

Type species. Paratrachyceras sutherlandi McLearn.

Frankites glaber n. sp.

Plate 83, figures 13–15; Figure 66a (p. 514)

Paratrachyceras sp. aff. *P. sutherlandi* McLearn. TOZER, 1967, p. 65.

Registered material. Holotype GSC 28798, two paratypes GSC 28799, GSC 28800 (all GSC loc. 68234).

Occurrence. Ladinian, Sutherlandi Subzone 1. Toad Formation, northeastern British Columbia. GSC locs. 56245 (1), 68234 (7).

Diagnosis. Frankites attaining a diameter of about 65 mm, H about 45 per cent, W about 30 per cent, U about 25 per cent of diameter. Ribs broad, flat, and simple with narrow interspaces on the outer whorl; on inner whorls there is frequent bifurcation of ribs near the umbilical shoulder.

Measurements. Holotype GSC 28798 (Pl. 83, fig. 15): 65, 0.46, 0.26, 0.26. Paratype GSC 28799 (83, fig. 14): 21, 0.50, 0.33, 0.24.

Remarks. In the holotype (Pl. 83, fig. 15), half a whorl of body chamber is preserved. All the exposed ribs are simple. The last five septa are visible and are closely spaced, probably approximated. On the phragmocone and the initial part of the body chamber, the relief of the sculpture is greatly reduced on the steinkern, because of the presence of the preseptal layer. GSC 28799 (Pl. 83, fig. 14), 21 mm in diameter has an outer whorl with at first bifurcating, later simple, ribs. GSC 28800 (Pl. 83, fig. 13), 13 mm in diameter, has mostly bifurcating ribs. Both GSC 28799 and GSC 28880 show the bituberculate venter characteristic of *Frankites* at a small diameter.

The simple ribbing of the outer whorl is quite unlike the branched ribbing of *Frankites sutherlandi* (McLearn), but the inner whorls of *F. glaber* are much like those of *F. sutherlandi* and this is taken to justify

the generic assignment of the new species. Closely comparable ammonoids seem to be "*Trachyceras*" *subdenticulatum* (Klipstein) of Mojsisovics (1882, Pl. 24, figs. 37, 39) and "*Trachyceras*" n. sp. aff. *T. subdenticulatum* (ibid., Pl. 81, figs 8a, b). These specimens illustrated by Mojsisovics are too small to permit detailed comparisons. The style of ribbing and the sulcate venter indicate affinity with *Asklepioceras segmentatum* (Mojsisovics), but the ribs of *Frankites glaber* are narrow compared with those of *A. segmentatum*. *Frankites glaber* is clearly a species with characters of both *Asklepioceras* and *Frankites*.

Frankites sutherlandi (McLearn)

Plate 82, figure 10; Plate 83, figures 8–12; Figure 66b–d (p. 514)

Paratrachyceras sutherlandi McLearn, 1947b, p. 22, Appendix p. 1, Pl. 5, fig. 9; TOZER, 1967, p. 30, 65, 66, Pl. 8, figs. 9–12; TOZER, 1970, Pl. 17, figs. 22a, b.

Frankites sutherlandi (McLearn). TOZER, 1971, p. 1029; TOZER, 1972, p. 640, Pl. 128, figs. 5–9.

Registered material. Holotype GSC 9547 (Tozer, 1967, Pl. 8, fig. 12), Prophet River, British Columbia. Hypotype GSC 18902 (ibid., figs. 9a, b) (GSC loc. 36484). Two hypotypes, GSC 18903 (ibid., figs. 10a, b), GSC 18904 (ibid., figs. 11a–c) (both GSC loc. 42351). Hypotype GSC 28025 (GSC loc. 42352). Two hypotypes GSC 28801, GSC 28802 (both GSC loc. 68267). Hypotype GSC 28803 (GSC loc. 68232). Hypotype GSC 28804 (GSC loc. 49998). Hypotype GSC 72321* (GSC loc. 89783).

Occurrence. Ladinian, Sutherlandi Subzone 2. Toad and Liard formations, northeastern British Columbia. GSC locs. 9797 (1), 9806 (8), 9811 (2), 36484 (1), 40084 (1), 42297 (2), 42351 (11), 42352 (2), 42354 (2), 49998 (5), 68232 (1), 68233 (2), 68266 (7), 68267 (8), 68269 (3), 68278 (2), 68279 (6), 74773 (3), 82645 (1), 84262 (1), 84265 (4), 89783 (1).

Diagnosis. Frankites attaining a diameter of about 65 mm, H about 48 per cent, W 25–32 per cent, U about 23 per cent of diameter. Ribs narrow and flat on surface of test of outer whorl, flat or rounded on the inner whorls, those variants with rounded ribs being more inflated than those with flat ribs. Ribs bifurcate frequently between inner quarter of the flank and the umbilical shoulder. Inflated variants have infrequent branching on outer quarter of flank. Preseptal layer thick on phragmocone and initial part of body chamber.

Measurements. Hypotype GSC 18903: 47, 0.47, 0.32, 0.21. Hypotype GSC 28802 (83, fig. 10): 40, 0.48, 0.25, 0.25. Hypotype GSC 72321*: 65, 0.50, 0.25, 0.22.

Remarks. Suture lines are essentially ceratitic, but the external saddle may have small wrinkles on the outer side (Fig. 66d). Inflated variants are typified by GSC 18903 (Tozer, 1967, Pl. 8, figs. 10a–c); compressed variants by the holotype (ibid., fig. 12) and GSC 28025 (Pl. 82, fig. 12).

This species closely resembles "*Dimorphites*" *apertus* Mojsisovics (1893, p. 147), which has a ceratitic suture line like that of *Frankites sutherlandi*, not ammonitic, as in true *Dimorphites* (Tozer, 1971, p. 1018). Some specimens identified as "*Paratrachyceras*" *regoledanum* (Mojsisovics) also resemble *Frankites sutherlandi* (Tozer, ibid.). The type specimen of "*Paratrachyceras*" *regoledanum* does not show the suture, making exact comparisons impossible.

Genus *Daxatina* Strand, 1919

Type species. Trachyceras canadense Whiteaves.

Daxatina canadensis (Whiteaves)

Plate 85, figures 2–9; Figure 68b–e (p. 518)

Trachyceras canadense Whiteaves, 1889, p. 142, Pl. 18, figs. 4, 4a, b.

Dawsonites canadensis (Whiteaves). BOEHM, 1903, p. 56, Pl. 6, figs. 25–30; McLEARN, 1947b, p. 25, Pl. 8, fig. 6; KUMMEL, 1957, p. L160, fig. 190.

Clionites (*Dawsonites*) *canadensis* (Whiteaves). SMITH, 1927, p. 92, Pl. 107, figs. 8–10.

Daxatina canadensis (Whiteaves). TOZER, 1962a, Pl. 6, figs. 12a, b; TOZER, 1967, p. 30, 63, 66; TOZER, 1970, Pl. 17, figs. 21a, b.

Registered material. Holotype GSC 4718 (Tozer, 1970, Pl. 17, figs. 21a, b), "about 25 miles below Devil's Portage, Liard River", collected by R.G. McConnell, 1887, presumably from the Toad Formation. Hypotype GSC 14234 (GSC loc. 36484) (Tozer, 1962a, Pl. 6, figs. 12a, b). Hypotype GSC 28806 (GSC loc. 68231). Three hypotypes GSC 28807–GSC 28809 (all GSC loc. 68229). Hypotype GSC 28810 (GSC loc. 42335). Hypotype GSC 28811 (GSC loc. 42316). Hypotype GSC 28812 (GSC loc. 16002). Three hypotypes GSC 28813, GSC 28814, GSC 85779* (all GSC loc. 68264).

Occurrence. Ladinian, Sutherlandi Subzone 2. Toad Formation, northeastern British Columbia. Ludington Formation, northeastern British Columbia; Sulphur Mountain Formation, Llama Member, northeastern British Columbia. GSC locs. 16002 (1), 36484 (1), 42316 (2), 42335 (1), 68229 (4), 68230 (1), 68231 (4), 68264 (5), 68272 (2), 68363 (1), 84265 (1).

Diagnosis. Daxatina attaining a diameter of about 70 mm; H about 25 per cent, W 35–45 per cent, U 18–25 per cent of diameter. Ribs branched and simple, rounded, density variable (14–22 ribs per quarter whorl at the venter), distinctly projected on the outer flank and venter. Tuberculation on ribs varies between 9–16 spirals between the umbilicus and the ventral sulcus, variants with dense ribbing being the more compressed and involute with the most spirals. At a diameter of about 10 mm, the venter is without a sulcus and tuberculation is more pronounced than the ribbing. Suture line essentially ceratitic, but there may be small wrinkles in the external saddle.

Measurements. Holotype GSC 4718: 51, 0.42, 0.43, 0.26. Hypotype GSC 14234: 72, 0.48, 0.34, 0.18. Hypotype GSC 28812 (Pl. 85, fig. 6): 44, 0.50, 0.39 0.18. Hypotype GSC 28814 (Pl. 85, fig. 9): 68, 0.49, 0.41, 0.22.

Remarks. GSC 28812 (Pl. 85, fig. 6) typifies the most densely ribbed variety and has about 16 tubercle-spirals between the umbilicus and the ventral sulcus; GSC 28810 (Pl. 85, fig. 4) has 15; the holotype about 10; and the most coarsely ribbed variants, like GSC 28813 (Pl. 85, fig. 8), eight or nine spirals. Associated with the coarsely ribbed form with few spirals (Pl. 85, fig. 8) is GSC 85779* with numerous spirals (16). When perfectly preserved, the tuberculation, at a large diameter, extends along the ribs to the ventral sulcus without interruption. At smaller diameter, two spirals adjacent to the sulcus may stand apart, as in *Trachyceras.* This is shown by GSC 28806 (Pl. 85, fig. 2). GSC 28810 (Pl. 85, fig. 4) shows the inner whorl at a diameter of 9 mm. The whorl section is depressed (width twice the height), ribbing is barely perceptible, the venter is without a sulcus and there are three or four spirals of large tubercles. In this specimen, ribs and a ventral sulcus are well expressed at a diameter of 15 mm.

Daxatina laubei n. sp.

Plate 85, figures 1a–c; Figure 68a (p. 518)

Registered material. Holotype GSC 28805 (GSC loc. 68267).

Occurrence. Ladinian, Sutherlandi Subzone 2. Toad Formation, northeastern British Columbia. GSC loc. 68267 (1).

Diagnosis. Daxatina attaining a diameter of about 40 mm, H about 50 per cent, W about 40 per cent, U about 15 per cent of diameter. Ribbing unusually dense, about eight ribs to a quadrant at the umbilicus, about 28 at the venter, about 18 spirals of small rounded tubercles on each rib. Two spirals adjacent to the ventral sulcus stand apart from those at the margin. Peripheral projection of ribs moderate.

Measurements. Holotype GSC 28805 (Pl. 85, fig. 1): at 31, 0.52, 0.39, 0.16.

Remarks. The holotype (Pl. 85, fig. 1), mostly steinkern, is incomplete, preserving only a quarter whorl of body chamber. The original diameter was about 40 mm. Ceratitic suture lines are well preserved and closely spaced although not clearly approximated (Fig. 68a).

The delicate ribbing, segregation of two tubercle-spirals adjacent to the ventral sulcus, and the smaller umbilicus, distinguish this species from *Daxatina canadensis* (Whiteaves). The sculpture, particularly the two spirals adjacent to the ventral sulcus, is more like that of *Trachyceras* than of *Daxatina,* but the broad, unindented saddles of *Daxatina laubei* are quite unlike the narrow ammonitic elements of all *Trachyceras* species.

Etymology. The name commemorates Gustav Laube.

Daxatina megabrotheus n. sp.

Plate 82, figures 6, 7; Figure 65e (p. 512)

Protrachyceras n. sp. aff. *Trachyceras brotheus* (Münster). TOZER, 1967, p. 30, 66.

Registered material. Holotype GSC 28821 (GSC loc. 89783). Paratype GSC 28822 (GSC loc. 40084).

Occurrence. Ladinian, Sutherlandi Subzone 2. Toad Formation, northeastern British Columbia; Liard Formation, northeastern British Columbia. GSC locs. 40084 (1), 89783 (1).

Diagnosis. Daxatina attaining a diameter of about 45 mm; H about 45 per cent, W about 50 per cent, U about 28 per cent of diameter. Ribbing unusually coarse; ribs simple, about seven on a quarter whorl, with five spirals of tubercles between the umbilicus and the ventral sulcus.

Measurements. Holotype GSC 28821 (Pl. 82, fig. 7): 46, 0.45, 0.52, 0.28

Remarks. The holotype (Pl. 82, fig. 7) is preserved as steinkern. The last half whorl is body chamber. Only the last two septa are visible. They are not obviously approximated. E is imperfectly exposed, but clearly narrow. The external saddle is rounded, L denticulate, the lateral saddle almost or perfectly rounded. The tubercles, as preserved on the steinkern, are blunt. Most were probably spines on the outer surface of the test. The umbilical and inner lateral spirals are of large rounded tubercles, the outer lateral and marginal spirals are smaller and clavate; tubercles of the external spiral are large and rounded. The last quarter whorl is imperfectly preserved and possibly had more spirals. At the beginning of the outer whorl the ventral sulcus is shallow; adorally it becomes deeper. In GSC 28822 (Pl. 82, fig. 6), some of the test is preserved. The umbilical edge is damaged, but was probably tuberculate. There are at least two lateral spirals, also one marginal and one external. Where the test is preserved it can be seen that the marginal spiral was of projecting clavate spines.

This species is sculptured like the inner whorls of *Trachyceras brotheus* (Muenster) (Laube, 1870, Pl. 38, figs. 8–14), *Muensterites glaciensis* (McLearn) and *Daxatina canadensis* (Whiteaves). Because the holotype is relatively large and has the body chamber preserved, it is interpreted as a mature ammonoid, not a very large nucleus. At a size comparable with *D. megabrotheus,* all species of *Trachyceras* and *Muensterites* and all other species of *Daxatina* have body chambers that are much more densely ribbed. Species of *Trachyceras* also differ in having ammonitic suture lines. This species forms a link between those of *Daxatina* and *Muensterites* and also anticipates some characters of *Trachyceras.*

Daxatina limpida n. sp.

Plate 88, figures 15–19; Figure 71c, d (p. 524)

Registered material. Holotype GSC 28815, two paratypes GSC 28816, 28817 (all GSC loc. 83824). Hypotype GSC 28818 (GSC loc. 83868). Hypotype GSC 28819 (GSC loc. 84271).

Occurrence. Lower Carnian, Desatoyense Zone. Liard Formation, northeastern British Columbia. GSC locs. 83824 (7), 83868 (1), 84271 (1).

Diagnosis. Daxatina attaining a diameter of at least 50 mm; H about 46 per cent, W about 50 per cent, U about 25 per cent of diameter. About six ribs to a quadrant at the umbilicus, 14 at the venter, with about 10 spirals of tubercles on each rib. Peripheral projection of ribs weak.

Remarks. The holotype (Pl. 88, fig. 16) does not show suture lines. Probably only the last quarter whorl is body chamber. Preservation is not perfect, but it appears that there is no significant change in the pattern of tuberculation between the umbilicus and the venter, i.e., the tuberculation is like that of *D. canadensis* (Whiteaves), not *D. laubei* n. sp. In GSC 28816 (Pl. 88, fig. 17), all the inner whorls in the umbilicus are shown. Ribbing is dense and delicate from the beginning. GSC 28817 (Pl. 88, fig. 15) shows the whole of the external suture line to be ceratitic (Fig. 71c). GSC 28819 (Pl. 88, fig. 18) shows an entire external saddle (Fig. 71d).

Remarks. The outer whorls of this species closely resemble those of *Daxatina canadensis* (Whiteaves) differing only in having appreciably weaker projection of ribs at the venter. Those of *D. limpida* meet the median line at an angle of about 60 degrees. The comparable figure for *Daxatina canadensis* is about 45 degrees. It would also appear that the inner whorls of *Daxatina limpida* are different from those of *D. canadensis,* having densely tuberculate delicate ribs instead of large nodes.

Genus Trachyceras Laube, 1869

Type species. Ammonites (*Ceratites*) *aon* Münster.

Trachyceras? sp. indet.

Plate 88, figures 14a, b

Registered material. GSC 28820 (GSC loc. 84268)

Occurrence. Lower Carnian. Liard Formation, northeastern British Columbia. GSC loc. 84268 (1).

Remarks. This specimen has 13 tubercle-spirals (umbilical, 10 lateral, 2 external). The sculpture closely resembles that of some specimens of *Trachyceras aon* (Muenster) (e.g., Mojsisovics, 1882, Pl. 21, figs. 17a, b). Mojsisovics (1893, p. 685) gives 14 spirals as the maximum for *T. aon.* Without knowledge of the suture line and the inner whorls, identification of this specimen is impossible, particularly as it might be a *Daxatina* related to *D. laubei* n. sp. Specific identity with *D. laubei* is improbable because that species has more numerous spirals of tubercles.

Trachyceras desatoyense Johnston

Plate 89, figures 4–7; Plate 90, figure 1; Figure 72c (p. 526)

Trachyceras (*Trachyceras*) *desatoyense* Johnston, 1941, p. 483, Pl. 66, figs. 3, 4; Pl. 67, fig. 4–6; Pl. 68, figs. 4–7.

Trachyceras sp. cf. *T. desatoyense* Johnston. TOZER, 1967, p. 31, 63.

Registered material. Hypotype GSC 28823 (GSC loc. 68217). Three hypotypes GSC 28824–GSC 28826 (all GSC loc. 84269). Hypotype GSC 72166 (GSC loc. 84212).

Occurrence. Lower Carnian, Desatoyense Zone. Ludington Formation, northeastern British Columbia; Liard Formation, northeastern British Columbia. GSC locs. 45745 (1), 68217 (2), 84212 (3), 84269 (4).

Remarks. GSC 28823 (Pl. 89, fig. 4) and GSC 28825 (Pl. 89, fig. 6) have nine lateral spirals; GSC 72166 (Pl. 90, fig. 1) has seven. In addition all have a moderately projected double spiral adjacent to the ventral sulcus. The number of spirals is the same as in some specimens of *Trachyceras desatoyense* from Nevada, GSC 28823 (Pl. 89, fig. 4) being closely similar to USNM 77535 (Johnston, 1941, Pl. 66, fig. 4). Suture lines are not well preserved, but ammonitic saddles are certainly demonstrable in GSC 28823, less certainly in GSC 28825 and GSC 72166.

Trachyceras aonoides Mojsisovics

Plate 89, figure 8; Figure 72b (p. 526)

Ammonites credneri Klipstein. HAUER, 1847, p. 275, Pl. 9, figs. 11–13 (not of Klipstein, 1843, p. 119).

Trachyceras aonoides Mojsisovics. MOJSISOVICS, 1882, p. 131; MOJSISOVICS, 1893, p. 684, Pl. 191, figs. 1–3; Pl. 192, figs. 1–4.

Trachyceras (*Trachyceras*) *aonoides aonoides* Mojsisovics. KRYSTYN, 1978, p. 55, Pl. 2, figs. 1–3.

Trachyceras (*Trachyceras*) *aonoides fissinodosum* Mojsisovics. KRYSTYN, 1978, p. 55, Pl. 3, figs. 1, 2.

Registered material. Hypotype GSC 28827 (GSC loc. 83872).

Occurrence. Lower Carnian, Desatoyense Zone. Liard Formation, northeastern British Columbia. GSC loc. 83872 (1).

Remarks. GSC 28827 (Pl. 89, fig. 8) has about 17 spirals of tubercles on the flank. Imperfect preservation precludes an accurate count. The venter is also imperfect, but is clearly sulcate. The presence of two closely spaced spirals adjacent to the sulcus is not demonstrable. Parts of the external saddle and lateral lobe are ammonitic (Fig. 72b).

Genus *Austrotrachyceras* Krystyn, 1978

Type species. Trachyceras austriacum Mojsisovics.

Austrotrachyceras obesum (Tozer)

Plate 90, figures 2, 3, 5, 6

Trachyceras sp. TOZER, 1962a, Pl. 7, figs. 1a, b.

Trachyceras obesum Tozer, 1967, p. 31, 63, 93, Pl. 9, figs. 1a, b.

Austrotrachyceras obesum (Tozer). KRYSTYN, 1978, p. 69.

Registered material. Holotype GSC 14311 (GSC loc. 42308). Hypotype GSC 72168 (GSC loc. 68209). Two hypotypes GSC 72169, GSC 72170 (both GSC loc. 84200).

Occurrence. Lower Carnian, Obesum Zone. Ludington Formation, northeastern British Columbia; Liard Formation, northeastern British Columbia. GSC locs. 42308 (2), 68209 (1), 84200 (4).

Remarks. None show suture lines. All show two spirals of tubercles adjacent to the ventral sulcus flanked by a smooth band. Clearly shown is the principal generic character of *Austrotrachyceras,* namely feeble projection of growth lines and tubercle spirals on the venter.

Genus *Trachysagenites* Mojsisovics, 1893

Type species. Ammonites erinaceus Dittmar.

Trachysagenites sp. indet.

Plate 94, figures 5, 10; Plate 101, figure 10

Sagenites (*Trachysagenites*) *herbichi* Mojsisovics. CARLISLE and SUSUKI, 1965, p. 481, Pl. 9, figs. 82, 83, 84, 87.

Trachysagenites herbichi Mojsisovics. TOZER, 1962a, Pl. 8, figs. 15a, b; TOZER, 1967, p. 33, 83.

Trachysagenites sp. cf. *T. herbichi* Mojsisovics. TOZER, 1967, p. 82.

Registered material. GSC 17981 (Carlisle and Susuki, 1965, Pl. 9, figs. 82, 87), GSC 18878 (ibid., figs. 83, 84). GSC 14246 (Tozer, 1962a, Pl. 8, figs. 15a, b) (GSC loc. 23066). GSC 28413 (GSC loc. 23147). GSC 28414 (GSC loc. 82936).

Occurrence. Upper Carnian, Dilleri and Welleri zones. Open Bay Formation, Quadra Island, British Columbia; Quatsino Limestone, Vancouver Island, British Columbia. GSC locs. 23066 (1), 23147 (2), 53340 (1), 82936 (2).

Remarks. None of the specimens from Canada certainly preserve the body chamber, and this is also true of the specimens described from California by Smith (1927). Carlisle and Susuki (1965, p. 481) suggested that GSC 17981 (ibid., Pl. 9, figs. 82, 87) is a mature example, but this cannot be confirmed because the specimen shows no septa. The specimens from the Dilleri and Welleri zones do not seem to be significantly different. Differences might be apparent if the characters of the body chamber were known.

Subfamily SIRENITINAE Tozer, 1971

Genus *Sirenites* Mojsisovics, 1893

Type species. Ammonites senticosus Dittmar.

Sirenites sp. indet.

Plate 90, figure 4

Registered material. GSC 72167 (GSC loc. 68209).

Occurrence. Lower Carnian, Obesum Zone. Ludington Formation, northeastern British Columbia. GSC loc. 68209 (1).

Sirenites nanseni Tozer

Plate 91, figures 4–6, 8–12; Figure 73 (p. 530)

Sirenites nanseni Tozer, 1961, p. 77, Pl. 23, figs. 1–8; Pl. 24, figs. 12–16; TOZER, 1967, p. 32, 45, 63, Pl. 9, figs. 2, 3; TOZER, 1970, Pl. 18, figs. 1a, b.

Sirenites sp. cf. *S. striatofalcatus* (Hauer). TOZER, 1967, p. 63 (in part).

Registered material. Holotype GSC 14161, six paratypes GSC 14159, GSC 14160, GSC 14162–GSC 14165, (Tozer, 1961, Pl. 23, figs. 1–8; Pl. 24, fig. 15), topotype GSC 18905 (Tozer, 1967, Pl. 9, figs. 2a, b) (all GSC loc. 28439). Two paratypes GSC 14151 (Tozer, 1961, Pl. 24, figs. 16a, b), GSC 14153 (ibid., figs. 12a, b), hypotype GSC 18906 (Tozer, 1967, Pl. 9, figs. 3a, b) (all GSC loc. 28427). Paratype GSC 14152* (GSC loc. 28569). Paratype GSC 14156* (GSC loc. 32220). Paratype GSC 14157 (Tozer, 1961, Pl. 24, figs. 14a, b) (GSC loc. 32369). Paratype GSC 14166 (ibid., Pl. 24, figs. 13a, b) (GSC loc. 30359). Three hypotypes GSC 28721, GSC 28722, GSC 28723 (all GSC loc. 42311). Two hypotypes GSC 72171, GSC 72172 (both GSC loc. 64787). Hypotype GSC 28726 (GSC loc. 68215). Two hypotypes GSC 28724, GSC 28725 (both GSC loc. 79387).

Occurrence. Lower Carnian, Nanseni Zone. Ludington Formation, northeastern British Columbia; Blaa Mountain Formation, Ellesmere and Axel Heiberg islands; Schei Point Formation, Hat Island. GSC locs. 28427 (25), 28439 (50), 28469 (5), 28569 (30), 30357 (6), 30359 (1), 32220 (18), 32369 (11), 42311 (3), 47567 (14), 64787 (16), 68215 (1), 79387 (2).

Remarks. This species, based on a large collection from Ellesmere Island, is interpreted within broad morphological limits. Ribs may be strong and branched, about as wide as the interspaces, with relatively few spirals of tubercles, or they may be weak and unbranched, with more numerous spirals. At diameters more than 25 mm specimens from the Arctic Islands have 7–13 tubercle-spirals between the umbilicus and the braided keels. Specimens from British Columbia that conform fairly closely are GSC 28724 (Pl. 91, fig. 9) and GSC 28725 (Pl. 91, fig. 10) which have eight spirals and GSC 28726 (Pl. 91, fig. 6) which has at least six. The collection from Ewe Mountain includes GSC 28722 (Pl. 91, fig. 8) with at least six spirals. This specimen has a close counterpart in GSC 18906 (Tozer, 1967, Pl. 9, figs. 3a, b) from Ellesmere Island.

Sirenites ovinus n. sp.

Plate 91, figures 2, 7

Sirenites sp. cf. *S. senticosus* (Dittmar). TOZER, 1962a, Pl. 8, fig. 9; TOZER, 1967, p. 63.

Registered material. Holotype GSC 14240, paratype GSC 28720 (both GSC loc. 42311).

Occurrence. Lower Carnian, Nanseni Zone. Ludington Formation, northeastern British Columbia. GSC loc. 42311 (2).

Diagnosis. Sirenites with H about 47 per cent, W about 30 per cent, U about 25 per cent of diameter. Tuberculation comprises one umbilical, two lateral and one marginal spiral.

Remarks. This species is distinguished from *Sirenites nanseni* Tozer, and from most, if not all, variants of *S. senticosus* (Dittmar) by the small number of lateral spirals. *Sirenites hayesi* Smith (1927, p. 82) differs in having three, instead of two, lateral spirals. Associated with *S. ovinus* are specimens with more lateral spirals, identified as *S. nanseni.* Possibly all the *Sirenites* from this bed are of one species, but those named *S. ovinus* do not fall within the range of variation of *S. nanseni* encountered at the type locality.

Sirenites serotinus n. sp.

Plate 102, figures 2, 4–9; Figure 81c (p. 552)

Sirenites senticosus (Dittmar). TOZER, 1961, p. 75, Pl. 24, figs. 7–9 (not of Dittmar, 1866, p. 375).

Sirenites hayesi Smith. BYCHKOV et al., 1976, p. 123, Pl. 41, figs. 3a, b (not of Smith, 1927, p. 82).

Registered material. Holotype GSC 14149, two paratypes GSC 14148, GSC 72183* (all GSC loc. 30369). Hypotype GSC 14150 (Tozer, 1961, Pl. 24, fig. 8) (GSC loc. 37218). Hypotype GSC 28728 (GSC loc. 55479). Three hypotypes GSC 72175–GSC 72177 (all GSC loc. 97561). Hypotype GSC 72174 (GSC loc. 28429).

Occurrence. Upper Carnian, Welleri Zone. Schei Point Formation, Table Island, Borden Island; Blaa Mountain Formation, Upper Calcareous Member, Ellesmere Island, Axel Heiberg Island; Otuk Formation, N Yukon. GSC locs. 28429 (1), 30369 (3), 37218 (1), 55479 (1), 97561 (5).

Diagnosis. Sirenites with H about 48 per cent, W about 23 per cent, U about 20 per cent of diameter. Tuberculation comprises one umbilical, two lateral and one marginal spiral; characteristically there is also an additional, relatively small, inner lateral spiral.

Remarks. The holotype (Pl. 102, fig. 5) has a distinctive type of sculpture on the flank with the inner lateral spiral, composed of small tubercles, close to the adjacent spiral of larger tubercles. The space is less than that separating the two lateral spirals of large tubercles. GSC 14148 (Pl. 102, fig. 4) lacks the inner spiral of small tubercles. This specimen has approximated septa. The distinctive lateral tuberculation is clearly shown by some specimens from the Yukon, e.g., GSC 72177 (Pl. 102, fig. 8). GSC 28728 (Pl. 102, fig. 9) is not certainly referable to this species, but has fewer spirals of tubercles than *Sirenites nanseni* Tozer.

This species, of Upper Carnian age, closely resembles the Lower Carnian *Sirenites ovinus* n. sp., but differs in having three, instead of two, lateral tubercle-spirals. Although there is a close resemblance between *Sirenites serotinus* and variants of *S. senticosus* (Dittmar), which have as few as three spirals on the flank (e.g., Mojsisovics, 1893, Pl. 161, figs. 15a, b), it would appear that such examples are not typical (cf. Tozer, 1961, p. 75). This is judging from the interpretation of Krystyn (1978, Pl. 4, fig. 3), according to which most representatives of *Sirenites senticosus* have six or more lateral spirals, i.e., more than any examples of *Sirenites serotinus. Sirenites hayesi* Smith has lateral tuberculation somewhat comparable to that of *S. serotinus,* but it is slightly different, the spiral of small tubercules being at mid-flank, not on the inner flank. The tuberculation of the specimen illustrated by Bychkov et al. (1976) has tuberculation more like that of *S. serotinus* than *S. hayesi.*

Sirenites yakutensis Kiparisova

Plate 102, figure 10

Sirenites yakutensis Kiparisova, 1937, p. 6, 30, Pl. 1, figs.1a, b; BYCHKOV et al., 1976, p. 123, Pl. 42, figs. 2, 6; DAGYS et al., 1979, Pl. 14, figs. 4, 5.

Registered material. Hypotype GSC 28727 (GSC loc. 28428).

Occurrence. Upper Carnian, Welleri Zone. Blaa Mountain Formation, Upper Calcareous Member, Ellesmere Island. GSC loc. 28428 (1).

Remarks. GSC 28727 (Pl. 102, fig. 10), although flattened, clearly shows that the inner whorls have

prominent lateral tuberculation, with not more than two lateral spirals. The outer whorl, in contrast, is almost smooth. This is the diagnostic character for *Sirenites yakutensis*.

Genus *Striatosirenites* Popov 1961a

Type species. Ammonites striatofalcatus Hauer.

Striatosirenites striatofalcatus (Hauer)

Plate 91, figures 1a, b

Ammonites striatofalcatus Hauer, 1847, p. 273, Pl. 9, figs. 7–9 (only).

Sirenites striatofalcatus (Hauer). MOJSISOVICS, 1893, p. 741, Pl. 164, figs. 1–3.

Sirenites sp. cf. *S. striatofalcatus* (Hauer). TOZER, 1967, p. 63 (in part).

Registered material. Hypotype GSC 28730 (GSC loc. 68361).

Occurrence. Lower Carnian, Nanseni Zone. Ludington Formation, northeastern British Columbia. GSC loc. 68361 (2).

Remarks. The specimens from Canada have the distinctive rounded, branching, falcoid ribs of this species, but they do not have the fine spiral sculpture preserved, which is another feature of the holotype.

Genus *Pamphagosirenites* Popov, 1961a

Type species. Ammonites pamphagus Dittmar.

Pamphagosirenites pamphagus (Dittmar)

Plate 97, figures 4a–c

Ammonites pamphagus Dittmar, 1866, p. 372, Pl. 16, figs. 20–22.

Sirenites pamphagus (Dittmar). MOJSISOVICS, 1893, p. 761, Pl. 160, figs. 4–8; GEMMELLARO, 1904, p. 67, Pl. 29, fig. 19; DIENER, 1906, p. 86, Pl. 10, figs. 8, 9.

Pamphagosirenites sp. cf. *P. pamphagus* (Dittmar). TOZER, 1962a, Pl. 7, figs. 5a–c.

Pamphagosirenites pamphagus (Dittmar). TOZER, 1967, p. 82.

Registered material. Hypotype GSC 17013 (GSC loc. 22270).

Occurrence. Upper Carnian, Welleri Zone. Quatsino Limestone, Vancouver Island, British Columbia. GSC loc. 22270 (1).

Remarks. Typical representatives of this species have delicate strigation on the flanks. GSC 17013 (Pl. 97, fig. 4) does not, otherwise agreement is close. Preservation of the test of GSC 17013 is not perfect. This probably accounts for the absence of strigation.

Pamphagosirenites pacificus n. sp.

Plate 94, figures 6a, b; Plate 97, figure 3

Registered material. Holotype GSC 28731, paratype GSC 28732* (both GSC loc. 82936). Paratype GSC 28733 (GSC loc. 28941).

Occurrence. Upper Carnian, Welleri Zone. Quatsino Limestone, Vancouver Island, British Columbia; Peril Formation, Queen Charlotte Islands, British Columbia; Unnamed formation, Iskut River area, British Columbia. GSC locs. 28941 (1), 82936 (3), 86284 (1), C-157295 (1), C-157373 (1).

Diagnosis. Pamphagosirenites like *P. pamphagus* (Dittmar), but with keels notched only at a small diameter (about 12 mm), being virtually smooth when larger (about 30 mm). Umbilical nodes strong; lateral and marginal clavi faint.

Remarks. Keels on the outer whorl of the holotype (Pl. 94, fig. 6), which is fully septate, are notched initially, but almost perfectly smooth on the adorad half. GSC 28732*, 12 mm in diameter, has notched keels and marginal clavi, but lacks umbilical and lateral tuberculation. Details of the suture line are not exposed.

The sculpture of the holotype, namely umbilical nodes, a spiral of low clavi at mid-flank, almost fused to form a ridge, and the strigation, indicate an obvious affinity with *Pamphagosirenites pamphagus* (Dittmar). The new species differs from *P. pamphagus* only in having a phragmocone on which the keels become smooth instead of remaining notched.

Genus *Pterosirenites* Tozer, 1980a

Type species. Pterosirenites auritus Tozer.

Pterosirenites auritus Tozer

Plate 110, figures 6–10; Plate 111, figures 2–6; Figure 89b–d (p. 570)

Sirenites nabeschi McLearn. TOZER, 1967, p. 60 (only).

Pterosirenites auritus Tozer, 1980a, p. 110, Pl. 17.1, figs. 18–22.

Registered material. Holotype GSC 28734, four paratypes GSC 28735–GSC 28738 (all GSC loc. 68180). Five hypotypes GSC 28739–28743 (all GSC loc. 83826).

Occurrence. Lower Norian, Kerri Zone. Pardonet Formation, northeastern British Columbia. GSC locs. 68180 (14), 83826 (8), 98515 (5), 98880 (1).

Diagnosis. Pterosirenites with the phragmocone attaining a diameter of about 85 mm; H about 55 per cent, W about 30 per cent, U about 15 per cent of diameter. Whorl side with five or six tubercle-spirals (umbilical, three or four lateral, marginal). Clavi on outer whorl spaced at about six to a quarter whorl.

Remarks. The holotype (Pl. 111, fig. 4) and probably also GSC 28742 (Pl. 110, fig. 8) have braided keels at the beginning of the outer whorl, with large external clavi and matching marginal tubercles appearing toward the aperture, at whorl heights of about 25 and 20 mm respectively. GSC 28738 (Pl. 111, fig. 6) and GSC 28740 (Pl. 110, fig. 10) are without clavi at larger diameters. The venter of the holotype is mostly preserved as steinkern and the nature of the clavi in terms of test surface is not determinable. Their pointed nature is best shown by GSC 28739 (Pl. 110, fig. 9), which has the outer shell layer preserved showing about six clavi on the last quadrant. Judging from the holotype (Pl. 111, fig. 4), GSC 28737 (Pl. 111, fig. 5) and GSC 28739 (Pl. 110, fig. 9) the marginal tubercles, like the external clavi, become widely spaced on the outer whorl. On the holotype there is no doubt that external clavi are present on the adoral part of the phragmocone. Of those for which an accurate count can be made, all from GSC locality 83826 have four spirals of lateral tubercles. They are most clearly expressed in GSC 28741 (Pl. 110, fig. 6) and GSC 28472 (Pl. 110, fig. 8). GSC 28743 (Pl. 110, fig. 7), a variant with subdued sculpture, has three inner lateral spirals and the suggestion of a fourth. The spirals are not as clearly expressed on specimens from GSC locality 68180. GSC 28736 (Pl. 111, fig. 2) and GSC 28735 (Pl. 111, fig. 3) have no more than three spirals. The holotype (Pl. 111, fig. 4) initially has three, later it appears to have four. GSC 28738 (Pl. 111, fig. 6) has at least four.

The holotype of *Sirenites nabeschi* McLearn (1939b, p. 7) is wholly septate (cf. McLearn, 1960a, p. 39) as are all the other specimens he described. These specimens are probably phragmocones of *P. auritus* comparable with GSC 28738 (Pl. 111, fig. 6), but it cannot be proved that the holotype of *Sirenites nabeschi* is a representative of *Pterosirenites. Sirenites nabeschi* is accordingly regarded as a *nomen dubium.*

Genus *Norosirenites* n. gen.

Type species. Norosirenites krystyni n. sp.

Diagnosis. Sirenitin with small umbilicus and phragmocone sculptured like that of *Sirenites* and *Pterosirenites,* with many spirals of tubercles, but distinguished by acquiring very finely notched keels on the body chamber instead of clavi (as in *Pterosirenites*) or coarse, braided keels (as in *Sirenites*). Suture line without adventitious elements in the external saddle.

Species assigned. Norosirenites krystyni n. sp.

Age. Lower Norian, Dawsoni Zone.

Remarks. The umbilicus of *Norosirenites* is appreciably smaller than that of *Sirenites* Mojsisovics (1893). The lateral sculpture of some species of *Pseudosirenites* Arthaber (1911) and *Argosirenites* Popov (1961a) resembles that of *Norosirenites*, but both genera differ, not only in retaining braided keels on the body chamber, but also in having adventitious elements in the external saddle.

Norosirenites krystyni n. sp.

Plate 119, figures 2–5; Plate 120, figures 7a, b; Figure 95d (p. 588)

Sirenites nabeschi McLearn. TOZER, 1967, p. 57 (not of McLearn, 1939b, p. 7).

Registered material. Holotype GSC 71023 (GSC loc. 97546). Paratype GSC 28744 (GSC loc. 64664). Three paratypes GSC 71024–GSC 71026 (all GSC loc. 47005).

Occurrence. Lower Norian, Dawsoni Subzone 1. Pardonet Formation, northeastern British Columbia. GSC locs. 47005 (4), 64664 (1), 97546 (4).

Diagnosis. Norosirenites with phragmocone attaining a diameter of about 50 mm; H about 60 per cent, W about 30 per cent, U about 8 per cent of diameter. Flanks with about seven tubercle spirals. Spirals most prominent at a small diameter; at larger diameters those on inner flank and at margin more prominent than those on the outer flank. On body chamber, ratio of ventral notches to marginal tubercles is about 5:1.

Remarks. At a small size, the ventral sculpture is that of *Sirenites*, as shown by GSC 28744 (Pl. 120, fig. 7), 31 mm in diameter, with eight marginal tubercles aligned with 14 external on one quadrant. The holotype (Pl. 119, fig. 5), has about a quarter whorl of body chamber preserved that has a shallow sulcus bordered by low keels with closely spaced transverse tubercles. The umbilical shoulder is rounded with a spiral of tubercles just outside. In all there are seven spirals on the flank between the umbilicus and the external keel. The inner four are prominent, the two outer lateral spirals are faint, the marginal spiral more distinct. The strength of the sculpture and the width of the ribs varies considerably, the extremes being illustrated by GSC 71025 (Pl. 119, fig. 3) and GSC 71026 (Pl. 119, fig. 4).

Sirenitins with phragmocones comparable to that of *Norosirenites krystyni* include "*Sirenites*" *nabeschi* McLearn (McLearn, 1960, p. 38), "*S.*" *obrucevi* Bajarunas (1932, p. 40), "*S.*" *kiparisovae* Zharnikova (*in* Buriy and Zharnikova, 1962, p. 89); "*S.*" *tenuistriatus* Popov (1961a, p. 87) and "*S.*" *spektori* Archipov (1974, p. 244). These species, all Lower Norian in age, have numerous tubercle-spirals on the flank and small umbilici, and in this way resemble *N. krystyni*. All are more involute than true *Sirenites* of Carnian age. Details of the body chamber characters of these species are not known, making satisfactory comparison with *N. krystyni* impossible. "*Sirenites*" *nabeschi* McLearn is here treated as a *nomen dubium*.

Etymology. The name is for Leopold Krystyn.

Genus *Pseudosirenites* Arthaber 1911

Type species. Sirenites stachei Mojsisovics.

Pseudosirenites pardoneti (McLearn)

Plate 135, figures 6, 7; Figure 109a (p. 618)

Sirenites pardoneti McLearn, 1940c, p. 115, Pl. 1, fig. 2; Pl. 4, fig. 4; McLEARN, 1947a, Pl. 5, figs. 8, 9.

Sirenites inaequiornatus McLearn, 1947a, Appendix p. 2, Pl. 6, fig. 3.

Pseudosirenites pardoneti (McLearn). McLEARN, 1960a, p. 40, Pl. 1, figs. 6a, b; Pl. 2, figs. 7, 8; TOZER, 1967, p. 58, 59.

Registered material. Holotype GSC 8844 (McLearn, 1960, Pl. 1, figs. 6a, b), paratype GSC 8845 (ibid., Pl. 2, figs. 7a–c), holotype of *S. inaequiornatus* GSC 9502 (ibid., Pl. 2, fig. 8) (all GSC loc. 9741). Hypotype GSC 28752 (GSC loc. 9781). Hypotype GSC 28753 (GSC loc. 83835).

Occurrence. Middle Norian, Columbianus Subzones 1, 2. Pardonet Formation, northeastern British Columbia. GSC locs. 9478 (1), 9632 (4), 9729 (1), 9741 (48), 9744 (4), 9745 (6), 9781 (16), 66027 (1), 83835 (3), 98518 (1), 98525 (3), 98540 (1), 98542 (2), 98550 (2), 98551 (6), 98552 (4), 98868 (l), 98869 (1), 98870 (5), 98878 (l), 98885 (10).

Measurements. Hypotype GSC 28753 (Pl. 135, fig. 6): 53, 0.57, 0.25, 0.06.

Remarks. GSC 28753 (Pl. 135, fig. 6) is complete with the peristome and was probably mature judging from the disappearance of tuberculation immediately adjacent to the aperture. A much larger size was also attained. The holotype, for example, although incomplete, is septate at a whorl height of 45 mm.

Pseudosirenites pressus (McLearn)

Plate 143, figures 4a, b

Sirenites pressus McLearn, 1947a, Appendix p. 2, Pl. 5, fig. 7.

Pseudosirenites pressus (McLearn). McLEARN, 1960a, p. 41, Pl. 2, figs. 6a, b; TOZER, 1967, p. 58, 59.

Registered material. Holotype GSC 9501 (GSC loc. 9745).

Occurrence. Middle Norian, Columbianus Subzone 2. Pardonet Formation, northeastern British Columbia. GSC locs. 9741 (20), 9745 (8), 98550 (1).

Pseudosirenites bullatus n. sp.

Plate 136, figures 5, 10; Plate 143, figure 8

Pseudosirenites sp., TOZER, 1967, p. 55.

Vredenburgites sp., McLEARN, 1960a, p. 42, Pl. 1, fig. 7.

Registered material. Holotype GSC 28757 (GSC loc. 68301). Paratype GSC 28758 (GSC loc. 68302). Hypotype GSC 12566 (GSC loc. 9784).

Occurrence. Middle Norian, Columbianus Subzone 3. Pardonet Formation, northeastern British Columbia. GSC locs. 9784 (2), 68301 (1), 68302 (3), 82455 (1), 98909 (1).

Diagnosis. Pseudosirenites with H about 58 per cent, W about 25 per cent, U about six per cent of diameter. Flanks with densely spaced delicate ribs that have spirals of slightly bullate tubercles, which are most prominent at mid-flank.

Remarks. The holotype (Pl. 136, fig. 5) shows no sutures, but part of the outer whorl is body chamber. Tuberculation is delicate and faint; marginal tubercles are well defined; six spirals at the mid-flank are also fairly prominent. Suture lines are shown by GSC 28758 (Pl. 136, fig. 10). At a whorl height of 7 mm there is one deep indentation in the outer side of the external saddle.

This species closely resembles *Pseudosirenites pardoneti* (McLearn), but differs in having more delicate sculpture, with the lateral tubercles more bullate, and less uniformly developed on the flank.

Pseudosirenites falcatus n. sp.

Plate 135, figures 8–10

Registered material. Holotype GSC 28754, two paratypes GSC 28755, GSC 28756 (all GSC loc. 64643).

Occurrence. Middle Norian, Columbianus Subzone 4. Pardonet Formation, northeastern British Columbia. GSC loc. 64643 (5).

Diagnosis. Pseudosirenites with tuberculation very faint or absent; ribbing conspicuously falcoid, with some branching on the outer flank, as well as branching with intercalation on the inner flank.

Remarks. The holotype (Pl. 135, fig. 8), preserved as steinkern, shows a faint trace of tuberculation. GSC 28756 (Pl. 135, fig. 10), a whorl fragment, also steinkern, shows no trace. GSC 28755 (Pl. 135, fig. 9), another whorl fragment, has the test preserved, with no trace of tuberculation. None show suture lines.

In having lateral tuberculation absent or very obscure, this species invites comparison with *Pseudosirenites pressus* (McLearn), which differs in having simpler, less falcoid ribbing.

Family CLIONITITIDAE (Arabu, 1932)

Genus *Clionitites* Strand, 1929

Type species. Clionites angulosus Mojsisovics.

Clionitites? *venerabilis* n. sp.

Plate 77, figure 7; Plate 79, figures 1a, b; Figure 62b (p. 506)

Clionitites? sp., TOZER, 1967, p. 30, 66.

Registered material. Holotype GSC 28688 (GSC loc. 42355).

Occurrence. Ladinian, Maclearni Subzone 2. Liard Formation, northeastern British Columbia. GSC loc. 42355 (1).

Diagnosis. Clionitites? with H about 30 per cent, W about 27 per cent, U about 45 per cent of diameter. Inner whorls with deep ventral sulcus; outer with a mere groove, which disappears completely at the aperture. Ribs thick, with convex curvature, slightly thickened at the margin, increasing by branching and intercalation on the inner third of the flank; primary ribs slightly bullate on the inner flank.

Measurements. Holotype GSC 28688 (Pl. 79, fig. 1): 40, 0.31, 0.27, 0.44.

Remarks. The holotype (Pl. 79, fig. 1) has half a whorl of body chamber and is probably complete. The ceratitic suture line is well preserved. No comparable species are known. Assignment to family and genus is uncertain. The deep sulcus of the inner whorls may indicate affinity with the Arpaditinae, but the venter of the outer whorl is more suggestive of Clionititinae.

Clionitites callazonensis n. sp.

Plate 88, figures 1–3; Figure 71a (p. 524)

Registered material. Holotype GSC 28689, two paratypes GSC 28690, GSC 28691 (GSC loc. 83824).

Occurrence. Lower Carnian, Desatoyense Zone. Liard Formation, northeastern British Columbia. GSC locs. 83824 (6), 84271 (1).

Diagnosis. Clionitites attaining a diameter of about 25 mm; H about 25 per cent, W about 30 per cent, U about 45 per cent of diameter. Phragmocone with well defined ventral sulcus; body chamber with ribs merely interrupted on the venter. Ribs mostly simple, with infrequent branching near the mid-flank; on phragmocone they end abruptly, but without nodes, adjacent to the ventral sulcus. Ribs on phragmocone are flatter and wider, particularly on the outer half of the flank, than those on the body chamber. Suture line goniatitic.

Remarks. GSC 28691 (Pl. 88, fig. 3), 24 mm in diameter with about half a whorl of body chamber, is the largest known specimen. The holotype (Pl. 88, fig. 1), has the suture line well preserved and there is no doubt that the lobes are truly unindented. The flat wide ribs of the phragmocone, best shown by GSC 28690 (Pl. 88, fig. 2), but also present on the holotype and GSC 28691, indicate close affinity with *Clionitites wheeleri* (Johnston) (1941, p. 449), but *C. callazonensis* differs in having denser ribbing on the body chamber.

Clionitites reesidei (Johnston)

Plate 88, figures 4–8

Clionites reesidei Johnston, 1941, p. 451, Pl. 58, figs. 19–25; Pl. 59, figs. 1–9.

Clionitites reesidei (Johnston). TOZER, 1967, p. 31, 64.

Registered material. Two hypotypes GSC 28692, GSC 28693 (both GSC loc. 45751). Two hypotypes GSC 28694, GSC 28695 (GSC loc. 83824). Hypotype GSC 28696 (GSC loc. 84271).

Occurrence. Lower Carnian, Desatoyense Zone. Liard Formation, northeastern British Columbia. GSC locs. 45751 (2), 83824 (2), 84271 (1).

Remarks. The style of ribbing and external tuberculation of the small specimens (Pl. 88, fig. 4–7) closely resembles that of specimens from the type locality in Nevada. GSC 28693 (Pl. 88, fig. 8), the largest specimen known from Canada, has the lateral ribbing of this species, but a different venter, without external nodes. This specimen may be pathological or, alternatively, may indicate the nature of the mature outer whorl. GSC 28695 and GSC 28696 show unindented lateral saddles, but none shows details of the lobes.

Clionitites arietinus n. sp.

Plate 91, figures 3a, b

Registered material. Holotype GSC 28697 (GSC loc. 42311).

Occurrence. Lower Carnian, Nanseni Zone. Ludington Formation, northeastern British Columbia. GSC loc. 42311 (4).

Diagnosis. Clionitites about 45 mm in diameter; H about 50 per cent, W about 25 per cent, U about 37 per cent of diameter. Ribs on outer whorl falcoid, much stronger on outer than on inner flank, crossing the venter with projection. Some ribs branch on the inner quarter of the flank.

Remarks. All known specimens are poorly preserved. The body chamber of the holotype (Pl. 91, fig. 3) is crushed and the nature of the venter, which is crossed by nontuberculate ribs, is clearly shown only near the aperture. Suture lines are not well preserved, but the last suture of the holotype has a narrow, apparently pointed unindented E, a rounded external saddle and an indented L. The lateral saddle is rounded, U2 deeply weathered.

The style of ribbing invites comparison with "*Buchites*" *aldrovandii* Mojsisovics (1893, p. 411), which, from an examination of the holotype is interpreted as being closely related, possibly conspecific with "*Clionites*" *angulosus* Mojsisovics (ibid., p. 465). A relationship between these two species was considered by Mojsisovics (ibid.). Compared with them, *Clionitites arietinus* is distinguished by the marked contrast in strength of ribbing between the inner and outer flank, and by being less evolute.

Clionitites punctulus n. sp.

Plate 109, figures 14a–d; Figure 87c (p. 566)

Choristoceras? sp. McLEARN, 1960a, p. 72, Pl. 19, figs. 3a, b.

Registered material. Holotype GSC 28698 (GSC loc. 68180). Hypotype GSC 13488 (McLearn, 1960a, Pl. 19, figs. 3a, b) (GSC loc. 9672).

Occurrence. Lower Norian, Kerri Zone. Pardonet Formation, northeastern British Columbia. GSC locs. 9672 (1), 68180 (1).

Diagnosis. Clionitites attaining a diameter of about 30 mm; H about 33 per cent, W about 30 per cent, U about 43 per cent of diameter. Median line smooth, depressed in relation to the tuberculate rib terminations, but not truly sulcate. Ribbing strong, most ribs branch at mid-flank and terminate in rounded tubercles at the margin. Suture line with L weakly indented.

Remarks. The holotype (Pl. 109, fig. 14) has only a quarter whorl of body chamber preserved. Both the phragmocone and body chamber are sharply ribbed. The external tuberculation and the absence of marginal tuberculation are taken to justify reference to *Clionitites* although the branched ribs of *C. punctulus* are not a feature of typical *Clionitites,* such as *C. angulosus* (Mojsisovics). No closely comparable species are known.

Clionitites laevis n. sp.

Plate 109, figures 15a–d; Figure 87d (p. 566)

Registered material. Holotype GSC 28699 (GSC loc. 68180).

Occurrence. Lower Norian, Kerri Subzone 2. Pardonet Formation, northeastern British Columbia. GSC loc. 68180 (1).

Diagnosis. Clionitites attaining a diameter of about 30 mm; H about 35 per cent, W about 33 per cent, U about 37 per cent of diameter. Median line smooth, depressed in relation to the tuberculate rib terminations, but not truly sulcate. Flanks with very faint branched ribs that terminate in rounded tubercles. Suture line goniatitic.

Remarks. The holotype (Pl. 109, fig. 15) has half a whorl of body chamber preserved and is probably complete. Ribbing is weak on the phragmocone and even weaker on the body chamber. The venter and tuberculation are like that of *C. punctulus* n. sp., which differs in having strong ribbing and a ceratitic suture line.

Genus *Sympolycyclus* Spath, 1951

Type species. Polycyclus nodifer Hyatt and Smith.

Sympolycyclus antiquus n. sp.

Plate 82, figures 1a, b; Figure 65c (p. 512)

Hannaoceras n. sp., TOZER, 1967, p. 30, 66.

Registered material. Holotype GSC 28828 (GSC loc. 42335).

Occurrence. Ladinian, Sutherlandi Subzone 2. Toad Formation, northeastern British Columbia. GSC loc. 42335 (1).

Diagnosis. Sympolycyclus about 30 mm in diameter; H about 25 per cent, W about 18 per cent, U about 55 per cent of diameter. Whorl section ovoid, with rounded umbilical shoulder and margin. About 10 ribs to a quadrant, appearing outside the smooth inclined umbilical wall, nearly straight on the flank, projected on the venter.

Remarks. The specimen is incomplete, but well preserved. The fragment of the penultimate whorl shows the goniatitic suture line. The outer whorl is body chamber. The style of ribbing on the two whorls is similar.

This species closely resembles *Hannaoceras newpassense* Johnston (1941, p. 454), but appears to differ in being more evolute.

Sympolycyclus gunningi n. sp.

Plate 92, figures 17a, b

Hannaoceras sp., TOZER, 1962a, Pl. 8, figs. 5a, b; CARLISLE and SUSUKI, 1965, p. 475, Pl. 4, figs. 35–38; Pl. 5, figs. 44, 45; TOZER, 1967, p. 82.

Registered material. Holotype GSC 14236 (GSC loc. 22691). Four hypotypes GSC 17977, GSC 17978, GSC 17997, GSC 18880 (Carlisle and Susuki, 1965, p. 475).

Occurrence. Upper Carnian, Dilleri Zone. Open Bay Formation, Quadra Island, British Columbia. GSC locs. 22691 (5), 22692 (4).

Diagnosis. Sympolycyclus attaining a diameter of about 20 mm; H about 35 per cent, W about 40 per cent, U about 40 per cent of diameter. Whorl section oval, there being no trace of ventrolateral shoulders. Outer whorl with about 25 perfectly radial ribs crossing the venter without projection or interruption.

Measurements. Holotype GSC 14236 (Pl. 92, fig. 17): 16, 0.34, 0.39, 0.41.

Remarks. All the specimens are silicified. None show suture lines.

Compared with *Sympolycyclus nodifer* (Hyatt and Smith) (1905, p. 201) ventral nodes are absent; with *S. kellyi* (Smith) (1927, p. 97), the whorls are more rounded in section and the ribbing is less dense.

Etymology. The name commemorates H.C. Gunning.

Sympolycyclus kellyi (Smith)

Plate 95, figures 1-3; Figure 76 (p. 538)

Choristoceras kellyi Smith, 1927, p. 97, Pl. 59, figs. 1-3.

Polycyclus major Smith, 1927, p. 97, Pl. 58, figs. 30-32.

Hannaoceras major (Smith). TOZER, 1967, p. 34, 62.

Registered material. Hypotype GSC 28829 (GSC loc. 42389). Hypotype GSC 28830 (GSC loc. 42378). Hypotype GSC 28831 (GSC loc. 42386).

Occurrence. Upper Carnian, Welleri Subzone 2. Pardonet Formation, northeastern British Columbia. GSC locs. 42378 (1), 42386 (1), 42389 (1).

Remarks. GSC 28829 (Pl. 95, fig. 1) has ribbing much like that of "*Polycyclus*" *major*. The holotype of that taxon has slight depression of the ribs at the beginning of the outer whorl, a feature not shown by GSC 28829. GSC 28830 (Pl. 95, fig. 2) is ribbed like "*Choristoceras*" *kellyi*. The two taxa are interpreted as densely ribbed (*major*) and distantly ribbed (*kellyi*) variants of one species.

Genus *Leconteiceras* Smith, 1914

Type species. Leconteia californica Hyatt and Smith.

Leconteiceras californicum (Hyatt and Smith)

Plate 92, figures 16a, b

Leconteia californica Hyatt and Smith, 1905, p. 36, Pl. 29, figs. 3-21.

Leconteiceras californicum (Hyatt and Smith). SMITH, 1927, p. 66, Pl. 29, figs. 3-21.

Leconteiceras sp., CARLISLE and SUSUKI, 1965, p. 480, Pl. 8, fig. 78; TOZER, 1967, p. 83.

Registered material. Hypotype GSC 17979 (Carlisle and Susuki, 1965, Pl. 8, fig. 78). Hypotype GSC 28832 (GSC loc. 22692).

Occurrence. Upper Carnian, Dilleri Zone. Open Bay Formation, Quadra Island, British Columbia. GSC loc. 22692 (1).

Family SANDLINGITIDAE Tozer, 1971

Genus *Sandlingites* Mojsisovics, 1893

Type species. Ammonites oribasus Dittmar.

Sandlingites oribasus (Dittmar)

Plate 104, figures 1a, b

Ammonites oribasus Dittmar, 1866, p. 384, Pl. 18, figs. 8-10.

Sandlingites oribasus (Dittmar). MOJSISOVICS, 1893, p. 706, Pl. 167, figs. 5-7; SMITH, 1927, p. 83, Pl. 57, figs. 24-27.

Registered material. Hypotype GSC 85780 (GSC loc. C-157006).

Occurrence. Upper Carnian, Dilleri Zone. Sadler Limestone, Moresby Island, British Columbia. GSC loc. C-157006 (1).

Genus *Traskites* Hyatt and Smith, 1905

Type species. Clionites (*Traskites*) *robustus* Hyatt and Smith.

Traskites sp. indet.

Plate 92, figures 18a, b

Californites sp. cf. *C. careyi* Smith. CARLISLE and SUSUKI, 1965, p. 474, Pl. 4, figs. 28, 29, 30.

Traskites (*Shastites*) sp. cf. *T.* (*S.*) *compressus* Hyatt and Smith. CARLISLE and SUSUKI, 1965, p. 475, Pl. 4, figs. 32, 33.

Traskites (*Stantonites*) sp. cf. *T.* (*S.*) *rugosus* Hyatt and Smith. CARLISLE and SUSUKI, 1965, p. 475, Pl. 4, figs. 31, 34.

Registered material. GSC 17982 (Carlisle and Susuki, 1965, Pl. 4, figs. 31, 34). GSC 18004 (ibid., figs. 28–30). GSC 18005 (ibid., figs. 32, 33).

Occurrence. Upper Carnian, Dilleri Zone. Open Bay Formation, Quadra Island, British Columbia.

Genus *Shastites* Hyatt and Smith, 1905

Type species. Clionites (*Shastites*) *compressus* Hyatt and Smith.

Shastites vulcanus n. sp.

Plate 92, figures 12, 14; Figure 74b (p. 532)

"*Sandlingites*" n. sp., McLEARN, *in* HOADLEY, 1953, p. 17.

Registered material. Holotype GSC 32560 (GSC loc. 79255). Paratype GSC 32561 (GSC loc. 79257).

Occurrence. Upper Carnian, Dilleri Zone? Karmutsen Group, Texada and Vancouver islands. GSC locs. 17123 (2), 79255 (2), 79257 (5).

Diagnosis. Shastites attaining a diameter of about 40 mm; H about 40 per cent, W about 33 per cent, U about 35 per cent of diameter. Ribs somewhat falcoid, most bifurcate near the umbilicus and bear about 10 spirals of small sharp tubercles, which are uniformly developed between the umbilicus and the ventral sulcus and are somewhat projected on the venter.

Remarks. The holotype (Pl. 92, fig. 14) is an uncrushed phragmocone 18 mm in diameter. Tuberculation is uniform on the whorl side on both the inner and outer whorls. The lateral lobe is goniatitic (Fig. 74b).

Shastites compressus Hyatt and Smith (1905, p. 188) differs in having fewer spirals of tubercles. *Shastites compressus* is evidently linked to *Traskites*, which has large marginal tubercles indicating affinity with *Sandlingites. Shastites vulcanus* shows no sign of this sculpture and it is possible that the resemblance to *S. compressus* is accidental. "*Sandlingites*" *pilari* Diener (1917, p. 379) is probably a related species, but differs in having more falcoid ribbing.

Family STEINMANNITIDAE new family

Most are ribbed serpenticones, the ribs generally branched and nodose. Ventral sulcus not deeply excavated, bordered by nodes or nodose keels. Suture line ceratitic, with a five-lobe formula (E, L, U2, U1, I).

Genera included. Metaclionites n. gen., *Scheutzites* Tatzreiter (1985), *Alloclionites* Spath (1951), *Steinmannites* Mojsisovics (1893), *Eosteinmannites* Tatzreiter (1951), *Brouwerites* Diener (1923), *Bihatites* Tatzreiter (1981), *Nannosteinmannites* Tatzreiter (1985), ?*Baonites* Tatzreiter (1985).

Distinguished from Clionititidae by having more complex ribbing, characteristically also in having nodose instead of smooth ribs. Steinmannitidae are probably related to the contemporary Thetiditidae, which differ in having spinose, rather than nodose, tuberculation.

Genus *Metaclionites* n. gen.

Type species. Metaclionites taylori n. sp.

Diagnosis. Bituberculate ribbed steinmannitid with median line not truly sulcate, but depressed in relation to external tubercles. Ribbing sharp, with some intercalated secondary ribs. Phragmocone with marginal and external rounded or slightly clavate tubercles. Tuberculation reduced in strength on body chamber. Ribs may be somewhat bullate, but are not truly tuberculate, on the inner flank. Suture line with indented L, U2 may be rounded, external saddle with one shallow indentation on the outer side.

Species assigned. Metaclionites taylori n. sp., "*Clionites*" *curvicostatus* Welter.

Age. Middle Norian.

Remarks. This genus is excluded from the Clionititidae by having marginal, in addition to external, tuberculation. Compared with *Alloclionites,* ribbing is sharper and there are fewer spirals of tubercles. The bituberculate venter invites comparison with that of *Sandlingites* (Sandlingitidae) and *Stikinoceras* (Thisbitidae). *Metaclionites* differs from *Sandlingites* in being devoid of large tubercles. The venter of *Stikinoceras* is different, having a low keel instead of being depressed, but in other characters the resemblances are close. The small indentation in the external saddle possibly indicates affinity with the

Tibetitidae, but members of that family differ in being discoidal and nearly all also differ in having lateral tuberculation.

Metaclionites taylori n. sp.

Plate 129, figures 12a–c; Figure 104c (p. 606)

Registered material. Holotype GSC 28700 (GSC loc. 83896).

Occurrence. Middle Norian, Rutherfordi Zone. Pardonet Formation, northeastern British Columbia. GSC locs. 83896 (1), 98876 (3).

Diagnosis. Metaclionites attaining a diameter of about 23 mm; H about 40 per cent, W about 38 per cent, U about 25 per cent of diameter. Ribs falcoid, increasing by intercalation at mid-flank, somewhat elevated on inner third of flank. Marginal tubercles rounded, external tubercles slightly clavate, both of about equal prominence, except near the aperture where on some ribs marginal tubercles are absent or less prominent than the external tubercles.

Measurements. Holotype GSC 28700 (Pl. 129, fig. 12): 22.5, 0.41, 0.38, 0.24.

Remarks. The holotype (Pl. 129, fig. 12) is mostly preserved as steinkern. The body chamber is about three quarters of a whorl. It is probably complete and mature judging from the change in sculpture adjacent to the aperture, where, on the last quadrant, at least one rib is without marginal tuberculation and all the ribs are lower and less prominent than on the preceding three quarters of a whorl. The venter lacks a true sulcus. The median line is depressed in relation to the external tubercles, but low ribs extend across the venter linking the external tubercles. Only the last suture line is visible. There is a shallow indentation on the outer side of the external saddle; L is indented; U2 apparently unindented.

"*Clionites*" *curvicostatus* Welter (1914, p. 139) is probably congeneric with *Metaclionites taylori,* judging from the similarities in ribbing and tuberculation. It differs, however, in being larger and more evolute. The suture line of Welter's species has not been illustrated, but is described as having an indentation in the external saddle. This similarity with *Metaclionites taylori* is possibly significant.

Etymology. The name is for G.C. Taylor.

Genus *Steinmannites* Mojsisovics, 1893

Type species. Ammonites hoernesi Hauer.

Steinmannites pacificus n. sp.

Plate 131, figures 5, 6; Figure 106a, b (p. 610)

Thetidites? n. sp., TOZER, 1967, p. 81.

Registered material. Holotype, GSC 28714, paratype GSC 28715 (both GSC loc. 19275).

Occurrence. Middle Norian, Columbianus Zone, Subzone 2? Parson Bay Formation, Vancouver Island, British Columbia. GSC loc. 19275 (2).

Diagnosis. Steinmannites with H about 35 per cent, W about 30 per cent, U about 38 per cent of diameter. Keels nodose, bordered by deep sulci on inner whorls, but not on the outer whorls. Ribs simple, faint, with convex curvature on the flank. Umbilical tuberculation absent, margin with prominent, pointed parabolic nodes, about 11 per whorl. Suture line with very narrow lobes.

Remarks. Although the keels are nodose, the nodes are small, and this is taken to justify assignment to *Steinmannites* rather than *Eosteinmannites.* Preservation is mostly as steinkern. Ribs are very thin, about 12 to a quadrant on the holotype (Pl. 131, fig. 6). GSC 28715 (Pl. 131, fig. 5) has nearly half a whorl preserved, of which a quarter whorl is body chamber. It is sculptured laterally like the holotype, but has a more compressed whorl section and lacks sulci outside the keels. These differences are attributed to differences in the growth stage, the holotype being smaller, and wholly septate. The large parabolic nodes invite comparison with *Steinmannites undulatostriatus* Mojsisovics (1896, p. 628), but that species differs in having much stronger ribs and fewer nodes. The specimens of *S. pacificus* have no test preserved, so it is not known if the oblique sculpture characteristic of *S. undulatostriatus* was present.

Steinmannites sp. indet.

Plate 131, figures 1, 2, 7; Figure 106c (p. 610)

Registered material. GSC 14308 (GSC loc. 46998). GSC 28716 (GSC loc. 24351). GSC 28717 (GSC loc. 64638).

Occurrence. Middle Norian, Columbianus Zone.

Pardonet Formation, northeastern British Columbia; Parson Bay Formation, Vancouver Island, British Columbia. GSC locs. 24351 (1), 46998 (1), 98909 (1).

Remarks. All these specimens lack body chambers. GSC 28716 (Pl. 131, fig. 1) has oblique sculpture, like that of *Steinmannites undulatostriatus* Mojsisovics (1896, p. 628).

Genus *Eosteinmannites* Tatzreiter, 1980

Type species. Steinmannites irregularis Welter.

Eosteinmannites orientalis n. sp.

Plate 143, figures 3a–c

Registered material. Holotype GSC 71005 (GSC loc. 98549).

Occurrence. Middle Norian, Columbianus Subzone 2. Pardonet Formation, northeastern British Columbia. GSC loc. 98549 (1).

Diagnosis. Eosteinmannites about 40 mm in diameter; H about 30 per cent, W about 30 per cent, U about 45 per cent of diameter. Whorl section quadrangular on both outer and inner whorls. Ribbing strong with marginal nodes at the ventrolateral shoulder.

Measurements. Holotype GSC 71005 (Pl. 143, fig. 3): 42, 0.31, 0.31, 0.44.

Remarks. The holotype (Pl. 143, fig. 3) is preserved as a steinkern; the sculpture of the test is thus unknown. On the outer whorl the keels are initially almost continuous; adorad they become increasingly nodose and at the aperture, the nodes are no longer on keels. Suture lines are not well preserved, but it appears that about three quarters of the outer whorl is body chamber. This, and the change in sculpture of the keels, suggests that the specimen was complete and mature. Most ribs appear to be simple. Some, as preserved on the steinkern, are very broad and flat. The broad, flat ribs are probably the internal expression of branched ribs. If so, on the last half whorl, one rib branched near the umbilicus and one or two near the ventrolateral shoulder.

This species is distinguished from *Eosteinmannites irregularis* (Welter) (1914, p. 141) and other species of the genus by retaining a quadrangular whorl section on the body chamber.

Eosteinmannites nitidus n. sp.

Plate 131, figures 4a–c; Plate 143, figures 1a–c

Alloclionites sp., McLEARN, 1960a, p. 43, Pl. 2, figs. 2a, b (only).

Registered material. Holotype GSC 12570, two paratypes GSC 72349*, GSC 72350* (all GSC loc. 10740). Hypotype GSC 28729 (GSC loc. 65935).

Occurrence. Middle Norian, Columbianus Subzone 3. Pardonet Formation, northeastern British Columbia. GSC locs. 10740 (3), 65935 (1).

Diagnosis. Small *Eosteinmannites* (mature at 38 mm or less); H about 40 per cent, W about 35 per cent, U about 35 per cent of diameter. Whorl section quadrangular on inner whorls, appreciably more compressed, with rounded ventrolateral shoulders, on outer. Ribs distinct, straight, simple or with some increase by intercalation and branching at the umbilicus and on the flank. Ribs may be thickened, but are not truly tuberculate at the rounded umbilical and ventrolateral shoulders. Surface without strigate or oblique sculpture.

Measurements. Holotype GSC 12570 (Pl. 143, fig. 1): 38, 0.42, 0.38, 0.33. Paratype GSC 72349*: 29, 0.39, 0.33, 0.33. Paratype GSC 72350*: 33, 0.39, 0.35, 0.36. Hypotype GSC 28729 (Pl. 131, fig. 4): 37, 0.41, 0.38, 0.36.

Remarks. The holotype (Pl. 143, fig. 1) and both paratypes all have outer whorls showing the change from a quadrangular to a more compressed whorl section and the acquisition of nodose in place of relatively smooth keels. All are probably complete and mature. They have parts of the test preserved, but show no strigate or oblique sculpture. The holotype has some bifurcation of ribs at the umbilical shoulder and some intercalation of ribs at the mid-flank, with the result that on the last half whorl there are 11 ribs at the umbilicus, 20 at the ventrolateral margin and 20 nodes on the keels. The style of ribbing of GSC 72349* is like that of the holotype. GSC 72350* has no branched or intercalated ribs on the outer whorl. GSC 28729 (Pl. 131, fig. 4) is mostly steinkern with ribbing preserved in a very blunt fashion. It is complete and mature with a body chamber five eighths of a whorl in length. All show the ceratitic suture line.

This is a small species comparable with *Eosteinmannites orientalis* n. sp., but differing in having the ventrolateral shoulders on the outer whorl rounded and without tuberculation, instead of being angular and

tuberculate. Compared with *Eosteinmannites irregularis* (Welter) (1914, p. 141), it is much smaller and devoid of oblique sculpture.

Eosteinmannites ursensis n. sp.

Plate 131, figures 3a–c

Registered material. Holotype GSC 28718 (GSC loc. 64638).

Occurrence. Middle Norian, Columbianus Zone, Subzone 3? Pardonet Formation, northeastern British Columbia. GSC loc. 64638 (1).

Diagnosis. Eosteinmannites like *E. nitidus* n. sp., but larger, thicker and more involute (U about 30 per cent of diameter) and with oblique sculpture.

Remarks. Suture lines are not well preserved. Half of the outer whorl appears to be body chamber; of this, the last quadrant is preserved only near the umbilicus. On the outer whorl, the keels are at first smooth, becoming nodose adorad, indicating acquisition of the mature character. The specimen is probably the remains of a mature individual. A patch of the test at the start of the outer whorl has the oblique sculpture preserved.

The closest resemblance is to *Eosteinmannites lubbocki* (Mojsisovics) (1896, p. 632) which, like *E. ursensis*, is known to have oblique (undulostriate) sculpture (Diener, 1906, p. 53). *Eosteinmannites lubbocki* may differ from the new species only in having weaker ribbing. *Eosteinmannites irregularis* (Welter) (1914, p. 141) is more evolute.

Genus *Alloclionites* Spath, 1951

Type species. Clionites ares timorensis Welter.

Alloclionites dieneri n. sp.

Plate 130, figures. 3a–c; Plate 131, figures 8, 9; Plate 143, figures 5a, b; Figure 106d (p. 610)

Alloclionites sp., McLearn, 1960a, p. 43 (in part).

Alloclionites sp. cf. *A. woodwardi* (Mojsisovics). TOZER, 1962a, Pl. 11, figs. 5a–c; TOZER, 1967, p. 55.

Registered material. Holotype GSC 28702, paratype GSC 14310 (both GSC loc. 46998). Hypotype GSC 28703 (GSC loc. 9471). Hypotype GSC 70997 (GSC loc. 97552).

Occurrence. Middle Norian, Columbianus Subzone 3. Pardonet Formation, northeastern British Columbia. GSC locs. 9471 (1), 46998 (2), 68303 (1), 97552 (2), 98909 (1).

Diagnosis. Alloclionites attaining a diameter of at least 75 mm; H about 40 per cent, W about 35 per cent, U about 30 per cent of diameter. Inner whorls quadrituberculate (umbilical, marginal, outer and inner external spirals). At medium diameter, large, infrequently developed nodes replace the regular umbilical tubercles. On the body chamber, flanks are merely ribbed, without umbilical, marginal and outer external tubercles. Ribs on flank of inner whorls simple; on outer whorl some are simple, some branch at umbilical nodes, and some are intercalated on the inner flank. Surface with strigate sculpture.

Measurements. Holotype GSC 28702 (Pl. 131, fig. 8): 71, 0.39, 0.35, 0.31. Paratype GSC 14310 (Pl. 131, fig. 9): 53, 0.43, 0.39, 0.32.

Remarks. The holotype (Pl. 131, fig. 8) which has at least half a whorl of body chamber preserved, is probably complete and mature. At the aperture it is slightly crushed. The original diameter was about 75 mm. Umbilical nodes persist to within half a whorl of the aperture. The last quadrant is slightly damaged, but it is nevertheless clear that at least some ribs are without marginal and outer external tuberculation. Only the inner external nodes, adjacent to the sulcus, persist to the end. The inner whorls of GSC 14310 (Pl. 131, fig. 9) have a tuberculate umbilical shoulder, simple ribs on the flank, and a spiral of marginal tubercles just inside the line of involution. On the outer whorl, which is septate, there are six large, somewhat bullate umbilical nodes and both branched and simple ribs. The marginal and two external spirals are distinct at the start of the outer whorl, but the marginal and outer external spirals fade in prominence adorad. Where distinct, four marginal tubercles, correspond with six outer external and seven inner external tubercles. The ceratitic suture line is well preserved (Fig. 106d). Comparison with the inner whorls of the holotype is taken to justify interpretation of GSC 28703 (Pl. 130, fig. 3) as an immature representative of this species that has not attained the diameter at which large umbilical nodes appear. On the last half whorl there are nine umbilical, nine marginal, 15 outer external and 17 inner external tubercles. GSC 70997 (Pl. 143, fig. 5) is quadrituberculate with three large umbilical nodes. It is thus sculptured like the holotype, but has much thicker whorls. It is interpreted as an inflated variant.

In being quadrituberculate with large umbilical nodes *Alloclionites dieneri* closely resembles *A. timorensis* (Welter, 1914, p. 133), which differs in being more evolute and in having more marked degenenation of the sculpture on the body chamber. *Alloclionites ares* (Mojsisovics) (1893, p. 478) and *A. woodwardi* (Mojsisovics) (1896, p. 624) also resemble *A. dieneri* but, besides being more evolute, they also differ in lacking large umbilical nodes.

Etymology. The name commemorates Carl Diener.

Alloclionites jeanneti n. sp.

Plate 130, figures 7a, b

Registered material. Holotype GSC 28701 (GSC loc. 74776).

Occurrence. Middle Norian, Columbianus Subzone 3. Pardonet Formation, northeastern British Columbia. GSC loc. 74776 (1).

Diagnosis. Alloclionites attaining a diameter of at least 45 mm; H about 45 per cent, W about 45 per cent U about 30 per cent of diameter. Outer whorl trituberculate (marginal, outer and inner external spirals), umbilical tuberculation absent. Marginal tubercles are larger than external; space between marginal and outer external spirals is greater than between the two external spirals. Flanks with strong simple ribs that are slightly bullate at mid-flank, i.e., there is the suggestion of a fourth, lateral, spiral of tubercles. Ribs link tubercles; some ribs branch between the marginal and the outer external spirals, and between the outer and inner external spirals. Strigation apparently absent.

Remarks. In addition to the piece illustrated (Pl. 130, fig. 7) the holotype includes a crushed part, which shows that a diameter of about 45 mm was attained. No septa are visible. Probably the greater part of the outer whorl is body chamber. On the best preserved quadrant there are six marginal, nine outer external and 13 inner external tubercles. The side illustrated shows the test; there is no indication of strigation.

Compared with *Alloclionites dieneri* n. sp. and other typical representatives of *Alloclionites, A. jeanneti* is distinguished by having a more distinct umbilical shoulder, the absence of umbilical tuberculation and more prominent marginal tubercles.

Etymology. The name commemorates Alphonse Jeannet.

Alloclionites welteri n. sp.

Plate 130, figures 4–6, 8

Alloclionites sp., McLEARN, 1960a, p. 43, Pl. 2, figs. 1a, b only; TOZER, 1967, p. 58.

Registered material. Holotype GSC 28704, two paratypes GSC 28705, 28706* (all GSC loc. 64634). Paratype GSC 32362 (GSC loc. 47004). Hypotype GSC 12571 (McLearn, 1960a, Pl. 2, figs. 1a, b) (GSC loc. 9771). Hypotype GSC 28707 (GSC loc. 9768).

Occurrence. Middle Norian, Columbianus Subzone 4. Pardonet Formation, northeastern British Columbia. GSC locs. 9768 (8), 9771 (1), 10750 (1), 47004 (10), 64634 (8), 98521 (1).

Diagnosis. Alloclionites about 45 mm in diameter; H about 40 per cent, W about 35 per cent, U about 35 per cent of diameter. Outer whorl trituberculate (marginal, outer and inner external spirals), umbilical tuberculation absent. All three spirals are equally spaced and of nodes of about the same size. Flanks with mostly simple and some intercalated ribs. Low ribs link the tubercle spirals with some branching between the marginal and outer external spirals and between the outer and inner external spirals. Ribbing and tuberculation absent at the mature aperture. Some, at least, with strigation.

Measurements. Paratype GSC 32362 (Pl. 130, fig. 4): 44.5, 0.38, 0.34, 0.35.

Remarks. On the quadrant with a whorl height of about 15 mm the holotype (Pl. 130, fig. 6) has six ribs at the umbilicus, eight, 10 and 11 tubercles on the marginal, outer and inner external spirals, respectively. The comparable figures for GSC 28705 (Pl. 130, fig. 5) are six, six, nine and 11. Both have the predominance of simple ribs on the flank, a similar arrangement of the three spirals of tubercles and an umbilical shoulder without tuberculation. The specimens have little or no test preserved. A small part on GSC 28705 shows strigation. GSC 32362 (Pl. 130, fig. 4), adjacent to the aperture, shows loss of ribbing, of marginal and outer external tubercles and replacement of the inner external spiral by low rounded keels. This specimen, with three quarters of the outer whorl body chamber, is evidently complete and mature. It shows the rounded lateral saddle of the last septum. The other specimens show no suture lines, the preserved parts probably being mostly or wholly body chamber. GSC 28707 (Pl. 130, fig. 8) has outer and inner external tubercle spirals, but lacks marginal tuberculation. As mentioned below, this specimen forms a morphological link with *Brouwerites maclearni* n. sp.

Alloclionites welteri most closely resembles *A. jeanneti* n. sp., but differs in having the tubercle spirals equally spaced in a radial sense, and also in having less prominent ribs and tubercles.

Etymology. The name commemorates Otto Welter.

Genus *Brouwerites* Diener, 1923

Type species. Clionites involutus Welter.

Brouwerites stotti n. sp.

Plate 130, figures 10–13

"*Buchites*" sp. cf. "*B.*" *modestus* (Buch). TOZER, 1967, p. 60.

Registered material. Holotype GSC 28710, three paratypes GSC 28711, GSC 28712, GSC 28713 (all GSC loc. 52233).

Occurrence. Middle Norian, Columbianus Zone, Subzone 4. Pardonet Formation, northeastern British Columbia. GSC loc. 52233 (11).

Diagnosis. Brouwerites at least 65 mm in diameter; H about 40 per cent, W about 33 per cent, U about 30 per cent of diameter. Flanks with strong, regular ribs, simple, with some intercalated secondaries on the outer flank. External tuberculation faint, comprising low, rounded nodes. Marginal tuberculation barely perceptible or absent. Ribs may cross the venter on the outer whorl.

Remarks. GSC 28713 (Pl. 130, fig. 12), 66 mm in diameter is the largest known specimen. On all specimens, external tuberculation is very faint. External nodes are present on the holotype (Pl. 130, fig. 13), GSC 28712 (Pl. 130, fig. 10) and GSC 28713 (Pl. 130, fig. 12). The holotype also shows a trace of marginal tuberculation. On GSC 28711 (Pl. 130, fig. 11), external nodes are barely perceptible and the ribs cross the venter virtually without any depression. None show suture lines clearly.

Examples with nodes invite comparison with "*Clionites*" *gandolphi* Mojsisovics (1893, p. 477); GSC 28711, with ribs crossing the venter, with "*Buchites*" *modestus* (Buch) (Mojsisovics, 1893, p. 414). Although these two species (both described from a single specimen) have different venters, their lateral ribbing is strikingly similar, as recognized by Mojsisovics (1893, p. 478). This ribbing, with intercalated secondaries on the outer flank, is similar to that of *Brouwerites stotti.* All three species are probably congeneric and are provisionally regarded as representatives of *Brouwerites,* despite the absence of strigate sculpture. *Brouwerites stotti* differs from the other two in being more involute.

Etymology. The name is for D.F. Stott.

Brouwerites maclearni n. sp.

Plate 130, figure 9; Plate 143, figures 6, 7; Figure 105b (p. 608)

Alloclionites sp., McLEARN, 1960a, p. 43, Pl. 3, fig. 6 (only).

Registered material. Holotype GSC 12573, two paratypes GSC 28708, GSC 28709* (all GSC loc. 9768). Topotype GSC 71017 (GSC loc. 64645).

Occurrence. Middle Norian, Columbianus Subzone 4. Pardonet Formation, northeastern British Columbia. GSC locs. 9768 (5), 64645 (1).

Diagnosis. Brouwerites attaining a diameter of about 85 mm; H about 40 per cent, W about 35 per cent, U about 30 per cent of diameter. Ribs mostly simple with infrequent bifurcation on inner flank; ribs generally more prominent on inner than outer flank. External tuberculation faint. Surface with strigate sculpture.

Remarks. The holotype (Pl. 143, fig. 6) is a crushed specimen 85 mm in diameter of which half a whorl is body chamber. Most ribs are simple, but on the outer whorl two bifurcate near the umbilicus. The venter is not well preserved, but external nodes are evident near the aperture. Marginal tuberculation is absent. The paratypes lack branched ribs. GSC 28708 (Pl. 130, fig. 9) and GSC 28709* have external nodes which are faint and closely spaced, almost forming low keels. GSC 28708 (Pl. 130, fig. 9) is a complete phragmocone 28 mm in diameter, with approximated septa. This is the remains of a mature specimen of about 40 mm diameter. The holotype (Pl. 143, fig. 6), has strigate sculpture preserved.

The style of ribbing, strigation and weak tuberculation indicate affinity with *Brouwerites involutus* (Welter) (1914, p. 136), which differs from *Brouwerites maclearni* in being more involute and inflated. *B. maclearni* differs from *B. stotti* n. sp. in having strigate sculpture, smoother inner whorls and ribs that do not branch on the outer flank. The absence of marginal tuberculation precludes reference to *Alloclionites. Alloclionites welteri* n. sp. may never-

theless be closely related, GSC 28707 (Pl. 130, fig. 8), identified as *A. welteri,* expressing the relationship, having marginal, but not lateral tuberculation. It is thus possible that *Brouwerites maclearni* is a very weakly sculptured variant of *Alloclionites welteri.*

Etymology. The name commemorates F.H. McLearn.

Genus *Nannosteinmannites* Tatzreiter, 1985

Type species. Steinmannites davidi Mojsisovics.

Nannosteinmannites yukonensis n. sp.

Plate 144, figures 19a–c

Steinmannites sp., TOZER, 1967, p. 84.

Registered material. Holotype GSC 28719 (GSC loc. 47134).

Occurrence. Upper Norian. Cordilleranus Zone. Otuk Formation, Yukon. GSC loc. 47134 (1).

Diagnosis. Nannosteinmannites about 15 mm in diameter; H about 40 per cent, W about 40 per cent, U about 33 per cent of diameter. Keels almost smooth, bordered by distinct sulci. Ribs are of moderate strength, with slight curvature on the flank, more prominent on inner than outer flank with intercalated secondaries appearing at the mid-flank.

Remarks. About half a whorl of the holotype (Pl. 144, fig. 19) is body chamber, although preservation is incomplete adorad. The surface bears fine growth striae, but spiral and oblique sculpture appear to be absent. Much of the last septum is visible. The external and lateral saddles are perfectly rounded, L is weakly indented. The small size and depressed keels justify assignment to *Nannosteinmannites. Nannosteinmannites davidi* (Mojsisovics) (1893, p. 483) differs in having nodose keels and oblique sculpture; *N. nusatenggarae* Tatzreiter (1985, p. 223) differs in having large marginal nodes.

Family TIBETITIDAE Hyatt, 1900

Subfamily TIBETITINAE Hyatt, 1900

Genus *Oxytibetites* n. gen.

Type species. Metacarnites dieneri Welter.

Diagnosis. Tibetitinid in which greater part of conch is a smooth oxycone with a narrowly bicarinate venter on the surface of the test. Inner whorls have a sulcate venter and marginal and ventral tuberculation; type species also has lateral tuberculation. Suture line ammonitic, foliaceous, with two adventitious lobes.

Species included. Metacarnites dieneri Welter (1914, p. 157), *Oxytibetites welteri* n. sp.

The outer whorl of *Oxytibetites* resembles that of some species of *Metacarnites* Diener. The nature of the inner whorls of the type species of *Metacarnites* (*Metacarnites footei* Diener, 1908, p. 108) is not known. If relatively smooth, they would indicate affinity with species referred to *Hauerites* in this report. If tuberculate, they would indicate affinity with *Oxytibetites.* Without knowledge about the inner whorls, the exact affinities of *Metacarnites* remain uncertain.

Oxytibetites welteri n. sp.

Plate 128, figures 1a–d; Figure 103b (p. 602)

Registered material. Holotype GSC 71018 (GSC loc. 97558).

Occurrence. Lower Norian, Magnus Subzone 1. Pardonet Formation, northeastern British Columbia. GSC loc. 97558 (1).

Diagnosis. Small *Oxytibetites* (diameter about 75 mm). Ribbed tuberculate whorls attain a diameter of at least 8 mm. Venter narrowly bicarinate on whole of the phragmocone.

Remarks. The holotype (Pl. 128, fig. 1) is incomplete, with part of the phragmocone preserved and part of the body chamber. The inner whorl 8 mm in diameter has been extracted (Pl. 128, fig. 1a–c). At this diameter the outer whorl has about 30 ribs with marginal and external tuberculation. Lateral tuberculation is absent and the nature of the umbilical shoulder is uncertain. At the end of the phragmocone (Pl. 128, fig. 1d) the whorl section is compressed, the flanks are smooth and the venter, 2 mm wide, is narrowly bicarinate. The test is not perfectly preserved, but there is no doubt that much of the phragmocone has a narrowly tabulate venter with marginal keels. The steinkern at the end of the phragmocone has a deep (1 mm) median sulcus and distinct marginal keels, much more pronounced than those on the surface of the test. The umbilicus is preserved mostly as steinkern, with some test adhering. The steinkern indicates an open umbilicus (Pl. 128, fig. 1d) with a width about 10 per cent of the diameter, but it is possible that it was sealed by the test and that the complete shell had a closed umbilicus. The last two

septa are approximated. Much of the suture line is well preserved showing the adventitious lobe and saddle (Fig. 103b). Auxiliary lobes, less well preserved, are probably three in number.

This species is clearly congeneric with *Oxytibetites dieneri* (Welter) (1914, p. 157), both having ribbed, tuberculate inner whorls and smooth outer whorls with a bicarinate, narrowly tabulate venter. *Oxytibetites dieneri* differs in being larger and apparently also in being more involute; it also differs in having lateral tuberculation at a small diameter, a feature not known in *O. welteri*. *Metacarnites footei* Diener (1908, p. 109), *M.? hendersoni* Diener (ibid.), *M.? intermedius* Wang and He (1976, p. 355) and *M.? xizangensis* Wang and He (ibid.) differ in being larger and more involute, and are not known to have the tuberculate inner whorls that characterize *Oxytibetites*. Diener (1908) described the venters of *Metacarnites hendersoni* and *M. footei* as acute, but Krystyn (1982, p. 26) has described specimens identified as *M. hendersoni* that are bicarinate at an intermediate growth stage.

Etymology. The name commemorates Otto Welter.

Genus *Dimorphotoceras* Spath, 1951

Type species. Pterotoceras abnorme Diener.

Dimorphotoceras caurinum (McLearn)

Plate 126, figures 2, 4; Figure 101a–c (p. 600)

Pterotoceras caurinum McLearn, 1939b, p. 56, Pl. 1, fig. 2; McLEARN, 1960a, p. 54, Pl.4, fig. 3 (only), Pl. 5, figs. 1a, b (only); TOZER, 1967, p. 37, 57.

Registered material. Holotype GSC 9412 (McLearn, 1960a, Pl. 5, figs. 1a, b), three topotypes GSC 28834, GSC 28836, GSC 28837* (all GSC loc. 9836). GSC 12581 (ibid., Pl. 4, fig. 3) (GSC loc. 13522).

Occurrence. Lower Norian, Magnus Subzone 2. Pardonet Formation, northeastern British Columbia. GSC locs. 9836 (10), 13522 (1), 64636 (3), 82452 (8), 97540 (1).

Diagnosis. Dimorphotoceras attaining a diameter of about 50 mm; H about 40 per cent, W about 25 per cent, U 20–35 per cent of diameter. Ribs falcoid, mostly bifurcating at mid-flank. Umbilical, lateral, marginal and external tuberculation present. Lateral and marginal tubercules very small. External tubercles distinctly clavate, distantly spaced. About eight umbilical and about 16 external tubercles per half whorl. Suture line ceratitic.

Measurements. Holotype GSC 9412: 38, 0.43, 0.22, 0.24. Topotype GSC 28836 (Pl. 126, fig. 2): 28, 0.39, 0.25, 0.29.

Remarks. Perfect preservation of the test, as on the holotype, is necessary to show the small lateral and marginal tubercles. The suture line is not seen in the holotype, but specimens closely similar in external characters, e.g., GSC 28836 (Pl. 126, fig. 2) and GSC 28837* (Fig. 101c), have well preserved ceratitic suture lines. GSC 28834 (Pl. 126, fig. 4), the largest known specimen, shows part of the last septum, which has a rounded lateral saddle.

Dimorphotoceras arctum (McLearn)

Plate 126, figures 1a–c

Pterotoceras caurinum var. *arctum* McLearn, 1940c, p. 115, Pl. 3, fig. 2.

Pterotoceras caurinum McLearn; McLEARN, 1960a, p. 54, Pl. 4, fig. 4, only.

Registered material. Holotype GSC 8846 (GSC loc. 9836).

Occurrence. Lower Norian, Magnus Subzone 2. Pardonet Formation, northeastern British Columbia. GSC loc. 9836 (1).

Diagnosis. Dimorphotoceras like *D. caurinum* (McLearn), but with more numerous umbilical and external tubercles, there being about 10 umbilical and 20 external tubercles on half a whorl. Suture line ceratitic.

Measurements. Holotype GSC 8846 (Pl. 126, fig. 1): 28, 0.49, 0.22, 0.20.

Remarks. Very faint marginal tuberculation is apparent only at the beginning of the outer whorl. Lateral tuberculation is not demonstrable. The holotype shows the last septum to be ceratitic.

Dimorphotoceras elegantulum (McLearn)

Plate 126, figures 3a, b; Plate 128, figures 14a, b; Figure 101d (p. 600)

Pterotoceras caurinum var. *elegantulum* McLearn, 1939b, p. 56, Pl. 1, fig. 4.

Pterotoceras caurinum McLearn; McLEARN, 1960a, p. 54, Pl. 5, fig. 2 (only).

Registered material. Holotype GSC 9413 (McLearn, 1960a, Pl. 5, fig. 2), two topotypes GSC 28835, GSC 28838 (all GSC loc. 9836).

Occurrence. Lower Norian, Magnus Subzone 2. Pardonet Formation, northeastern British Columbia. GSC loc. 9836 (3).

Diagnosis. Dimorphotoceras like *D. caurinum* (McLearn), and more particularly *D. arctum* (McLearn), but with denser ribbing, most ribs being simple; also tubercles are more numerous, with about eight umbilical and 27 external tubercles per half whorl. Suture line weakly ammonitic.

Measurements. Holotype GSC 9413: 30, 0.50, 0.24, 0.20. Topotype GSC 28835 (Pl. 128, fig. 14): 20, 0.47, 0.25, 0.21.

Remarks. The holotype is probably a complete phragmocone because, although the suture line is not shown, the umbilical seam of an additional half whorl is preserved on one side. The holotype and GSC 28835 (Pl. 126, fig. 3) have one spiral of lateral tubercles. GSC 28835 (Pl. 128, fig. 14) has two. Interpretation of this species as having a weakly ammonitic suture line is from GSC 28835 and GSC 28838 (Fig. 101d), both of which have a small lobe near the summit of the external saddle.

Dimorphotoceras ursinum n. sp.

Plate 128, figures 13a–c; Figure 103g, h (p. 602)

Registered material. Holotype GSC 72345 (GSC loc. 9836). Hypotype GSC 28840* (GSC loc. 64636).

Occurrence. Lower Norian, Magnus Subzone 2. Pardonet Formation, northeastern British Columbia. GSC locs. 9836 (1), 64636 (4), 68212 (1), 82452 (2).

Diagnosis. Small *Dimorphotoceras* with H about 40 per cent, W about 25 per cent, U about 30 per cent of diameter. Ribs falcoid with some increase by bifurcation and intercalation. Umbilical and external tuberculation developed. Some ribs thickened laterally and marginally, but not truly tuberculate. External tubercles somewhat clavate. Suture line becomes ammonitic on last half whorl of phragmocone.

Measurements. Holotype GSC 72345 (Pl. 128, fig. 13): 20, 0.40, 0.26, 0.30.

Remarks. The holotype (Pl. 128, fig. 13) is wholly septate, probably a complete phragmocone. On the last half whorl there are 10 umbilical and 17 external tubercles. The test surface is well preserved, but there are no discrete lateral or marginal tubercles. On the last quadrant ribs increase by branching and intercalation. Adapically most ribs are simple. At the beginning of the outer whorl, the suture line is ceratitic; at the aperture, ammonitic (Fig. 103g, h).

In shape and sculpture this species resembles *Dimorphotoceras caurinum* (McLearn) and *D. arctum* (McLearn), except that it is devoid of discrete lateral and marginal tubercles. The holotype of *D. arctum* has a ceratitic suture line and thus differs from *D. ursinum*. The suture line is not seen in the holotype of *D. caurinum*, but specimens with identical sculpture have ceratitic sutures, and a ceratitic suture line is taken to characterize that species. *Dimorphotoceras elegantulum* (McLearn) has denser ribbing and distinct lateral and marginal tuberculation, unlike *D. ursinum*. The suture line is not seen in the type of *D. elegantulum*, but topotypes with similar sculpture have an external saddle with an indentation, a feature noted by McLearn (1960a, p. 55). The external saddle of *D. ursinum* is different, with more complex indentation. All these taxa may be variants of one species, but the names are used to distinguish forms with different types of suture line and tuberculation.

Genus *Sirenotibetites* n. gen.

Type species. Sirenotibetites cornutus n. sp.

Diagnosis. Discoidal tibetitin with numerous spirals of lateral tubercles, and large external clavate ears arranged opposite one another adjacent to a shallow ventral sulcus. Both phragmocone and body chamber are tuberculate. Suture line ammonitic with a single adventitious lobe.

Species assigned. Sirenotibetites cornutus n. sp.

Age. Lower Norian, Magnus Zone.

Remarks. The presence of external clavi and the adventitious element in the suture line indicates affinity with Tibetitinae. *Sirenotibetites* differs from all other Tibetitinae in having at least four spirals of lateral tubercles, one spiral being the general rule, as in *Tibetites* Mojsisovics (1896), although species of *Dimorphotoceras* Spath (1951) may have two. The suture line, being ammonitic, is more like that of *Ammotibetites* Krystyn (1982) than *Tibetites,* but *Ammotibetites* also lacks the distinctive lateral

tuberculation of *Sirenotibetites*. This lateral tuberculation is more like that of the Sirenitinae than of the Tibetitinae, there being a distinct resemblance to *Pterosirenites* Tozer (1980a). However *Pterosirenites* differs, not only in having a suture line without an adventitious element, but also in having the external ears arranged en echelon. *Wangoceras* Tozer (1980b) (Heraclitidae) differs in the same way. *Pseudosirenites* Arthaber (1911), the only sirenitin with adventitious elements, has a venter with the braided keel of the *Sirenitinae,* quite unlike the tibetitid venter of *Sirenotibetites*.

Sirenotibetites cornutus n. sp.

Plate 127, figures 1, 2

Registered material. Holotype GSC 28750, paratype GSC 28751 (both GSC loc. 83829).

Occurrence. Lower Norian, Magnus Subzone 2. Pardonet Formation, northeastern British Columbia. GSC loc. 83829 (2).

Diagnosis. Sirenotibetites with a phragmocone diameter of at least 40 mm; H about 45 per cent, W about 28 per cent, U about 23 per cent of diameter. Most, or all, ribs are simple. Tuberculation consists of six spirals between the umbilicus and the external clavi (one near the rounded umbilical shoulder, four lateral, one marginal); those near the umbilicus slightly bullate, lateral and marginal spirals are of virtually rounded tubercles. External clavi high.

Remarks. The holotype (Pl. 127, fig. 1) is entirely septate. GSC 28751 (Pl. 127, fig. 2) is a fragment showing the venter, what is probably the last septal surface, and a small part of the body chamber. Suture lines are not well preserved, but both specimens show septal surfaces with an adventitious lobe in the external saddle. The holotype shows the external saddle to be ammonitic and GSC 28751 shows an ammonitic lateral saddle. This specimen also shows the that external clavi are arranged opposite one another. Both the steinkern and the external impression are preserved. When the steinkern is placed in the impression, which preserves part of the test, the smooth blunt clavi of the steinkern are seen to be aligned with high clavate ears with rounded tops. At the base of these clavi a layer of shell is preserved, evidently the preseptal layer. This presumably indicates that the clavi were hollow.

The description of the genus provides comparisons with other forms.

Genus *Neotibetites* Krumbeck, 1913

Type species. Tibetites (*Neotibetites*) *weteringi* Krumbeck.

Neotibetites minor n. sp.

Plate 128, figure 3; Figure 103d, e (p. 602)

Registered material. Holotype GSC 28842 (GSC loc. 83830).

Occurrence. Lower Norian, Magnus Zone. Pardonet Formation, northeastern British Columbia. GSC loc. 83830 (1).

Diagnosis. Very small (diameter about 22 mm) *Neotibetites* with relatively large umbilicus (U about 18 per cent of diameter). Outer whorl smooth with falcoid striae. Suture line with rounded saddles.

Remarks. The holotype (Pl. 128, fig. 3) is the internal mould of a complete phragmocone with parts of about a quarter whorl of body chamber. The last four septa are approximated, indicating that the specimen, despite the small size, was mature. The exact nature of the venter is not clearly shown, but it appears to have been very narrowly rounded. On the whole of the outer whorl the flanks are smooth. The presence of the tuberculation characteristic of the inner whorls of *Neotibetites weteringi* Krumbeck (1913, p. 100) is not demonstrable. "*Paratibetites*" *tornquisti* Mojsisovics (1896, p. 644), here regarded as a representative of *Neotibetites,* attains a smooth stage while septate and has a suture line comparable with that of *N. minor.* The new species differs, however, not only in being much smaller, but also in being more evolute. Small specimens of *Hauerites piceus* n. sp. are superficially similar, but at a comparable diameter are more involute and have an ammonitic suture line.

Subfamily CYRTOPLEURITINAE Diener, 1925

Genus *Prodrepanites* n. gen.

Type species. Prodrepanites catenatus n. sp.

Diagnosis. Discoidal cyrtopleuritin with falcoid ribbing. Ribbing very weak on inner flank, stronger, forming crescents, on outer flank. Whorl side with distinct rounded umbilical and external tubercles, faint lateral and marginal tubercles also present. Suture line weakly ammonitic with small adventitious elements as in Tibetitinae.

Species assigned. Prodrepanites catenatus n. sp.

Age. Lower Norian, Magnus Zone.

Remarks. Morphologically this genus has characters of both the Cyrtopleuritinae and Tibetitinae. The tuberculation and suture line resembles that of *Dimorphotoceras* Spath (1951), but the external tubercles of *Prodrepanites* are much less clavate compared with those of *D. abnorme* (Diener), type species of *Dimorphotoceras.* The falcoid curvature of the growth lines is like that of *Drepanites* Mojsisovics (1893) and *Cyrtopleurites* Mojsisovics (1893). *Cyrtopleurites* differs in having stronger ribbing and clavate, denticulate external tubercles, at least on the phragmocone. Although the external tubercles of *Prodrepanites* differ from those of *Cyrtopleurites,* by being rounded instead of clavate, the venter of *Prodrepanites* has regular growth striae that form a delicately denticulate sculpture where they cross the tubercles, in a sense anticipating the denticulate ears of *Cyrtopleurites. Drepanites* differs in having much more delicate external tuberculation and in having lateral sculpture reduced to no more than crescents on the outer flank. The suture line of *Cyrtopleurites,* with a deep indentation in the external saddle is more like that of *Prodrepanites* than that of *Drepanites,* which lacks this feature. *Prodrepanites* has morphological features suggesting that it may be ancestral to both *Cyrtopleurites* and *Drepanites.*

Prodrepanites catenatus n. sp.

Plate 128, figures 7a, b; Figure 103c (p. 602)

Pterotoceras caurinum McLearn. McLEARN, 1960a, p. 56, in part, not of McLEARN, 1939b, p. 56.

Registered material. Holotype GSC 28845 (GSC loc. 9836).

Occurrence. Lower Norian, Magnus Subzone 2. Pardonet Formation, northeastern British Columbia. GSC loc. 9836 (1).

Diagnosis. Prodrepanites with H about 45 per cent, W about 23 per cent, U about 20 per cent of diameter.

Remarks. The unique holotype (Pl. 128, fig. 7), which is wholly septate, is the specimen with 37 ears per half whorl described by McLearn (1960a, p. 56) and regarded as a variant of "*Pterotoceras*" *caurinum.* Ribbing is faint, all ribs are simple. External tuberculation is prominent, umbilical tuberculation distinct, lateral and marginal tuberculation are faint. On the penultimate quadrant there are seven umbilical tubercles, seven crescentic ribs on the outer flank and 19 external tubercles. On the adorad quadrant, the external tubercles maintain their strength, but ribbing becomes faint. The venter has the test preserved. Regular growth striae, about seven within 1 mm, are present in the ventral sulcus and cross the tubercles. These striae make the tubercles somewhat comparable to the denticulate external ears of *Cyrtopleurites.* The suture line shows both the external and lateral saddles to be ammonitic.

The most closely related species are *Dimorphotoceras elegantulum* (McLearn) and *D. ursinum* n. sp. Both differ in having the ribbing developed evenly on the whole flank or more prominently on the inner than outer flank. The distinctive crescents on the outer flank of *Prodrepanites catenatus* are not a feature of any *Dimorphotoceras.*

Genus *Acanthinites* Mojsisovics, 1893

Type species. Cyrtopleurites (*Acathinites*) *excelsus* Mojsisovics.

Acanthinites magnificus (McLearn)

Plate 124, figures 1, 5, 6; Figure 99a (p. 596)

Cyrtopleurites magnificus McLearn, 1939b, p. 55, Pl. 1, fig. 5; McLEARN, 1960a, p. 48, Pl. 4, figs. 1a, b, 2; TOZER, 1967, p. 37, 57.

Acanthinites magnificus (McLearn). TOZER, 1971, p. 1019.

Registered material. Holotype GSC 9414 (McLearn, 1960a, Pl. 4, figs. 1a, b), three topotypes GSC 28843, GSC 35363, GSC 35364 (all GSC loc. 9836). Topotype GSC 12578 (ibid., Pl. 4, fig. 2) (GSC loc. 9473).

Occurrence. Lower Norian, Magnus Subzone 2. Pardonet Formation, northeastern British Columbia. GSC locs. 9473 (2), 9836 (8).

Remarks. This is an *Acanthinites* with broad ribs and interspaces. Some ribs are simple, some branch just inside the mid-flank. There are five tubercle-spirals (umbilical, three lateral, marginal). The umbilical and inner lateral spirals are of single pointed spines; the outermost lateral, double pointed; the marginal, triple pointed. The keels have a single row of denticles on clavate ears. Between the ears the keels are smooth. The bispinose outer lateral spiral is clearly shown by the holotype, GSC 12578, GSC 28843 (Pl. 124, fig. 1)

and GSC 35363 (Pl. 124, fig. 5). The exact nature of the marginal tubercles is shown only by GSC 35363 (Pl. 124, fig. 5), on which some are clearly trispinose. GSC 35364 (Pl. 124, fig. 6), the "very large incomplete specimen" described by McLearn (1960a, p. 49), which probably attained a diameter of 70 mm, shows that the ears are retained at this diameter. On this specimen the test is well preserved only between the ears. Here it is smooth and the ears are not demonstrably denticulate. This specimen has low spiral ridges linking the lateral tubercles.

This species, by virtue of the broad ribs bearing double and triple pointed spines, closely approaches *Acanthinites excelsus* Mojsisovics (1893, p. 530), which differs in being larger, in having more numerous lateral tubercle-spirals, and in lacking ears on the keels. *Cyrtopleurites* shows a change, with growth, from clavate to continuous keels, which suggests that the difference between the keels of *A. excelsus* and *A. magnificus* is not of great significance.

Genus *Carinacanthites* n. gen.

Type species. Acanthinites calypso Mojsisovics.

Diagnosis. Cyrtopleuritin with dense sigmoidal ribs that bifurcate on the whorl side and bear numerous (about 15) spirals of small, characteristically double-pointed tubercles. On the inner whorls, the ventral sulcus is bordered by clavate ears; on the outer whorl it is bordered by keels, each of which has two spirals of very small tubercles.

Species assigned. Acanthinites calypso Mojsisovics (1893, p. 532).

Age. Middle Norian, Rutherfordi Zone, Bicrenatus Zone.

Remarks. Having tubercles with more than one point, the lateral sculpture of *Carinacanthites* is somewhat like that of *Acanthinites* Mojsisovics (1893), *Himavatites* Diener (1906), *Mesohimavatites* n. gen., and *Neohimavatites* Tozer (1980a). This sculpture, however, is much more delicate compared with that of *Acanthinites, Himavatites* and *Mesohimavatites*. *Neohimavatites* has delicate sculpture, but the number of lateral spirals is greater in *Carinacanthites*. The venter of *Carinacanthites* is also distinctive. The keels of *Acanthinites* differ in having one, instead of two, rows of tubercles. The venters of *Himavatites, Mesohimavatites* and *Neohimavatites* have a shallow sulcus or are barely sulcate, quite unlike the deep sulcus of *Carinacanthites*. Exact details of the suture line are not known for *Carinacanthites*. In the specimens from the Hallstatt Limestone described by Mojsisovics (1893) and Diener (1920a), suture lines are not seen. The specimen described below has a suture line that is ammonitic, with an indentation on the outer side of the external saddle, a feature common in Cyrtopleuritinae.

Carinacanthites calypso (Mojsisovics)

Plate 129, figures 11a, b

Acanthinites calypso Mojsisovics, 1893, p. 532, Pl. 157, figs. 2–4; DIENER, 1920a, p. 606, Pl. 2, fig. 8.

Registered material. Hypotype GSC 28844 (GSC loc. 64663).

Occurrence. Middle Norian, Rutherfordi Zone. Pardonet Formation, northeastern British Columbia. GSC loc. 64663 (1).

Remarks. GSC 28844 (Pl. 129, fig. 11) is preserved in intractable matrix and all the details of the sculpture have not been exposed. It is apparently a complete phragmocone, which, when complete, attained a diameter of about 25 mm, like the holotype (Mojsisovics, 1893, Pl. 157, figs. 4a, b). The density of the ribbing and lateral tuberculation is apparently like that of the holotype, many ribs bifurcating on the flank and some of the lateral tubercles appear to be double-pointed. The keels are not perfectly preserved. An outer row of denticles is visible, but the presence of an inner row has not been established. Full details of the suture lines are not visible, but an ammonitic external saddle with a large indentation on the outer side is visible. Suture lines have not been described on the specimens from the localities in the Hallstatt Limestone.

Genus *Cyrtopleurites* Mojsisovics, 1893

Type species. Ammonites bicrenatus Hauer.

Cyrtopleurites bicrenatus (Hauer)

Plate 129, figures 1–4; Figure 104j (p. 606)

Ammonites bicrenatus Hauer, 1846, p. 29, Pl. 9, figs. 6–8.

Cyrtopleurites bicrenatus (Hauer). MOJSISOVICS, 1893, p. 520, Pl. 158, fig. 3, Pl. 159, figs. 8, 9; Pl. 160, figs. 1, 2.

Cyrtopleurites sp., McLEARN, 1960a, p. 47, Pl. 3, figs. 4a, b, 5; TOZER, 1967, p. 37, 57.

Registered material. Two hypotypes GSC 12576 (McLearn, 1960a, Pl. 3, figs. 4a, b), GSC 28849 (both GSC loc. 9840). Hypotype GSC 12577 (ibid., Pl. 3, fig. 5) (GSC loc. 9380). Two hypotypes GSC 28850, GSC 28851 (both GSC loc. 83849). Hypotype GSC 28852 (GSC loc. 83831).

Occurrence. Middle Norian, Rutherfordi Zone. Pardonet Formation, northeastern British Columbia. GSC locs. 9380 (1), 9840 (4), 83831 (1), 83849 (2), 97529 (1), 97531 (1), 97580 (1), 98536 (3).

Remarks. Identified with this species are *Cyrtopleurites* that retain lateral and marginal tuberculation to an appreciable diameter. GSC 28850 (Pl. 129, fig. 1) has an inner lateral spiral only. GSC 28851 (Pl. 129, fig. 2) has two lateral spirals, GSC 28852 (Pl. 129, fig. 4), three, the outer much less prominent than the inner two. GSC 28849 (Pl. 129, fig. 3), a steinkern of the body chamber, shows the loss of the inner lateral spiral, with retention of the mid-lateral row, and is closely comparable with a specimen from the Sommeraukogel illustrated by Mojsisovics (1893, Pl. 159, fig. 8). GSC 28849 (Pl. 129, fig. 3), which attained a diameter of about 60 mm, is the largest known from Canada. In GSC 28851 (Pl. 129, fig. 2), a complete phragmocone, the suture line is seen (Fig. 104j).

Cyrtopleurites hersiliae Diener

Plate 128, figures 11, 12

Cyrtopleurites hersiliae Diener, 1920a, p. 601, Pl. 2, fig. 6; Pl. 3, fig. 4.

Registered material. Hypotype GSC 28846 (GSC loc. 46467). Hypotype GSC 28847 (GSC loc. 83838).

Occurrence. Middle Norian, Rutherfordi Zone. Pardonet Formation, northeastern British Columbia. GSC locs. 9466 (1), 46467 (1), 83838 (1), 97530 (1).

Remarks. Identified with this species are *Cyrtopleurites* devoid of lateral and marginal tuberculation at a diameter of more than 20 mm. GSC 28847 (Pl. 128, fig. 11), which is closely comparable in size and sculpture with the specimens from the Feuerkogel illustrated by Diener (1920a) has marginal tuberculation and a faint suggestion of the characteristic *Cyrtopleurites* mid-lateral spiral at the beginning of the outer whorl. On the last half whorl there is no tuberculation. GSC 28846 (Pl. 128, fig. 12) is devoid of well defined tuberculation and is identified as a large *Cyrtopleurites hersiliae,* but the resemblance to some specimens identified as *C. bicrenatus* (Hauer) (e.g., Mojsisovics, 1893, Pl. 159, figs. 9a, b) should also be considered. This specimen, which has only the body chamber preserved, is appreciably larger than the largest described by Diener.

Genus *Drepanites* Mojsisovics, 1893

(Preoccupied, but conservation proposed by Spamer and Bogan, 1989).

Type species. Drepanites hyatti Mojsisovics.

Drepanites rutherfordi McLearn

Plate 128, figures 5, 6; Figure 103a (p. 602)

Drepanites rutherfordi McLearn, 1937a, p. 98, Pl. 1, fig. 13.

Drepanites hyatti rutherfordi McLearn. McLEARN, 1960a, p. 46, Pl. 3, figs. 10a, b, 11; Pl. 21, fig. 6; TOZER, 1962a, Pl. 10, figs. 1a, b; TOZER, 1967, p. 37, 57, 60, Pl. 10, figs. 4a, b; TOZER, 1972, Pl. 127, figs. 1, 2.

Registered material. Holotype GSC 8817 (McLearn, 1960a, Pl. 3, fig. 11), three topotypes GSC 12575 (ibid., Pl. 3, figs. 10a, b), GSC 13493 (ibid., Pl. 21, fig. 6), GSC 28021 (Tozer, 1972, Pl. 127, figs. 1, 2) (all GSC loc. 9146). Hypotype GSC 14248 (Tozer, 1967, Pl. 10, figs. 4a, b; GSC loc. 42537). Hypotype GSC 28853 (GSC loc. 83836). Two hypotypes GSC 28854, GSC 28855* (GSC loc. 9842).

Occurrence. Middle Norian, Rutherfordi Zone. Pardonet Formation, northeastern British Columbia. GSC locs. 9146 (25), 9842 (2), 42537 (20), 46459 (2), 83831 (5), 83836 (10), 83849 (2), 83850 (12), 97536 (5), 97531 (2), 97533 (5), 97534 (1), 97536 (5), 98536 (15), 98876 (1).

Remarks. The specimens from the upper beds of the Rutherfordi Zone at GSC locs. 97531 and 97533 are small with rather feebly indented suture lines. They possibly represent a distinct species.

Genus *Acanthodrepanites* n. gen.

Type species. Acanthodrepanites dieneri n. sp.

Diagnosis. Cyrtopleuritin with shape, keels and suture line like *Drepanites*, but distinguished by having

tuberculate instead of smooth flanks. Lateral tuberculation dense, consisting of up to about 20 spirals of small, single pointed nodes.

Species assigned. *"Acanthinites" eusebii* Diener (1920a, p. 607), *Acanthodrepanites dieneri* n. sp.

Age. Middle Norian, Rutherfordi and Bicrenatus zones.

Remarks. The keels have a single row of delicate tubercules on the outer side, like those of *Drepanites* Mojsisovics (1893). The single, as opposed to double- or triple-pointed nature of the lateral tubercles distinguishes *Acanthodrepanites* from *Acanthinites* Mojsisovics (1893) and *Carinacanthites* n. gen.

Acanthodrepanites dieneri n. sp.

Plate 128, figures 8–10; Figure 103f (p. 602)

Acanthinites sp. cf. *A. eusebii* Diener? McLEARN, 1960a, p. 53, Pl. 19, figs. 1a, b; TOZER, 1967, p. 37, 57.

Registered material. Holotype GSC 71034, paratype GSC 71033 (both GSC loc. 97532). Paratype GSC 13489 (GSC loc. 9841).

Occurrence. Middle Norian, Rutherfordi Zone. Pardonet Formation, northeastern British Columbia. GSC locs. 9841 (1), 97532 (2).

Diagnosis. *Acanthodrepanites* attaining a diameter of about 50 mm; H about 50 per cent, W about 33 per cent of diameter; U small, less than 10 per cent of diameter. At small diameter, the conch is thicker and more evolute. Umbilical and ventrolateral shoulders rounded. Spiral tuberculation uniformly developed on the whole flank.

Remarks. The holotype (Pl. 128, fig. 10) does not show sutures, but the outer whorl is probably mostly body chamber. All three specimens have the ventral sulcus bordered by low blunt keels that are denticulate on the outer side. Between the keel and the umbilicus, GSC 71033 (Pl. 128, fig. 8) 17 mm in diameter, has 14 tuberculate spirals at a whorl height of 8 mm; GSC 13489 (Pl. 128, fig. 9) has 11 at 10.5 mm; the holotype (Pl. 128, fig. 10), has 20 at 20 mm. The ammonitic suture line, which lacks a deep indentation in the external saddle, is shown only by GSC 71033 (Fig. 103f).

Whorl section and style of sculpture indicate affinity with *"Acanthinites" eusebii* Diener (1920a, p. 607) which differs in lacking tuberculation at the umbilical edge and on the inner quarter of the flank.

Etymology. The name commemorates Carl Diener.

Genus *Hauerites* Mojsisovics, 1893

Type species. *Ammonites rarestriatus* Hauer.

Hauerites piceus n. sp.

Plate 129, figures 6–9; Figure 104b, d–f (p. 606)

Metacarnites sp., McLEARN, 1960a, p. 54, Pl. 19, fig. 4; TOZER, 1967, p. 37, 57, 60.

Registered material. Holotype GSC 28857, paratype GSC 28858 (both GSC loc. 64663). Paratype GSC 13491 (McLearn, 1960a, Pl. 19, fig. 4) (GSC loc. 9838). Paratype GSC 28859 (GSC loc. 9841). Paratype GSC 28860 (GSC loc. 42537).

Occurrence. Middle Norian, Rutherfordi Zone. Pardonet Formation, northeastern British Columbia. GSC locs. 9838 (1), 9841 (1), 42537 (1), 64663 (2), 83896 (2), 97534 (1), 97580 (2), 98536 (1), 98876 (1).

Diagnosis. *Hauerites* attaining a diameter of about 165 mm; H about 60 per cent, W about 25 per cent of diameter; umbilicus occluded. Venter of inner whorls relatively broad with a shallow sulcus, bordered by denticulate keels. On most of phragmocone, smooth keels border the sulcus. At the aperture, the keels are barely expressed and the venter is narrowly tabulate. On the outer whorl, the flanks have faint spiral ridges, one at the inner third, one at the outer third of the flank. Faint distantly spaced ribs may also be present. Suture line with deeply indented elements.

Remarks. The holotype (Pl. 129, fig. 6) is entirely septate and was probably a complete phragmocone about 80 mm in diameter. The outer whorl is not well preserved. The specimen has been broken to show the inner whorls. Most of the specimen is steinkern. At a whorl height of 6 mm, the flanks have faint ribs, slightly bullate at mid-flank, about four to a quadrant. The venter is not clearly shown at this diameter. The suture line is already ammonitic. At larger diameters, the venter is not perfectly preserved, but what remains resembles the well preserved venter of GSC 28858, (Pl. 129, fig. 7), which at a whorl height between 20 and 35 mm has a venter that is narrowly tabulate on the steinkern and narrowly bicarinate, with smooth

raised keels, on the surface of the test. GSC 28859 (Pl. 129, fig. 8) at a whorl height of 10 mm has a relatively broad venter with a shallow sulcus bordered by angular, denticulate shoulders. Adorad, at a whorl height of 17 mm, the venter has smooth raised keels, like those of GSC 28858. Spiral ridges on the flank are seen in GSC 28860 (Pl. 129, fig. 9). This specimen, about 165 mm in diameter with half a whorl of body chamber, is the largest known. It has a narrowly bicarinate venter with smooth keels to within half a whorl of the aperture. At the aperture the keels are barely expressed and the venter is narrowly tabulate.

Ammonoids that are certainly closely related are *Hauerites rarestriatus timorensis* Diener (1923, p. 200), *H. rarestriatus* (Hauer) (Mojsisovics, 1893, p. 529) and "*Paratibetites*" *angustosellatus posterior* Welter (1914, p. 153). Closest is *H. rarestriatus timorensis,* the only one of the three known to have denticles on the ventral keels. It differs in having lateral nodes and in retaining denticles at a larger diameter. *Hauerites rarestriatus,* although not known to have denticulation, nevertheless has comparable ribbing and a similar venter. It differs in having more numerous spiral ridges on the flank, and a less indented suture line. The form described by Welter has more pronounced sculpture, with faint nodes on the lateral spiral ridges.

The type species of *Metacarnites* (*M. footei* Diener, 1908, p. 109) and others assigned to that genus are oxycones with an outer whorl section and suture line much like that of *Hauerites piceus.* The nature of the inner whorls of *Metacarnites footei* and *M.? hendersoni* is not known, making comparison with *Hauerites piceus* impossible.

Hauerites astrictus n. sp.

Plate 128, figures 2a–e; Figure 104a (p. 606)

Registered material. Holotype GSC 28856 (GSC loc. 46467).

Occurrence. Middle Norian, Rutherfordi Zone. Pardonet Formation, northeastern British Columbia. GSC locs. 46467 (1), 97529 (1).

Diagnosis. Hauerites attaining a diameter of about 60 mm; H about 60 per cent, W about 25 per cent of diameter; umbilicus probably occluded. Venter of inner whorls with two very closely spaced rows of denticles, venter of outer whorl with one row on an acute venter. Outer flanks with low crescentic ribs.

Remarks. The outer whorl of the holotype (Pl. 128, fig. 2) appears to be body chamber. Inner whorls have been exposed. At a whorl height of 2.5 mm the flanks are smooth, the venter narrowly tabulate, and the suture line is goniatitic with an adventitious lobe in the external saddle. At a whorl height of 15 mm the venter is denticulate and acute on the steinkern. Denticulation is very delicate in the form of two very closely spaced rows (Pl. 128, fig. 2e). Ammonitic suture lines are exposed, but not well preserved. On the outer whorl, the venter is also denticulate, but where the test is preserved, near the aperture, there is only one row of denticles on the acute venter.

This species is distinguished from all other *Hauerites* species by having an acute venter on the outer whorl. The two rows of denticles on the inner whorls, a feature shared with *Hauerites rarestriatus timorensis* Diener (1923, p. 200) are taken to justify the generic assignment, although Diener's species differs in having an appreciably broader venter and more prominent lateral sculpture.

Genus *Himavatites* Diener, 1906

Type species. Acanthinites (Himavatites) watsoni Diener).

Himavatites planiplicatus n. sp.

Plate 132, figures 1–4; Figure 107c (p. 612)

Registered material. Holotype, GSC 28866, three paratypes GSC 28863, GSC 28864, GSC 28865 (all GSC loc. 83835).

Occurrence. Middle Norian, Columbianus Subzone 1. Pardonet Formation, northeastern British Columbia. GSC locs. 83835 (14), 98542 (5).

Diagnosis. Himavatites attaining a diameter of about 85 mm; H about 50 per cent, W about 35 per cent, U about 12 per cent of diameter. Ribs broad, rather flat on phragmocone, less so on the body chamber. Flanks with up to about 17 lateral tubercle spirals, tubercles bearing two, three or four spines, the number increasing radially. Phragmocone without large nodes on the flank; body chamber with large umbilical, lateral and marginal nodes. Outer external spiral has large ears, larger than any on the inner spiral. Strength of ribbing undiminished on body chamber.

Measurements. Paratype GSC 28864 (Pl. 132, fig. 2): 45, 0.51, 0.35, 0.12.

Remarks. In the holotype (Pl. 132, fig. 3) septa are not shown, but the holotype is probably partly phragmocone, partly body chamber. It lacks large nodes on the flank, as does GSC 28864 (Pl. 132, fig. 2), a complete phragmocone. GSC 28863 (Pl. 132, fig. 4), a body chamber fragment with a whorl height of 30 mm, has 17 lateral spirals and large umbilical and lateral nodes. There is a scar indicating the position of one marginal node. GSC 28865 (Pl. 132, fig. 1) 30 mm in diameter has 15 lateral spirals; GSC 28864 (Pl. 132, fig. 2) and the holotype (Pl. 132, fig. 3) have 16; GSC 28863 (Pl. 132, fig. 4), the largest known specimen, has 17. The outer three spirals on the holotype (Pl. 132, fig. 3) are trispinose, the inner are mostly bispinose. Four spines are present on some of the outer spirals of GSC 28864 (Pl. 132, fig. 2). The holotype (Pl. 132, fig. 3), GSC 28863 (Pl. 132, fig. 4) and GSC 28865 (Pl. 132, fig. 1) all have external tuberculation preserved, with large ears on the outer external spiral. GSC 28864 (Pl. 132, fig. 2) probably had similar sculpture, but the venter is preserved mostly as steinkern, providing little detail. The ammonitic suture line is well preserved in GSC 28864 (Fig. 107c).

The flat ribs, each with numerous spines, form a sculpture similar to that of *Himavatites welteri* Diener (1923, p. 202), but that species differs in having less elaborate external sculpture, without the large ears of *H. planiplicatus*. *Himavatites watsoni* Diener (1906a, p. 72), and *H. multiauritus* McLearn have large nodes on the flank, as on the body chamber of *H. planiplicatus*. *Himavatites watsoni* differs in having more spirals on the flank; *H. multiauritus* in having umbilical, lateral and marginal nodes already present on the phragmocone.

Himavatites multiauritus McLearn

Plate 132, figures, 5a, b; Plate 134, figures 2, 12, 13

Himavatites multiauritus McLearn, 1947a, Appendix p. 2, Pl. 6, figs. 5, 6; McLEARN, 1960a, p. 50, Pl. 4, figs. 8a, b; TATZREITER, 1981, p. 109.

Himavatites sp. cf. *H. watsoni* Diener. McLEARN, 1960a, p. 49, Pl. 4, figs. 6, 7.

Registered material. Holotype GSC 9503 (GSC loc. 9745). Two topotypes GSC 12579 (McLearn, 1960a, Pl. 4, fig. 6), GSC 12580 (ibid., fig. 7) (both GSC loc. 9744). Hypotype GSC 28867 (GSC loc. 19678). Topotype GSC 72191 (GSC loc. 98551). Topotype GSC 72192 (GSC loc. 98867).

Occurrence. Middle Norian, Columbianus Subzone 2. Pardonet Formation, northeastern British Columbia; Parson Bay Formation, Vancouver Island, British Columbia. GSC locs. 9729 (1), 9744 (5), 9745 (2), 19678 (1), 98551 (1), 98867 (1), 98868 (1), 98869 (1).

Diagnosis. Himavatites attaining a diameter of at least 85 mm. Phragmocone thick, H about 55 per cent, W about 55 per cent, U about 13 per cent of diameter. Ribs broad, rounded, distantly spaced. Flanks with up to about 16 lateral tubercule-spirals with two, rarely three small spines on each tubercle. Large umbilical, lateral and marginal nodes present on both the phragmocone and body chamber. Outer external spiral has large ears, larger than any on the inner spiral. Ears on the external spirals are present on most or all of the outer whorl.

Remarks. The holotype (Pl. 134, fig. 2), which is wholly septate, has 15 lateral spirals, mostly of tubercles with two spines. Scars show the position of umbilical, lateral and marginal nodes. GSC 12580 (McLearn, 1960a, Pl. 4, fig. 7) is part of the body chamber of a *Himavatites* that attained a diameter of about 85 mm. It has three spirals of large nodes, and tubercles that are mostly bispinose with a few trispinose. This specimen is interpreted as a body chamber of *H. multiauritus*. GSC 72192 (Pl. 134, fig. 13) is the remains of an even larger specimen with large ears on the outer external spiral, large marginal nodes and the scar of a large lateral node. The umbilical edge is imperfectly preserved, otherwise it is comparable to GSC 12580. GSC 72191 (Pl. 134, fig. 12), a small specimen with 10 lateral spirals, three or four spines on each tubercle, a suggestion of large umbilical, lateral and marginal nodes, and outer external clavi larger than the inner, is probably an immature example. The holotype shows septa, but no details of the suture line.

The presence of large nodes on the phragmocone, not merely on the body chamber, and rounded, rather than somewhat flat, ribs distinguish this species from *H. planiplicatus* n. sp.

Himavatites sp. indet.

Plate 132, figure 6

Registered material. GSC 28862 (GSC loc. 9839).

Occurrence. Middle Norian, Columbianus Subzones 1 and 2. Pardonet Formation, northeastern British Columbia. GSC locs. 9741 (1), 9781 (1), 9839 (1),

97525 (2), 97526 (1), 97528 (3), 98518 (1), 98541 (1), 98885 (1).

Remarks. These specimens are not well preserved, but neverthless clearly show numerous spirals of lateral tubercles suggesting an affinity to *Himavatites* rather than *Mesohimavatites* or *Neohimavatites*.

Himavatites apinnatus n. sp.

Plate 134, figures 3–5

Registered material. Holotype GSC 71010 (GSC loc. 98549). Two paratypes GSC 71011, GSC 71012 (both GSC loc. 97557).

Occurrence. Middle Norian, Columbianus Subzone 2. Pardonet Formation, northeastern British Columbia. GSC locs. 97557 (2), 98549 (1).

Diagnosis. Himavatites attaining a diameter of about 80 mm. Ribs narrow. Flanks with up to about 16 lateral tubercle spirals, with tubercles bearing one or two spines on each rib, the number increasing radially. Body chamber with large umbilical, lateral and marginal nodes. Outer and inner external spirals similar, there being no large ears on the outer spiral.

Remarks. The holotype (Pl. 134, fig. 4) is a fragment, apparently wholly of body chamber. There are 16 spirals of lateral tubercles and large nodes at the umbilicus, mid-flank and margin. On most of the flank nearly all ribs have tubercles with single spines; on the outer flank most have double spines. Tuberculation on the inner and outer external spirals is similar, with trispinose clavi replaced, adorad, by almost continuous denticles. GSC 71011 (Pl. 134, fig. 3) and GSC 71012 (Pl. 134, fig. 5) are sculptured much like the holotype, GSC 71012 having at least 15 spirals of lateral tubercles. Both have double spines on the outer parts of the ribs. The venter of GSC 71011 resembles that of the holotype in lacking large ears.

Remarks. The closest resemblance is to *Himavatites multiauritus* McLearn, which differs in having large ears on the outer external spiral. *Himavatites planiplicatus* n. sp. differs in the same way and also in having much wider ribs. *Himavatites hogarti* (Diener) (Tatzreiter, 1981, p. 110) has a somewhat similar venter, but has appreciably more lateral spirals.

Genus *Mesohimavatites* n. gen.

Type species. Himavatites columbianus McLearn.

Diagnosis. Cyrtopleuritin with barely sulcate venter bordered on each side by two (outer and inner external) spirals of tubercles. On most of phragmocone both external spirals are of denticulate clavi or small ears, the internal and external spirals characteristically being similarly sculptured. On the body chamber, spirals may be of continuous denticles. Flanks ribbed, with up to about 12 spirals of tubercles, individual tubercles bearing single or double spines. The mid-flank invariably has one spiral of widely spaced large nodes on thickened ribs, large nodes generally also present near the umbilicus and infrequently at the margin.

Species assigned. Mesohimavatites parvus n. sp., *M. costatus* n. sp., *M. columbianus* (McLearn), *M. caponicus* n. sp., *M. indigiricus* (Bychkov) (= *Himavatites canadensis indigiricus* Bychkov; Bychkov and Polubotko, 1970).

Age. Middle Norian, Columbianus Zone.

Remarks. The spinose lateral tubercles, large nodes on the flank and the two spirals on each side of the mid-line indicate close affinity with *Himavatites.* All species assigned to *Himavatites* differ from *Mesohimavatites* in acquiring more numerous (more than 15) spirals of lateral tubercles. Species assigned to *Neohimavatites* (*N. canadensis* (McLearn), *N. burlingi* McLearn, *N. peregrinus* n. sp.) have relatively few spirals of lateral tubercles like *Mesohimavatites,* but differ in being devoid of large nodes on the whorl side and in having denser ribbing. The venter of *Himavatites* is characteristically more deeply sulcate compared with that of *Mesohimavatites*, that of *Neohimavatites* is not sulcate at all.

Mesohimavatites parvus n. sp.

Plate 133, figures 1–4, 9

Registered material. Holotype GSC 28871, three paratypes GSC 28872, GSC 28873, GSC 28874 (all GSC loc. 83834). Paratype GSC 28875 (GSC loc. 46468).

Occurrence. Middle Norian, Columbianus Subzone 2. Pardonet Formation, northeastern British Columbia. GSC locs. 46468 (1), 83834 (14), 97555 (6).

Diagnosis. Mesohimavatites 35 to about 55 mm in diameter; H about 55 per cent, W about 33 per cent, U about 10 per cent of diameter. Most ribs rounded, narrow, ribs and interspaces being of about the same width. Outer whorl has at least one thick rib, with a large node at mid-flank. Flanks with about 10 spirals of tubercles; most of tubercles have single spines, some

are double. Some variants have enlarged ears on the outer external spiral and large nodes umbilical and marginal nodes.

Measurements. Holotype GSC 28871 (Pl. 133, fig. 1): 34, 0.56, 0.34, 0.09.

Remarks. GSC 28874 (Pl. 133, fig. 4), about 57 mm in diameter, indicates the size attained. The outer whorl is partly body chamber, but the limit cannot be determined, suture lines not being well preserved. On the flank there are 10 spirals of small tubercles with single or double spines. On the body chamber there is one thick rib with the scar of a large node at mid-flank. The external spirals are of denticulate clavi. The holotype (Pl. 133, fig. 1) is complete and was probably mature at a diameter of 34 mm. Most of the ribs have tubercles with single spines. On the body chamber there are 10 spirals on the flank and one thickened rib with an enlarged tubercle at mid-flank. The venter has external spirals of denticulate clavi at the beginning of the outer whorl, but near the aperture these spirals are formed of continuous denticles. GSC 28872 (Pl. 133, fig. 2) has nine lateral spirals, ribs with double spines and the scars of large ears on the outer external spiral. GSC 28873 (Pl. 133, fig. 3) has 10 tubercle-spirals between the umbilicus and the outer external spiral and some tubercles with double spines, large outer external ears and large nodes at the umbilicus, mid-flank and margin. These two specimens (GSC 28872, GSC 28873) have tuberculation much like that of *Himavatites,* GSC 28873 in particular, being like *H. multiauritus* McLearn. However, the number of lateral spirals is the same as the holotype and less than normal for *Himavatites* and for this reason they are regarded as variants of *M. parvus.*

The holotype differs from typical examples of *Mesohimavatites columbianus* (McLearn) by being much smaller and in having much more delicate ribbing and tuberculation, and denticles instead of clavi on the venter. The large specimens identified as *M. parvus* more closely resemble *M. columbianus* and it is possible that the two taxa are small (*M. parvus*) and large (*M. columbianus*) variants of one species.

Mesohimavatites costatus n. sp.

Plate 134, figure 6

Registered material. Holotype GSC 71009 (GSC loc. 97555).

Occurrence. Middle Norian, Columbianus Subzone 2. Pardonet Formation, northeastern British Columbia. GSC loc. 97555 (1).

Diagnosis. Mesohimavatites about 55 mm in diameter; H about 55 per cent, W about 30 per cent, U about 10 per cent of diameter. Most ribs thin and rounded; body chamber with thick ribs, nodose near the umbilicus and mid-flank, but not at the margin. Flanks with about nine spirals of tubercles. External spirals are of short denticulate clavi and tubercles.

Measurements. Holotype GSC 71009 (Pl. 134, fig. 6): 55, 0.55, 0.31, 0.10.

Remarks. The holotype (Pl. 134, fig. 6) has half a whorl of body chamber preserved, and apparently includes part of the peristome. Little of the phragmocone is preserved. On the body chamber there are five thick ribs, all with big nodes near the umbilicus. The first two have the scars of large lateral nodes, the remaining three are only partly preserved. There are no marginal nodes. There are about nine spirals of tubercles on the flank, of which the inner spirals are faint. The thin ribs have single spines, the thick, double. The tubercles of the external spirals are small, those at the beginning of the body chamber being short, clavate and bituberculate, those near the aperture being simple denticles.

This species differs from both *Mesohimavatites columbianus* (McLearn) and *M. parvus* n. sp. in having more numerous thick ribs on the body chamber, which contrast more markedly with the intervening ribs.

Mesohimavatites columbianus (McLearn)

Plate 133, figures 5–8; Plate 134, figure 11

Himavatites columbianus McLearn, 1939b, p. 55, Pl. 1, fig. 1; McLEARN, 1946c, Appendix p. 1, Pl. 1, figs. 1, 2; McLEARN, 1960a, p. 51, Pl. 5, figs. 6a, b, 7; TOZER, 1962a, Pl. 10, figs. 9a, b (not Pl. 11, figs. 7a, b); TOZER, 1967, p. 37, 58, Pl. 10, figs. 5a, b; TOZER, 1970, Pl. 18, fig. 10a, b.

Registered material. Holotype GSC 9411, four topotypes GSC 28868*, GSC 85781, GSC 85782*, GSC 85783* (all GSC loc. 9767). Hypotype GSC 9265 (McLearn, 1960a, Pl. 5, figs. 6a, b) (GSC loc. 10739). Two hypotypes GSC 28869, GSC 28870 (both GSC loc. 74775). Hypotype GSC 72190 (GSC loc. 98552).

Occurrence. Middle Norian, Columbianus Zone, Subzone 2 and ?3. Pardonet Formation, northeastern British Columbia. GSC locs. 9767 (15), 10739 (10), 74775 (3), 98525 (5), 98552 (2).

Diagnosis. Mesohimavatites attaining a diameter of about 150 mm; H about 55 per cent, W about 35 per

cent, U about 10 per cent of diameter. Ribs broad, rounded, distantly spaced. Flanks with nine or ten spirals of tubercles, tubercles with one or two spines on each rib, two spines being present only on the outer three or four spirals. Phragmocone without large nodes on flank. Body chamber with large nodes at mid-flank, about three on the last quadrant. Somewhat bullate large nodes commonly present near the umbilicus, large marginal nodes infrequent. Outer and inner external spirals are of denticulate clavi, large ears not developed, outer and inner external spirals essentially similar.

Remarks. GSC 85781 (Pl. 133, fig. 7) is a body chamber fragment with a whorl height of 45 mm, and 10 spirals of tubercles on the flank. It has large nodes at the umbilicus and mid-flank, like the holotype (Pl. 133, fig. 8), with, in addition, large nodes at the margin, at least three on a quadrant (McLearn, 1960a, p. 52). GSC 85782* a phragmocone 42 mm in diameter, has no large nodes. GSC 85783* shows the external lobe and external saddle at a whorl height of 13 mm. The ammonitic external saddle is similar to that of *Himavatites planiplicatus* n. sp. (Fig. 107c).

Mesohimavatites caponicus n. sp.

Plate 132, figure 7; Plate 134, figures 7–10

Registered material. Holotype GSC 71013 (GSC loc. 10741). Two paratypes GSC 71014, GSC 71015 (GSC loc. 10742). Hypotype GSC 28881 (GSC loc. 64634). Hypotype GSC 71016 (GSC loc. 9768).

Occurrence. Middle Norian, Columbianus Subzone 4. Pardonet Formation, northeastern British Columbia. GSC locs. 9768 (1), 10741 (1), 10742 (2), 47004 (1), 64634 (2), 83847 (4), 97556 (1).

Diagnosis. Mesohimavatites about 80 mm in diameter; H about 55 per cent, W about 30 per cent, U about 10 per cent of diameter. Ribs flat, as wide or wider than interspaces. Flanks with about 12 spirals of tubercles, most tubercles with single spines. External spirals are of short denticulate clavi.

Remarks. The holotype (Pl. 134, fig. 10) is not well preserved. It appears to be a body chamber. The large lateral nodes indicate reference to *Mesohimavatites*, but it is distinguished from *M. columbianus* (McLearn), *M. parvus* n. sp. and *M. costatus* n. sp. by having flat instead of narrow, rounded ribs. The holotype is the only specimen that has large lateral nodes preserved. The other specimens are ribbed like the holotype and are identified as *M. caponicus,* although from their morphology they could be regarded as representatives of *Neohimavatites.* It is assumed that they are specimens too immature to have formed nodes or too imperfect to have them preserved. The venters of the holotype (Pl. 134, fig. 10), GSC 28881 (Pl. 132, fig. 7) and GSC 71016 (Pl. 134, fig. 7) have denticulate clavi forming the external spirals. The outer lateral spiral of GSC 71014 (Pl. 134, fig. 8) has some tubercles with double spines, but single spines are the rule on all the others. None have suture lines preserved.

The ribbing and venter is essentially like that of *Neohimavatites burlingi* (McLearn), but the holotype of that species, which has the body chamber preserved, is without lateral nodes. At first sight there seems to be a close resemblance to *Mesohimavatites indigiricus* (Bychkov) (Bychkov and Polubotko, 1970, p. 118), but that species is described as having fewer (about 8 instead of 12) spirals of lateral tubercles.

Genus *Neohimavatites* Tozer, 1980a

Type species. Himavatites canadensis (McLearn).

Neohimavatites canadensis (McLearn)

Plate 132, figures 9, 10

Himavatites canadensis McLearn, 1940c, p. 115, Pl. 3, fig. 3; McLEARN, 1960a, p. 52, Pl. 4, figs. 5a, b; TOZER, 1967, p. 55.

Neohimavatites canadensis (McLearn). TOZER, 1980a, Pl. 17.1, figs. 23–25.

Registered material. Holotype GSC 8847 (McLearn, 1960a, Pl. 4, figs. 5a, b) (GSC loc. 9830). Hypotype GSC 28877 (GSC loc. 68305). Hypotype GSC 28876 (GSC loc. 82455).

Occurrence. Middle Norian, Columbianus Subzone 3. Pardonet Formation, northeastern British Columbia. GSC locs. 9471 (1), 9829 (1), 9830 (1), 10740 (2), 68305 (2), 82455 (2), 97554 (1).

Diagnosis. Neohimavatites up to about 55 mm in diameter; H about 55 per cent, W about 25 per cent, U about 7 per cent of diameter. Ribs broad, flat, imbricate, moderately closely spaced. Flanks with 10 or 11 spirals of tubercles. Tubercles on the phragmocone with one or two spines, on the body chamber with one. Lateral spirals faint or absent on the adoral quadrant. Phragmocone with external spirals of denticulate clavi; body chamber with spirals of denticles.

Remarks. GSC 28877 (Pl. 132, fig. 10) has a little more than half a whorl of body chamber, and reduced sculpture near the aperture, which is apparently the peristome. It is probably complete and mature. There are 11 lateral spirals at the start of the outer whorl. The outer six are of bispinose tubercles, the inner five single. On the body chamber the lateral tubercles are single-pointed. At the start of the outer whorl the external spirals are of denticulate clavi. Adorally, the clavi merge and at the aperture the spirals are of continuous denticles. The lateral spirals become increasingly faint toward the aperture, a feature also shown, at a smaller diameter, by GSC 28876 (Pl. 132, fig. 9). Lateral tuberculation is very faint on the holotype, in which half a whorl of body chamber is preserved, and traces of an ammonitic external saddle. GSC 28876, unlike GSC 28877, retains small external clavi on nearly the whole of the outer whorl and, although complete, may not have been mature.

Neohimavatites peregrinus n. sp.

Plate 135, figures 1–3

Himavatites cf. *H. canadensis* McLearn. TOZER, 1967, p. 44.

Registered material. Holotype GSC 28878 (GSC loc. 74777). Paratype GSC 28879 (GSC loc. 68301). Hypotype GSC 28880 (GSC loc. 51643).

Occurrence. Middle Norian, Columbianus Subzone 3. Heiberg Formation, Axel Heiberg Island; Pardonet Formation, northeastern British Columbia. GSC locs. 26450 (2), 51643 (6), 64638 (1), 68301 (2), 74777 (1), 97552 (1), 98522 (1).

Diagnosis. Neohimavatites about 40 mm in diameter; H about 55 per cent, W about 25 per cent, U about 7 per cent of diameter. Ribs rounded, thin, about as wide as interspaces. Flanks with 10 spirals of tubercles, those on inner flank very faint. Double-pointed lateral tubercles restricted to the phragmocone, those on the body chamber being single pointed. Venter of outer whorl with external spirals of short clavi, replaced adorad by continuous spirals of denticles.

Remarks. In the holotype (Pl. 135, fig. 1), a crushed specimen, no suture lines are seen, but it is probably mostly or wholly body chamber. At the start of the preserved portion the ribs have bispinose tubercles on the outer flank and two spirals of clavate tubercles on each side of the median line, which is barely sulcate. Adorad most or all lateral spirals are of tubercles with a single spine and the external spirals are of continuous denticles. GSC 28879 (Pl. 135, fig. 2) has half a whorl of body chamber preserved, including part of the peristome. It provides an accurate count of 10 tubercle-spirals on the flank. All tubercles are single pointed and the external spirals are of denticles, not clavi. GSC 28880 (Pl. 135, fig. 3), although poorly preserved, appears to be sculptured like GSC 28879.

This species most closely resembles *N. canadensis* (McLearn), but is distinguished by having ribs that are narrower and devoid of imbrication.

Neohimavatites burlingi (McLearn)

Plate 132, figures 8a, b; Plate 134, figures 1a, b

Himavatites burlingi McLearn, 1947a, Appendix p. 2, Pl. 6, figs. 1, 2; McLEARN, 1960a, p. 52, Pl. 4, figs. 9a, b; TOZER, 1967, p. 58.

Registered material. Holotype GSC 9504 (GSC loc. 9784). Hypotype GSC 28882 (GSC loc. 65935).

Occurrence. Middle Norian, Columbianus Subzone 3. Pardonet Formation, northeastern British Columbia. GSC locs. 9784 (1), 65935 (3).

Diagnosis. Neohimavatites like *N. canadensis* (McLearn), but a little thicker, and with ribs that are relatively broad and flat, but not imbricate. Tuberculation of the body chamber is also different, tubercles with double spines being present on the outer lateral spirals and external spirals formed of discrete denticulate clavi instead of continuous denticles.

Remarks. The holotype (Pl. 134, fig. 1) apparently has the body chamber preserved. Large lateral nodes being absent, it is interpreted as a species of *Neohimavatites.* There are nine or ten spirals of lateral tubercles. Preservation is mostly as steinkern, but the tubercles on at least the two outer lateral spirals were the base of double spines. In GSC 28882 (Pl. 132, fig. 8) the outer five have double spines. Both have two spirals of denticulate external clavi on each side of the median line. Suture lines are not preserved.

The external clavi on the body chamber distinguish *N. burlingi* from *N. canadensis* and *N. peregrinus* n. sp.

Family HERACLITIDAE Diener, 1920a

Genus *Wangoceras* Tozer, 1980b

Type species. Pseudotibetites pax Tozer.

Wangoceras pax (Tozer)

Plate 120, figures 1–6; Figure 95c (p. 588)

Pseudotibetites pax Tozer, 1980a, p. 111, Pl. 17.1, figs. 8–14.

Wangoceras pax (Tozer). TOZER, 1980b, p. 276.

"*Tibetites*" sp., McLEARN, 1960a, p. 57, Pl. 5, figs. 8, 9; TOZER, 1967, p. 57.

Registered material. Holotype GSC 28745, two paratypes GSC 28746, GSC 28747 (all GSC loc. 9373). Paratype GSC 12583 (GSC loc. 9161). Paratype GSC 28748 (GSC loc. 64664). Paratype GSC 28749 (GSC loc. 64606). Hypotype GSC 12582 (McLearn, 1960a, Pl. 5, fig. 8) (GSC loc. 9699).

Occurrence. Lower Norian, Dawsoni Subzone 1. Pardonet Formation, northeastern British Columbia. GSC locs. 9161 (1), 9373 (4), 9695 (1), 9699 (1), 64606 (1), 64664 (1), 97546 (3).

Diagnosis. Wangoceras with phragmocone diameter to at least 40 mm; H about 45 per cent, W about 35 per cent, U about 28 per cent of diameter. Ribbing moderately to very weak, barely perceptible on steinkern. Tuberculation pronounced with four or five spirals between the umbilicus and the external clavi (umbilical, two or three lateral, marginal). Umbilical and lateral tubercles round and pointed. Marginal tubercles become clavate and projected outward. At a small diameter, the keels have spirally arranged tubercles (i.e., are notched, not braided), and the number of tubercles match or slightly exceed the number at the margin. At a larger diameter, the density of marginal and external clavi is about the same, with the external clavi arranged en echelon.

Remarks. Most of the specimens are wholly septate. None certainly preserve the body chamber.

The nature and development of the sculpture on the surface of the test is shown best by GSC 12582 (McLearn, 1960a, Pl. 5, fig. 8). At the beginning of the outer whorl, all tubercle spirals (umbilical, two lateral, marginal, external) are of rounded, pointed nodes, and the number of external nodes barely exceeds the number at the margin. Adorad the spirals comprise umbilical, three lateral, marginal and external. The innermost lateral tubercles are very much smaller than the middle and outer. At this stage the marginal spiral is of large clavi, with one clavus opposite two outer lateral tubercles. The size of the external tubercles in relation to the marginal increases adorad, finally being one to one. Ribbing is distinct on this specimen, most ribs branching at the middle lateral spirals, and the number of outer lateral tubercles consequently doubles that of the middle lateral tubercles. Parts of the steinkern are exposed showing a very subdued indication of the tuberculation, compared with that of the test surface.

The notched keels are also shown by GSC 28747 (Pl. 120, fig. 1), which also has parts of the test preserved. GSC 28749 (Pl. 120, fig. 2) at a comparable diameter is preserved as steinkern and has subdued sculpture with a barely impressed ventral sulcus, but with low clavi, arranged like the notches of GSC 28748 (Pl. 120, fig. 4). The differences between GSC 28749 (Pl. 120, fig. 2) and GSC 28747 (Pl. 120, fig. 1) illustrate the differences between the inner and outer surfaces of the test. GSC 28747 (Pl. 120, fig. 1) and GSC 28748 (Pl. 120, fig. 4) have one spiral of lateral tubercles at the beginning of the outer whorl, later they have two. The holotype (Pl. 120, fig. 3), a steinkern, shows only one; GSC 12583 (Pl. 120, fig. 6) and GSC 28746 (Pl. 120, fig. 5), in which parts of the test are preserved, have two. The venter of GSC 28748 (Pl. 120, fig. 4) has parts of the test preserved at a more mature stage. The marginal tubercles are high and project outward. The external clavi are spirally elongate. The ammonitic suture lines showing the external saddle to be without deep indentations are well preserved on the holotype and GSC 12582 (Fig. 95c).

It has been indicated by Rostovstev and Zhamoida (1984, p. 91) that *Paratibetites? seimkanensis* Bychkov (Bychkov et al., 1976, p. 133) is a representative of *Wangoceras.* In the writer's opinion this species is more probably a *Pterosirenites. Pterotoceras? svalbardense* Korchinskaya (1980, p. 34) is a possible *Wangoceras,* but the details of the suture line are not known, making precise comparison impossible.

Genus *Heraclites* Mojsisovics, 1879

Type species. Ammonites robustus Hauer.

Heraclites canadensis n. sp.

Plate 128, figures 4a, b

Registered material. Holotype GSC 71032 (GSC loc. 97580).

Occurrence. Middle Norian, Rutherfordi Zone. Pardonet Formation, northeastern British Columbia. GSC loc. 97580 (1).

Diagnosis. Heraclites about 50 mm in diameter; H about 50 per cent, W about 30 per cent, U about 20 per cent of diameter. Ribbing weak, tuberculation strong, becoming weak on last quadrant of phragmocone. Strong tuberculation consists of bullate tubercles at umbilical margin, pointed tubercles on the inner flank, clavate tubercles at the margin and finely denticulate external keels. On the last quadrant of phragmocone, umbilical and lateral tuberculation is absent and the tubercles of the marginal and external spirals are replaced by spiral ridges.

Remarks. The holotype (Pl. 128, fig. 4) is wholly septate, probably a complete phragmocone. With the body chamber it was about 50 mm in diameter. Ribs are very thin, little more than striae. The change in sculpture on the outer whorl suggests that it was mature. Tuberculation is well developed except on the last quadrant. Two lateral and three marginal tubercles stem from one at the umbilicus. The external denticulation is much denser than the marginal tuberculation, about four external denticles falling within the scope of two marginal tubercles. The broad ammonitic external saddle characteristic of *Heraclites* is well preserved.

The suture line, style of lateral tuberculation and the nature of the external keels leave no doubt that this is a species of *Heraclites,* but compared with *H. robustus* (Hauer) (Mojsisovics, 1893, p. 505), *H. bellonii* Mojsisovics (ibid., p. 507) and *H. gorgonii* Diener (1920a, p. 596) the new species is smaller, very weakly ribbed, and more compressed.

Family DISTICHITIDAE Diener, 1920b

Genus *Ectolcites* Mojsisovics, 1893

Type species. Ammonites pseudoaries Hauer.

Ectolcites childerhosei n. sp.

Plate 143, figures 10–12

Registered material. Holotype GSC 72205, paratype GSC 72204 (both GSC loc. 98885). Paratype GSC 70998 (GSC loc. 97528).

Occurrence. Middle Norian, Columbianus Subzone 1. Pardonet Formation, northeastern British Columbia. GSC locs. 97528 (1), 98885 (4).

Diagnosis. Ectolcites attaining a diameter of about 50 mm; H about 33 per cent, W about 25 per cent, U about 45 per cent of diameter; W somewhat greater at smaller diameter. Ribbing and faint marginal tuberculation present at a small diameter, outer whorl nearly smooth. Suture line with very small indentations in the saddles.

Measurements. Holotype GSC 72205 (Pl. 143, fig. 11): 48, 0.32, 0.24, 0.45. Paratype GSC 72204 (Pl. 143, fig. 10): 25, 0.34, 0.36, 0.44.

Remarks. The holotype (Pl. 143, fig. 11) has a body chamber of a little less than one and a quarter whorls. Only the lateral saddle is visible; it is weakly denticulate. GSC 72204 (Pl. 143, fig. 10) also has the body chamber preserved, but although complete, the specimen was probably not mature. It has ribbing like the inner whorls of the holotype, both having about 14 ribs on half a whorl. Both have strigate sculpture. GSC 72204 (Pl. 143, fig. 10) has moderately well defined marginal tuberculation, a feature not visible on the holotype. GSC 70998 (Pl. 143, fig. 12) has somewhat denser ribbing. This specimen also has weakly denticulate lateral saddles.

The nearly smooth body chamber distinguishes this species from *Ectolcites pseudoaries* (Hauer) (Tatzreiter, 1981, p. 128), *E. duncani* Diener (1906, p. 113), *E. arietiformis* (Diener) (ibid., p. 112), *E. hollandi* Diener (ibid., p. 111) and *E. hochstetteri* Mojsisovics (1893, p. 615). All these species also differ in having more prominent marginal tuberculation.

Genus *Distichites* Mojsisovics, 1893

Type species. Distichites megacanthus Mojsisovics.

Distichites columbianus n. sp.

Plate 137, figures 9a, b

Registered material. Holotype GSC 28918 (GSC loc. 83835).

Occurrence. Middle Norian, Columbianus Subzone 1. Pardonet Formation, northeastern British Columbia. GSC locs. 83835 (1), 98542 (1).

Diagnosis. Distichites about 135 mm in diameter; H about 45 per cent, W about 30 per cent, U about 28 per cent of diameter. Ribs virtually absent. Number of umbilical and marginal spines about equal, about 17 per whorl. Marginal spines present on much or all of the outer whorl, but umbilical spines are reduced to nodes. Umbilical seam is inside marginal spines.

Measurements. Holotype GSC 28918 (Pl. 137, fig. 9): 132, 0.44, 0.29, 0.28.

Remarks. The holotype (Pl. 137, fig. 9), which preserves about three quarters of a whorl of body chamber, is probably complete.

In having the umbilical seam inside and covering the marginal spines, this species is comparable with members of Mojsisovics' "compressi", for example *Distichites hippocratis* Mojsisovics (1893, p. 602), which differs in having more closely spaced marginal spines.

Distichites gethingi McLearn

Plate 137, figures 7, 8; Figure 111d (p. 622)

Distichites gethingi McLearn, 1940c, p. 116, Pl. 2, fig. 4; McLEARN, 1960a, p. 68, Pl. 6, figs. 7a, b.

Distichites sp. cf. *D. megacanthus* Mojsisovics. McLEARN, 1960a, p. 69, Pl. 7, figs. 4a, b.

Distichites sp. cf. *D. mesacanthus* Diener. McLEARN, 1960a, p. 69, Pl. 7, fig. 5.

Distichites sp. cf. *D. celticus* Mojsisovics. McLEARN, 1960a, p. 69, Pl. 21, fig. 5.

Registered material. Holotype GSC 8849 (McLearn, 1960a, Pl. 6, figs. 7a, b), two topotypes GSC 12590 (ibid., Pl. 7, 4a, b), GSC 28915 (all GSC loc. 9744). Hypotype GSC 12591, GSC 12590 (ibid., Pl. 7, fig. 5) (both GSC loc. 9781). Hypotype GSC 13492 (ibid., Pl. 21, fig. 5) (GSC loc. 9741). Two hypotypes GSC 28913*, GSC 28914 (both GSC loc. 83835). Two hypotypes GSC 72347*, GSC 72348* (both GSC loc. 98541).

Occurrence. Middle Norian, Columbianus Subzones 1, 2. Pardonet Formation, northeastern British Columbia. GSC locs. 9741 (2), 9744 (4), 9781 (1), 66027 (3), 83835 (6), 97555 (1), 98518 (2), 98540 (1), 98541 (2), 98878 (1).

Remarks. This species is interpreted in a broad sense to accomodate the *Distichites* from British Columbia that have the characters of Mojsisovics' (1893) "megacanthi", i.e., coronate inner whorls, weak ribbing, and umbilical and marginal spines that are large, at least on the phragmocone. The number of umbilical and marginal spines is about equal, 12–18 per whorl. The umbilical seam lies outside and in contact with the marginal spines. GSC 28915 (Pl. 137, fig. 8) shows that the marginal spines appear before the umbilical spines, at a diameter of 4 mm there are marginal spines only, at 6 mm both are present. Loss of marginal spines on the body chamber is seen in GSC 12591 (McLearn, 1960a, Pl. 7, fig. 5), GSC 13492 (ibid., Pl. 21, fig. 5), and GSC 72348*.

Distichites canadensis McLearn

Plate 136, figures 6, 7, 11

Distichites loidli var. *canadensis* McLearn, 1940a, p. 50, Pl. 2, fig. 6.

Distichites canadensis McLearn. McLEARN, 1947a, p. 14; McLEARN, 1960a, p. 70, Pl. 7, fig. 3; TOZER, 1967, p. 59.

Distichites palliseri McLearn, 1947a, Appendix p. 2, Pl. 5, figs. 10, 11; McLEARN, 1960a, p. 71, Pl. 7, figs. 1a–c; TOZER, 1967, p. 59.

Distichites sp., TOZER, 1967. p. 81.

Registered material. Holotype GSC 8816, holotype of *D. palliseri* GSC 9505 (McLearn, 1960a, Pl. 7, figs. 1a–c) (both GSC loc. 9741). Hypotype GSC 28916 (GSC loc. 9744). Hypotype GSC 28917 (GSC loc. 19709).

Occurrence. Middle Norian, Columbianus Subzone 2. Pardonet Formation, northeastern British Columbia; Parson Bay Formation, Vancouver Island, British Columbia. GSC locs. 9741 (17), 9744 (38), 19709 (1), 98542 (1), 98550 (1), 98552 (1).

Remarks. Identified with this species are *Distichites* with inner whorls that are compressed, not coronate, in section. Ribs are fairly prominent, falcoid, with frequent branching at the marginal tubercles and less frequent branching on the inner flank, between the umbilical and marginal tubercles. The tubercles are sharp nodes rather than true spines. There are up to about 20 umbilical and about 33 marginal nodes per whorl. The umbilical seam is immediately outside the marginal nodes.

Compared with specimens identified as *Distichites gethingi* McLearn, this species is more involute, with more compressed inner whorls, and has more pronounced and complex ribbing.

Genus *Pleurodistichites* Tozer, 1980a

Type species. Pleurodistichites stotti Tozer.

Pleurodistichites stotti Tozer

Plate 137, figures 1, 2; Figure 111b (p. 622)

Pleurodistichites stotti Tozer, 1980a, p. 111, Pl. 17.1, figs. 15–17.

Registered material. Holotype GSC 28921, paratype GSC 28922 (both GSC loc. 66027).

Occurrence. Middle Norian, Columbianus Subzone 1. Pardonet Formation, northeastern British Columbia. GSC locs. 66027 (7), 98542 (1).

Diagnosis. Pleurodistichites attaining a diameter of about 25 mm; H about 55 per cent, W about 40 per cent, U about 10 per cent of diameter. Ribs falcoid; on the phragmocone they increase by bifurcation and intercalation on the inner flank at a small diameter; near the mid-flank at larger diameters. Some ribs on the body chamber are simple. Umbilical shoulder rounded, without tuberculation.

Measurements. Holotype GSC 28921 (Pl. 137, fig. 1): 22, 0.53, 0.41, 0.09.

Remarks. The holotype (Pl. 137, fig. 1) has a quarter whorl of body chamber preserved. The presence of a few simple ribs near the aperture may indicate that it was mature.

Pleurodistichites hindei (Mojsisovics)

Plate 136, figures 1a, b

Arpadites (*Dittmarites*) *hindei* Mojsisovics, 1896, p. 623, Pl. 14, figs. 8a, b; MOJSISOVICS, 1899, p. 60, Pl. 14, figs. 8a, b.

Dittmarites sp. cf. *D. hindei* Mojsisovics. TOZER, 1967, p. 38, 81.

Registered material. Hypotype, GSC 28923 (GSC loc. 21430).

Occurrence. Middle Norian, Columbianus Zone. Parson Bay Formation, Vancouver Island, British Columbia. GSC loc. 21430 (2).

Remarks. In common with the specimen described by Mojsisovics, and unlike *Pleurodistichites stotti* Tozer, this species has small nodes at the umbilical shoulder. About four flat ribs stem from each node. GSC 28923 does not show suture lines.

Pleurodistichites sp. indet.

Plate 143, figures 2a, b

Registered material. GSC 72346 (GSC loc. 98518).

Occurrence. Middle Norian, Columbianus Subzone 1. Pardonet Formation, northeastern British Columbia. GSC loc. 98518 (1).

Remarks. No septa are present on GSC 72346 (Pl. 141, fig. 2), which is probably a piece of the body chamber. The specimen is more densely ribbed compared with *Pleurodistichites stotti* Tozer and has a thicker whorl section, and rounded, rather than flat ribs compared with *P. hindei* (Mojsisovics). The umbilical shoulder is not preserved, making a more exact identification impossible.

Genus *Leiodistichites* n. gen.

Type species. Leiodistichites ursidens n. sp.

Diagnosis. Nearly smooth distichitid with small umbilicus and oval whorl section. Ribbing weak or absent. Umbilical shoulder smooth or with small nodes. Lateral tuberculation characteristically absent although some may have small nodes at mid-flank. Marginal tuberculation absent.

Species assigned. Leiodistichites ursidens n. sp., *L. beachi* n. sp., *Distichites hacqueti* Mojsisovics (1893, p. 610), *Distichites anacanthus* Diener (1923, p. 227).

Age. Middle Norian, Columbianus and Hogarti zones.

Remarks. In lacking spines, the sculpture of *Leiodistichites* is much more comparable to that of *Paradistichites* than *Distichites*, but it differs from both in being nearly smooth and in having a smaller umbilicus.

Leiodistichites ursidens n. sp.

Plate 137, figures 3–5; Figure 111c (p. 622)

Distichites sp. cf. *D. hacqueti* Mojsisovics. McLEARN, 1960a, p. 72, Pl. 7, fig. 2.

Registered material. Holotype GSC 12592, two paratypes GSC 28919, GSC 28920 (all GSC loc. 9744). Hypotype GSC 70999* (GSC loc. 97555). Hypotype GSC 71000* (GSC loc. 97557).

Occurrence. Middle Norian, Columbianus Subzone 2. Pardonet Formation, northeastern British Columbia. GSC locs. 9744 (10), 97555 (2), 97557 (1), 98550 (20), 98552 (1), 98868 (20).

Diagnosis. Leiodistichites attaining a diameter of about 40 mm; H about 45 per cent, W about 33 per cent, U about 20 per cent of diameter. On body chamber a distinct ventrolateral shoulder is developed, producing an almost tabulate venter. Flanks merely striate, without ribbing. Low bullate umbilical nodes are present on the phragmocone, but are characteristically absent on the outer whorl. Lateral tuberculation absent.

Measurements. Holotype GSC 12592 (Pl. 137, fig. 5): 41, 0.48, 0.31, 0.20. Paratype GSC 28919 (Pl. 137, fig. 4): 29, 0.45, 0.34, 0.20. Paratype GSC 28920 (Pl. 137, fig. 3): 34, 0.46, 0.34, 0.20.

Remarks. The holotype (Pl. 137, fig. 5) and GSC 28920 (Pl. 137, fig. 3) both have the body chamber preserved and are probably complete. GSC 28919 (Pl. 137, fig. 4) is wholly septate, showing ammonitic saddles. On the holotype there is a suggestion of umbilical nodes at the beginning of the outer whorl, but on the last half whorl the umbilical shoulder is smooth. Ventral shoulders are rounded and indistinct on the smaller specimens, more distinct on the holotype. GSC 28919 (Pl. 137, fig. 4) and GSC 28920 (Pl. 137, fig. 3) have small bullate umbilical nodes, about 14 on half a whorl. GSC 70999* and GSC 71000* are the remains of smooth specimens about 15 mm in diameter.

This species is clearly congeneric with "*Distichites*" *hacqueti* Mojsisovics (1893, p. 610), which differs in being more involute. The specimen illustrated by Mojsisovics lacks umbilical nodes, but they are present on a specimen from Timor (Tatzreiter, 1981, p. 119).

Leiodistichites beachi n. sp.

Plate 143, figures 9a, b

Registered material. Holotype GSC 72202, paratype GSC 72201* (both GSC loc. 98869).

Occurrence. Middle Norian, Columbianus Subzone 2. Pardonet Formation, northeastern British Columbia. GSC loc. 98869 (4).

Diagnosis. Leiodistichites attaining a diameter of at least 100 mm; H about 50 per cent, W about 33 per cent, U about 15 per cent of diameter. Ventrolateral shoulders rounded. Flanks with slightly falcoid ribs increasing by branching and intercalation on the flank. Umbilical shoulder nodose; small faint to moderately distinct nodes also present at the mid-flank.

Measurements. Holotype GSC 72202 (Pl. 143, fig. 9): 63, 0.50, 0.32, 0.16.

Remarks. The holotype (Pl. 143, fig. 9) is wholly septate with the last two septa approximated. It is probably a complete phragmocone. Ribbing and umbilical tuberculation are distinct, lateral tuberculation very faint. GSC 72201* is the remains of the body chamber of a specimen that attained a diameter of about 100 mm. Ribbing is less distinct, compared with the holotype. Lateral nodes, about 12 on the half whorl, are distinct.

The most closely related species appears to be *Distichites anacanthus* Diener (1923, p. 227), which differs in lacking lateral tuberculation and in being more evolute.

Etymology. The name commemorates H.H. Beach.

Family THETIDITIDAE Tozer, 1971

Genus *Eothetidites* n. gen.

Type species. Eothetidites lacrimosus n. sp.

Diagnosis. Thetiditid with umbilical, marginal and external tuberculation. Umbilical and marginal tuberculation acquired at a small diameter; external tuberculation at a larger diameter. Umbilical and marginal tubercles are spines, linked by single ribs; external tubercles are transverse or oblique, more numerous than the spines at the margin. Suture line ceratitic.

Species assigned. Eothetidites lacrimosus n. sp., *E. pardoneti* n. sp.

Age. Middle Norian, Columbianus Zone.

Remarks. The transverse external tuberculation forms a venter somewhat like that of *Thetidites* Mojsisovics (1896), but the external tubercles of that genus are very

low in comparison, and form transverse ribs. *Thetidites* also differs in lacking the umbilical tuberculation of *Eothetidites*. *Acanthothetidites* Tatzreiter (1980) has umbilical and marginal tuberculation, but differs in having weak external tuberculation, which is restricted to the phragmocone and a body chamber with ribs crossing the venter, like *Thetidites,* not *Eothetidites*. External tuberculation of *Parathetidites* Tozer (1971) differs in being clavate, with the clavate nodes forming keels. External tuberculation of both *Pseudothetidites* Jeannet (1958) and *Leislingites* Tatzreiter (1980) differs in that the external tubercles almost match those at the margin, unlike *Eothetidites* in which the external spirals are more densely tuberculate than those at the margin.

Eothetidites lacrimosus n. sp.

Plate 138, figures 1–7; Figure 112a–c (p. 624)

Registered material. Holotype GSC 28883, six paratypes GSC 28884–GSC 28889 (all GSC loc. 83835).

Occurrence. Middle Norian, Columbianus Subzone 1. Pardonet Formation, northeastern British Columbia. GSC locs. 83835 (12), 97528 (1), 98877 (1), 98878 (1).

Diagnosis. Eothetidites attaining a diameter of about 100 mm; H 25–30 per cent, W 40–60 per cent, U 43–50 per cent of diameter. Ribs single, straight (not looped). Umbilical tubercles rounded and pointed; marginal tubercles more prominent than umbilical, spinose or forming ears (on inflated variants). External tubercles transverse with about two opposite one marginal tubercle. Umbilical and marginal tubercles appear at a smaller diameter than the external. All three persist on the outer whorl, but the umbilical tubercles may decline in strength on the last quadrant. Suture line with two indented lateral lobes. Preseptal layer thick on phragmocone and posterior part (about 30 degrees radius) of the body chamber.

Measurements. Holotype GSC 28883 (Pl. 138, fig. 3): 44, 0.32, 0.41, 0.45. Paratype GSC 28884 (Pl. 138, fig. 1): 31, 0.32, 0.45, 0.45. Paratype GSC 28885 (Pl. 138, fig. 2): 27, 0.26, 0.43, 0.50. Paratype GSC 28886 (Pl. 138, fig. 4): 34, 0.38, 0.59, 0.47. Paratype GSC 28887 (Pl. 138, fig. 5): 45, 0.31, 0.42, 0.47. Paratype GSC 28889 (Pl. 138, fig. 7): 98, 0.34, 0.42, 0.43.

Remarks. There appears to have been considerable variation in size and proportions. GSC 28885 (Pl. 138, fig. 2) has a complete phragmocone about 17 mm in diameter, with the last septum approximated. GSC 28889 (Pl. 138, fig. 7), the largest specimen, does not preserve the complete body chamber; diameter of the phragmocone, which has approximated septa, is 70 mm. Of intermediate size is GSC 28887 (Pl. 138, fig. 5), which has a complete phragmocone with approximated septa at a diameter of 40 mm. At a diameter of about 15 mm, the venter may be smooth. This is seen in GSC 28885 (Pl. 138, fig. 2), which has about five eighths of a whorl of body chamber and, despite the small size, may have been mature, judging from the approximated septa. A smooth venter is also apparent on septate nuclei of this diameter. GSC 28886 (Pl. 138, fig. 4), an inflated variant, has marginal tuberculation of large transverse ears. Decline in strength of the umbilical tuberculation on the outer whorl is seen only in the holotype (Pl. 138, fig. 3). This might indicate maturity despite the fact that the specimen does not show approximated septa.

Apart from *Eothetidites pardoneti* n. sp. (see below) no closely comparable thetiditids are known.

Eothetidites pardoneti n. sp.

Plate 141, figures 9a, b; Figure 115a (p. 630)

Sandlingites? sp., McLEARN, 1960a, p. 43, Pl. 2, figs. 3a, b; TOZER, 1967, p. 58.

Registered material. Holotype GSC 12569 (GSC loc. 9781).

Occurrence. Middle Norian, Columbianus Subzone 2. Pardonet Formation, northeastern British Columbia. GSC loc. 9781 (1).

Diagnosis. Eothetidites attaining a diameter of at least 30 mm; H about 32 per cent, W about 35 per cent, U about 45 per cent of diameter. Ribs single or looped. Umbilical tubercles bullate, marginal tubercles are spines. External tubercles oblique with about three opposite two marginal spines. Umbilical and marginal tubercles appear at a smaller diameter than the external. Suture line with an indented lateral lobe.

Remarks. The holotype (GSC loc. 141, fig. 9) has the steinkern of about a quarter of a whorl of body chamber preserved. Most of the outer whorl is preserved and part of the pentultimate whorl is also exposed. On the penultimate whorl, most umbilical tubercles are broken, but were clearly bullate. The marginal tubercles are spines. The venter has low nodose keels. Trituberculation is strongly expressed on the outer whorl. Umbilical tubercles are bullate, as on the pentultimate whorl. Marginal tubercles, as

preserved, are less spinose. External tubercles are pronounced with about three opposite two at the margin. Ribbing on the outer whorl consists of single ribs and one pair firmly looped to an umbilical tubercle, less firmly to one at the margin. Of the suture line, only E, the external saddle and part of L are visible.

There is a resemblance to *Pseudothetidites indicus* Jeannet (sensu Tatzreiter, 1981, p. 29), but the new species is distinguished by having more densely arranged external tubercles. This relatively dense external tuberculation is taken to justify assignment to *Eothetidites* rather than to *Pseudothetidites*. Compared with *Eothetidites lacrimosus* n. sp., *E. pardoneti* has a more quadrangular whorl section and oblique, instead of transverse, external tubercles. The venter of the penultimate whorl is much like that of *Parathetidites exquisitus* (McLearn), but the large discrete tubercules on the outer whorl are different.

Genus *Parathetidites* Tozer, 1971

Type species. Heraclites? *exquisitus* McLearn.

Parathetidites exquisitus (McLearn)

Plate 139, figures 11, 19; Figure 113a (p. 626)

Heraclites? *exquisitus* McLearn, 1947a, p. 13, Appendix p. 1, Pl. 5, figs. 1–4.

Thetidites exquisitus (McLearn). McLEARN, 1960a, p. 77, Pl. 8, figs. 4, 5; TOZER, 1967, p. 58.

Parathetidites exquisitus (McLearn). TOZER, 1971, p. 1030.

Registered material. Holotype GSC 9496 (McLearn, 1960a, Pl. 8, figs. 5a, b), topotype GSC 32359 (both GSC loc. 9782). Paratype GSC 9497 (ibid., figs. 4a, b), topotype GSC 33285 (both GSC loc. 9781).

Occurrence. Middle Norian, Columbianus Subzone 2. Pardonet Formation, northeastern British Columbia. GSC locs. 9781 (9), 9782 (13).

Measurements. Holotype GSC 9496: 10.5, 0.38, 0.40, 0.33. Topotype GSC 32359 (Pl. 139, fig. 11): 11.0, 0.41, 0.39, 0.27.

Remarks. GSC 32359 (Pl. 139, fig. 11) is complete with the peristome. This species has simple or branched ribs, some of which are looped to marginal tubercles. Umbilical tubercles are low and bullate. Marginal tubercles are more prominent. Those of GSC 32359 may be described as parabolic nodes. At the aperture of GSC 33285 (Pl. 139, fig. 19) they form projecting spines. Both umbilical and marginal tubercles appear at a diameter of about 6 mm and are retained on the outer whorl. In the holotype and paratype, the venter of the outer whorl is nearly smooth at the beginning and acquires nodose keels adorad. In GSC 32359 (Pl. 139, fig. 11) and GSC 33285 (Pl. 139, fig. 19), topotypes that attain a slightly larger size, nodose keels are present on the whole of the outer whorl, becoming more prominent adorad.

Parathetidites robustus n. sp.

Plate 138, figures 8a, b

Registered material. Holotype GSC 35312 (GSC loc. 9632).

Occurrence. Middle Norian, Columbianus Subzone 2. Pardonet Formation, northeastern British Columbia. GSC loc. 9632 (1).

Diagnosis. Parathetidites about 25 mm in diameter; H about 30 per cent, W about 35 per cent, U about 40 per cent of diameter. Ribs mostly bifurcating, with some looping. Umbilical, marginal and external tuberculation strong.

Remarks. The unique specimen (Pl. 138, fig. 8) shows no septa. On the part preserved, which is probably body chamber, there are six umbilical tubercles aligned with eight at the margin and about 10 nodes on the keels. One pair of ribs is looped with a marginal tubercle.

The nodose keels indicate affinity with *Parathetidites exquisitus* (McLearn), which differs in being more involute, in having much less prominent umbilical tuberculation and more densely spaced nodes on the external keels.

Parathetidites laevis n. sp.

Plate 142, figures 8a–e

Registered material. Holotype GSC 72200 (GSC loc. 98870).

Occurrence. Middle Norian, Columbianus Subzone 2. Pardonet Formation, northeastern British Columbia. GSC loc. 98870 (1).

Diagnosis. Parathetidites about 15 mm in diameter; H about 33 per cent, W about 47 per cent, U about 38 per cent of diameter. Venter smooth. Ribs mostly simple, sigmoidal. On most of outer whorl, thick bullate ribs alternate with thin ribs. Thick ribs end as large round marginal tubercles, thin as small. Near aperture, all ribs are thin, without umbilical or marginal tubercles.

Measurements. Holotype GSC 72200 (Pl. 142, fig. 8): 15, 0.33, 0.47, 0.38.

Remarks. In the unique holotype (Pl. 142, fig. 8), no suture lines are seen. On the last one eighth of the outer whorl the bullate ribs are replaced by thin ribs and marginal nodes are not present. Probably the specimen was mature. On the outer whorl there are about 12 ribs at the umbilicus, about 18 nodes or ribs at the margin. At least one pair of ribs is looped to a marginal node. Some of the marginal nodes are embraced by crescentic growth lines, forming parabolic sculpture.

The form of the lateral bullate ribs, the marginal nodes with parabolic sculpture, and the looping of ribs closely resemble the lateral sculpture of *Parathetidites exquisitus* (McLearn). *Parathetidites exquisitus* has a smooth venter at a small diameter, but acquires nodose keels on the outer whorl, unlike *P. laevis*. It is possible that the smooth venter of *Parathetidites laevis* is an indication of immaturity, but in view of the change in lateral sculpture the alternative interpretation, according to which it is mature, is adopted. If the specimen is immature, it is of a *Parathetidites* much larger than *P. exquisitus*.

Genus *Helictites* Mojsisovics, 1893

Type species. Ammonites geniculatus Hauer.

Helictites minor n. sp.

Plate 142, figures 6a–d

Registered material. Holotype GSC 72197 (GSC loc. 98518).

Occurrence. Middle Norian, Columbianus Subzone 1. Pardonet Formation, northeastern British Columbia. GSC loc. 98518 (1).

Diagnosis. Helictites about 13 mm in diameter; H about 32 per cent, W about 45 per cent, U about 40 per cent of diameter. Whorl section ovoid, the umbilical shoulders, ventrolateral shoulders and venter being rounded. Outer whorl with about 15 primary ribs at the umbilicus and about 30 at the venter, increase by intercalation at the mid-flank. Ribs cross the venter, but with diminished strength. Umbilical and marginal tuberculation absent. Suture line goniatitic.

Measurements. Holotype GSC 72197 (Pl. 142, fig. 6): 13.3, 0.32, 0.44, 0.41.

Remarks. The holotype (Pl. 142, fig. 6), the only known specimen, has five eighths of a whorl of body chamber preserved and was probably complete. This species differs from all variants of *Helictites decorus* McLearn in being more evolute, having more inflated whorls, in being devoid of marginal shoulders, and in having the secondary ribs introduced at mid-flank instead of the inner flank.

Helictites decorus McLearn

Plate 137, figures 6a, b; Figure 111a (p. 622)

Helictites decorus McLearn, 1940a, p. 49, Pl. 2, figs. 4, 5; McLEARN, 1960a, p. 61, Pl. 6, figs. 8–10; TOZER, 1967, p. 59.

Helictites decorus var. *transitionis* McLearn, 1940a, p. 50, Pl. 2, figs. 7, 8.

Helictites decorus var. *obesus* McLearn, 1940a, p. 50, Pl. 1, fig. 12.

Helictites decorus McLearn? McLEARN, 1960a, p. 63, Pl. 5, figs. 5a, b.

Helictites decorus McLearn. TATZREITER, 1981, p. 39, Pl. 3, figs. 5a, b.

Registered material. Holotype GSC 8824 (McLearn, 1960a, Pl. 6, figs. 9a, b), topotype GSC 12586 (ibid., Pl. 5, figs. 5a, b) (both GSC loc. 9744). Holotype var. *transitionis,* GSC 8823 (ibid., Pl. 6, figs. 10a, b), holotype var. *obesus* GSC 8822 (ibid., Pl. 6, fig. 8), topotype GSC 28924 (all GSC loc. 9741).

Occurrence. Middle Norian, Columbianus Subzone 2. Pardonet Formation, northeastern Briitish Columbia. GSC locs. 9741 (43), 9744 (15), 98549 (2), 98550 (1), 98551 (1), 98867 (25), 98868 (4).

Remarks. Identified with this species are highly variable *Helictites*. The venter may be tabulate with distinct shoulders or slightly arched, with rounded shoulders. Ribs are curved. All ribs may be simple, extending from the umbilicus to the venter or there may be intercalated secondaries arising on the inner

flank. The ribs cross the venter with undiminished strength. They may be slightly thickened on the inner flank and at the margin, but they are not truly tuberculate. The surface of the test bears regular striae. In GSC 28924 (Pl. 137, fig. 6, Fig. 111a) the suture line is goniatitic.

The holotype (McLearn, 1960a, Pl. 6, figs. 9a, b) is an example with many intercalated ribs and distinct marginal shoulders. GSC 8822 (var. *obesus,* ibid., fig. 8) has simple ribs and rounded shoulders. GSC 8823 (var. *transitionis,* ibid., figs. 10a, b) has mixed ribbing and moderately well defined shoulders. These three specimens have at least part of the body chamber preserved, but owing to the thickness of the test, the full extent has not been determined. The outer whorl of GSC 12586 (ibid., Pl. 5, figs. 5a, b), 35 mm in diameter and indicative of the maxiumum size attained, is partly body chamber. Ribbing on the outer whorl is dense. Judging from what can be seen of the inner whorls, there is little doubt that this specimen is a mature individual, as suggested by McLearn (1960a, p. 63).

Helictites pacalis n. sp.

Plate 135, figures 5a, b

Helictites sp. cf. *H. subgeniculatus* Mojsisovics. McLEARN, 1960a, p. 60, Pl. 5, figs. 3, 4; TOZER, 1967, p. 59.

Registered material. Holotype GSC 28925, paratype GSC 28926* (both GSC loc. 9729). Topotype GSC 12584 (McLearn, 1960a, Pl. 5, figs. 4a, b) (GSC loc. 9741). Topotype GSC 12585 (ibid., Pl. 5, figs. 3a, b) (GSC loc. 9744).

Occurrence. Middle Norian, Columbianus Subzone 2. Pardonet Formation, northeastern British Columbia. GSC locs. 9729 (2), 9741 (1), 9744 (1).

Diagnosis. Helictites about 25 mm in diameter; H about 33 per cent, W about 40 per cent, U about 40 per cent of diameter. Venter tabulate or slightly arched, ventrolateral shoulders distinct. Ribs straight, simple with bullate nodes on the inner flank and projecting nodes at the margin. Nodes on both flank and venter diminish in strength on the body chamber.

Remarks. Suture lines are seen on the holotype (Pl. 135, fig. 5) although not clearly. It appears that the lateral lobe is rounded and half of the outer whorl is body chamber. On the outer whorl there are about 25 ribs, which become more closely spaced on the last quadrant. Bullate nodes on the inner flank and rounded nodes at the margin are distinct except on the last quadrant where they diminish in prominence. At a small diameter (e.g., in GSC 12584, McLearn, 1960a, Pl. 5, figs. 4a, b) the ribs are of diminished strength where they cross the venter. Where the test is well preserved it is seen to have delicate, regular growth striae superimposed on the ribs.

This species is obviously closely related to *Helictites subgeniculatus* Mojsisovics and *H. geniculatus* (Hauer) (Tatzreiter, 1981, p. 35, 36). The differences are minor; umbilical tuberculation is less prominent than in *H. subgeniculatus;* marginal tuberculation is more prominent than in *H. geniculatus.*

Genus *Pseudotheditites* Jeannet, 1958

Type species. Pseudothetidites indicus Jeannet.

Pseudothetidites brysonis (Diener)

Plate 139, figures 15a, b

Thetidites brysonis Diener, 1923, p. 161, Pl. 19, figs. 8a–c.

Pseudothetidites brysonis (Diener). TATZREITER, 1981, p. 31, Pl. 1, figs. 2a, b.

Registered material. Hypotype GSC 28908 (GSC loc. 68303).

Occurrence. Middle Norian, Columbianus Subzone 3. Pardonet Formation, northeastern British Columbia. GSC loc. 68303 (1).

Remarks. GSC 28908 (Pl. 139, fig. 15), wholly septate, has umbilical, marginal and external tubercles, with all three spirals matching. This is the trituberculate sculpture that characterizes the phragmocone of this species. The marginal tubercles of the penultimate whorl, as seen in the umbilicus, are spines.

Genus *Leislingites* Tatzreiter, 1980

Type species. Sandlingites archibaldi Mojsisovics.

Leislingites semiviatus n. sp.

Plate 142, figures 5a–c

Registered material. Holotype GSC 71001 (GSC loc. 97557).

Occurrence. Middle Norian, Columbianus Subzone 2. Pardonet Formation, northeastern British Columbia. GSC loc. 97557 (1).

Diagnosis. Leislingites about 20 mm in diameter; H about 35 per cent, W about 35 per cent, U about 40 per cent of diameter. Ribs mostly simple. Marginal and external tuberculation unusually weak.

Measurements. Holotype GSC 71001 (Pl. 142, fig. 5): 20, 0.36, 0.36, 0.40.

Remarks. Most of the outer whorl of the unique holotype (Pl. 142, fig. 5) has the test preserved. Suture lines are concealed. At the aperture there are no septa, showing that the outer whorl is partly body chamber, but its extent has not been determined. On the outer whorl there are 27 ribs at the umbilicus, 33 at the margin. The ribs are thus mostly simple, with a few secondaries intercalated close to the umbilicus. Most, but not all, are bullate at the umbilical shoulder. Weak, but distinct marginal and external tuberculation is present with the number of tubercles in the two spirals the same. Fine regular growth striae are present on the surface of the test.

The style of ribbing and the regular growth striae indicate this species is related to *Helictites decorus* McLearn, but it differs from that species, and all other *Helictites,* in having external tuberculation. This external tuberculation is very subdued compared with that of typical *Leislingites*, such as *L. archibaldi* (Mojsisovics) (Tatzreiter, 1981, p. 41) and *L. quadratus* n. sp. The new species evidently forms a morphological link between *Helictites* and *Leislingites.*

Leislingites quadratus n. sp.

Plate 139, figures 1–10; Figure 113b (p. 626)

"*Sandlingites*" sp. cf. "*S.*" *archibaldi* Mojsisovics. TOZER, 1967, p. 55.

Helictites sp., TOZER, 1962a, Pl. 11, figs. 4a, b.

Registered material. Holotype, GSC 28890, two paratypes GSC 28891, GSC 28892* (all GSC loc. 68302). Four paratypes GSC 28893–GSC 28896 (all GSC loc. 68301). Paratype GSC 28897 (GSC loc. 68303). Paratype GSC 14309 (Tozer, 1962a, Pl. 11, figs. 4a, b) (GSC loc. 46998). Three hypotypes GSC 28898–GSC 28900 (all GSC loc. 74777).

Occurrence. Middle Norian, Columbianus Subzone 3. Pardonet Formation, northeastern British Columbia. GSC locs. 46998 (2), 68301 (14), 68302 (5), 68303 (1), 74777 (5), 98909 (2).

Diagnosis. Leislingites attaining a diameter of about 30 mm; H about 30 per cent, W about 30 per cent, U about 45 per cent of diameter. W and U particularly variable. Venter flat, with little or no inclination between the marginal and external tubercles. Ribs simple, curved, with some intercalation on the inner flank and infrequent looping of ribs to marginal tubercles. Ribs elevated near umbilical edge, but true umbilical tuberculation infrequent. Marginal and external tuberculation prominent. Marginal tubercles may be very prominent, forming projected ears. External tubercles not appreciably clavate. External tubercles barely perceptible at a diameter of less than 10 mm, marginal tubercles present at a smaller diameter. Marginal tubercles retained on much or all of the outer whorl, external tubercles become faint or disappear on the body whorl.

Measurements. Holotype GSC 28890 (Pl. 139, fig. 7): 26, 0.30, 0.33, 0.41. Paratype GSC 28894 (Pl. 139, fig. 8): 25, 0.28, 0.26, 0.48. Hypotype GSC 28898 (Pl. 139, fig. 1): 19, 0.26, 0.29, 0.48. Hypotype GSC 28899 (Pl. 139, fig. 3): 14, 0.22, 0.29, 0.52.

Remarks. Size, ribbing and tuberculation vary considerably. Marginal and external tubercles correspond in number. GSC 28895 (Pl. 139, fig. 9), the incomplete remains of a specimen that attained a diameter of about 30 mm, is the most prominently sculptured variant, with marginal tubercles forming ears, ribs in the umbilical area elevated and almost bullate, and with some looped ribs. GSC 28894 (Pl. 139, fig. 8) is less prominently sculptured, the holotype (Pl. 139, fig. 7) even less so. GSC 28897 (Pl. 139, fig. 4), 10.5 mm in diameter, illustrates the stage at which external tuberculation is acquired, having marginal tuberculation alone at the beginning of the outer whorl, marginal and external at the aperture. The holotype (Pl. 139, fig. 7), which has about half a whorl of body chamber, shows nearly complete loss of external tuberculation on the adorad quadrant, with ribs crossing the venter without interruption and only marginal tubercles present at the aperture. GSC 28896 (Pl. 139, fig. 10), the remains of the body chamber of an individual about 30 mm in diameter shows almost complete loss of external tuberculation. Both retain an essentially flat venter. These specimens were probably mature. All these specimens have fine regular growth striae superimposed on the ribs and tubercles. The goniatitic suture line is seen in GSC 28892 (Fig. 113b).

Specimens from Mount Stearns include GSC 28899 (Pl. 139, fig. 3), which lacks external tuberculation on the whole of the outer whorl. It is associated with another specimen (GSC 28898, Pl. 139, fig. 1), which has faint external tuberculation. The test of GSC 28899 is well preserved with sharp, regular widely spaced growth striae, some of which, on both the flank and venter, are looped to the marginal tubercles. Their faint external tuberculation suggests that specimens from this locality acquired mature sculpture at a smaller diameter than those from the type locality.

This species closely resembles *Leislingites archibaldi* (Mojsisovics), differing only in retaining a flat venter on the outer whorl (see Tatzreiter, 1981, p. 41).

Leislingites vancouverensis n. sp.

Plate 139, figures 16–18

Thetidites sp. cf. *T. brysonis* Diener. TOZER, 1967, p. 81.

Registered material. Holotype GSC 28909, two paratypes GSC 28910, GSC 28911 (all GSC loc. 24352).

Occurrence. Middle Norian, Columbianus Zone, probably Subzone 3. Parson Bay Formation, west coast of Vancouver Island, British Columbia. GSC loc. 24352 (3).

Diagnosis. Leislingites attaining a diameter of about 60 mm; H about 33 per cent, W about 33 per cent, U about 45 per cent of diameter. Venter obtusely trapezoidal in section, the inclination being between the marginal and external tubercles. Ribs simple, slightly curved, without looping. Ribs thickened near the umbilical edge, but true umbilical tuberculation absent. Marginal and external tuberculation prominent on phragmocone. Marginal tubercles rounded, external tubercles somewhat clavate. Tuberculation absent on body chamber.

Remarks. The holotype (Pl. 139, fig. 16) has a little more than half a whorl of body chamber preserved. Except on the last quadrant, the venter is well preserved, showing marginal and external tubercles corresponding in number. GSC 28911 (Pl. 139, fig. 17) is a body chamber fragment of a specimen that attained a diameter of about 60 mm. The dorsum shows the impression of external tubercles, but the venter is devoid of external, and apparently also marginal, tuberculation, with ribs crossing the venter without interruption. None show well preserved suture lines.

In whorl section and the nature of the ribbing there is a close resemblance to *Pseudothetidites brysonis* (Diener), which differs in having umbilical tuberculation, a generic character for *Pseudothetidites*, but not *Leislingites*. The other similarities illustrate the close relationship between the two genera.

Leislingites politus n. sp.

Plate 135, figures 11–13; Plate 139, figures 12–14; Figure 113c (p. 626)

Registered material. Holotype GSC 28904, three paratypes GSC 28905, GSC 28906, GSC 28907* (all GSC loc. 68302). Paratype GSC 28901 (GSC loc. 83848). Two paratypes GSC 28902, GSC 28903 (both GSC loc. 82455).

Occurrence. Middle Norian, Columbianus Subzone 3. Pardonet Formation, northeastern British Columbia. GSC locs. 68301 (3), 68302 (7), 82455 (12), 83848 (1).

Diagnosis. Leislingites attaining a diameter of about 33 mm; H about 35 per cent, W about 40 per cent, U about 35 per cent of diameter. Venter obtusely trapezoidal in section with slight inclination between the marginal and external tubercles. Ribs simple with some branching and intercalation on the inner flank, no looping. Some ribs are bullate on inner flank, but true umbilical tuberculation absent. Marginal and external tuberculation well developed on phragmocone; tubercles rounded, not clavate; marginal tubercles less prominent than external tubercles. On body chamber first the marginal, then the external tubercles disappear.

Measurements. Holotype GSC 28904 (Pl. 139, fig. 12): 23, 0.36, 0.40, 0.36. Paratype GSC 28905 (Pl. 139, fig. 13): 23, 0.37, 0.43, 0.35.

Remarks. The holotype (Pl. 139, fig. 12) has five eighths of a whorl of body chamber preserved, has 33 ribs at the umbilicus and 43 ribs and nodes at the margin and venter on the outer whorl. GSC 28906 (Pl. 139, fig. 14), the largest specimen, has a damaged body chamber. It was about 33 mm in diameter, and has 40 ribs at the umbilicus, 52 at the venter. On the body chamber, both specimens show loss of first the marginal, then the external tubercles, with ribs crossing the venter uninterrupted. On the phragmocone, the marginal and external tubercles are exactly matched. Specimens with the test preserved show regular growth striae. The goniatitic suture line is seen in the holotype (Fig. 113c) and GSC 28905.

"Sandlingites" cuspidianus Diener (1923, p. 236) is the most closely comparable species, but differs in being more involute. The new species differs from typical *Leislingites* (e.g., *L. quadratus* n. sp.) in having less prominent marginal than external tuberculation instead of the normal situation with the two being similar, or the marginal tubercles the more prominent.

Genus *Thetidites* Mojsisovics, 1896

Type species. Sibirites (Thetidites) huxleyi Mojsisovics.

Thetidites nudus n. sp.

Plate 142, figures 9a–c

Registered material. Holotype GSC 72198 (GSC loc. 98909).

Occurrence. Middle Norian, Columbianus Subzone 3. Pardonet Formation, northeastern British Columbia. GSC loc. 98909 (1).

Diagnosis. Thetidites about 35 mm in diameter; H about 30 per cent, W about 35 per cent, U about 30 per cent of diameter. Flanks smooth, marginal spines prominent, about 15 per whorl. Venter of outer whorl initially nearly smooth, acquiring, adorad, faint transverse tuberculation with about four tubercles between each marginal spine.

Measurements. Holotype GSC 72198 (Pl. 142, fig. 9): 34, 0.29, 0.35, 0.29.

Remarks. In the unique holotype (Pl. 142, fig. 9), no septa are seen, but the outer whorl is probably body chamber. The last three whorls show strong marginal tuberculation. Most tubercles are broken, but a few show that they were certainly spines. Also visible in the umbilicus are the smooth flanks, with no trace of umbilical tuberculation. The venter of the outer whorl is initially merely striate, but on the adorad half there are faint ribs and spirals of external nodes.

The style of tuberculation is exactly that of *Thetidites huxleyi* Mojsisovics (Tatzreiter, 1981, p. 26), which differs in having a larger umbilicus, distinct ribbing on the flanks, and more distinct tuberculation and ribbing on the venter.

Genus *Idaoceras* n. gen.

Type species. Sandlingites idae Mojsisovics.

Diagnosis. Thetiditid with subtrapezoidal whorl section. Ribs distinct, bifurcating at low nodes on the umbilical shoulder, somewhat falcoid on the flank. Clavate nodes present at margin; these are linked with similar ventral nodes, which are adjacent to a shallow ventral sulcus. Suture line goniatitic.

Species assigned. Sandlingites idae Mojsisovics (1893, p. 714), *Idaoceras maclearni* n. sp.

Age. Middle Norian, Columbianus Zone and correlatives.

Remarks. The ribbing and tuberculation indicate affinity with *Leislingites* Tatzreiter (1980) which differs in having rounded or spinose, not clavate, marginal and ventral tubercles.

Idaoceras maclearni n. sp.

Plate 142, figures 1–3

Sandlingites sp. cf. *S. idae* Mojsisovics. McLEARN, 1960a, p. 42, Pl. 2, figs. 4, 5.

Registered material. Holotype GSC 12568, two paratypes GSC 12567, GSC 35365 (all GSC loc. 9471)

Occurrence. Middle Norian, Columbianus Subzone 3. Pardonet Formation, northeastern British Columbia. GSC loc. 9471 (3).

Diagnosis. Idaoceras about 15 mm in diameter; H about 42 per cent, W about 38 per cent, U about 35 per cent of diameter. Venter obtusely trapezoidal in section with slight inclination between the marginal and external tubercles. Most ribs bifurcate and are somewhat bullate, on the inner flank; many are looped to marginal tubercles. Marginal and external tubercles relatively blunt, somewhat clavate, of similar strength, present on both the phragmocone and body chamber.

Remarks. The holotype (Pl. 142, fig. 2) and GSC 35365 (Pl. 142, fig. 3) are the remains of specimens that attained a diameter of about 15 mm. Both have the body chamber preserved and have clavate marginal and external tubercles in neatly matched spirals, persisting, with undiminished strength, on the outer whorl. On the last quadrant of the holotype there are eight ribs at the umbilicus, and 10 marginal and external tubercles. GSC 12567 (Pl. 142, fig. 1) shows a goniatitic suture line.

As recognized by McLearn these specimens closely resemble *"Sandlingites" idae* Mojsisovics (1893,

p. 714) which differs in being a little more evolute and in lacking looped ribs.

Etymology. The name commemorates F.H. McLearn.

Genus *Nassichukites* Tozer, 1979

Type species. Nassichukites dimidiatus Tozer.

Nassichukites dimidiatus Tozer

Plate 146, figures 15–17; Figure 119c (p. 640)

Nassichukites dimidiatus Tozer, 1979, p. 129, Pl. 16.1, figs. 17a–c, Textfig. 16.1H.

Registered material. Holotype GSC 28941 (GSC loc. 68300). Two hypotypes, GSC 28942, GSC 28943 (both GSC loc. 51207).

Occurrence. Upper Norian, Cordilleranus Subzone 1. Pardonet Formation, northeastern British Columbia. GSC locs. 51207 (2), 68300 (4).

Diagnosis. Nassichukites about 20 mm in diameter; H about 35 per cent, W about 28 per cent, U about 30 per cent of diameter. Some ribs are simple, some bifurcate, some are intercalated. Bifurcation and intercalation is at the inner flank.

Measurements. Holotype GSC 28941 (Pl. 146, fig. 16): at 16, 0.37, 0.28, 0.28. Hypotype GSC 28943 (Pl. 146, fig. 15): 18, 0.33, 0.28, 0.33.

Remarks. The holotype (Pl. 146, fig. 16) has half a whorl of body chamber and was probably complete. The diameter was 20 mm, but the last quadrant is partly crushed, precluding accurate measurements. Ribbing is variable. The holotype has alternating simple, bifurcating and intercalated ribs, about 40 at the venter, 25 at the umbilicus. GSC 28943 (Pl. 146, fig. 15) has mostly simple and a few branching ribs, with about 29 at the venter, 23 at the umbilicus. GSC 28942 (Pl. 146, fig. 17) has branched and simple ribs on the penultimate whorl, simple ribs on the outer, with the branching and intercalation being on the inner flank. All three specimens have comparable venters with the ribs projected, ending abruptly and almost nodose, *en echelon* adjacent to a smooth band on the venter. The holotype shows the goniatitic suture line (Fig. 119c). GSC 28942 (Pl. 146, fig. 17) shows a septal surface with eight lobes (i.e., a five-lobe formula) confirming assignment of *Nassichukites* to the Clydonitaceae rather than the Choristocerataceae.

Family CLYDONITIDAE Hyatt, 1877

Genus *Clydonites* Hauer

Type species. Goniatites decoratus Hauer.

Clydonites pacificus n. sp.

Plate 136, figures 4a–c; Figure 110a (p. 620)

"*Sandlingites*" sp. cf. "*S.*" *striatissimus* Diener. TOZER, 1967, p. 38, 81.

Registered material. Holotype GSC 28833 (GSC loc. 20255).

Occurrence. Middle Norian, Columbianus Zone? Parson Bay Formation, Vancouver Island, British Columbia. GSC loc. 20255 (1).

Diagnosis. Clydonites about 65 mm in diameter; H about 30 per cent, W about 25 per cent, U about 50 per cent of diameter. Ribs mostly simple with a few intercalated at the inner third of the flank. Tuberculation apparently absent on the flank (at least on the outer whorl), but well expressed on the venter (at least on the penultimate whorl) where there are at least three spirals of small rounded tubercles on each side of the ventral sulcus.

Remarks. The unique holotype (Pl. 136, fig. 4) is mostly phragmocone, retaining a little less than a quarter whorl of body chamber. Both the steinkern and external impression are preserved. Suture lines are somewhat weathered. They appear to be goniatitic (Fig. 110a). The last three septa are approximated. The dorsum of the steinkern shows the impression of at least three, possibly four spirals of granular tubercles on each side of the sulcus. The outer whorl, which is somewhat worn, has two or three spirals. Ribs on the flank are apparently smooth, without tubercles, on both the steinkern and the impression.

This species is presumably allied to *Clydonites decoratus* (Hauer) (Mojsisovics, 1893, p. 718) by virtue of the dense ribs, the contrast between the lateral and ventral sculpture, and the goniatitic suture line. *Clydonites decoratus*, which is also known from only one specimen, differs in having granular tuberculation on the flank as well as the venter. The ventral sulcus of *Clydonites decoratus*, as illustrated by Hauer and Mojsisovics, appears to resemble that of *C. pacificus*, but the sulcus on the actual specimen is not well preserved. *Sandlingites striatissimus* is regarded as a synonym of *Leislingites archibaldi* (Mojsisovics) by Tatzreiter (1981, p. 41). The ventral sculpture of

Leislingites, with no more than two tuberculate spirals on each side of the median line, is unlike that of *Clydonites pacificus*.

Superfamily LOBITACEAE Mojsisovics, 1882

Family LOBITIDAE Mojsisovics, 1882

Genus *Lobites* Mojsisovics, 1875a

Type species. Clydonites ellipticus Hauer.

Lobites pacianus McLearn

Plate 72, figures 5a, b; Plate 74, figures 15–18; Figure 57h (p. 496)

Lobites pacianus McLearn, 1937a, p. 96, Pl. 1, fig. 15; McLEARN, 1940b, p. 81; McLEARN, 1947b, p. 5, Pl. 2, figs. 7–10; TOZER, 1967, p. 66, 67.

Lobites sp. cf. *L. pacianus* McLearn. McLEARN, 1947b, p. 8.

Registered material. Holotype GSC 8789, two topotypes GSC 9524, GSC 9525 (McLearn, 1947b, Pl. 2, figs. 8, 9), all from Beattie Ledge, Peace River. Topotype GSC 28945 (GSC loc. 9341). Hypotype GSC 28946 (GSC loc. 68245). Hypotype GSC 28947 (GSC loc. 10790).

Occurrence. Ladinian, Meginae and Maclearni zones. Toad Formation, northeastern British Columbia. GSC locs. 9163 (30), 9341 (50), 10790 (25), 42394 (12), 42535 (1), 68236 (3), 68237 (2), 68243 (1), 68245 (1), 74748 (5).

Remarks. Identified with this species are *Lobites* with a rounded outline, a body chamber without appreciable contraction behind the widened part at the aperture, and the part facing posteriorly with an arched venter. The smallest known complete specimen is 33 mm in diameter (GSC 28947, Pl. 72, fig. 5), the largest (GSC 28945, Pl. 74, fig. 17), is 42 mm in diameter.

Lobites ellipticus (Hauer)

Plate 87, figures 11–16; Figure 70c (p. 522)

Clydonites ellipticus Hauer, 1860, p. 128, Pl. 5, figs. 12–14 (only).

Lobites ellipticus (Hauer). MOJSISOVICS, 1875a, p. 161, Pl. 68, figs. 17, 18; Pl. 69, figs. 1–3; MOJSISOVICS, 1902, p. 289; FRECH and RENZ, 1908, p. 460, Pl. 15, fig. 3; Pl. 17, figs. 2, 3; RENZ, 1910, Pl. 19, fig. 3; Pl. 22, figs. 1, 3; RENZ, 1911, p. 58, Pl. 5, figs. 1, 2, 4, 6; SIMIONESCU, 1913, p. 324, 362, Pl. 5, fig. 6; Pl. 6, fig. 2.

Lobites sp. cf. *L. ellipticus* (Hauer); TOZER, 1967, p. 30, 65.

Registered material. Hypotype GSC 28948 (GSC loc. 68230). Two hypotypes GSC 28949, GSC 28950 (both GSC loc. 42351). Hypotype GSC 28951 (GSC loc. 68229). Hypotype GSC 28952 (GSC loc. 68280). Hypotype GSC 28953 (GSC loc. 36399).

Occurrence. Ladinian, Sutherlandi Zone. Toad Formation, northeastern British Columbia; Liard Formation, northeastern British Columbia. GSC locs. 36399 (1), 42351 (4), 68229 (4), 68230 (3), 68280 (2), 68364 (1), 82645 (1).

Remarks. Identified with this species are *Lobites* like *L. pacianus* McLearn, but with an angular outline, a body chamber contracted behind the aperture, and the posterior facing part with a narrowly rounded, almost subangular, venter. The smallest complete specimen is 32 mm in diameter (GSC 28948, Pl. 87, fig. 11), the largest (GSC 28950, Pl. 87, fig. 15), about 52 mm. Largest of all is an incomplete specimen (GSC 28953, Pl. 87, fig. 16), the remains of an individual that attained a diameter of about 60 mm.

Lobites sp. indet.

Plate 87, figures 10a, b

Registered material. GSC 28954 (GSC loc. 42335).

Occurrence. Ladinian, Sutherlandi Subzone 2. Toad Formation, northeastern British Columbia. GSC loc. 42335 (1).

Remarks. This specimen is the remains of a species much smaller than *Lobites ellipticus* (Hauer). Because most of the body chamber is missing, the specimen is specifically indeterminable.

Genus *Coroceras* Hyatt, 1877

Type species. Clydonites monilis Laube.

Coroceras nasutum (Mojsisovics)

Plate 89, figures 1a–c

Lobites nasutus Mojsisovics, 1875a, p. 171, Pl. 70, figs. 17a, b.

Lobites (Coroceras) nasutus Mojsisovics. MOJSISOVICS, 1902, p. 292.

Coroceras sp. cf. *C. nasutum* (Mojsisovics). TOZER, 1967, p. 31, 64.

Registered material. Hypotype GSC 28957 (GSC loc. 45745).

Occurrence. Lower Carnian, Desatoyense Zone. Liard Formation, northeastern British Columbia. GSC loc. 45745 (1).

Coroceras sp. indet.

Plate 88, figures 10, 11

Occurrence. Lower Carnian, Desatoyense Zone. Liard Formation, northeastern British Columbia. GSC loc. 83824 (2).

Remarks. These specimens lack complete body chambers and are specifically indeterminable. GSC 28955 (Pl. 88, fig. 10) appears to have a constriction on the flank, suggesting that a hood was present and thus indicating reference to *Coroceras* rather than *Lobites*.

Superfamily TROPITACEAE Mojsisovics, 1875b

Family TROPITIDAE Mojsisovics, 1875b

Genus *Tropites* Mojsisovics, 1875b

Type species. Ammonites subbullatus Hauer.

Tropites dilleri Smith

Plate 94, figures 4a, b

Tropites dilleri Smith, 1904, p. 393, Pl. 46, figs. 3, 4; Pl. 47, fig. 3; SMITH, 1927, p. 29, Pl. 68, figs. 1–13; SILBERLING, 1959, p. 45; CARLISLE and SUSUKI, 1965, p. 476, Pl. 5, figs. 39–43, 46; Pl. 6, figs. 47–49; TOZER, 1967, p. 33, 64, 82, Pl. 9, figs. 4, 5; SILBERLING and TOZER, 1968, p. 42.

Tropites subbullatus (Hauer). HYATT and SMITH, 1905, p. 67, Pl. 33, figs. 1–7; Pl. 34, figs. 1–14; Pl. 79, figs. 1–10; SMITH, 1927, p. 29, Pl. 34, figs. 1–14; Pl. 79, figs. 1–10 (not of HAUER, 1850, p. 19).

Tropites discobullatus Mojsisovics. SMITH, 1927, p. 28, Pl. 68, figs. 32–34 (not of MOJSISOVICS, 1893, p. 212).

Tropites torquillus Mojsisovics. SMITH, 1927, p. 28, Pl. 68, figs. 1–31 (not of MOJSISOVICS, 1893, p. 210).

Tropites armatus Smith, 1927, p. 31, Pl. 33, figs. 1–7; Pl. 69, figs. 1–12.

Tropites morloti Mojsisovics. SMITH, 1927, p. 31, Pl. 69, figs. 13–24 (not of MOJSISOVICS, 1893, p. 195).

Tropites occidentalis Smith, 1927, p. 31, Pl. 70, figs. 1–20.

Registered material. Three hypotypes GSC 17983 (Carlisle and Susuki, 1965, Pl. 5, figs. 39–41), GSC 17984 (ibid., Pl. 6, figs. 47–49), GSC 17986 (ibid., Pl. 5, figs. 42, 43, 46) (all Quadra Island). Three hypotypes GSC 18907 (Tozer, 1967, Pl. 9, fig. 4), GSC 18908 (ibid., fig. 5), GSC 18909 (ibid., fig. 5) (all GSC loc. 68208). Hypotype GSC 28981 (GSC loc. 86293).

Occurrence. Upper Carnian, Dilleri Zone. Ludington Formation, northeastern British Columbia; Open Bay Formation, Quadra Island, British Columbia; Quatsino Limestone, Vancouver Island, British Columbia. GSC locs. 68208 (4), 86293 (2).

Remarks. The broad interpretation adopted for this species is that of Silberling (1959, p. 43). All the specimens known from Canada are small and incomplete. GSC 28981 (Pl. 94, fig. 4), the best preserved, resembles *Tropites armatus* Smith.

Tropites keiliformis n. sp.

Plate 93, figures 13a, b

Tropites sp., CARLISLE and SUSUKI, 1965, p. 477, Pl. 7, fig. 63.

Registered material. Holotype GSC 18877 (GSC loc. 22691).

Occurrence. Upper Carnian, Dilleri Zone. Open Bay Formation, Quadra Island, British Columbia. GSC loc. 22691 (1).

Diagnosis. Tropites about 40 mm in diameter; H about 45 per cent, W about 50 per cent, U about 25 per cent of diameter. Inner whorls with ovoid whorl section.

Body chamber not contracted. Umbilical tubercles very faint. Ribs weak, branching at mid-flank. Ventral projection of ribs very weak (about 70 degrees).

Measurements. Holotype GSC 18877 (Pl. 93, fig. 13): 40, 0.44, 0.50, 0.25.

Remarks. In the unique holotype, no suture lines are seen, but the slight excentricity of the umbilical spiral suggests that the outer whorl is body chamber. The umbilical wall is slightly undercut. Umbilical nodes are no more than faint bullae. On the outer whorl, the ratio of ribs at the keel to those at the umbilicus is about 2:1, the penultimate quadrant having 10 nodes leading to about 20 ribs. The keel is not bordered by sulci.

Tropites keili Mojsisovics (1893, p. 220) is closely similar, but differs in having somewhat more pronounced umbilical tuberculation.

Tropites izardi n. sp.

Plate 95, figures 10a, b

Registered material. Holotype GSC 28985, paratype GSC 28986* (both GSC loc. 23066). Hypotype GSC 28987* (GSC loc. 82936).

Occurrence. Upper Carnian, Welleri Subzone 1. Quatsino Limestone, Vancouver Island, British Columbia. GSC locs. 23066 (12), 82936 (1).

Diagnosis. Tropites at least 35 mm in diameter; H about 45 per cent, W about 55 per cent, U about 35 per cent of diameter. Inner whorls coronate in section, widest at an angular umbilical shoulder. Body chamber not contracted. Umbilical tuberculation weak. Ribs strong on outer whorl, weak on inner, with bifurcation and intercalation on the inner flank. Ventral projection of ribs moderate (45 degrees) to weak (60 degrees), decreasing adorad on the outer whorl.

Measurements. Holotype GSC 28985 (Pl. 95, fig. 10): 34.5, 0.43, 0.57, 0.35.

Remarks. The holotype (Pl. 95, fig. 10) has about 10 small umbilical nodes on the last half whorl. Two ribs branch from these nodes on the inner flank. There are also some simple ribs intercalated between the bifurcating ribs. The venter is sulcaticarinate. There is no sign of spiral sculpture. Suture lines are not preserved, but the specimen appears to be excentrumbilicate and may have been complete. The nature of the inner whorls is interpreted from GSC 28986, a cadicone nucleus about 17 mm in diameter, 19 mm wide and with an umbilicus about 9 mm wide. Ribbing is faint and the maximum width is at the angular umbilical shoulder, which bears eight nodes on a quarter whorl. GSC 28987 is also a cadicone nucleus, 15 mm in diameter, 20 mm wide.

This species appears to be related to *Tropites welleri* Smith, as interpreted by Silberling (1959, p. 44). It differs in having weaker umbilical tuberculation, ribs that are less projected at the aperture, and apparently differs also in lacking spiral sculpture.

Tropites bufonis n. sp.

Plate 95, figures 4, 8, 9

Tropites sp. aff. *T. welleri* Smith. TOZER, 1967, p. 34, 62, Pl. 9, figs. 6a, b.

Registered material. Holotype GSC 28982, three paratypes GSC 18910 (Tozer, 1967, Pl. 9, figs. 6a, b), GSC 28983, GSC 28984 (all GSC loc. 42389).

Occurrence. Upper Carnian, Welleri Subzone 2. Pardonet Formation, northeastern British Columbia. GSC locs. 42378 (2), 42389 (16).

Diagnosis. Tropites at least 40 mm in diameter; H about 45 per cent, W about 55 per cent, U about 25 per cent of diameter. Inner whorls with ovoid whorl section, forming an arch extending from the umbilical shoulder to the venter. Body chamber not contracted. Umbilical tubercles small, but prominent. Ribs strong, with branching at the umbilical shoulder; branching and intercalation at the mid-flank. Ventral projection of ribs moderate (45 degrees) to very weak (80 degrees), weaker on inner than outer whorls.

Remarks. The holotype (Pl. 95, fig. 9) is crushed, but enough of the umbilicus is preserved to leave little doubt that the species is a true excentrumbilicate *Tropites*. The paratypes are undistorted phragmocones: e.g., GSC 18910 (Tozer, 1967, Pl. 9, figs. 6a, b), GSC 28984 (Pl. 95, fig. 4) and GSC 28983 (Pl. 95, fig. 8), showing that the inner whorls are sphaerocone, not cadicone. The keel is bordered by deep sulci. Increase in ribs on the flank, between the umbilicus and keel, is in a ratio of about 3:1. GSC 18910, the best preserved phragmocone, has seven umbilical nodes and about 20 ribs at the keel on the last half whorl. Two ribs stem from each node near the umbilicus. There is also some increase by bifurcation and intercalation on the mid-flank. The last half whorl of the holotype has about 25 ribs at the keel. GSC 18910

shows fine spiral sculpture on both the steinkern and the test. None show details of the suture line.

The outer whorl is much like that of *Tropites izardi* n. sp., but *T. bufonis* differs in having inner whorls with an ovoid, not coronate section.

Genus *Gymnotropites* Hyatt and Smith, 1905

Type species. Paratropites (Gymnotropites) americanus Hyatt and Smith.

Gymnotropites americanus Hyatt and Smith

Plate 92, figures 15a, b

Paratropites (Gymnotropites) americanus Hyatt and Smith, 1905, p. 56, Pl. 32, figs. 1–10; SMITH, 1927, p. 46, Pl. 32, figs. 1–10.

Gymnotropites sp. cf. *G. americanus* Hyatt and Smith. CARLISLE and SUSUKI, 1965, p. 479, Pl. 8, figs. 74–76.

Registered material. Hypotype GSC 17996 (Carlisle and Susuki, 1965, Pl. 8. figs. 74–76) (Quadra Island). Hypotype GSC 28958 (GSC loc. 22692).

Occurrence. Upper Carnian, Dilleri Zone. Open Bay Formation, Quadra Island, British Columbia. GSC loc. 22692 (1).

Genus *Pleurotropites* n. gen.

Type species. Paratropites gabbi Smith.

Diagnosis. Tropitid with a narrow umbilicus and concentric coiling. Phragmocone with distinct, flat, commonly imbricate ribs. Body chamber very weakly ribbed or smooth. Tuberculation absent.

Species assigned. Pleurotropites gracilis (Smith), *P. gabbi* (Smith).

Age. Upper Carnian, Dilleri Zone.

Remarks. The most closely related genus is the contemporary *Gymnotropites* Hyatt and Smith (1905), the body chambers of the two genera being somewhat similar, although *Gymnotropites* is even smoother than *Pleurotropites*. More significantly, *Gymnotropites* differs in lacking the distinct ribbing that characterizes the phragmocone of *Pleurotropites*. In shape and mode of coiling, *Pleurotropites* resembles *Paratropites* Mojsisovics (1893), but that genus differs in having umbilical tubercles and rounded, instead of flat, ribs.

Pleurotropites gracilis (Smith)

Plate 93, figures 7–10, 12

Paratropites gracilis Smith, 1927, p. 44, Pl. 25, figs. 10–13.

Paratropites sp. cf. *P. sulcatus* (Calcara 1845, of Gemmellaro, 1904). SILBERLING, 1961, p. 539, Pl. 74, figs. 5–11; TOZER, 1967, p. 33, 82; SILBERLING and TOZER, 1968, p. 35, 48.

Registered material. Hypotype GSC 28968 (GSC loc. 68208). Three hypotypes GSC 28969–GSC 28971 (all GSC loc. 23147). Two hypotypes GSC 28972*, GSC 28973 (GSC loc. 23939).

Occurrence. Upper Carnian, Dilleri Zone. Ludington Formation, northeastern British Columbia; Karmutsen Group, Vancouver Island, British Columbia; Quatsino Limestone(?), Vancouver Island, British Columbia. GSC locs. 23147 (28), 23939 (11), 24033 (1), 68208 (1), 82852 (9).

Remarks. GSC 28969 (Pl. 93, fig. 12), which has a distinctly ribbed phragmocone and a nearly smooth body chamber, is interpreted as a mature example. This stage of growth is not shown by the holotype (Smith, 1927, Pl. 25, figs. 10–12), but the resemblance between the holotype and phragmocones like GSC 28968 (Pl. 93, fig. 7) and GSC 28970 (Pl. 93, fig. 8) justifies the identification.

Pleurotropites gabbi (Smith)

Plate 93, figures 1–3, 5, 6; Plate 94, figures 2, 3

Paratropites gabbi Smith, 1927, p. 44, Pl. 24, figs. 9–13.

Paratropites arnoldi Smith, 1927, p. 44, Pl. 25, figs. 3–9.

Paratropites antiselli Smith, 1927, p. 43, Pl. 24, figs. 1–8.

Paratropites (Gymnotropites) yatesi Smith, 1927, p. 47, Pl. 25, figs. 21–24.

Paratropites spepsumensis Crickmay, 1930, p. 60, Pl. 7, figs. c–e.

Paratropites sellai Mojsisovics. HYATT and SMITH, 1905, p. 54, Pl. 30, figs. 6–10; Pl. 31, figs. 1–26; SMITH 1927, p. 45, Pl. 24, figs. 14–16; Pl. 30, figs. 6–10; Pl. 31, figs. 1–26; CARLISLE and SUSUKI, 1965, p. 479, Pl. 7, figs. 62, 64; Pl. 8, figs. 68–72; TOZER, 1967, p. 33, 82 (not of MOJSISOVICS, 1893, p. 242).

Paratropites dittmari Mojsisovics. SMITH, 1904, p. 396, Pl. 46, fig. 1; Pl. 47, fig. 1; SMITH, 1927, p. 44, Pl. 25, figs. 1, 2 (not of MOJSISOVICS, 1893, p. 245).

Registered material. Three hypotypes GSC 17980 (Carlisle and Susuki, 1965, figs. 62, 64), GSC 17998 (ibid., figs. 68–70), GSC 17999 (ibid., figs. 71, 72) (all Quadra Island). Four hypotypes GSC 28960–GSC 28963 (all GSC loc. 68208). Hypotype GSC 28964* (GSC loc. 23939). Hypotype GSC 28965 (GSC loc. 23147). Two hypotypes GSC 28966, GSC 28967 (GSC loc. 86293).

Occurrence. Upper Carnian, Dilleri Zone. Ludington Formation, northeastern British Columbia; Nicola Group, southern British Columbia; Open Bay Formation, Quadra Island, British Columbia; Quatsino Limestone, Vancouver Island, British Columbia. GSC locs. 18667 (1), 23147 (1), 23939 (4), 68208 (7), 86293 (5), 91898 (1).

Remarks. GSC 28962 (Pl. 93, fig. 3) and GSC 28967 (Pl. 94, fig. 3) lack distinct ribbing on the outer whorl and are comparable to *Paratropites dittmari* Mojsisovics of Smith (1927, p. 44). They are probably mature at a diameter of about 50 mm. GSC 28960 (Pl. 93, fig. 1), GSC 28961 (Pl. 93, fig. 2) and GSC 28965 (Pl. 93, fig. 5), are distinctly ribbed, like specimens identified as *Paratropites sellai* by Smith (1927, p. 45). Although they do not show septa, they are probably phragmocones or immature specimens. GSC 28963 (Pl. 93, fig. 6) shows reduced ribbing on the outer whorl and is presumably mature or nearly so. Although crushed, it is neverthless comparable with the holotype from California, being about 60 mm in diameter. *Paratropites spepsumensis* Crickmay (1930, p. 60) is interpreted as a synonym because of the close resemblance with "*Paratropites*" *antiselli* Smith (1927, p. 43). The nature of the ribbing and the contrast between the sculpture of the phragmocone with that of the body chamber indicate affinity with *Pleurotropites gracilis* (Smith), but *P. gabbi* is distinguished by having much wider ribs.

Pleurotropites sp. indet.

Plate 93, figures 4a, b

Registered material. GSC 32363 (GSC loc. 82852).

Occurrence. Upper Carnian, Dilleri Zone. Sadler Limestone, Moresby Island, British Columbia; Karmutsen Group, Vancouver Island, British Columbia. GSC locs. 82852 (2), C-157006 (1).

Remarks. GSC 32363 (Pl. 93, fig. 4) has ribbing much like that of *Pleurotropites gracilis* (Smith), with which it is associated, but it is appreciably more inflated than all the specimens identified as that species.

Genus *Paratropites* Mosisovics, 1893

Type species. Ammonites saturnus Dittmar.

Paratropites sulfurensis n. sp.

Plate 92, figures 3–5

Thisbites sp., TOZER, 1967, p. 33, 64.

Registered material. Holotype GSC 28974, two paratypes GSC 28975, GSC 28976 (all GSC loc. 68208).

Occurrence. Upper Carnian, Dilleri Zone. Ludington Formation, northeastern British Columbia. GSC loc. 68208 (13).

Diagnosis. Paratropites attaining a diameter of about 15 mm; H about 40 per cent, W about 40 per cent, U about 20 per cent of diameter. Ribs sinuous, some branched and stemming from umbilical nodes, some intercalated on flank. Ratio of nodes to ribs at the keel about 5:1. Projection of ribs on venter very weak (about 80 degrees). Ventral keel bordered by sulci.

Remarks. In the holotype (Pl. 92, fig. 4), no suture lines are seen. The outer whorl is probably body chamber. On the last half whorl there are six nodes at the umbilicus, from which stem bifurcating ribs. There are also intercalated ribs, the total at the keel being about 28. GSC 28975 (Pl. 92, fig. 3) has half a whorl of incomplete body chamber at a diameter of 10 mm. This specimen shows the large ammonitic external saddle of the last septum. GSC 28976 (Pl. 92, fig. 5) is a variant with thicker ribs than the holotype.

Paratropites sulfurensis is comparable to *P. parvulus* Mojsisovics (1893, p. 255), *P. aberrans* Mojsisovics (ibid., p. 256) and *P. schultesi* Mojsisovics (ibid., p. 239). *Paratropites parvulus* differs in being more evolute, *P. aberrans* by lacking a keel on the outer whorl and *P. schultesi* by having more pronounced projection of ribbing.

Paratropites teres n. sp.

Plate 95, figures 5–7, 11

Registered material. Holotype GSC 28977 (GSC loc. 42320). Three paratypes GSC 28978–GSC 28980 (all GSC loc. 42386).

Occurrence. Upper Carnian, Welleri Subzone 2. Baldonnel Formation, northeastern British Columbia; Pardonet Formation northeastern British Columbia. GSC locs. 42320 (1), 42322 (1), 42386 (3).

Diagnosis. Paratropites attaining a diameter of about 35 mm; H about 50 per cent, W about 45 per cent, U about 12 per cent of diameter. Umbilical nodes low, bullate. Flanks smooth. Ribs present on venter. Ratio of nodes to ribs at the keel about 3:1. Projection of ribs on venter very weak (about 80 degrees). Ventral keel bordered by sulci.

Measurements. Paratype GSC 28979 (Pl. 95, fig. 7): 25, 0.52, 0.44, 0.12.

Remarks. The holotype (Pl. 95, fig. 11) shows no suture lines. The outer whorl is probably body chamber. On the last quadrant there are five nodes at the umbilicus and about 15 ribs at the keel. All three paratypes have umbilical nodes. The smallest, GSC 28978 (Pl. 95, fig. 6) has a smooth venter and flanks. GSC 28979 (Pl. 95, fig. 7) and GSC 28980 (Pl. 95, fig. 5) have outer whorls that are initially smooth, with ribs appearing on the venter adorad. None show details of the suture line.

The smooth flanks distinguish this species from typical *Paratropites*, such as *P. saturnus* (Dittmar) (Mojsisovics, 1893, p. 240).

Paratropites arcticus n. sp.

Plate 103, figures 7–9

Tropites sp. cf. *T. morani* Smith. TOZER, 1961, p. 85, Pl. 27, figs. 3–5; TOZER, 1967, p. 34, 44.

Registered material. Holotype GSC 72189, four paratypes GSC 14179*, GSC 14180 (Tozer, 1967, Pl. 27, fig. 3), GSC 14181 (ibid., fig. 4), GSC 14182 (ibid., fig. 5) (all GSC loc. 35611). Paratype GSC 72188 (GSC loc. 25868). Hypotype GSC 72187 (GSC loc. 89716).

Occurrence. Upper Carnian, Welleri Zone. Schei Point Formation, Cameron Island; Blaa Mountain Formation, Axel Heiberg Island. GSC locs. 25868 (2), 35611 (6), 89716 (1).

Diagnosis. Paratropites attaining a diameter of about 80 mm; H about 45 per cent, W up to about 45 per cent, U about 15 per cent of diameter. Umbilical shoulder without nodes. Flanks with concave rounded ribs, most of which bifurcate near the mid-flank.

Remarks. Suture lines are not preserved. The mode of coiling is like that of *Paratropites* and *Pleurotropites*. Compared with *Paratropites saturnus* (Dittmar) and other typical *Paratropites,* the new species is distinguished by having an umbilical shoulder without tuberculation. However, the rounded ribs are much more like those of *Paratropites* than *Pleurotropites*. *Tropites morani* Smith (1927, p. 36) shows some similarities, but is more evolute and has straighter ribs on the outer whorl.

Genus *Discotropites* Hyatt and Smith

Type species. Ammonites sandlingensis Hauer.

Discotropites sandlingensis (Hauer)

Plate 92, figures 6–11

Ammonites sandlingensis Hauer, 1850, p. 10, Pl. 3, figs. 1–12.

Eutomoceras sandlingense (Hauer). MOJSISOVICS, 1893, p. 285, Pl. 130, figs. 11–13; Pl. 131, figs. 1–11; GEMMELLARO, 1904, p. 77, Pl. 8, figs. 8–10; SMITH 1904, p. 397, Pl. 46, fig. 10; Pl. 48, figs. 5, 6; ARTHABER, 1905, p. 461, Textfig.

Discotropites sandlingensis (Hauer). HYATT and SMITH, 1905, p. 63, Pl. 35, figs. 1–12; Pl. 36, figs. 1–26; SMITH, 1927, p. 39, Pl. 35, figs. 1–12; Pl. 36, figs. 1–26; McLEARN, 1960a, p. 73, Pl. 8, fig. 7; TOZER, 1967, p. 33, 34, 64.

Discotropites sp. cf. *D. mojsvarensis* Smith. TOZER, 1962a, Pl. 8, fig. 7 (only).

Registered material. Hypotype GSC 12595 (McLearn, 1960a, Pl. 8, fig. 7) (GSC loc. 9360). Two hypotypes GSC 14238, GSC 28988 (both GSC loc. 43695). Four hypotypes GSC 28989–GSC 28992 (all GSC loc. 68208). Hypotype GSC 28993* (GSC loc. 22693).

Occurrence. Upper Carnian, Dilleri Zone. Ludington Formation, northeastern British Columbia; Nicola

Group, southern British Columbia; King Salmon Formation, northern British Columbia; Open Bay Formation, Quadra Island, British Columbia. GSC locs. 9360 (5), 18667 (1), 22693 (1), 43695 (3), 64630 (2), 68208 (8).

Remarks. Identified with this species are *Discotropites* with indistinct ventral shoulders, which are not tuberculate, on both the inner and outer whorls. The flanks have about 20 tubercle-spirals, all more or less of uniform strength.

Discotropites smithi Kutassy

Plate 96, figures 1–7; Plate 104, figures 14a, b; Figure 77a, b (p. 540)

Discotropites gemmellaroi Smith, 1927, p. 41, Pl. 10, figs. 1–13 (not of MANSUY, 1913, p. 42).

Discotropites smithi Kutassy, 1933, p. 504 (for *Discotropites gemmellaroi* Smith, 1927, not of MANSUY, 1913); TOZER, 1971, p. 1000.

Discotropites theron (Dittmar). TOZER, 1967, p. 62 (in part) (not of DITTMAR, 1866, p. 370).

Registered material. Six hypotypes GSC 14237, GSC 28994–GSC 28997, GSC 28998* (all GSC loc. 42306). Hypotype, GSC 28999 (GSC loc. 51265). Hypotype GSC 29000 (GSC loc. 56250). Hypotype GSC 29001 (GSC loc. 53340).

Occurrence. Upper Carnian, Welleri Subzone 1. Ludington Formation, northeastern British Columbia; Quatsino Limestone, Vancouver Island, British Columbia; Peril Formation, Queen Charlotte Islands, British Columbia. GSC locs. 23161 (1), 42306 (19), 42384 (1), 51265 (3), 53340 (1), 56250 (3), 64650 (1), 94736 (1), C-157061 (1).

Remarks. Identified with this species are *Discotropites* with distinct, almost angular and tuberculate ventral shoulders on the inner whorls. On the outer whorl the shoulders may be somewhat rounded. The flanks have about 20 tubercle-spirals. Some rows may be more prominent than others. The ribbing and tuberculation is much like that of *Discotropites sandlingensis* (Hauer), from which *D. smithi* is distinguished by having distinct ventral shoulders, at least on the phragmocone.

Discotropites theron (Dittmar)

Plate 96, figures 8–15

Ammonites theron Dittmar, 1866, p. 370, Pl. 16, figs. 15–17.

Eutomoceras theron (Dittmar). MOJSISOVICS, 1893, p. 288, Pl. 130, figs. 7–10; GEMMELLARO, 1904, p. 79, Pl. 29, fig. 28.

Discotropites theron (Dittmar). SMITH, 1927, p. 40, Pl. 9, figs. 1–3; TOZER, 1967, p. 34, 61, 62 (in part); TOZER, 1972, Pl. 128, figs. 1, 2.

Discotropites sp., TOZER, 1962a, Pl. 8, figs. 8a, b; TOZER, 1970, Pl. 18, figs. 4a, b.

Registered material. Five hypotypes GSC 14239, GSC 28023, GSC 29002–GSC 29004 (all GSC loc. 42389). Hypotype GSC 29005 (GSC loc. 42320). Hypotype GSC 29006 (GSC loc. 42321). Hypotype GSC 29007 (GSC loc. 42377).

Occurrence. Upper Carnian, Welleri Subzone 2. Baldonnel Formation, northeastern British Columbia; Pardonet Formation, northeastern British Columbia; Quatsino Limestone, Vancouver Island, British Columbia; Peril Formation, Queen Charlotte Islands, British Columbia. GSC locs. 24335 (1), 42320 (1), 42321 (1), 42377 (1), 42378 (1), 42386 (2), 42388 (1), 42389 (20), 68220 (1), C-157063 (1), C-157295 (1), C-157373 (1).

Remarks. Identified with this species are *Discotropites* with ventral shoulders that are distinctly angular and tuberculate on the inner whorls and almost so on the outer whorl. Ribs are flat and wide and may be two or three times as wide as the interspaces. The flanks have up to about 20 tubercle-spirals, some of which are commonly more prominent than the others. Phragmocones exhibit great variation, as illustrated by specimens from GSC locality 42389. Robustly sculptured variants, e.g., GSC 29004, (Pl. 96, fig. 15) are essentially the same as some examples of *Discotropites smithi* Kutassy. The distinctive characters of *D. theron* are expressed by compressed variants, e.g., GSC 29002 (Pl. 96, fig. 11), and GSC 29003 (Pl. 96, fig. 8), which have broad flat ribs, unlike all variants of *D. smithi*. Compressed variants like GSC 28023 (Pl. 96, fig. 12) and GSC 29005 (Pl. 96, fig. 9) resemble *Discotropites plinii* (Mojsisovics) (1893, p. 289), which possibly should be added to the synonymy of this species, although Krystyn (1982, p. 34) maintains that the taxa are distinct.

Genus *Indonesites* Welter, 1914

Type species. Indonesites dieneri Welter.

Indonesites sphaericus (Smith)

Plate 94, figures 1a, b

Jovites (*Bacchites*) *sphaericus* Smith, 1927, p. 54, Pl. 14, figs. 6–9.

Jovites (*Bacchites*) *bacchus* Mojsisovics. SMITH, 1927, p. 53, Pl. 14, figs. 1–5 (not of MOJSISOVICS, 1893, p. 143).

Bacchites sp. cf. *B. bacchus* Mojsisovics. CARLISLE and SUSUKI, 1965, p. 480, Pl. 8, figs. 73, 77, 81.

Registered material. Hypotype GSC 18879 (Carlisle and Susuki, 1965, Pl. 8, figs. 73, 77, 81). Hypotype GSC 28959 (GSC loc. 86293).

Occurrence. Upper Carnian, Dilleri Zone. Open Bay Formation, Quadra Island, British Columbia; Quatsino Limestone, Vancouver Island, British Columbia. GSC loc. 86293 (1).

Remarks. Although no specimens are known to be excentrumbilicate and the keel is better defined, there is nevertheless sufficient resemblance to regard this species as congeneric with *Indonesites dieneri* Welter. The keel is much more prominent than in *Bacchites bacchus* Mojsisovics (1893, p. 143).

Genus *Homerites* Mojsisovics, 1893

Type species. Ammonites semiglobosus Hauer.

Homerites semiglobosus (Hauer)

Plate 98, figures 1–4

Ammonites semiglobosus Hauer, 1855, p. 155, Pl. 4, figs. 10–13; HAUER, 1860, p. 145, Pl. 4, figs. 8–10.

Halorites (*Homerites*) *semiglobosus* (Hauer). MOJSISOVICS, 1893, p. 57, Pl. 89, figs. 1–6; HYATT and SMITH, 1905, p. 43, Pl. 28, figs. 19–24.

Homerites semiglobosus (Hauer). SMITH, 1927, p. 52, Pl. 28, fig. 19–24; Pl. 59, figs. 21–26; TOZER, 1962a, Pl. 8, figs. 4a, b; TOZER, 1967, p. 34, 62, 82; TOZER, 1970, Pl. 18, figs. 6a, b.

Registered material. Two hypotypes GSC 14235, GSC 32100 (both GSC loc. 42384). Hypotype GSC 32101 (GSC loc. 28941). Hypotype GSC 32102 (GSC loc. 23161).

Occurrence. Upper Carnian, Welleri Subzone 1. Ludington Formation, northeastern British Columbia; Unnamed formation, Telegraph Creek area, British Columbia; Quatsino Limestone, Vancouver Island, British Columbia; Peril Formation, Queen Charlotte Islands, British Columbia. GSC locs. 23161 (1), 28941 (1) 42384 (2), 69190 (1).

Remarks. The beginning of the outer whorl of GSC 14235 (Pl. 98, fig. 2) shows the stage of growth at which the conch is striate and has a delicate keel not bordered by sulci. This is abruptly replaced by the stage with strong ribs and external nodes. The transverse horns that characterize *Homerites* are completely preserved in GSC 32102 (Pl. 98, fig. 4), partly preserved in GSC 32101 (Pl. 98, fig. 3). Their scars appear to be present in GSC 14235 (Pl. 98, fig. 2). GSC 14235 (Pl. 98, fig. 2) and GSC 32101 (Pl. 98, fig. 3) have the external tubercles arranged opposite one another. GSC 32102 (Pl. 98, fig. 4) has the first two opposite and the remainder en echelon. In none of the specimens are suture lines seen.

Genus *Homeroceras* n. gen.

Type species. Homeroceras grandis n. sp.

Diagnosis. Excentrumbilicate sulcaticarinate tropitid uniformly ribbed on penultimate and outer whorls. About half of outer whorl has large external nodes bordering the keel; these nodes are absent at the aperture. Some ribs are looped to nodes.

Species assigned. Homeroceras grandis n. sp.

Age. Upper Carnian, Welleri Zone.

Remarks. The distinctive external nodes are like those of *Homerites* Mojsisovics (1893), presumably indicating affinity. *Homerites* differs in having nodes on the whole of the outer whorl; a striate, weakly keeled penultimate whorl; and in having transverse horns marking the start of nodose sculpture at the beginning of the outer whorl.

Homeroceras grandis n. sp.

Plate 98, figures 5–7

Registered material. Holotype GSC 32103 (GSC loc. 56250). Two paratypes GSC 32104, GSC 32105 (both GSC loc. 51265).

Occurrence. Upper Carnian, Welleri Subzone 1. Ludington Formation, northeastern British Columbia. GSC locs. 51265 (3), 56250 (1).

Diagnosis. Homeroceras attaining a diameter of at least 40 mm; H about 45 per cent, W about 45 per cent, U about 25 per cent of diameter. Ribbing strong, with frequent bifurcation on the flank. Keel strong, bordered by sulci, except at aperture. Outer whorl with external nodes on about half, about six per quadrant; initially ribs are looped to nodes, toward the aperture each rib is linked with one node, and on the last quadrant nodes are absent and the venter is carinate, not sulcaticarinate.

Measurements. Holotype GSC 32103 (Pl. 98, fig. 6): 40, 0.44, 0.43, 0.27.

Remarks. The outer whorl of the holotype (Pl. 98, fig. 6) is fairly well preserved, except at the beginning. External nodes are absent on the last quadrant, present on the preceding half. This specimen was probably complete and mature. GSC 32105 (Pl. 98, fig. 7) is an incomplete specimen about 33 mm in diameter, appreciably thicker than the holotype. It shows the ribbed, sulcaticarinate stage of growth and the abrupt appearance of external nodes with looped ribs. The first node is rounded and smaller than those immediately following and evidently was not the base of a transverse horn. The nodes on this specimen are not arranged exactly opposite one another, nor are they exactly en echelon. In none are the suture lines seen.

No comparable species are known.

Genus *Margaritropites* Diener, 1916b

Type species. Anatropites margaritiformis Diener.

Margaritropites johnsoni (Smith)

Plate 95, figures 13–15

Tropites johnsoni Smith, 1927, p. 36, Pl. 74, figs. 10–15; SILBERLING, 1959, p. 46; TOZER, 1962a, Pl. 8, figs. 12a, b; TOZER, 1967, p. 34, 82; TOZER, 1970, Pl. 18, figs. 5a, b.

Tropites traski Smith, 1927, p. 35, Pl. 75, figs. 1, 2.

Tropites philippii Smith, 1927, p. 36, Pl. 75, figs. 12–16.

Tropites boehmi Smith, 1927, p. 36, Pl. 75, figs. 3–11.

Registered material. Hypotype GSC 14243 (GSC loc. 28941). Two hypotypes GSC 29008, GSC 29009 (both GSC loc. 42306).

Occurrence. Upper Carnian, Welleri Subzone 1. Pardonet Formation(?), northeastern British Columbia; Unnamed formation, Telegraph Creek area, British Columbia. GSC locs. 28941 (1), 42306 (2).

Remarks. GSC 14243 consists of a well preserved phragmocone (Pl. 95, fig. 15 b–d) and the external mould from which an impression has been taken (Pl. 95, fig. 15a). Both show well defined umbilical nodes. The phragmocone has faint marginal nodes only on the last quadrant. The external mould shows what is probably the start of the body chamber, on which there are pronounced marginal nodes. Bituberculation is also clear in GSC 29008 (Pl. 95, fig. 13) and GSC 29009 (Pl. 95, fig. 14). All three show delicate spiral lirae.

Margaritropites kokeni (Smith)

Plate 95, figures 12a, b

Tropites kokeni Smith, 1927, p. 35, Pl. 76, figs. 1–7.

Registered material. Hypotype GSC 29010 (GSC loc. 28941).

Occurrence. Upper Carnian, Welleri Subzone 1. Unnamed formation, Telegraph Creek area, British Columbia. GSC loc. 28941 (1).

Remarks. GSC 29010 (Pl. 95, fig. 12) shows bifurcation of the ribs on the flank and at the margin, but has no marginal nodes preserved. No spiral lirae are apparent. The style of ribbing is much like that of "*Tropites*" *kokeni*. The type of this species, from California, has rudimentary marginal nodes, which are taken to justify reference to *Margaritropites*.

Genus *Hoplotropites* Spath, 1929

Type species. Ammonites jokeleyi Hauer.

Hoplotropites circumspinatus (Mojsisovics)

Plate 104, figures 13a, b

Margarites circumspinatus Mojsisovics, 1893, p. 299, Pl. 117, figs. 1–6, 9, 10; DIENER, 1906, p. 141, Pl. 3, fig. 7.

Hoplotropites circumspinatus (Mojsisovics). WANG and HE, 1976, p. 365, Pl. 27, figs. 23–25; KRYSTYN, 1982, p. 33, Pl. 6, fig. 5 (with synonymy).

Registered material. Hypotype GSC 38624* (GSC loc. 24335). Hypotype GSC 85785 (GSC loc. C-157295).

Occurrence. Upper Carnian, Welleri Subzone 2. Quatsino Limestone, Vancouver Island, British Columbia; Peril Formation, Queen Charlotte Islands, British Columbia. GSC locs. 24335 (1), C-157295 (1).

Hoplotropites marii (Gemmellaro)

Plate 97, figures 9a, b

Margarites marii Gemmellaro, 1904, p. 130, Pl. 19, figs. 15, 16.

Registered material. Hypotype GSC 29011 (GSC loc. 68179).

Occurrence. Upper Carnian, Welleri Subzone 2. Baldonnel Formation, northeastern British Columbia. GSC loc. 68179 (1).

Hoplotropites auctus (Dittmar)

Plate 97, figures 10–18; Plate 98, figures 10a–c

Ammonites auctus Dittmar, 1866, p. 367.

Margarites auctus (Dittmar). MOJSISOVICS, 1893, p. 305, Pl. 118, fig. 13; Pl. 128, fig. 2 (lectotype, KRYSTYN, 1982, p. 32).

Hoplotropites sp. cf. *H. auctus* (Dittmar). TOZER, 1962a, Pl. 8, fig. 10, 11; TOZER, 1967, p. 34, 62.

Hoplotropites auctus (Dittmar). WANG and HE, 1976, p. 366, Pl. 27, figs. 26–27; KRYSTYN, 1982, p. 32, Pl. 6, fig. 2 (with synonymy).

Registered material. Six hypotypes GSC 14241, GSC 14242, GSC 32087–32090 (all GSC loc. 42389). Hypotype GSC 32091 (GSC loc. 42388). Two hypotypes GSC 32092, GSC 32093 (GSC loc. 42386). Hypotype GSC 32094 (GSC loc. 68360).

Occurrence. Upper Carnian, Welleri Subzone 2. Baldonnel Formation, northeastern British Columbia; Pardonet Formation, northeastern British Columbia. GSC locs. 42386 (6), 42388 (1), 42389 (8), 68360 (1).

Remarks. Identified with this species are *Hoplotropites,* which are ultimately trituberculate, with umbilical and marginal spines and external clavate nodes. The number of tubercles increases radially, the ratio being about six umbilical to nine marginal to 12 external. Ribs are faint, with some branching on the flanks and venter. The specimens from GSC localities 42386, 42389 and 42388 are probably from the same bed. They vary greatly in proportions and sculpture. Most are phragmocones. The body chamber is not seen in any of the specimens with certainty. Without knowledge of the body chamber, a satisfactory assessment of the variation is impossible. Provisionally, all are regarded as representatives of one species. GSC 14242 (Pl. 97, fig. 16), closely resembles the lectotype selected by Krystyn (1982, p. 32). GSC 32094 (Pl. 97, fig. 10), which has more prominent ribbing between the external tubercles and the keel compared with the others, resembles "*Margarites*" *sushena* Diener, (1906, p. 140), which is placed in the synonymy of this species by Krystyn (op. cit.).

Hoplotropites? *globosus* n. sp.

Plate 97, figures 5, 6

Registered material. Holotype GSC 32098 (GSC loc. 42380). Paratype GSC 32097 (GSC loc. 42320).

Occurrence. Upper Carnian, Welleri Subzone 2. Baldonnel Formation, northeastern British Columbia; Pardonet Formation, northeastern British Columbia. GSC locs. 42320 (1), 42380 (1).

Diagnosis. Tropitid with tuberculation as in bituberculate *Hoplotropites*, but with very thick depressed whorls, H being about 45 per cent, W about 75 per cent, U about 20 per cent of diameter. Sculpture consists of two spirals of tubercles immediately outside the umbilical shoulder, some of which are linked by simple, concave ribs. Outside these ribs the whorls are nearly smooth, except for concave growth lines and delicate spiral lirae.

Remarks. At the beginning of the outer whorl of the holotype (Pl. 97, fig. 5) there is one spiral of spinose tubercles on the inner part of the whorl side. Adorad a second spiral of nodes appears, inside the first. The two spirals are linked by weak ribs of irregular strength. In GSC 32097 (Pl. 97, fig. 6) the ribs near the umbilicus are stronger and more regular than in the holotype, with only an outer spiral of tubercles present. These specimens leave no doubt that the outer spiral appears at a smaller diameter than the inner, as in *Hoplotropites*, not *Margaritropites*. In neither specimen are suture lines seen.

This species closely resembles *Hoplotropites septentrionalis* (Smith) (1927, p. 49), which differs in being less inflated and having a more distinct suggestion of ribbing outside the tubercles.

Hoplotropites? intermedius n. sp.

Plate 97, figures 7, 8

Registered material. Holotype GSC 32095 (GSC loc. 42398). Paratype GSC 32096 (GSC loc. 42320).

Occurrence. Upper Carnian, Welleri Subzone 2. Baldonnel Formation, northeastern British Columbia. GSC locs. 42320 (1), 42398 (1).

Diagnosis. Tropitid with tuberculation developed as in *Hoplotropites auctus* (Dittmar), but with very thick depressed whorls, H being about 45 per cent, W about 65 per cent, U about 30 per cent of diameter. Sculpture consists of two spirals of tubercles immediately outside the umbilical shoulder, linked by simple straight ribs. On the flank, increase of ribs takes place by bifurcation and some intercalation. Ribs at the margin show a trace of tuberculation. Keel bordered by sulci.

Remarks. Two spirals of tubercles adjacent to the umbilicus are present on the whole of the outer whorl of the holotype (Pl. 97, fig. 8). On the last half whorl there are eight short, simple, bituberculate ribs near the umbilicus. Two ribs branch from these simple ribs. There are also a few intercalated ribs, with a total of about 20 at the margin of the last half whorl. GSC 32096 (Pl. 97, fig. 7) has short ribs near the umbilicus with the outer tubercles more prominent than the inner. In neither specimen are suture lines seen.

This species, like *Hoplotropites? globosus* n. sp., is much thicker and more involute than normal species of *Hoplotropites*. The tuberculation near the umbilicus is essentially the same in both species, but *H.? intermedius* differs in having distinct ribbing.

Genus *Jovites* Mojsisovics, 1893

Type species. Jovites dacus Mojsisovics.

Jovites ellipticus n. sp.

Plate 94, figures 11a-d

Registered material. Holotype GSC 70995 (GSC loc. 94736). Paratype GSC 70996* (GSC loc. 28941).

Occurrence. Upper Carnian, Welleri Subzone 1. Ludington Formation, northeastern British Columbia; Unnamed formation, Telegraph Creek area, British Columbia. GSC locs. 28941 (5), 94736 (1).

Diagnosis. Jovites about 35 mm in diameter; H about 45 per cent, W about 65 per cent, U about 15 per cent of diameter. Outline elliptical.

Remarks. The holotype (Pl. 94, fig. 11) has a ribbed, weakly carinate inner whorl. The body chamber is nearly smooth, and contracted, the width being less than that of the phragmocone. Ultimately it is without a keel. The outline is elliptical, with an obtuse elbow about half a whorl from the aperture (as preserved) and another about a quarter whorl from the aperture. Aperture and peristome are not not well preserved, but the specimen is probably nearly complete. The suture line is not visible.

Specimens from GSC locality 28941 are similarly sculptured and of about the same size as the holotype. Two show a suggestion of elliptical coiling, but not clearly, owing to imperfect preservation. GSC 70996, a phragmocone 17 mm in diameter, shows the septal surface and traces of the suture line revealing two large ammonitic saddles (external and lateral).

The ribbed and weakly carinate phragmocone is unmistakably that of a *Jovites*, but this species is distinguished from all others in having an elliptical outline.

Jovites bosnensis Mojsisovics

Plate 98, figures 8, 9

Halorites (*Jovites*) *bosnensis* Mojsisovics, 1893, p. 52, Pl. 83, figs. 2, 3.

Halorites (*Jovites*) *bosnensis* var. *bajuvarica* Mojsisovics, 1893, p. 53, Pl. 196, figs. 6a-c.

Jovites sp. cf. *J. bosnensis* Mojsisovics. TOZER, 1962a, Pl. 7, figs. 4a, b; TOZER, 1967, p. 34, 62.

Registered material. Hypotype GSC 14314 (GSC loc. 42377). Hypotype GSC 32099 (GSC loc. 42379).

Occurrence. Upper Carnian, Welleri Subzone 2. Pardonet Formation, northeastern British Columbia. GSC locs. 42377 (1), 42379 (1), 42389 (1).

Remarks. Identified with this species are *Jovites* with a body chamber broadly arched in section instead of

being narrowly rounded as in *J. dacus* (Mojsisovics) (1893, p. 49). Krystyn (1982, p. 35–37) makes a case for regarding these two taxa as synonyms, suggesting that the differences may indicate a form of sexual dimorphism. The specimens from Canada do not show details of the suture line.

Jovites borealis Tozer

Plate 103, figures 6a–c; Figure 82a (p. 554)

Jovites borealis Tozer, 1961, p. 86, Pl. 26, figs. 2–7; TOZER, 1967, p. 34, 44.

Registered material. Holotype GSC 14112, three paratypes GSC 14107 (Tozer, 1961, Pl. 26, figs. 2a, b), GSC 14108, GSC 14109 (ibid., figs. 3a, b) (all GSC loc. 28435). Two paratypes GSC 14113 (ibid., fig. 7), GSC 14114 (ibid., fig. 6) (both GSC loc. 26168). Paratype GSC 14115 (ibid., fig. 5) (GSC loc. 30369).

Occurrence. Upper Carnian, Welleri Subzone 2. Blaa Mountain Formation, Axel Heiberg Island; Schei Point Formation, Table Island. GSC locs. 26168 (3), 28435 (14), 28438 (3), 30369 (1), 51650 (10).

Remarks. This species closely resembles *Jovites dacus* (Mojsisovics) (1893, p. 49) and may differ only in being somewhat smaller.

Genus *Arctotropites* n. gen.

Type species. Jovites richardsi Tozer.

Diagnosis. Excentrumbilicate tropitid devoid of tuberculation, with striate inner whorls and a ribbed body chamber.

Species assigned. Jovites richardsi Tozer.

Age. Upper Carnian.

Remarks. The mode of coiling resembles that of some species of *Jovites* Mojsisovics (1893) and *Tropites* Mojsisovics (1875b). *Arctotropites* differs from both in having striate instead of ribbed inner whorls. From *Tropites* it also differs in lacking tuberculation.

Arctotropites richardsi (Tozer)

Plate 103, figures 10a, b

Jovites richardsi Tozer, 1961, p. 88, Pl. 27, figs. 6–8; TOZER, 1967, p. 34, 44.

Registered material. Holotype GSC 14118, two paratypes GSC 14116 (Tozer, 1961, Pl. 27, figs. 6a, b), GSC 14117 (ibid., fig. 7) (all GSC loc. 35611).

Occurrence. Upper Carnian, Welleri Zone. Schei Point Formation, Cameron Island. GSC loc. 35611 (3).

Genus *Acanthotropites* n. gen.

Type species. Acanthotropites racklaensis n. sp.

Diagnosis. Moderately evolute tropitid with quadrangular whorl section. Venter with well defined keel bordered by shallow sulci. Flanks ribbed and tuberculate. Ribs bifurcate on the flank. Tubercles form four spirals: two on the inner flank, one on the outer flank and one at the margin.

Species assigned. Acanthotropites racklaensis n. sp.

Age. Upper Carnian.

Remarks. Tritropidoceras Schenk (1935) is the only tropitid with tuberculation comparable to that of *Acanthotropites*. It differs in having simple ribs and deep sulci bordering the keel. The whorl section of *Acanthotropites* is somewhat like that of *Platotropites* Wang and He (1976), but that genus differs in having tuberculation only at the umbilical shoulder and the margin. *Margaritropites* Diener (1916b) and *Hoplotropites* Spath (1929) also differ in having fewer spirals of tubercles.

Acanthotropites racklaensis n. sp.

Plate 103, figures 3–5

Registered material. Holotype GSC 72179, paratypes GSC 72178, GSC 72180 (all GSC loc. 97561).

Occurrence. Upper Carnian, Welleri Zone? Otuk Formation, Yukon. GSC loc. 97561 (3).

Diagnosis. Acanthotropites attaining a diameter of about 50 mm; H about 40 per cent, W about 40 per cent, U about 25 per cent of diameter. Umbilical and marginal shoulders well defined. Flanks with strong ribs and small rounded tubercles. Tubercle spirals consist of a pair, closely spaced, near the umbilical shoulder, a third spiral on the outer flank, and a fourth weak spiral at the margin. The inner paired tubercles are linked by short, simple ribs. Bifurcation of ribs takes place at the outer of the pair. Strong ribbing is maintained between the paired tubercles and

those on the outer flank. Ribbing weakens outside the outer tubercles and at the margin. Growth striae projected adorad at about 50 degrees. Keel bordered by shallow sulci.

Remarks. The holotype (Pl. 103, fig. 4) and GSC 72178 (Pl. 103, fig. 5) are well preserved phragmocones with crushed parts of the body chamber adhering. When complete both were about 50 mm in diameter. The proportions given in the diagnosis are derived from the complete phragmocone. The holotype and GSC 72178 have nine ribs at the umbilicus, on half a whorl, most or all of which bifurcate on the flank. Marginal tuberculation is fairly well defined in the holotype, much less so in GSC 72178. GSC 72180 (Pl. 103, fig. 3), 13 mm in diameter, is proportionately much thicker than the holotype. Lateral tuberculation comprises an inner pair and an outer spiral, suggesting that it is a nucleus of this species. Suture lines are not seen in any specimens.

No other tropitid has tuberculation in conjunction to branched ribs comparable to that of this species.

Genus *Anatropites* Mojsisovics, 1893

Type species. Tropites (Anatropites) spinosus Mojsisovics.

Anatropites pardoneti n. sp.

Plate 108, figures 13–15

Anatropites sp., TOZER, 1965c, p. 220; TOZER, 1967, p. 61, Pl. 9, figs. 7a, b.

Registered material. Holotype GSC 18911, paratype GSC 32106 (both GSC loc. 64627). Paratype GSC 32107 (GSC loc. 64616).

Occurrence. Upper Carnian, Macrolobatus Zone. Pardonet Formation, northeastern British Columbia. GSC locs. 64616 (12), 64627 (5).

Diagnosis. Anatropites attaining a diameter of at least 45 mm; H about 40 per cent, W about 47 per cent, U about 30 per cent of diameter. Body chamber not contracted. Ribs weak, covering most of flank, but fading on the venter. Two ribs generally stem from each umbilical tubercle. Umbilical tubercles are blunt bullate nodes. Ventral keel not bordered by sulci.

Remarks. On the last half whorl of the holotype (Pl. 108, fig. 14) there are eight umbilical nodes from which stem 15 ribs. Growth lines meet the keel at an angle of about 15 degrees. GSC 32106 (Pl. 108, fig. 13), an incomplete specimen about 30 mm in diameter, shows branching of ribs at mid-flank, but in other characters resembles the holotype. Details of the suture line are not seen in any specimens.

This species closely resembles *Anatropites nihalensis* Diener (1906, p. 153), which differs in having true spines at the umbilical shoulder and more prominent ribbing.

Anatropites cupressus n. sp.

Plate 105, figures 3a, b

Registered material. Holotype GSC 71029 (GSC loc. 94738).

Occurrence. Upper Carnian, Macrolobatus Zone. Ludington Formation, northeastern British Columbia. GSC loc. 94738 (1).

Diagnosis. Anatropites attaining a diameter of at least 50 mm; H is about 35 per cent, W about 40 per cent, U about 43 per cent of diameter. Body chamber not contracted. Ribs strong on flank, fading on venter. Two ribs commonly stem from each umbilical tubercle. Umbilical tubercles are bullate nodes. Ventral keel not bordered by sulci, at least on the outer whorl.

Remarks. On half of the outer whorl of the holotype (Pl. 105, fig. 3) there are seven umbilical nodes, from which stem 12 ribs. Growth lines meet the keel at an angle of about 25 degrees. Suture lines are not visible.

Compared with *Anatropites pardoneti* n. sp., this species is more evolute and has more pronounced ribbing and tuberculation.

Anatropites maclearni n. sp.

Plate 105, figures 6a, b; Plate 108, figures 11, 12

Registered material. Holotype GSC 32111, paratype GSC 32112 (both GSC loc. 68202). Hypotype GSC 71030 (GSC loc. 94738).

Occurrence. Upper Carnian, Macrolobatus Zone. Ludington Formation, northeastern British Columbia; Pardonet Formation, northeastern British Columbia. GSC locs. 68202 (2), 68221 (5), 94738 (1).

Diagnosis. Anatropites attaining a diameter of at least 35 mm; H about 32 per cent, W about 40 per cent, U

about 35 per cent of diameter. Body chamber not contracted. Ribs very weak, confined to the inner flank. One, less commonly two, ribs stem from each umbilical tubercle. Umbilical tubercles are sharp bullate nodes. Ventral keel bordered by shallow sulci.

Remarks. On half of the outer whorl of the holotype (Pl. 108, fig. 11) there are nine umbilical nodes, from which stem 10 ribs. Growth lines meet the keel at an angle of about 20 degrees. Part of the last septum is the visible, followed by one whorl of the body chamber, but details of the suture line cannot be seen. The specimens from GSC locality 68221 are crushed, but nevertheless appear to be closely comparable with those from the type locality. GSC 71030 (Pl. 105, fig. 6) has tuberculation and ribbing much like that of the holotype on part of the outer whorl. This fades in the last quadrant.

This species differs from *Anatropites nihalensis* Diener, *A. pardoneti* n. sp., and *A. cupressus* n. sp. in having very faint, instead of distinct, ribbing. Also, the umbilical tubercles are sharper, compared with those of *A. pardoneti,* and the umbilicus is small, compared with that of *A. cupressus.*

Etymology. The name commemorates F.H. McLearn.

Anatropites silberlingi n. sp.

Plate 105, figures 2a–c

Tropites (*Anatropites*) sp., SILBERLING, 1959, p. 51, Pl. 5, figs. 12–15, 18–21.

Registered material. Holotype GSC 71028 (GSC loc. 94738).

Occurrence. Upper Carnian, Macrolobatus Zone. Ludington Formation, northeastern British Columbia. GSC loc. 94738 (1).

Diagnosis. Anatropites attaining a diameter of at least 37 mm; H about 38 per cent, W about 45 per cent, U about 35 per cent of diameter. Body chamber not contracted. Ribbing strong on inner flank, fading toward the venter. One or two ribs stem from each umbilical tubercle. Umbilical tubercles are small nodes. Ventral keel bordered by shallow sulci.

Remarks. Suture lines are not preserved. At least part of the outer whorl (Pl. 105, fig. 2) is probably body chamber. On half of the outer whorl there are 10 umbilical nodes, from which stem 14 ribs. Growth lines meet the keel at an angle of 15 degrees or less.

Coiling is much like that of *Anatropites maclearni* n. sp., which differs from *A. silberlingi* in having much less prominent ribbing. Ribbing of *A. cupressus* is similar, but that species is appreciably more evolute. Of the specimens described by Silberling, this species particularly resembles USNM 128289 (Silberling, 1959, Pl. 5, figs. 14, 15).

Etymology. The name is for N.J. Silberling.

Anatropites cascadensis n. sp.

Plate 105, figures 4a, b; Plate 108, figures 16a, b

Tropites sp., McLEARN, 1947a, Pl. 3, figs. 6, 7; McLEARN, 1960a, p. 73, Pl. 8, figs. 10a, b.

Registered material. Holotype GSC 12594 (GSC loc. 9688). Hypotype GSC 32113 (GSC loc. 64628).

Occurrence. Upper Carnian, Macrolobatus Zone. Pardonet Formation, northeastern British Columbia. GSC locs. 9687 (2), 9688 (1), 64628 (1).

Diagnosis. Anatropites attaining a diameter of about 60 mm; H about 30 per cent, W about 60 per cent, U about 38 per cent of diameter. Body chamber not contracted. Ribs strong on inner flank, outer flank nearly smooth with very strongly projected growth lines. One or two ribs stem from each umbilical tubercle. Umbilical tubercles are bullate nodes. Ventral keel bordered by shallow sulci.

Remarks. On the last half whorl of the holotype (Pl. 105, fig. 4), there are eight umbilical nodes, from which stem 12 ribs. Growth lines on the venter meet the keel at an angle of about 30 degrees. GSC 32113 (Pl. 108, fig. 16), the remains of a specimen that attained a diameter of about 65 mm, has sculpture and a depressed whorl section much like that of the holotype. These specimens show no suture lines.

Although it is not certain that the two specimens represent the same species, the name serves to characterize an *Anatropites* with much thicker and depressed whorls compared with *A. pardoneti* n. sp., *A. cupressus* n. sp., *A. maclearni* n. sp., and *A. silberlingi* n. sp.

Anatropites ausoniformis n. sp.

Plate 105, figures 5a–c

Registered material. Holotype GSC 71031 (GSC loc. 94738).

Occurrence. Upper Carnian, Macrolobatus Zone. Ludington Formation, northeastern British Columbia. GSC loc. 94738 (1).

Diagnosis. Anatropites attaining a diameter of at least 55 mm; H about 25 per cent, W about 65 per cent, U about 40 per cent of diameter. Body chamber contracted to W of about 40 per cent of diameter. Ribs very weak, confined to inner flank, with one rib stemming from each umbilical tubercle. Umbilical tubercles are bullate nodes, becoming increasingly bullate toward the aperture. Ventral keel not bordered by sulci.

Remarks. The contraction of the outer whorl and the degeneration of sculpture indicates that the holotype (Pl. 105, fig. 5) was a complete, or nearly complete, mature specimen. On the last half whorl there are eight nodes at the umbilicus, from which stem simple ribs. Growth lines meet the keel at an angle of about 20 degrees. No suture lines are exposed.

The most closely comparable species appears to be *Tropites ausonii* Mojsisovics (1893, p. 217), which differs in having more prominent ribbing, with some bifurcation at the umbilical tubercles.

Anatropites sulfurensis n. sp.

Plate 108, figures 9, 10; Figure 86b, c (p. 564)

Tropites sp. aff. *T. latiumbilicatus* Silberling. TOZER, 1967, p. 35, 61.

Registered material. Holotype GSC 32108, two paratypes GSC 32109, GSC 32110* (all GSC loc. 68202).

Occurrence. Upper Carnian, Macrolobatus Zone. Pardonet Formation, northeastern British Columbia. GSC loc. 68202 (3).

Diagnosis. Anatropites attaining a diameter of at least 47 mm; H about 35 per cent, W about 45 per cent, U about 43 per cent of diameter. Body chamber contracted to W of about 40 per cent of diameter. Ribs very weak, confined to the inner flank, with one, less commonly two, stemming from each umbilical tubercle. Umbilical tubercles are sharp bullate nodes, becoming blunt toward the aperture. Ventral keel bordered by shallow sulci at a small diameter, without sulci on the body chamber.

Remarks. The holotype (Pl. 108, fig. 9) has a projected rostrum, with nodes greatly reduced in strength on the last quadrant. It was probably a complete, mature specimen. There are 18 umbilical nodes on the outer whorl. GSC 32109 (Pl. 108, fig. 10) and GSC 32110 (Fig. 86b) are nuclei showing suture lines.

The most closely comparable species are *Anatropites xenophanis* Diener (1923, p. 157) and *A. latiumbilicatus* (Silberling) (1959, p. 47). *Anatropites xenophanis* differs in having denser umbilical tuberculation, *A. latiumbilicatus* has a larger umbilicus and a more contracted body chamber.

Anatropites sp. indet.

Plate 104, figures 12a–c

Registered material. GSC 85818 (GSC loc. C–157119).

Occurrence. Upper Carnian, Macrolobatus Zone. Peril Formation, Queen Charlotte Islands, British Columbia. GSC loc. C–157119 (1).

Remarks. GSC 85818 is a crushed, depressed cadicone. The venter is broad and merely with striae that meet the keel at an angle of about 60 degrees. It is evidently the nucleus of a species like *Anatropites ausoniformis* n. sp.

Genus *Euisculites* Spath, 1951

Type species. Isculites bittneri Gemmellaro.

Euisculites krystyni n. sp.

Plate 107, figures 7, 8; Figure 85e (p. 562)

Registered material. Holotype GSC 43084, two paratypes GSC 43085, GSC 43086* (all GSC loc. 68221).

Occurrence. Upper Carnian, Macrolobatus Zone. Pardonet Formation, northeastern British Columbia. GSC loc. 68221 (3).

Diagnosis. Euisculites about 30 mm in diameter; H about 40 per cent, W about 50 per cent, U about 25 per cent of diameter. Venter without a keel. Strigation absent. Suture line with external saddle having relatively few shallow indentations, confined to the sides.

Measurements. Holotype GSC 43084 (Pl. 107, fig. 7): 30, 0.38, 0.52, 0.26.

Remarks. The holotype (Pl. 107, fig. 7) is evidently complete and mature. The whole of the outer whorl being body chamber, no suture lines are seen. In GSC 43085 (Pl. 107, fig. 8), a phragmocone 16 mm in diameter, the suture line is seen (Fig. 85e).

The mode of coiling, absence of ribbing and suture line, indicate affinity with *Euisculites bittneri* (Gemmellaro) (1904, p. 250), which differs in having a wider umbilicus and a faint keel on the outer whorl, probably also in having somewhat deeper indentations in the external saddle. *Euisculites acestes* (Gemmellaro) (ibid., p. 249) is also comparable, but less evolute. *Eusiculites canavarii* (Gemmellaro) (ibid., p. 253) differs in having an appreciably more indented suture line. Probably also congeneric are "*Isculites*" *heimi* Mojsisovics (1893, p. 67), "*I.*" *baltzeri* Mojsisovics (ibid., p. 69) and "*I.*" *petrarcae* Mojsisovics (ibid., p. 71). The first two differ in having delicate strigation, the third in having a much more indented suture line.

Etymology. The name is for Leopold Krystyn.

Genus *Arietoceltites* Diener, 1916b

Type species. Tropiceltites arietitoides Diener.

Arietoceltites lewesensis n. sp.

Plate 126, figures 10a, b

Registered material. Holotype GSC 28912 (GSC loc. 23406).

Occurrence. Lower Norian, Magnus Zone. Lewes River Group, Formation D, southern Yukon. GSC loc. 23406 (1).

Diagnosis. Arietoceltites with umbilicus about 35 per cent of diameter, and about 15 straight ribs on half a whorl.

Remarks. The unique holotype is crushed; no suture lines are seen. The nature of the venter is uncertain. There is certainly a sulcus. It was probably sulcaticarinate. Although the material is imperfect, the style of ribbing suggests affinity with *Arietoceltites arietitoides* (Diener) (1906, p. 156), which differs in being more evolute and in having more numerous ribs that are somewhat curved, not straight as in *A. lewesensis.*

Family TROPICELTITIDAE Spath, 1951

Genus *Tornquistites* Hyatt and Smith, 1905

Type species. Tornquistites evolutus Hyatt and Smith.

Tornquistites transiens n. sp.

Plate 118, figures 5a, b; Figure 93c (p. 584)

Registered material. Holotype GSC 34604, paratype GSC 34605 (both GSC loc. 68181).

Occurrence. Lower Norian, Kerri Subzone 1. Pardonet Formation, northeastern British Columbia. GSC loc. 68181 (2).

Diagnosis. Tornquistites attaining a diameter of about 25 mm; H about 38 per cent, W about 25 per cent, U about 38 per cent of diameter. Venter angular to within a quarter whorl of the aperture, where it becomes arched. Surface with prorsiradiate striae, projected where they cross the venter to form a rounded rostrum.

Measurements. Holotype GSC 34604 (Pl. 118, fig. 5): 24, 0.38, 0.25, 0.38.

Remarks. The holotype (Pl. 118, fig. 5) has a body chamber of seven eighths of a whorl. The last suture line, which is goniatitic, is visible. On the greater part of the outer whorl the venter is obtusely and bluntly angular. There is no raised keel. The acquisition of a rounded venter suggests that it was complete and mature.

The course of the growth lines and the goniatitic suture line suggest affinity with *Tornquistites evolutus* Hyatt and Smith (1905, p. 60), but the new species differs in being more involute and in retaining an angular venter on the outer whorl. There is also a resemblance to weakly keeled, discoidal species that have been assigned to *Styrites*, e.g., *S. caroli* Mojsisovics (1893, p. 275), but that species is appreciably more involute. Typical species of *Styrites* differ from *Tornquistites transiens* in having a raised keel.

Genus *Tardeceras* Hyatt and Smith, 1905

Type species. Tardeceras parvum Hyatt and Smith.

Tardeceras parvum Hyatt and Smith

Plate 94, figures 9a, b; Plate 99, figures 1–4

Tardeceras parvum Hyatt and Smith, 1905, p. 44, Pl. 79, figs. 11–20; SPATH, 1951, p. 111.

Metasibirites parvus (Hyatt and Smith). SMITH, 1927, p. 64, Pl. 60, figs. 31–46; Pl. 79, figs. 11–20.

Tardececeras pygmaeus (Smith). TOZER, 1967, p. 82.

Registered material. Four hypotypes GSC 32125–GSC 32128 (all GSC loc. 20236). Hypotype GSC 32124 (GSC loc. 82936).

Occurrence. Upper Carnian, Welleri Subzone 1. Quatsino Limestone, Vancouver Island, British Columbia. GSC locs. 20236 (15), 82936 (10), 86284 (2).

Remarks. In none of the specimens from Canada are suture lines seen. The variation in rib density and strength of the bullae shown by specimens (Pl. 99, figs. 1–4) from GSC locality 20236 suggests that the ten taxa of "*Metasibirites*", recognized by Smith (1927, p. 62–65), may be variants of one species.

Genus *Styrites* Mojsisovics, 1893

Type species. Styrites tropitiformis Mojsisovics.

Styrites dawsoni n. sp.

Plate 104, figures 4–6

Registered material. Holotype GSC 85788, two paratypes GSC 85789, GSC 85790 (all GSC loc. C–157123).

Occurrence. Upper Carnian, Macrolobatus Zone. Peril Formation, Queen Charlotte Islands. GSC loc. C–157123 (4).

Diagnosis. Styrites about 25 mm in diameter; H about 30 per cent, W about 30 per cent, U about 38 per cent of diameter. Outer whorl not contracted. Surface with curved, simple ribs on the inner flank, about 10 on half a whorl.

Remarks. The holotype (Pl. 104, fig. 4) is a crushed specimen indicating the size attained. The keel on the outer whorl is low, but retained to the aperture. GSC 85789 (Pl. 104, fig. 5) is a well preserved phragmocone 12 mm in diameter, to which adheres crushed parts of the succeeding whorl. Ribs are present on the inner flank and the venter has a rounded raised keel. GSC 85790 (Pl. 104, fig. 6) is smooth and possibly represents another species. In none of the specimens are suture lines preserved.

This species is of the group that links *Tropiceltites* and *Styrites*, exemplified by *Styrites signatus* (Dittmar) (Mojsisovics, 1893, p. 267). There is a resemblance to *Tropiceltites pacificus* n. sp., but in that species the ribs cover the whole of the flank, not merely the inner part.

Etymology. The name commemorates G.M. Dawson.

Styrites communis Mojsisovics

Plate 109, figures 9, 10; Figure 87e, f (p. 566)

Styrites communis Mojsisovics, 1893, p. 273, Pl. 121, figs. 9–14.

Registered material. Two hypotypes GSC 32129, GSC 32130 (both GSC loc. 68180).

Occurrence. Lower Norian, Kerri Subzone 2. Pardonet Formation, northeastern British Columbia. GSC loc. 68180 (2).

Remarks. Identified with this species are *Styrites* with an umbilical width about 35 per cent of the diameter, concentric coiling, no contraction of the body chamber, and no umbilical tuberculation. GSC 32129 (Pl. 109, fig. 9) agrees closely in external characters with the largest specimen described by Mojsisovics (1893, Pl. 121, fig. 12). There are minor differences in the suture lines. The specimens described by Mojsisovics have E deeper than L; those from Canada have L deeper than E.

Genus *Tropiceltites* Mojsisovics, 1893

Type species. Tropiceltites rotundus Mojsisovics.

Tropiceltites pacificus n. sp.

Plate 104, figures 7a, b

Registered material. Holotype GSC 85787 (GSC loc. C–157119).

Occurrence. Upper Carnian, Macrolobatus Zone. Peril Formation, Queen Charlotte Islands, British Columbia. GSC loc. C–157119 (1).

Diagnosis. Tropiceltites about 25 mm in diameter; H about 35 per cent, W about 38 per cent, U about 38 per cent of diameter. Inner whorls relatively compressed. Outer whorl with about 25 curved ribs.

Measurements. Holotype GSC 85787 (Pl. 104, fig. 7): 26, 0.35, 0.38, 0.38.

Remarks. In the holotype (Pl. 104, fig. 7), no suture lines are seen, but judging from the diminished sculpture adjacent to the aperture the specimen is probably of a complete and mature individual. On the last quarter whorl, ribbing is very weak; the preceding one and a half whorls are ribbed; what is seen of the earlier formed whorls in the umbilicus is smooth.

This species very closely resembles *Tropiceltites columbianus* (McLearn), particularly compressed variants like GSC 32138 (Pl. 109, fig. 3). Typical variants of *T. columbianus*, e.g., GSC 32137 (Pl. 109, fig. 7), differ in having inflated, strongly ribbed, inner whorls.

Tropiceltites columbianus (McLearn)

Plate 109, figures 3–7; Figure 87g (p. 566)

Styrites columbianus McLearn, 1940a, p. 48, Pl. 1, fig. 3; McLEARN, 1947a, p. 12, Pl. 3, fig. 1.

Tropiceltites columbianus (McLearn). McLEARN, 1960a, p. 76, Pl. 8, figs. 6a, b; TOZER, 1967, p. 36, 58, 60.

Registered material. Holotype GSC 8827 (McLearn, 1960a, Pl. 8, figs. 6a, b), two topotypes GSC 32137, GSC 32138 (all GSC loc. 9663). Topotype GSC 32139 (GSC loc. 9662). Topotype GSC 32140 (GSC loc. 9661). Hypotype GSC 32141 (GSC loc. 68180).

Occurrence. Lower Norian, Kerri Zone. Pardonet Formation, northeastern British Columbia. GSC locs. 9640 (1), 9661 (1), 9662 (6), 9663 (13), 9672 (8), 68180 (1), 98513 (6), 98515 (2).

Measurements. Holotype GSC 8827: 26, 0.34, 0.34, 0.40. Topotype GSC 32139 (Pl. 109, fig. 5): 34, 0.29, 0.28, 0.39. Topotype GSC 32138 (Pl. 109, fig. 3): 25, 0.32, 0.32, 0.35. Hypotype GSC 32141 (Pl. 109, fig. 4): 27, 0.31, 0.30, 0.39.

Remarks. GSC 32139 (Pl. 109, fig. 5) and GSC 32141 (Pl. 109, fig. 4) have a raised keel at the beginning of the outer whorl, and a bluntly angular venter at the aperture. GSC 32139 has approximated septa. These two are probably complete and mature. GSC 32140 (Pl. 109, fig. 6) also has approximated septa and although the peristome is not preserved, it is probably the remains of another mature individual. GSC 32138 (Pl. 109, fig. 3) is the specimen with slender ribs on the whole of the outer whorl described by McLearn (1960a, p. 77). The suture line of GSC 32139 (Fig. 87g) appears to have a very weakly indented L, but on the holotype and GSC 32141 this lobe is rounded.

Tropiceltites inflatus n. sp.

Plate 109, figures 1, 2

Registered material. Holotype GSC 32135, paratype GSC 32136 (both GSC loc. 68180).

Occurrence. Lower Norian, Kerri Subzone 2. Pardonet Formation, northeastern British Columbia. GSC loc. 68180 (2).

Diagnosis. Tropiceltites about 20 mm in diameter; H about 25 per cent, W about 40 per cent, U about 48 per cent of diameter. Ribbing strong, similar on phragmocone and body chamber, prorsiradiate, about 20 ribs on the outer whorl.

Measurements. Holotype GSC 32135 (Pl. 109, fig. 2): 21, 0.25, 0.38, 0.48. Paratype GSC 32136 (Pl. 109, fig. 1): 21, 0.27, 0.41, 0.48.

Remarks. The holotype (Pl. 109, fig. 2) has half a whorl of body chamber preserved. At the beginning of the outer whorl, the venter has a distinct rounded keel. At the aperture, the keel is barely discernible, presumably indicating the mature form. The whole of the outer whorl of GSC 32136 (Pl. 109, fig. 1) is carinate. The last four septa of the holotype are visible. They are not approximated. L is rounded.

This species resembles *Tropiceltites columbianus* (McLearn), but differs in being smaller, more inflated and more evolute.

Discostyrites n. gen.

Type species. Styrites ireneanus McLearn.

Diagnosis. Smooth, discoidal tropiceltitid with a narrow umbilicus (about 15 per cent of diameter or less). Whorl section compressed, with an abruptly rounded umbilical shoulder, weakly convex flanks and a smooth, raised, rounded keel, except on the last quadrant where the keel almost disappears and the venter becomes broad and flat with rounded, but distinct ventral shoulders. Growth striae very weakly falcoid on the flank, projected on the venter with reduction of projection at the aperture. Suture line goniatitic with one auxiliary lobe.

Species assigned. Styrites ireneanus McLearn, *Styrites altus* Mojsisovics (1893, p. 278), *Styrites disciformis* Gemmellaro (1904, p. 10).

Age. Lower Norian.

The keel and the simple suture line indicate affinity with *Styrites* Mojsisovics (1893), but typical representatives of that genus differ in being inflated and have a much larger umbilicus. There is a closer resemblance to the species assigned by Mojsisovics to *Styrites* of the "*Acuti*" group. *Styrites altus* Mojsisovics, which has an umbilicus even smaller than that of *S. ireneanus*, was classed in the "*Acuti*" by Mojsisovics. Here it is assigned to *Discostyrites*. The remaining "*Acuti*" have wider umbilici and form a link between *Styrites* and *Discostyrites*.

Discostyrites ireneanus (McLearn)

Plate 109, figures 8a, b; Plate 110, figures 1–3; Figure 88b (p. 568)

Styrites ireneanus McLearn, 1940a, p. 48, Pl. 1, figs. 1, 2; McLEARN, 1947a, p. 12, Pl. 3, fig. 2, 3; McLEARN, 1960a, p. 75, Pl. 8, figs. 3a, b; TOZER, 1965c, p. 220; TOZER, 1967, p. 36, 58.

Registered material. Holotype GSC 8826 (McLearn, 1960a, Pl. 8, figs. 3a, b) three topotypes GSC 32131–GSC 32133 (all GSC loc. 9663). Hypotype GSC 32134 (GSC loc. 64597).

Occurrence. Lower Norian, Kerri Subzone 1. Pardonet Formation, northeastern British Columbia. GSC locs. 9659 (5), 9663 (30), 9672 (1), 64597 (1), 98514 (6).

Measurements. Topotype GSC 32133 (Pl. 110, fig. 3): 31, 0.48, 0.26, 0.14. Topotype GSC 32132 (Pl. 110, fig. 2): 34, 0.47, 0.26, 0.15.

Remarks. GSC 32133 (Pl. 108, fig. 3), the specimen referred to by McLearn (1960a, p. 75) as having a relatively wide flat venter, evidently indicates the mature form.

Family THISBITIDAE Spath, 1951

Genus *Thisbites* Mojsisovics, 1893

Type species. Ceratities (*Thisbites*) *agricolae* Mojsisovics.

Thisbites selwyni n. sp.

Plate 108, figures 1, 2

Registered material. Holotype GSC 32293 (GSC loc. 64628). Hypotype GSC 32294 (GSC loc. 64617).

Occurrence. Upper Carnian, Macrolobatus Zone. Pardonet Formation, northeastern British Columbia. GSC locs. 64616 (1), 64617 (1), 64628 (1).

Diagnosis. Thisbites about 30 mm in diameter; H about 40 per cent, W about 30 per cent, U about 33 per cent of diameter. Flanks flat, ventral shoulders moderately well defined. Ribs mostly simple, delicate and faint. On the phragmocone, ribs end abruptly at small, low, round tubercles. Phragmocone with raised keel, not bordered by sulci. Mature body chamber shows loss of keel and external tuberculation, most ribs cross the venter without interruption.

Remarks. The holotype (Pl. 108, fig. 1) has a distinct keel at the beginning of the outer whorl, but no keel near the aperture. It is probably complete and mature. Ribbing is very fine and delicate, with about 20, mostly simple, ribs on the first quarter of the outer whorl. Ribs and growth striae are not clearly differentiated. No suture lines are visible. GSC 32294 (Pl. 108, fig. 2) has more distinct ribbing.

The most closely related species is *Thisbites custi* McLearn. The holotype of *T. selwyni* has much finer ribbing than examples of *T. custi*, but the ribbing of GSC 32294 is much the same.

Etymology. The name commemorates A.R.C. Selwyn.

Thisbites huxleyi n. sp.

Plate 104, figures 3a–c

Registered material. Holotype GSC 85786 (GSC loc. C–157119).

Occurrence. Upper Carnian, Macrolobatus Zone. Peril Formation, Queen Charlotte Islands. GSC loc. C–157119 (3).

Diagnosis. Thisbites about 17 mm in diameter; H about 38 per cent, W about 35 per cent, U about 32 per cent of diameter. Ribs mostly simple, a few merging at the umbilicus, about 11 at the margin on a quadrant.

Measurements. Holotype GSC 85786 (Pl. 104, fig. 3): 17, 0.38, 0.35, 0.32.

Remarks. In the holotype (Pl. 104, fig. 3), half a whorl of body chamber is preserved. The aperture appears to be the peristome, probably indicating that the specimen is complete. At the beginning of the outer whorl, the marginal tubercles and keel are very distinct. Adorad they become less so. The last three ceratitic septa are

visible. No approximation is apparent. L is indented, U2 is not visible.

This species differs in having more regular and distinct ribbing compared to *Thisbites selwyni* n. sp. Ribbing is less dense compared to *Thisbites custi* McLearn, much less so than in *T. petralis* n. sp.

Thisbites custi McLearn

Plate 108, figures 5–8; Figure 86a (p. 564)

Thisbites charybdis var. *custi* McLearn, 1940a, p. 49, Pl. 1, figs. 6, 7.

Thisbites charybdis var. *ireneanus* McLearn, 1940a, p. 49, Pl. 1, figs. 9, 10 (only).

Thisbites custi (McLearn). McLEARN, 1960a, p. 65, Pl. 6, figs. 3–5; TOZER, 1967, p. 58.

Registered material. Holotype GSC 8801 (McLearn, 1960a, Pl. 6, figs. 5a, b), topotype GSC 8802 (holotype of *T. charybdis* var. *ireneanus*) (ibid., Pl. 6, figs. 3a, b) (both GSC loc. 9672). Topotype GSC 12588 (ibid., Pl. 6, fig. 4) (GSC loc. 9662). Four hypotypes GSC 32295–GSC 32298 (all GSC loc. 68181).

Occurrence. Lower Norian, Kerri Subzone 1. Pardonet Formation, northeastern British Columbia. GSC locs. 9638 (1), 9662 (1), 9663 (1), 9672 (17), 64597 (2), 68181 (7), 98512 (1), 98513 (5).

Remarks. Identified with this species are *Thisbites* that have dense ribbing compared to that of *T. huxleyi* n. sp., there being about 15 ribs on a quadrant at the margin. Most ribs are simple; a few merge at the umbilicus.

Thisbites petralis n. sp.

Plate 108, figures 3, 4

Thisbites charybdis var. *ireneanus* McLearn, 1940a, p. 49, Pl. 2, fig. 3 (only).

Thisbites charybdis Gemmellaro. McLEARN, 1960a, p. 64, Pl. 6, fig. 6; Pl. 7, fig. 6.

Registered material. Holotype GSC 14330 (GSC loc. 9638). Paratype GSC 8791 (= paratype of *T. charybdis* var. *ireneanus*) (GSC loc. 9663).

Occurrence. Lower Norian, Kerri Subzone 1. Pardonet Formation, northeastern British Columbia. GSC locs. 9638 (1), 9663 (1).

Diagnosis. Thisbites about 20 mm in diameter; H about 42 per cent, W about 30 per cent, U about 22 per cent of diameter. Ribs, keel and marginal tubercles well defined on phragmocone. Ribs mostly simple, a few merge near the umbilical margin or on the inner flank, about 20 to a quadrant at the margin.

Measurements. Holotype GSC 14330 (Pl. 108, fig. 4): 20, 0.42, 0.30, 0.22.

Remarks. In neither specimen are the suture lines seen. The holotype (Pl. 108, fig. 4) has the keel and marginal tuberculation well defined at the beginning of the outer whorl, much less so at the aperture. It was probably complete and mature. GSC 8791 (Pl. 108, fig. 3), robustly sculptured on the whole of the outer whorl, appears to be an incomplete specimen.

McLearn identified these specimens as *T. charybdis* Gemmellaro (1904, p. 35) and the resemblance is indeed very close. Comparison with a plaster replica shows that the marginal tuberculation is less conspicuous on Gemmellaro's type specimen. The density of the ribbing is appreciably greater compared to that of *T. custi* McLearn.

Thisbites robustus n. sp.

Plate 112, figures 4a–c

Thisbites sp. cf. *T. pyrami* (Gemmellaro). McLEARN, 1960a, p. 67.

Registered material. Holotype GSC 13481 (GSC loc. 9672).

Occurrence. Lower Norian, Kerri Subzone 1. Pardonet Formation, northeastern British Columbia. GSC loc. 9672 (1).

Diagnosis. Thisbites attaining a diameter of at least 25 mm; H about 35 per cent, W about 30 per cent, U about 40 per cent of diameter. Ribs simple, very strong, about 20 on half a whorl. On phragmocone, keel is low and blunt, bordered by abrupt rib terminations in the form of rudimentary tubercles.

Remarks. The unique holotype (Pl. 112, fig. 4) is an unusualy strongly ribbed *Thisbites*. Suture lines are not preserved, but the abrupt ending of crystalline preservation suggests that the last quarter whorl is

body chamber. The venter is tolerably well preserved at the beginning of the outer whorl, showing a very low keel. Preservation deteriorates adorad, but it appears that the keel is absent with ribs extending across much of the venter. Ribs appear to be arranged en echelon.

Thisbites pyrami Gemmellaro (1904, p. 34) differs in having secondary ribs on the flank.

Genus *Hadrothisbites* n. gen.

Type species. Hadrothisbites taylori n. sp.

Diagnosis. Thisbitid with quadrangular whorl section, tuberculate at the ventral shoulder, with a carinate venter. Ribbing complex with branching and intercalation on the inner flank. Primary ribs may be weakly bullate at the umbilical margin. Some ribs may loop to tubercles at the ventral shoulder. Suture line with one lateral lobe (L) indented, the other (U2) unindented.

Species assigned. Hadrothisbites taylori n. sp.

Age. Upper Carnian, Macrolobatus Zone.

Remarks. The ribbing is somewhat like that of *Jellinekites* Diener (1906), but in that genus the ribs and growth lines are much more projected on the venter. The keel and external tuberculation are taken to indicate affinity with *Thisbites*, from which *Hadrothisbites* differs in having much more complex ribbing and larger and less regular tubercles.

Hadrothisbites taylori n. sp.

Plate 107, figures 1, 2; Figure 85d (p. 562)

Registered material. Holotype GSC 29012, paratype GSC 29013 (both GSC loc. 68202).

Occurrence. Upper Carnian, Macrolobatus Zone. Pardonet Formation, northeastern British Columbia. GSC loc. 68202 (2).

Diagnosis. Hadrothisbites at least 30 mm in diameter; H about 34 per cent, W about 36 per cent, U about 35 per cent of diameter.

Remarks. The holotype (Pl. 107, fig. 1) has part of the phragmocone and body chamber preserved. At the start of the outer preserved whorl, the test is preserved showing the ventral keel bordered by sulci. The adoral half is steinkern with no sulci evident. Ribs are sharp and sinuous, two generally stemming from short primaries at the rounded umbilical margin, and a third intercalated on the flank. At the start of the outer whorl, the primary ribs become somewhat bullate on the inner flank. Initially the ribs are thickened at the ventral shoulder to form nodose marginal keels. Adorad, discrete nodes of variable strength are developed on the shoulder. Irregular looping of ribs occurs on the whole of the outer whorl. Initially the looping is to the nodose keels at the shoulder. Adorad, looping is to the tubercles. On the best preserved quadrant, there are eight bullate ribs at the umbilical margin, 22 ribs on the flank, and 15 nodes at the ventral shoulder. The suture line shows a deeply indented L and a narrow, unindented U2 (Fig. 85d). E is not visible. GSC 29013 (Pl. 107, fig. 2), a body chamber fragment, is poorly preserved, except at the venter. The keel, external and umbilical tuberculation suggest affinity with the holotype, but the ribs, although poorly preserved, appear to be simple, not complexly branched. Proportions are also different, the whorls of the holotype being more compressed than those in what is preserved of GSC 29013. Despite the differences, GSC 29013 is tentatively interpreted as a representative of this species, giving grounds for suggesting that simple ribbing may have been acquired on the body chamber.

No comparable species are known.

Etymology. The name is for G.C. Taylor.

Genus *Tropithisbites* n. gen.

Type species. Tropiceltites ?densicostatus Silberling.

Diagnosis. Densely ribbed serpenticone carinate thisbitid with rounded umbilical and ventral shoulders. Ribs simple, as wide or wider than interspaces, extending with uniform strength from the umbilicus to the ventral keel. Tuberculation absent. Ventral keel rounded, smooth, not bordered by sulci.

Species assigned. Tropiceltites ?densicostatus Silberling (1959, p. 51), possibly also *Ceratites* (*Thisbites*) *biondii* Gemmellaro (1904, p. 37), *Thisbites* sp. cf. *T. biondii* Gemmellaro of Welter (1914, p. 129).

Age. Upper Carnian, Macrolobatus Zone.

Remarks. This genus is regarded as a thisbitid, but with equal justification might be assigned to the Tropiceltitidae. The suture line is not perfectly known, but is evidently ceratitic (Silberling, 1959, p. 52), suggesting assignment to the Thisbitidae rather than

the Tropiceltitidae. The style of ribbing is unlike that of all described genera of both families. Ribbing is much denser and more prominent compared to any genus of the Tropiceltitidae although the mode of coiling and the nature of the keel are like that of *Tropiceltites* Mojsisovics (1893) and *Arnioceltites* Mojsisovics (1893). The ribbing on the flank is somewhat like that of *Thisbites* Mojsisovics (1893) and *Metathisbites* n. gen. *Thisbites* differs in having ribs with external tuberculation and a less prominent keel; *Metathisbites* in having a nearly smooth venter.

Tropithisbites densicostatus (Silberling)

Plate 104, figures 8–10

Tropiceltites? *densicostatus* Silberling, 1959, p. 51, Pl. 5, figs. 16–17.

Registered material. Hypotype GSC 85791 (GSC loc. C-157119). Three hypotypes GSC 85792, GSC 85793, GSC 85794* (all GSC loc. C-157382).

Occurrence. Upper Carnian, Macrolobatus Zone. Peril Formation, Queen Charlotte Islands, British Columbia. GSC loc. C-157119 (1), C-157382 (3).

Remarks. None of the specimens is complete or perfectly preserved and in none are suture lines seen. The specimens nevertheless show the distinctive sculpture of this species, namely flat simple ribs, densely arranged, extending from the umbilical seam to the keel.

Genus *Metathisbites* n. gen.

Type species. Buchites hilaris var. *dawsoni* McLearn.

Diagnosis. Thisbitid with ovoid whorl section. Phragmocone with or without a faint keel, body chamber ultimately without a keel and ribs crossing the venter. Ribs prominent, mostly simple, with some ribs intercalated on the flank. Ribs on phragmocone characteristically end abruptly in the form of small, low, rounded external tubercles. Suture line ceratitic.

Species assigned. Buchites hilaris var. *dawsoni* McLearn, *Buchites hilaris* Mojsisovics (1893, p. 415), ?*Thisbites* s.l. (ohne Externknoten) (Krystyn, 1974, p. 5).

Age. Lower Norian.

Remarks. Sculpture on the type species is variable. The holotype (McLearn, 1960a, Pl. 6, figs. 1a, b) has a low keel and faint external tuberculation at the beginning of the outer whorl. A topotype, GSC 12587 (Pl. 109, fig. 11) lacks the keel and tubercles. The sculpture of the holotype clearly indicates affinity with *Thisbites* Mojsisovics (1893), but both the keel and tuberculation in all species of that genus are much more prominent.

Metathisbites dawsoni (McLearn)

Plate 109, figures 11–13; Plate 111, figures 7a, b; Plate 117, figures 6a, b; Figure 87i, j (p. 566)

Buchites hilaris var. *dawsoni* McLearn, 1940a, p. 49, Pl. 1, figs. 4, 5.

Thisbites dawsoni (McLearn). McLEARN, 1960a, p. 63, Pl. 6, figs. 1, 2; TOZER, 1967, p. 35, 57, 58.

Registered material. Holotype GSC 8825 (McLearn, 1960a, Pl. 6, figs. 1a, b), topotype GSC 12587 (both GSC loc. 9643). Three hypotypes GSC 32300, GSC 32301, GSC 34606 (all GSC loc. 68180). Hypotype GSC 34607 (GSC loc. 9856).

Occurrence. Lower Norian, Kerri Subzone 2. Pardonet Formation, northeastern British Columbia. GSC locs. 9643 (2), 9856 (2), 64632 (10), 68180 (10), 84198 (10).

Remarks. The specimens from GSC locality 68180 include some without a ventral keel (Pl. 109, fig. 12, 13) and one (Pl. 111, fig. 7) with a very faint keel preserved on the steinkern.

Metathisbites? *griphus* n. sp.

Plate 109, figures 16a–c; Plate 113, figures 6a, b; Figure 87h (p. 566)

Miltites? sp., McLEARN, 1960a, p. 106.

Registered material. Holotype GSC 32299 (GSC loc. 64625). Three hypotypes GSC 35359*, GSC 35360, GSC 35361* (all GSC loc. 9694).

Occurrence. Lower Norian, Kerri Zone? Pardonet Formation, northeastern British Columbia. GSC locs. 9694 (3), 64625 (2).

Diagnosis. Metathisbites? about 35 mm in diameter; H about 32 per cent, W about 38 per cent, U about 35 per cent of diameter. Ribs strong, increasing by bifurcation or intercalation on the inner third of the flank, somewhat thickened at point of branching. Median line smooth, depressed in relation to rib terminations,

which are not tuberculate. Adjacent to the aperture, some ribs cross the venter.

Measurements. Holotype (Pl. 109, fig. 16): 34, 0.32, 0.38, 0.36.

Remarks. The holotype (Pl. 109, fig. 16) has half a whorl of body chamber preserved and shows a change in whorl section on the last quadrant, the venter changing from arched with the ribs interrupted, to flat with some ribs extending across. The specimen was probably complete and mature. On half a whorl there are 12 ribs at the umbilicus and about double the number at the margin. Except at the aperture, the ribs are arranged en echelon at the venter. The venter, preserved as steinkern, is smooth except on the last quadrant. The specimens identified as *Miltites*? sp. by McLearn are more densely ribbed. GSC 35359*, 27 mm in diameter, is otherwise comparable. GSC 35360 (Pl. 113, fig. 6) is comparable with *Miltites christinae* Mojsisovics (1893, p. 342), as recognized by McLearn. GSC 35361, 31 mm in diameter, resembles GSC 35360 (Pl. 113, fig. 6) except in size. Of all these specimens, only the holotype has a ceratitic suture line with two lateral lobes.

Affinities of this species, even at the level of family, are uncertain. The style of ribbing and ceratitic suture line may indicate affinity with *Metathisbites dawsoni* (McLearn), although it is much smaller, with much simpler ribbing. The resemblance between GSC 35360 and *Miltites christinae* may be significant. The holotype of *Metathisbites*? *griphus* is certainly no *Miltites*, a genus with an ammonitic suture line. But the suture line of *Miltites christinae*, as of GSC 35360, is unknown and it is possible that *Metathisbites* ?*griphus* and *Miltites christinae* are congeneric.

Genus *Stikinoceras* McLearn, 1930

Type species. Stikinoceras kerri McLearn.

Stikinoceras kerri McLearn

Plate 109, figures 17–20; Plate 119, figures 1a, b; Figures 87a, b (p. 566)

Stikinoceras kerri McLearn, 1930, p. 5, Pl. 1, fig. 2; McLEARN, 1947a, p. 13, Pl. 2, figs. 1, 2; SPATH, 1951, p. 75; McLEARN, 1960a, p. 58, Pl. 3, figs. 1–3.

Stikinoceras robustum McLearn, 1937a, p. 98, Pl. 1, fig. 4; SPATH, 1951, p. 76.

Mojsisovicsites kerri (McLearn). SILBERLING, 1959, p. 40, Pl. 1, figs. 3–5; TOZER, 1965c, p. 221; TOZER, 1967, p. 35, 57, 58, 60, 61, 81, Pl. 10, figs. 1a, b; TOZER, 1970, Pl. 18, figs. 8a, b.

Mojsisovicsites robustus (McLearn). SILBERLING, 1959, p. 40, Pl. 1, figs. 1, 2.

Registered material. Holotype GSC 9048 (McLearn, 1960a, Pl. 3, figs. 2a–c), topotype GSC 22736 (Tozer, 1967, Pl. 10, figs. 1a, b) (both GSC loc. 9157). Two topotypes GSC 8839 (holotype *S. robustum*), GSC 12574 (McLearn, 1960a, Pl. 3, fig. 3) (both GSC loc. 9851). Two topotypes GSC 32302, GSC 32303* (GSC loc. 64654). Hypotype GSC 32304 (GSC loc. 64607). Hypotype GSC 32305 (GSC loc. 68180). Hypotype GSC 32306 (GSC loc. 23266).

Occurrence. Lower Norian, Kerri Subzone 2. Pardonet Formation, northeastern British Columbia; unnamed beds, Telegraph Creek area, British Columbia; Quatsino Limestone, Vancouver Island, British Columbia; Parson Bay Formation, Vancouver Island, British Columbia. GSC locs. 9157 (48), 9719 (5), 9851 (24), 13248 (3), 13712 (2), 23266 (1), 64607 (1), 64653 (10), 64654 (75), 64666 (20), 68180 (2), 94741 (5), 97547 (2), 98510 (5), 98561 (1), 98562 (35), 98900 (2).

Remarks. Density of ribbing varies considerably. GSC 32304 (Pl. 109, fig. 17) typifies the most densely ribbed variants; the holotype of *Stikinoceras robustum* (Pl. 119, fig. 1) is a variant with the most widely spaced ribs. The full range of variation is shown by specimens from GSC locality 98562.

Family JUVAVITIDAE Tozer, 1971

Genus *Bacchites* Smith, 1927

Type species. Juvavites (*Anatomites*) *bacchus* Mojsisovics.

Bacchites hyatti (Smith)

Plate 94, figures 8a, b; Plate 99, figures 12–14; Figure 78c (p. 546)

Gonionotites hyatti Smith, 1927, p. 59, Pl. 13, figs. 1–10.

Juvavites (*Anatomites*) sp. cf. *J. hyatti* Smith. TOZER, 1962a, Pl. 8, figs. 14a, b; TOZER, 1967, p. 62.

Registered material. Two hypotypes GSC 14245, GSC 32142 (both GSC loc. 42306). Hypotype GSC 32143 (GSC loc. 56250). Hypotype GSC 32144 (GSC loc. 82936).

Occurrence. Upper Carnian, Welleri Subzone 1. Ludington Formation, northeastern British Columbia; Quatsino Limestone, Vancouver Island, British Columbia; Peril Formation, Queen Charlotte Islands, British Columbia. GSC locs. 42306 (2), 51265 (1), 56250 (4), 69190 (1), 82936 (2).

Remarks. Identified with this species are smooth or nearly smooth juvavitids from the Welleri Zone. The best specimen, GSC 14245 (Pl. 99, fig. 14) has a faint keel on the steinkern, but not on the surface of the test, which is smooth. The suture line (Fig. 78c) lacks distinct auxiliary lobes, indicating reference to *Bacchites*, not *Gonionotites*.

Genus *Projuvavites* Tozer, 1971

Type species. Juvavites (*Anatomites*) *brockensis* Smith.

Projuvavites brockensis (Smith)

Plate 94, figures 7a, b; Plate 99, figures 7–10; Figure 78a, b (p. 546)

Juvavites (*Anatomites*) *brockensis* Smith, 1927, p. 56, Pl. 16, figs. 15–24.

Juvavites sp. cf. *J. brockensis* Smith. TOZER, 1967, p. 62.

Registered material. Five hypotypes GSC 32145–GSC 32149 (all GSC loc. 42306). Hypotype GSC 32151 (86284).

Occurrence. Upper Carnian, Welleri Subzone 1. Ludington Formation, northeastern British Columbia; Quatsino Limestone, Vancouver Island, British Columbia. GSC locs. 20236 (6), 23066 (10), 42306 (10), 42384 (1), 82936 (3), 86284 (1).

Remarks. All the specimens from British Columbia have close counterparts among those from the type locality, Brock Mountain, California.

Projuvavites strongi (Smith)

Plate 99, figures 11a–c; Figure 78a

Juvavites (*Anatomites*) *strongi* Smith, 1927, p. 58, Pl. 16, figs. 1–10.

Registered material. Hypotype GSC 32150 (GSC loc. 42306).

Occurrence. Upper Carnian, Welleri Subzone 1. Ludington Formation, northeastern British Columbia. GSC loc. 42306 (1).

Remarks. Except for being a little less inflated, GSC 32150 (Pl. 99, fig. 11) closely resembles the holotype from Brock Mountain, California. This species may be no more than an inflated variant of *Projuvavites brockensis* (Smith).

Genus *Goniojuvavites* Krystyn, 1982

Type species. Projuvavites (*Goniojuvavites*) *tuvalicus* Krystyn.

Goniojuvavites kellyi (Smith)

Plate 100, figures 1–6; Plate 101, figures 1–9; Figures 79 (p. 548), 80 (p. 550)

Juvavites kellyi Smith, 1927, p. 55, Pl. 18, figs. 8–25.

Juvavites (*Anatomites*) sp. cf. *J. knowltoni* Smith. TOZER, 1962a, Pl. 8, figs. 13a, b; TOZER, 1967, p. 84; TOZER, 1970, Pl. 18, figs. 7a, b.

Juvavites subintermittens Hyatt and Smith. TOZER, 1967, p. 34, 62 (not of HYATT and SMITH, 1905, p. 47).

Registered material. Ten hypotypes, GSC 14244, GSC 32152–GSC 32160 (all GSC loc. 42389). Hypotype GSC 32161 (GSC loc. 42388). Hypotype GSC 32162 (GSC loc. 42320). Hypotype GSC 32163 (GSC loc. 42325). Hypotype GSC 32164 (GSC loc. 68360). Hypotype GSC 32165 (GSC loc. 42378). Hypotype GSC 32166 (GSC loc. 42377).

Occurrence. Upper Carnian, Welleri Subzone 2. Baldonnel Formation, northeastern British Columbia; Pardonet Formation, northeastern British Columbia; Quatsino Limestone, Vancouver Island, British Columbia. GSC locs. 24335 (2), 42320 (4), 42322 (1), 42323 (2), 42325 (4), 42377 (1), 42378 (1), 42379 (2), 42385 (1), 42388 (6), 42389 (100), 68360 (2).

Remarks. The juvavitids identified with this species are known from numerous phragmocones, but data for the body chamber are sparse. At GSC locality 42389, the phragmocones vary greatly in proportions and strength of ribbing. The variation encountered at this locality is taken to justify a broad interpretation of the species.

To a diameter of about 25 mm, ribbing is generally strong and paulostome constrictions may be present. Of those with constrictions, GSC 32152 (Pl. 101, fig. 1) has weakened ribbing adorad of the constrictions; GSC 32155 (Pl. 100, fig. 5) does not. GSC 32153 (Pl. 101, fig. 2), at the same diameter, has no constrictions. At a diameter of about 40 mm, compressed variants are nearly smooth, e.g., GSC 32156 (Pl. 100, fig. 4). Thicker examples, like GSC 32157 (Pl. 100, fig. 1) have distinct ribbing that is interrupted on the venter. This specimen closely resembles the holotype from Squaw Creek, California. Specimens with distinct ribbing, e.g., GSC 14244 (Pl. 101, fig. 8) show increase by bifurcation or intercalation at both the inner third and outer third of the flank. GSC 32160 (Pl. 100, fig. 6) is a well preserved ribbed phragmocone with part of the body chamber, unfortunatelty crushed, but nearly smooth. The ribbed part of this specimen also resembles the holotype. The specimens from this locality are interpreted to indicate that *Goniojuvavites kellyi* was characterized by a phragmocone that varied from thick and ribbed to thin and smooth, followed by a smooth body chamber.

Some specimens referred to *G. kellyi* from other localities do not have exact counterparts at GSC locality 42389 and may represent different species. GSC 32165 (Pl. 101, fig. 9), a large smooth specimen, shows no septa, but probably has the body chamber preserved. Although more compressed, it is comparable to GSC 32160 (Pl. 100, fig. 6). GSC 32161 (Pl. 101, fig. 3) and GSC 32162 (Pl. 101, fig. 4) are small specimens with particularly deep constrictions, but are nevertheless somewhat comparable to GSC 32152 (Pl. 101, fig. 1). These two are from the same locality as GSC 32163 (Pl. 101, fig. 6) and GSC 32164 (Pl. 101, fig. 5), larger specimens with characters more typical of *G. kellyi*.

Genus *Gonionotites* Gemmellaro, 1904

Type species. Gonionotites italicus Gemmellaro.

Gonionotites avarus n. sp.

Plate 105, figures 1a, b; Plate 107, figures 3–6; Figure 85a–c (p. 562)

Registered material. Holotype GSC 32167, three paratypes GSC 32168, GSC 32169, GSC 32170 (all GSC loc. 68202). Hypotype GSC 71027 (GSC loc. 94738).

Occurrence. Upper Carnian, Macrolobatus Zone. Ludington Formation, northeastern British Columbia; Pardonet Formation, northeastern British Columbia. GSC locs. 68202 (4), 94738 (1).

Diagnosis. Gonionotites attaining a diameter of at least 90 mm; H about 55 per cent, W 45–50 per cent, U small, less than 8 per cent of diameter. Venter of outer whorl broadly arched. Phragmocone with distinct, relatively thick ribs, ribbing on body chamber is weaker, but perceptible. Ribs are of even strength on the whole flank, bifurcating at mid-flank or outer flank. Ribs interrupted on venter, ventral projection weak (70–80 degrees). Suture line with at least three well developed auxiliary lobes.

Remarks. The holotype (Pl. 107, fig. 6) is a complete undistorted phragmocone with half a whorl of slightly crushed body chamber. The contrast in ribbing between the phragmocone and the body chamber is clear. Suture lines are not perfectly preserved, but the elements are deeply indented in the style of *Gonionotites*. GSC 32170 (Pl. 107, fig. 3), at a diameter of 38 mm, has shallow paulostome constrictions. This specimen, and GSC 32168 (Pl. 107, fig. 5), a phragmocone 43 mm in diameter, have three auxiliary lobes (Figs. 85a–c) as has GSC 71027 (Pl. 105, fig. 1).

The shape and sculpture is much like that of species of the slightly older genus *Goniojuvavites*, but this species differs, and is assigned to *Gonionotites* because of the well developed auxiliary lobes.

Gonionotites nobilis n. sp.

Plate 106 figs. 2–7; Figure 84 (p. 560)

Gonionotites gethingi (McLearn). TOZER, 1965c, p. 220; TOZER, 1967, p. 61 (not of McLEARN, 1947a, p. 14, Appendix p. 1).

Registered material. Holotype GSC 32171, three paratypes GSC 32172–GSC 32174 (all GSC loc. 64628). Two paratypes GSC 32177, GSC 32178 (both GSC loc. 68202).

Occurrence. Upper Carnian, Macrolobatus Zone. Pardonet Formation, northeastern British Columbia. GSC locs. 64628 (4), 68202 (2).

Diagnosis. Gonionotites attaining a diameter of at least 55 mm; H about 55 per cent, W about 40 per cent, U small, less than 8 per cent of diameter. Venter of outer whorl narrowly arched. Phragmocone with relatively thin ribs, ribbing on body chamber is weaker, but perceptible. Ribs are of even strength on whole flank at

small (about 25 mm) diameter, bifurcating at the mid-flank or outer flank, at larger diameters more prominent on the outer than the inner flank, the inner and mid-flank becoming nearly smooth. Ribs projected on the outer flank, interrupted on the venter, ventral projection weak (about 70 degrees). Suture line with at least three well developed auxiliary lobes.

Remarks. GSC 32174 (Pl. 106, fig. 5), the remains of a specimen about 55 mm in diameter, is the largest known specimen. Only part of the outer whorl is preserved, most of which appears to be body chamber. The holotype (Pl. 106, fig. 4) is a complete phragmocone 38 mm in diameter, that has part of the body chamber preserved near the umbilicus. This specimen shows a decline in ribbing on the inner flank of the adorad quadrant of the phragmocone. GSC 32172 (Pl. 106, fig. 2) (diameter 17 mm) and GSC 32173 (Pl. 106, fig. 3) (diameter 30 mm) have uniform ribbing on the flank and paulostome furrows. The holotype and GSC 32178 (Fig. 84) have three auxiliary lobes.

This species is distinguished from *Gonionotites avarus* n. sp. by having ribs that vary in strength on the whorl side, being more pronounced on the outer than on the inner flank.

Gonionotites gethingi McLearn

Plate 114, figures 4a–c

Juvavites (*Gonionotites*) *gethingi* McLearn, 1947a, p. 12, Appendix p. 1, Pl. 3, figs. 4, 5.

Gonionotites gethingi (McLearn). McLEARN, 1960a, p. 93, Pl. 13, figs. 3, 4a, b.

not *Gonionotites gethingi* (McLearn). TOZER, 1965c, p. 220; 1967, p. 61 (= *Gonionotites nobilis* n. sp.).

Registered material. Holotype GSC 9490 (McLearn, 1960a, Pl. 13, fig. 3), paratype GSC 9491 (ibid., figs. 4a, b), topotype GSC 32203 (all GSC loc. 9640).

Occurrence. Lower Norian, Kerri Subzone 1. Pardonet Formation, northeastern British Columbia. GSC locs. 9640 (8), 98880 (1).

Remarks. This species resembles *Gonionotites nobilis* n. sp., but is distinguished by having thin ribs on the inner flank.

Gonionotites scapulatus n. sp.

Plate 116, figures 1–3

Registered material. Holotype GSC 72335 (GSC loc. 9640). Paratype GSC 72336 (GSC loc. 9672). Paratype GSC 32181 (GSC loc. 42444).

Occurrence. Lower Norian, Kerri Subzone 1. Pardonet Formation, northeastern British Columbia. GSC locs. 9640 (1), 9672 (1), 42444 (1).

Diagnosis. Gonionotites with inner whorls strongly and uniformly ribbed, and a smooth body chamber with distinct ventral shoulders.

Remarks. The holotype (Pl. 116, fig. 2) has a penultimate whorl with strong, relatively thick ribs and a smooth outer whorl with rounded, but distinct ventral shoulders. Suture lines have not been exposed, but there is little doubt that the outer whorl is body chamber. GSC 72336 (Pl. 116, fig. 3) has a smooth outer whorl and a ribbed penultimate whorl. It, too, probably has the body chamber preserved. GSC 32181 (Pl. 116, fig. 1) is a phragmocone with an outer whorl at first ribbed, then smooth. It shows that the smooth stage may be attained on the phragmocone. Septa are visible, but details of the suture line have not been determined.

Gonionotites scapulatus is distinguished from the otherwise similar *Gonionotites avarus* n. sp. by having distinct ventral shoulders on the body chamber.

Gonionotites spiekeri McLearn

Plate 114, figures 9a, b; Figure 91d (p. 576)

Juvavites (*Gonionotites*) *spiekeri* McLearn, 1937b, p. 130, Pl. 1, fig. 13.

Gonionotites spiekeri (Mclearn). McLEARN, 1960a, p. 94, Pl. 14, figs. 1a–c.

Gonionotites sp. cf. *G. italicus* Gemmellaro. McLEARN, 1960a, p. 94, Pl. 20, fig. 3.

Registered material. Holotype GSC 8807 (McLearn, 1960a, Pl. 14, figs. 1a–c) (GSC loc. 9157). Hypotype GSC 13483 (ibid., Pl. 20, fig. 3) (GSC loc. 9640). Hypotype GSC 32180 (GSC loc. 83826).

Occurrence. Lower Norian, Kerri Zone. Pardonet Formation, northeastern British Columbia. GSC locs. 9157 (1), 9640 (1), 64654 (1), 83826 (1).

Remarks. This is a weakly sculptured *Gonionotites* comparable to *G. nobilis* n. sp. and *G. gethingi* McLearn. The holotype and all other specimens are entirely septate. None have the body chamber

preserved. The presence of thin, but distinct ribs on the inner flank of GSC 32180 (Pl. 114, fig. 9) distinguish this specimen from examples of *G. nobilis*. This style of ribbing is like that of *G. gethingi*, a species known only from relatively small specimens. *Gonionotites gethingi* and *G. spiekeri* are possibly small and large representatives of one species, but without knowledge of the body chamber of *G. spiekeri*, this cannot be determined.

Gonionotites rarus McLearn

Plate 119, figures 8a, b; Figure 94 (p. 586)

Juvavites (Gonionotites) rarus McLearn, 1940c, p. 114, Pl. 3, fig. 5; McLEARN, 1947a, p. 12, Pl. 2, fig. 7.

Gonionotites rarus (McLearn). McLEARN, 1960, p. 97, Pl. 15, figs. 2, 3; TOZER, 1965c, p. 221; TOZER, 1967, p. 36, 57, 58, 61.

Registered material. Holotype GSC 8830 (McLearn, 1960a, Pl. 15, figs. 3a–c), topotype GSC 9512 (ibid., figs. 2a, b) (both GSC loc. 9854). Topotype GSC 32179* (GSC loc. 64654). Hypotype GSC 72351* (GSC loc. 98899).

Occurrence. Lower Norian, Kerri Subzone 2. Pardonet Formation, northeastern British Columbia. GSC locs. 9719 (6), 9854 (5), 64629 (1), 64654 (7), 64666 (1), 94741 (2), 98511 (2), 98899 (2).

Remarks. This species differs from all other *Gonionotites* in the Canadian faunas by the complete absence of ribbing. Other distinctive features are: the compressed form; a venter broad at the mature aperture, but narrowly rounded on most of the conch; and a very small, probably occluded umbilicus. The suture line has at least three auxiliary lobes (Fig. 94).

Genus *Griesbachites* Mojsisovics, 1896

Type species. Ammonites medleyanus Stoliczka.

Griesbachites auctoris n. sp.

Plate 106, figures 1, 8

Griesbachites sp. cf. *G. kastneri* (Mojsisovics). TOZER, 1967, p. 35, 61.

Registered material. Holotype, GSC 32176, hypotype GSC 32175 (both GSC loc. 64628).

Occurrence. Upper Carnian, Macrolobatus Zone. Pardonet Formation, northeastern British Columbia. GSC loc. 64628 (2).

Diagnosis. Griesbachites at least 55 mm in diameter; H about 50 per cent, W about 40 per cent, U less than 10 per cent of diameter. Ribbing weak, with bifurcation on the inner flank. Ribs interrupted on the venter with moderate (45 degree) projection. Marginal tubercles small, present only on the body chamber.

Remarks. This species is certainly known from only one incomplete specimen (Pl. 106, fig. 8). Suture lines are not preserved, but about half of the outer whorl appears to be body chamber. On the last half whorl there are about 10 ribs at the umbilicus and about 15 on the flank. GSC 32175 (Pl. 106, fig. 1) is a phragmocone devoid of marginal tubercles and with barely perceptible ribbing. It is from the same bed as the holotype and is tentatively assigned to the species. The suture line is not well preserved, but there are two well developed auxiliary lobes outside the umbilical shoulder.

Griesbachites kastneri (Mojsisovics) (1893, p. 95) is somewhat similar, but differs in having nodes on the phragmocone.

Griesbachites pinensis n. sp.

Plate 115, figures 8, 9

Registered material. Holotype GSC 32209 (GSC loc. 83826). Paratype GSC 32204 (GSC loc. 9640).

Occurrence. Lower Norian, Kerri Subzone 1. Pardonet Formation, northeastern British Columbia. GSC locs. 9640 (1), 83826 (1).

Diagnosis. Griesbachites at least 75 mm in diameter; H about 55 per cent, W about 30 per cent, U less than 10 per cent of diameter. Ribbing strong on phragmocone, weak on body chamber. Phragmocone ribs bifurcate at the inner and outer third of the flank. Ribs interrupted on the venter with moderate (45 degree) projection. Marginal tubercles small, present only on the body chamber.

Remarks. The last half whorl of the holotype (Pl. 115, fig. 8) is body chamber. Septa can be seen, but suture lines are not well preserved. There is a close resemblance to *Griesbachites auctoris* n. sp., but that species has more uniform ribbing, which is not known to be as strong as that on the phragmocone of *G. pinensis*.

Griesbachites humi (McLearn)

Plate 115, figures 1–7; Plate 117, figures 2a–c; Figure 92a, b (p. 578)

Juvavites (Anatomites) humi McLearn, 1937b, p. 130, Pl. 1, fig. 4; McLEARN, 1947a, p. 11, Pl. 2, fig. 5; McLEARN, 1960, p. 88, Pl. 11, figs. 2a–c; Pl. 12, figs. 3a, b, 4a, b.

Juvavites mackenzii McLearn, 1937b, p. 130, Pl. 1, fig. 5; McLEARN, 1960a, p. 86, Pl. 11, figs. 1a, b.

Juvavites (Griesbachites) caurinus McLearn, 1947a, p. 11, Appendix p. 2, Pl. 2, fig. 6.

Juvavites humi McLearn. TOZER, 1967, p. 36, 57, 58.

?*Juvavites schoolerensis* McLearn, 1947a, p. 11, Appendix p. 1, Pl. 2, figs. 3, 4; McLEARN, 1960, p. 86, Pl. 11, figs. 3a, b; TOZER, 1967, p. 36, 57.

Registered material. Holotype GSC 8799 (GSC loc. 9157). Two topotypes GSC 9489 (holotype of *J. (G.) caurinus*), GSC 32208 (both GSC loc. 9851). Topotype(?) GSC 9488 (holotype of *J. schoolerensis*) (McLearn, 1960a, Pl. 11, figs. 3a, b) (GSC loc. 9854). Hypotype GSC 8829 (holotype of *Juvavites mackenzii*) (ibid., Pl. 11, figs. 1a, b), Peace River, exact locality unknown. Hypotype GSC 9511 (ibid., Pl. 11, figs. 3a, b) (GSC loc. 9719). Hypotype GSC 32202 (GSC loc. 68180). Three hypotypes GSC 72337–GSC 72339 (all GSC loc. 98562).

Occurrence. Lower Norian, Kerri Subzone 2. Pardonet Formation, northeastern British Columbia. GSC locs. 9157 (1), 9719 (5), 9851 (3), 9854 (1), 64654 (1), 64666 (1), 68180 (1), 98562 (10).

Remarks. Identified with this species are *Griesbachites* with strong ribbing on the phragmocone and most of the body chamber. GSC 72339 (Pl. 115, fig. 7) has a smooth subtabulate venter near the aperture. This specimen appears to be complete and mature and shows that the greater part of the body chamber bears strong ribs. Marginal tubercles are pointed nodes situated at the point of branching of ribs, and are present only on the body chamber. This specimen (Pl. 115, fig. 7) has nine nodes on the last half whorl. Ribs may branch at the inner flank and at mid-flank, also at the marginal tubercles. Ribs are interrupted on the venter. At a small diameter they end very abruptly and almost appear nodose. At larger diameters they end less abruptly. Projection of ribs on the venter is moderate (about 45 degree). Paulostome constrictions may be present at a small diameter. The suture line has three auxiliary lobes (Fig. 92b). GSC 72338 (Pl. 115, fig. 2) closely resembles the holotype of *Juvavites mackenzii* McLearn.

The unique holotype of *Juvavites schoolerensis* McLearn, a phragmocone 50 mm in diameter, has a venter with ribs that terminate neatly adjacent to the smooth band at the mid-line. Except for being larger, the venter is like that of the holotype of *G. humi*. The specimen is probably the phragmocone of a *Griesbachites*, possibly of a large individual of *G. humi*. *Griesbachites pinensis* n. sp. is closely similar, particularly the phragmocone, but differs in having a nearly smooth body chamber.

Griesbachites laevis n. sp.

Plate 114, figures 5–7; Figure 91a, b (p. 576)

Registered material. Holotype GSC 32205, paratype GSC 32206 (both GSC loc. 64666). Paratype GSC 32207 (GSC loc. 9157).

Occurrence. Lower Norian, Kerri Subzone 2. Pardonet Formation, northeastern British Columbia. GSC locs. 9157 (1), 64666 (2).

Diagnosis. Griesbachites at least 50 mm in diameter; H about 55 per cent, W about 35 per cent, U about 5 per cent of diameter. Ribbing very weak on both phragmocone and body chamber. On phragmocone, flanks nearly smooth, outer flank with short densely spaced ribs; on body chamber inner flank has straight simple ribs which are curved adorad on the outer flank. Ribs interrupted on the venter with moderate (about 45 degree) projection. Marginal tubercles are on the simple ribs, low and somewhat bullate and crescentic, present only on the body chamber.

Remarks. The holotype (Pl. 114, fig. 7) is part of a body chamber, the remains of a specimen about 50 mm in diameter. On the penultimate quadrant there are about four simple ribs at the mid-flank with two or three short intercalated ribs on the outer flank. The simple ribs are somewhat thickened, but not nodose, at the margin. On the last quadrant there are four simple ribs ending at four crescentic marginal nodes. GSC 32206 (Pl. 114, fig. 5) is a phragmocone 40 mm in diameter with nearly smooth flanks and short ribs, about 25 on a quadrant of the outer flank. There are no marginal nodes. GSC 32207 (Pl. 114, fig. 6) preserves the suture line showing three auxiliary lobes (Fig. 91b).

This is the smoothest *Griesbachites* in the Canadian faunas, distinguished from the other species not only by the weak ribbing, but also by the somewhat bullate shape of the marginal tubercles. The ribbing of *Gonionotites gethingi* McLearn is somewhat similar, but that species lacks the regular marginal tuberculation of *Griesbachites laevis*.

Griesbachites borealis n. sp.

Plate 112, figures 1–3; Plate 113, figures 1–5; Figures 90a–c (p. 572)

Griesbachites n. sp., TOZER, 1967, p. 60.

Registered material. Holotype GSC 32197, seven paratypes GSC 32194–GSC 32196, GSC 32198–GSC 32201 (all GSC loc. 68180).

Occurrence. Lower Norian, Kerri Subzone 2. Pardonet Formation, northeastern British Columbia. GSC locs. 68180 (20), 97524 (1).

Diagnosis. Griesbachites about 70 to about 110 mm in diameter; H about 55 per cent, W 30–40 per cent, U about eight per cent of diameter. Ribbing strong on phragmocone, weak on body chamber. On phragmocone, ribs bifurcate at the inner and outer third of the flank. Ribs interrupted on the venter with weak (60 degree) to very weak (80 degree) projection. Marginal tubercles large, somewhat clavate, generally blunt, present only on the body chamber.

Remarks. Complete specimens with nearly smooth body chambers range in diameter from about 68 mm (the holotype, Pl. 113, fig. 1), to 80 mm (GSC 32201, Pl. 113, fig. 5), up to about 110 mm (GSC 32196, Pl. 112, fig. 3). Nodes, 11 in all, are present on the whole of the body chamber of the holotype. GSC 32195 (Pl. 112, fig. 2), an incomplete phragmocone 68 mm in diameter, has one poorly defined paulostome constriction on the outer whorl. It resembles the inner whorls of the largest mature specimen (GSC 32196, Pl. 112, fig. 3). GSC 32196 has at least two auxiliary lobes (Fig. 90c).

Griesbachites pinensis n. sp. resembles *G. borealis* in having a smoother body chamber than phragmocone but the ribs of *G. borealis* differ in being less projected on the venter and the marginal nodes are differently shaped, being blunter and more clavate. The ribbing of *G. humi* (McLearn) and *G. laevis* n. sp. differs from that of *G. borealis* in the same way.

Griesbachites selwyni (McLearn)

Plate 114, figures 8a, b

Juvavites selwyni McLearn, 1940c, p. 113, Pl. 2, fig. 3; McLEARN, 1960a, p. 87, Pl. 10, figs. 1a, b; TOZER, 1967, p. 58.

Registered material. Holotype GSC 8820 (GSC loc. 9636). Topotype(?) GSC 72352* (GSC loc. 98900).

Occurrence. Lower Norian, Kerri Zone. Pardonet Formation, northeastern British Columbia. GSC locs. 9636 (1), 98900 (1).

Remarks. This is a species of *Griesbachites* with distinct ribbing on both the phragmocone and body chamber. Ribs may branch at the inner flank, mid-flank and on the outer flank. They are interrupted on the venter. On the holotype they are weakly projected. Marginal tubercles are very poorly defined. The holotype has a subtabulate venter at the aperture and was probably mature and complete. GSC 72352*, is a slightly crushed specimen 80 mm in diameter, with three quarters of a whorl of body chamber preserved. Compared with those of the holotype, the ribs are stronger and more projected. Marginal tuberculation is barely perceptible. *Griesbachites humi* (McLearn) is the only other *Griesbachites* in the Canadian faunas that has a distinctly ribbed body chamber. It differs from *G. selwyni* in having distinct marginal tuberculation.

Genus *Margarijuvavites* n. gen.

Type species. Acrochordiceras? *carlottense* Whiteaves.

Diagnosis. Discoidal juvavitid with irregular ribbing and randomly arranged blunt clavate nodes on the inner flank, and typical juvavitid branching ribs on the outer flank.

Species assigned. Acrochordiceras? *carlottense* Whiteaves.

Age. Upper Carnian.

Remarks. The blunt clavate nodes on the inner flank distinguish this genus from all other Juvavitidae, but the shape and style of ribbing clearly indicate membership in that family. Blunt nodes are a feature of Haloritidae, but the discoidal involute conch of *Margarijuvavites* clearly excludes it from that family.

Margarijuvavites carlottensis (Whiteaves)

Plate 104, figure 11; Plate 105, figures 7–9

Acrochordiceras? *carlottense* Whiteaves, 1889, p. 141, Pl. 19, fig. 1; TOZER, 1967, p. 83.

Juvavites? *carlottensis* (Whiteaves). SMITH, 1927, p. 54, Pl. 108, fig. 1.

Juvavites sp. cf. *J. carlottensis* (Whiteaves). McLEARN, 1947a, p. 4.

Registered material. Lectotype, here chosen, GSC 4717, paralectotype, GSC 4717a, Houston Stewart Channel, Queen Charlotte Islands, collected by G.M. Dawson, 1878. Topotype GSC 85795 (GSC loc. C–157382). Hypotype GSC 38627 (GSC loc. 9687).

Occurrence. Upper Carnian, Macrolobatus Zone. Pardonet Formation, northeastern British Columbia; Peril Formation, Queen Charlotte Islands, British Columbia. Dawson collection (2), GSC locs. 9687 (1), C–157382 (1).

Remarks. None of the specimens shows suture lines. Both the lectotype (Pl. 105, fig. 8) and GSC 38627 (Pl. 105, fig. 7) probably have part of the body chamber preserved. Ribs cross the venter of the lectotype. The venter is defined by moderately prominent ventrolateral shoulders, although their prominence may be exaggerated by slight distortion. The venter of GSC 38627 (Pl. 105, fig. 7) does not show comparable shoulders, but it is not completely preserved. The sculpture on the flank is virtually identical to that of the lectotype.

Genus *Dimorphites* Mojsisovics, 1893

Type species. Juvavites (*Dimorphites*) *selectus* Mojsisovics.

Dimorphites pardonetiensis McLearn

Plate 114, figures 1–3; Figure 91c (p. 576)

Juvavites (*Dimorphites*?) *pardonetiensis* McLearn, 1940a, p. 48, Pl. 1, fig. 13.

Dimorphites pardonetiensis (McLearn). McLEARN, 1960a, p. 92, Pl. 16, figs. 1a–c, 2a, b; TOZER, 1967, p. 36, 57, 58, 60.

Registered material. Holotype GSC 8833 (McLearn, 1960a, Pl. 16, figs. 2a, b) (GSC loc. 9481). Hypotype GSC 12602 (ibid., figs. 1a–c) (GSC loc. 9719). Hypotype GSC 32219 (GSC loc. 68180). Hypotype GSC 32220 (GSC loc. 42444). Topotype GSC 34600 (GSC loc. 64666).

Occurrence. Lower Norian, Kerri Zone. Pardonet Formation, northeastern British Columbia. GSC locs. 9157 (1), 9481 (1), 9719 (2), 9854 (2), 42444 (1), 64654 (2), 64666 (1), 68180 (4), 83826 (3), 98562 (5), 98880 (1), 98900 (6).

Remarks. GSC 32220 (Pl. 114, fig. 1) is the only specimen that has much of the test preserved. On the test surface, the ribs are wide and flat and the venter is initially narrowly subtabulate, becoming rounded adorad. The ribs are interrupted by a smooth band on the venter, but they are not elevated. Where preserved as steinkern, the ribs are narrowly rounded and at the venter they are raised and end abruptly, as on the holotype (McLearn, 1960a, Pl. 16, figs. 2a, b). On phragmocone steinkerns, the prominence of the marginal shoulders varies considerably. GSC 34600 (Pl. 114, fig. 3) has a narrowly rounded venter, without shoulders; GSC 12602 (McLearn, 1960a, Pl. 16, figs. 1a–c) has vaguely defined shoulders; in GSC 32219 (Pl. 114, fig. 2) they are distinct.

Genus *Guembelites* Mojsisovics, 1896

Type species. Heraclites (*Guembelites*) *jandianus* Mojsisovics.

Guembelites clavatus (McLearn)

Plate 118, figures 1–4; Figure 93a, b (p. 584)

Juvavites clavatus McLearn, 1939b, p. 51, Pl. 1, fig. 6.

Gonionotites clavatus (McLearn). McLEARN, 1960a, p. 96, Pl. 13, figs. 1, 2a, b.

Guembelites clavatus (McLearn). SILBERLING, 1959, p. 52, Pl. 6, figs. 9–13; TOZER, 1962a, Pl. 9, figs. 7a, b; TOZER, 1967, p. 36, 58; KRYSTYN, 1982, p. 48, Pl. 12, figs. 1–5.

Registered material. Holotype GSC 9408 (McLearn, 1960a, Pl. 13, figs. 2a, b) (GSC loc. 9640). Topotype GSC 12598 (ibid., fig. 1) (GSC loc. 9661). Hypotype GSC 14247 (GSC loc. 42444). Hypotype GSC 32215* (GSC loc. 64598). Three hypotypes GSC 32216–GSC 32218 (GSC loc. 83826).

Occurrence. Lower Norian, Kerri Subzone 1. Pardonet Formation, northeastern British Columbia. GSC locs. 9640 (5), 9659 (2), 9661 (1), 9663 (1), 9672 (3), 42444 (1), 64598 (1), 64623 (2), 83826 (9), 97548 (1), 98514 (1), 98880 (1).

Remarks. The specimens from GSC locality 83826 (=GSC loc. 42444) show that the size of smooth examples, which were probably mature, varies considerably. GSC 32216 (Pl. 118, fig. 1) is almost perfectly smooth at a diameter of about 50 mm. At the same size, GSC 32218 (Pl. 118, fig. 3) is nearly smooth, GSC 32217 (Pl. 118, fig. 2) distinctly ribbed. Part of the body chamber of GSC 32217 (Pl. 118, fig. 2) is preserved. It is much like that of GSC 14247 (Pl. 118, fig. 4) and the holotype.

Guembelites jandianus Mojsisovics

Plate 117, figures 1, 3–5

Heraclites (*Guembelites*) *jandianuus* Mojsisovics, 1896, p. 634, Pl. 10, figs. 1a, b; MOJSISOVICS, 1899, p. 74, Pl. 10, figs. 1a, b.

Guembelites jandianus Mojsisovics. DIENER, 1923, p. 149, Pl. 30, fig. 1; MULLER and FERGUSON, 1939, p. 1602; SILBERLING, 1959, p. 53, Pl. 6, figs. 1–8, Pl. 7, figs. 4–10; TOZER, 1967, p. 36, 60; MOUTERDE, 1971, Pl. 1, fig. 5; WANG and HE, 1976, p. 388, Pl. 33, figs. 4–8; KRYSTYN, 1982, p. 48, Pl. 13, figs. 1–4.

Guembelites sp., McLEARN, 1960, p. 90, Pl. 12, figs. 2a, b; TOZER, 1967, p. 37, 57.

Registered material. Hypotype GSC 32211 (GSC loc. 40295). Three hypotypes GSC 32212–GSC 32214 (all GSC loc. 68180). GSC 12599 (McLearn, 1960a, Pl. 12, figs. 2a, b) (?GSC loc. 9836).

Occurrence. Lower Norian, Kerri Subzone 2. Pardonet Formation, northeastern British Columbia. GSC locs. 40295 (1), 64632 (1), 68180 (8), 84198 (1), 98900 (1).

Remarks. Guembelites is now known to be restricted to the Kerri Zone and its correlatives. The record of the genus from the Magnus Zone (McLearn, 1960a, p. 90) has not been confirmed. It is based on a single specimen, which presumably was not collected in place.

Genus *Malayites* Welter, 1914

Type species. Malayites informis Welter.

Malayites bococki (McLearn)

Plate 120, figures 8–13; Figures 95a, b (p. 588)

Juvavites bococki McLearn, 1937a, p. 98, Pl. 1, fig. 14; McLEARN, 1947a, p. 11.

Malayites bococki (McLearn). McLEARN, 1960a, p. 104, Pl. 17, figs. 1a, b, 2.

Juvavites mertoni McLearn, 1937b, p. 130, Pl. 1, figs. 14, 15; McLEARN, 1960a, p. 85, Pl. 8, figs. 1a–c, 2.

Juvavites (*Malayites*) *parcus* McLearn, 1940c, p. 115, Pl. 2, fig. 1.

Malayites parcus (McLearn). McLEARN, 1960a, p. 102, Pl. 18, figs. 1a, b, 2; Pl. 20, figs. 5a, b; TOZER, 1967, p. 58.

Juvavites custi (McLearn), 1940c, p. 113, Pl. 2, fig. 2.

Malayites custi (McLearn). McLEARN, 1960a, p. 103, Pl. 17, figs. 3a–c; TOZER, 1967, p. 58.

Registered material. Holotype GSC 8831 (McLearn, 1960a, Pl. 17, figs. 1a, b), four topotypes GSC 12608 (ibid., Pl. 17, fig. 2), GSC 8828 (holotype of *J. mertoni,* ibid., Pl. 8, figs. 1a–c), GSC 8796 (paratype of *J. mertoni,* ibid., Pl. 8, fig. 2), GSC 32223 (all GSC loc. 9161). Three hypotypes GSC 8843 (holotype of *J.* (*M.*) *parcus*, ibid., Pl. 18, figs. 1a, b), GSC 12607 (ibid., Pl. 18, fig. 2), GSC 13486 (ibid., Pl. 20, figs. 5a, b) (all GSC loc. 9649). Two hypotypes GSC 8821 (holotype of *J. custi,* ibid., Pl. 17, figs. 3a–c), GSC 35415* (both GSC loc. 9649). Four hypotypes GSC 32224–GSC 32227 (all GSC loc. 64606).

Occurrence. Lower Norian, Dawsoni Subzone 1. Pardonet Formation, northeastern British Columbia. GSC locs. 9161 (44), 9373 (40), 9649 (9), 9691 (10), 9695 (1), 47005 (1), 64606 (9).

Remarks. Identified with this species are *Malayites* with very delicate strigation preserved on the surface of the test, but not on the steinkern. Ribs are weak or absent on the phragmocone and absent on the body chamber. Low radial, slightly bullate marginal tubercles may be present on the mature body chamber. Phragmocone ribs branch at about mid-flank. Ribs cross the venter with moderate projection (about 45 degree) and are slightly depressed on the median line. The suture line has at least two auxiliary lobes.

The holotype does not have strigate sculpture preserved, but it is clearly visible, although very delicate, on a topotype, GSC 32223 (Pl. 120, fig. 12). The synonymy adopted for this species is based mainly on specimens from GSC locality 64606, which is almost certainly the source of McLearn's talus block GSC locality 9161 and probably also GSC localities 9649 and 9691. These blocks provided the types of *Juvavites bococki, J. mertoni, J. parcus* and *J. custi*. Specimens from GSC locality 64606 includes GSC 32224 (Pl. 120, fig. 8), which is devoid of ribbing, similar to the holotype of *J. bococki*. GSC 32226 (Pl. 120, fig. 9) is somewhat like the holotype of *J. parcus,* although more faintly ribbed. GSC 32225 (Pl. 120, fig. 11), a variant with prominent ribbing, invites comparison with the holotype of *J. mertoni,* although that specimen shows no strigation and is more finely ribbed than GSC 32225. Nothing exactly like the holotype of *J. custi,* which has a relatively broad venter, is known from GSC locality 64606, but GSC 35415*, the large specimen of *Malayites custi* described by McLearn (1960a, p. 104), although imperfect, closely resembles GSC 32226 (Pl. 120, fig. 9) in size, shape and sculpture. Faint bullate marginal nodes, about four to a quadrant, are present on the body chamber of GSC 32227 (Pl. 120, fig. 10). This specimen may indicate the mature characteristics of *Malayites bococki*.

Malayites dawsoni McLearn

Plate 121, figures 8–13; Figure 96e (p. 590)

Malayites dawsoni McLearn, 1937b, p. 130, Pl. 1, fig. 16; McLEARN, 1960a, p. 100, Pl. 17, figs. 7, 8a, b; TOZER, 1967, p. 36, 57, 58, 60, Pl. 10, figs. 2a, b; TOZER, 1970, Pl. 18, figs. 9a, b.

Malayites sp. cf. *M. dawsoni* McLearn, TOZER, 1967, p. 58.

Malayites sp. McLEARN, 1960a, p. 105; TOZER, 1967, p. 57.

Juvavites (*Malayites*) *butleri* McLearn, 1940c, p. 114, Pl. 2, fig. 5

Malayites butleri (McLearn). McLEARN, 1960a, p. 101, Pl. 17, figs. 5, 6a, b; TOZER, 1967, p. 57, 58; KRYSTYN, 1982, p. 52, Pl. 15, figs. 3a, b.

Registered material. Holotype GSC 8836 (McLearn, 1960a, Pl. 17, figs. 8a, b) (GSC loc. 9556). Hypotype GSC 8840 (holotype of *J.* (*M.*) *butleri,* ibid., Pl. 17, figs. 6a, b) (GSC loc. 9832). Hypotype GSC 12604 (ibid., Pl. 17, fig. 7) (GSC loc. 9467). Hypotype GSC 12605 (ibid., Pl. 17, fig. 5) (GSC loc. 9722). Hypotype GSC 32228 (GSC loc. 68190). Hypotype GSC 32229 (GSC loc. 68200). Hypotype GSC 32230 (GSC loc. 64605). Hypotype GSC 32231 (GSC loc. 64602). Hypotype GSC 32232 (GSC loc. 64626). Hypotype GSC 32233 (GSC loc. 9850). Hypotype GSC 72263 (Tozer, 1984, p. 24, 153) (GSC loc. 39915).

Occurrence. Lower Norian, Dawsoni Subzone 2. Pardonet Formation, northeastern British Columbia. GSC locs. 9467 (2), 9556 (1), 9722 (3), 9832 (2), 9849 (1), 9850 (1), 9859 (1), 39915 (17), 42327 (2), 42328 (5), 42519 (4), 64602 (2), 64605 (2), 64626 (4), 68190 (5), 68200 (7), 68308 (1), 83892 (2), 97543 (5), 97544 (2), 97576 (7), 98538 (1).

Remarks. Identified with this species are *Malayites* that attained at least 120 mm in diameter. Strigation is much more pronounced compared with that of *Malayites bococki* (McLearn). Marginal tuberculation is unknown. Ribbing may be strong (e.g., GSC 32229, Pl. 121, fig. 13), weak (GSC 32233, Pl. 121, fig. 11) or virtually absent (GSC 32230, Pl. 121, fig. 8). When present, it is generally more pronounced on the inner than on the outer whorls. Branching takes place at the mid-flank, less frequently on the outer flank. Large complete specimens are unknown, but fragments like GSC 32232 (Pl. 121, fig. 10) leave no doubt that a large size was attained. Collections from GSC localities 39915, 68200 and 97576 include both strongly and weakly ribbed variants, like the holotypes of *Malayites, butleri* and *M. dawsoni* respectively. The two taxa are accordingly treated as synonyms.

Genus *Dryojuvavites* n. gen.

Type species. Dryojuvavites orchardi n. sp.

Diagnosis. Juvavitid sculptured with ribs that bifurcate on the inner flank, are abruptly projected on the outer flank and terminate at the venter as low, slightly oblique, clavate external nodes, the nodes of each side being separated by a shallow sulcus on the median line.

Species assigned. Dryojuvavites orchardi n. sp.

Age. Lower Norian, Dawsoni Zone.

Remarks. The only other juvavitid with external nodes is *Guembelites*, on which they are much more elevated in relation to the median line compared with those of *Dryojuvavites*. They may be clavate, as in *Dryojuvavites,* but are arranged spirally, not obliquely. The ventral projection of the nodes of the new genus forms a venter somewhat like that of *Waldthausenites*, but in

that genus, the ribs of each side join to form a solid keel, without the median depression of *Dryojuvavites*. *Waldthausenites* also differs in having spiral sculpture and umbilical tuberculation.

Dryojuvavites orchardi n. sp.

Plate 119, figures 6a–c

Registered material. Holotype GSC 71022 (GSC loc. 97576).

Occurrence. Lower Norian, Dawsoni Subzone 2. Pardonet Formation, northeastern British Columbia. GSC loc. 97576 (1).

Diagnosis. Dryojuvavites at least 55 mm in diameter; H about 45 per cent, W about 45 per cent, U about 14 per cent of diameter.

Remarks. The unique holotype (Pl. 119, fig. 6) has nearly half a whorl of body chamber preserved. Most is steinkern with some test adhering. The surface of the test has no spiral sculpture. On the last half whorl of the phragmocone, there are about eight ribs at the umbilicus and 16 nodes at the venter. On the steinkern, these nodes have appreciably more relief than on the surface of the test. On the test, the nodes of each side are separated by a very shallow depression on the median line. On the outer flank, at the point of flexure, the secondary ribs are slightly thickened, but not tuberculate. Nodes and ribs are present on the first part (12 mm measured at the venter) of the body chamber. Interpretation of the remainder of the body chamber is ambiguous. The venter is arched, without regular paired nodes. One side has nearly smooth flanks. The other has a flank, for the most part smooth, a spiral depression on the outer flank, bordered by a single spiral of nodes. The spiral depression appears to be a scar resulting from injury. This introduces an element of uncertainty concerning the nature of the body chamber. It may have become smooth or it may have retained external nodes. The suture line has one auxiliary lobe below the umbilical shoulder.

Despite the uncertainty about the body chamber, the phragmocone alone is sufficiently distinctive to justify the recognition of the taxon. No closely comparable ammonoids are known.

Etymology. The name is for M.J. Orchard, who found the specimen.

Genus *Pseudocardioceras* Tozer, 1971

Type species. Waldthausenites idunae Diener.

Pseudocardioceras idunae (Diener)

Plate 121, figures 2a, b; Figure 96d (p. 590)

Waldthausenites idunae Diener, 1920b, p. 509, Pl. 9, figs. 8, 9.

Waldthausenites leophanis Diener, 1923, p. 159, Pl. 19, figs. 5a–c.

Waldthausenites sp. cf. *W. leophanis* Diener. McLEARN, 1960a, Pl. 17, figs. 4a, b; TOZER, 1967, p. 36, 60.

Pseudocardioceras idunae (Diener). TOZER, 1971, p. 1030.

Registered material. Hypotype GSC 12609 (McLearn, 1960a, Pl. 17, figs. 4a, b) (GSC loc. 9860). Hypotype GSC 32235 (GSC loc. 42329).

Occurrence. Lower Norian, Dawsoni Subzone 2. Pardonet Formation, northeastern British Columbia. GSC locs. 9860 (1), 42329 (1).

Remarks. GSC 12609 (McLearn, 1960a, Pl. 17, figs. 4a, b) is a wholly septate steinkern. No strigation is evident. GSC 32235 (Pl. 121, fig. 2) includes a small part of the body chamber and has the test preserved. Faint delicate strigation is preserved near the venter. This is a feature of the specimens from the type locality.

Pseudocardioceras acutum (Mojsisovics)

Plate 121, figures 1a–c; Figure 96c (p. 590)

Eutomoceras acutum Mojsisovics, 1893, p. 290, Pl. 130, figures 1, 2.

Discotropites sp. cf. *D. acutus* (Mojsisovics). McLEARN, 1960a, p. 74, Pl. 8, figs. 8a, b.

Waldthausenites sp. cf. *W. acutus* (Mojsisovics). TOZER, 1967, p. 36.

Waldthausenites sp., TOZER, 1967, p. 60.

Registered material. Hypotype GSC 12596 (McLearn, 1960a, Pl. 8, figs. 8a, b) (GSC loc. 9144). Hypotype GSC 32234 (GSC loc. 68200). Hypotype GSC 85796*

(GSC loc. 97544). Hypotype GSC 85797* (GSC loc. 97543).

Occurrence. Lower Norian, Dawsoni Subzone 2. Pardonet Formation, northeastern British Columbia. GSC locs. 9144 (1), 68200 (1), 97543 (1), 97544 (2).

Remarks. Identified with this species are *Pseudocardioceras* like *P. idunae* (Diener), but more compressed and with ribbing less prominent or absent. GSC 12596 (McLearn, 1960a, Pl. 8, figs. 8a, b), a septate steinkern is the most weakly sculptured example. It is devoid of ribs. The keel is weakly nodose. GSC 32234 (Pl. 121, fig. 1) has stronger ribbing and strigation, larger nodes on the keel and forms a morphological link between GSC 12596 and the specimens identified as *P. idunae.* GSC 85796* and GSC 85797* are imperfect specimens with ribbing like GSC 32234. Strigation is not preserved. GSC 85797 was about 40 mm in diameter. GSC 85796 is a body chamber fragment, mostly steinkern, of a specimen that attained a diameter of at least 70 mm. The keel is nodose, but less elevated than in GSC 32234. The ribbed examples are assigned to *P. acutum* because of the resemblance to the original of Mojsisovics, 1893, Pl. 130, fig. 2. GSC 12596, the smooth specimen, is more comparable to the original of Pl. 130, fig. 1.

Despite the differences between the type specimens, *Pseudocardioceras acutum* and *P. idunae* may be variants of one species. Both type specimens are from the Hallstatt Limestone of the Feuerkogel and are preserved in an identical distinctive purple limestone. The specimens probably came from the same spot. Recent work at the Feuerkogel has not produced more specimens. Probably the types were from a fissure filling that was completely removed by the early collectors.

Genus *Discomalayites* n. gen.

Type species. Discomalayites carinatus n. sp.

Diagnosis. Discoidal juvavitid with smooth or faintly ribbed flanks, a smooth keel, and spiral lirae.

Species assigned. Discomalayites carinatus n. sp.

Age. Lower Norian, Dawsoni Zone.

Remarks. The spiral sculpture and keel obviously indicate affinity with *Pseudocardioceras* Tozer (1971), which differs in having a nodose keel. *Pseudocardioceras acutum* (Mojsisovics), with a nodose keel at a small diameter replaced by a nearly smooth keel on the body chamber indicates the link.

Discomalayites carinatus n. sp.

Plate 121, figures 3–5; Figure 96a, b (p. 590)

Registered material. Holotype GSC 32236, four paratypes GSC 32237, GSC 32238, GSC 32239*, GSC 32240 (all GSC loc. 68193). Hypotype GSC 85798* (GSC loc. 97542).

Occurrence. Lower Norian, Dawsoni Subzone 3. Pardonet Formation, northeastern British Columbia. GSC locs. 68193 (6), 97542 (1).

Diagnosis. Discomalayites attaining a diameter of about 50 mm; H about 52 per cent, W about 33 per cent, U less than five per cent of diameter. Phragmocone with smooth or weakly ribbed flanks.

Remarks. GSC 32238 (Pl. 121, fig. 5) is the body chamber fragment of a specimen that attained a diameter of about 50 mm. The keel is smooth and what remains of the flank has spiral lirae, but no ribbing. The holotype (Pl. 121, fig. 3), GSC 32239 and GSC 32240 are wholly septate and have smooth flanks. GSC 32237 (Pl. 121, fig. 4), 25 mm in diameter, is more inflated than the others and has distinct, low, delicate ribs, some simple, some bifurcating, there being 25 on the last quadrant at the venter, 15 at the inner flank. The keels of the holotype (Pl. 121, fig. 3) and GSC 32237 (Pl. 121, fig. 4) are similar, being perfectly smooth on the steinkern and only slightly irregular, where crossed by growth striae, on the surface of the test. Both have delicate spiral lirae preserved. In GSC 32239 the suture line can be seen (Figs. 96a, b). GSC 85798* is a well preserved specimen 22 mm in diameter, which may have part of the body chamber preserved. The keel is smooth, ribbing is absent and the surface is strigate.

The only comparable species is *Pseudocardioceras acutum* (Mojsisovics) (1893, p. 290), which differs in having a nodose keel.

Genus *Omojuvavites* n. gen.

Type species. Omojuvavites ventroplicatus n. sp.

Diagnosis. Juvavitid with relatively large umbilicus (about 10 per cent of diameter), a distinct umbilical shoulder and a subtabulate or narrowly rounded venter. Surface weakly ribbed or smooth. Ribbing, when present, most pronounced on the outer flank and venter. Growth striae projected at the margin, meeting on the venter in the form of a rounded rostrum. Suture line ammonitic with weakly indented elements, one or two auxiliary lobes below the umbilical shoulder.

Species assigned. *Gonionotites fuscus* McLearn, *Omojuvavites magnumbilicatus* n. sp., *O. minor* n. sp., *O. ventroplicatus* n. sp., *O. rostratus* n. sp.

Age. Lower Norian, Dawsoni Zone.

Remarks. This genus unites a group of weakly ribbed or smooth juvavitids, characterized by a relatively simple suture line and a large umbilicus. Also distinctive is the pronounced projection of striae or ribs on the venter. The type species has a tabulate, ribbed venter and is unlike any other juvavitid. The other assigned species have almost smooth body chambers, inviting comparison with *Gonionotites* Gemmellaro (1904). The suture lines are different, however, *Omojuvavites* having fewer elements, which are less deeply indented. *Epijuvavites* Krystyn (1982) also has a smooth body chamber, but compared to all *Omojuvavites*, the inner whorls have more prominent ribbing and the body chamber has a broadly arched instead of narrowly rounded or subtabulate venter.

Omojuvavites fuscus (McLearn)

Plate 119, figures 7a, b

Juvavites (*Gonionotites*) *fuscus* McLearn, 1940c, p. 114, Pl. 1, fig. 1.

Gonionotites fuscus (McLearn). McLEARN, 1960a, p. 99, Pl. 15, figs. 1a, b; Pl. 16, figs. 3a, b; TOZER, 1967, p. 57.

Gonionotites rarus (McLearn). McLEARN, 1960a, p. 98 (specimens from GSC locality 9722 only) (not of McLEARN, 1940c, p. 114).

Registered material. Holotype GSC 8835 (McLearn, 1960a, Pl. 16, figs. 3a, b), two topotypes GSC 32386* (*G. rarus* McLearn, ibid., p. 98), GSC 32387* (ibid., p. 99) (all GSC loc. 9722). Hypotype GSC 12603 (ibid., Pl. 15, figs. 1a, b) (GSC loc. 9859). Hypotype GSC 34601* (ibid., p. 99) (GSC loc. 9144).

Occurrence. Lower Norian, Dawsoni Subzone 2. Pardonet Formation, northeastern British Columbia. GSC locs. 9144 (1), 9722 (3), 9859 (1).

Diagnosis. *Omojuvavites* attaining a diameter of at least 55 mm; H about 50 per cent, W about 30 per cent, U about 12 per cent of diameter. Flanks flat, venter broadly arched. Surface smooth.

Remarks. About three quarters of the outer whorl of the holotype (Pl. 119, fig. 7) appears to be body chamber. GSC 12603 (McLearn, 1960a, Pl. 15, figs. 1a, b) and GSC 32386 have suture lines with only one auxiliary lobe below the umbilical shoulder.

Being smooth, the species resembles *Gonionotites rarus* (McLearn), but *Omojuvavites fuscus,* like all species of *Omojuvavites,* differs by having a larger umbilicus and fewer elements in the suture line.

Omojuvavites magnumbilicatus n. sp.

Plate 121, figures 6a–c, Figure 96f (p. 590)

Gonionotites sp. aff. *G. gethingi* McLearn. TOZER, 1967, p. 60.

Gonionotites rarus (McLearn). McLEARN, 1960a, p. 15, 98; TOZER, 1967, p. 57 (in part, not of McLEARN, 1940c, p. 114).

Registered material. Holotype GSC 32182 (GSC loc. 42328). Hypotype GSC 35417* (GSC loc. 9849).

Occurrence. Lower Norian, Dawsoni Subzone 2. Pardonet Formation, northeastern British Columbia. GSC locs. 9849 (1), 42328 (1), 97543 (1).

Diagnosis. *Omojuvavites* attaining a diameter of about 60 mm; H about 50 per cent, W about 30 per cent, U about 10 per cent of diameter. Venter narrowly arched. Surface smooth.

Remarks. The holotype (Pl. 121, fig. 6) has three quarters of a whorl of body chamber preserved, but not the peristome. The adoral quadrant is displaced by a fracture. The original diameter was about 60 mm. Growth striae are prorsiradiate on the greater part of the flank, strongly projected (about 30 degree) on the outer flank and form a narrow, rounded rostrum on the venter. The suture line has one large and one small auxiliary lobe below the umbilical shoulder (Fig. 96f). GSC 35417*, a complete phragmocone about 35 mm in diameter with approximated septa, has the whorl section and suture line of this species (cf. McLearn, 1960a, p. 98; Tozer, 1967, p. 57). The specimen from GSC locality 97543 is somewhat crushed. The whorl section is like that of the holotype on the greater part of the outer whorl, but is apparently broadly subtabulate at the aperture.

The smooth shell, course of the growth striae, and suture line indicate affinity with *Omojuvavites fuscus* (McLearn), which differs only in whorl section, having a broadly arched venter.

Omojuvavites minor n. sp.

Plate 121, figures 7a–c

Registered material. Holotype GSC 32183 (GSC loc. 42328).

Occurrence. Lower Norian, Dawsoni Subzone 2. Pardonet Formation, northeastern British Columbia. GSC locs. 42328 (1), 97543 (3).

Diagnosis. Omojuvavites attaining a diameter of about 40 mm; H about 50 per cent, W about 30 per cent, U about 10 per cent of diameter. Venter narrowly arched. Phragmocone sculptured with weak ribs on the outer half of the flank. Ribs strongly projected on outermost flank, fading at midline of venter. Body chamber nearly smooth.

Remarks. The holotype (Pl. 121, fig. 7) has half a whorl of body chamber preserved, which is nearly smooth. The reduced sculpture probably indicates maturity. Most, or all, ribs are simple. Projection on the outer flank is strong (about 30 degrees). Growth lines on the venter form a rounded rostrum. There is one large and one small auxiliary lobe outside the umbilical shoulder, but the details of the suture line are not clearly shown.

The most closely comparable species is *Omojuvavites magnumbilicatus* n. sp., the whorl section, curvature of growth striae being similar. *Omojuvavites minor* differs in having a ribbed phragmocone.

Omojuvavites rostratus n. sp.

Plate 122, figures 1a–c

Registered material. Holotype GSC 32186 (GSC loc. 68193).

Occurrence. Lower Norian, Dawsoni Subzone 3. Pardonet Formation, northeastern British Columbia. GSC loc. 68193 (1).

Diagnosis. Omojuvavites attaining a diameter of about 40 mm; H about 57 per cent, W about 35 per cent, U about eight per cent of diameter. Venter arched. Phragmocone and body chamber with weak simple, ribs which are abruptly and strongly (about 20 degree) projected on the venter, where they form a blunt rostrum.

Measurements. Holotype GSC 32186 (Pl. 122, fig. 1): 42, 0.57, 0.35, 0.08.

Remarks. The holotype (Pl. 122, fig. 1) has part of the peristome preserved, and has three quarters of a whorl of body chamber. Details of the suture line are not clear.

Morphologically, this species forms a link between *Omojuvavites fuscus* (McLearn), *O. magnumbilicatus* n. sp. and *O. ventroplicatus* n. sp. Compared with *O. magnumbilicatus* and *O. fuscus,* sculpture is more pronounced and more projected on the venter. The venter is broad compared with that of *O. magnumbilicatus,* narrow compared with that of *O. fuscus.* The course of the growth lines clearly indicates close affinity with *O. ventroplicatus,* but that species differs in having a subtabulate venter.

Omojuvavites ventroplicatus n. sp.

Plate 122, figures 2–5; Figure 97c, d (p. 592)

"*Juvavites*" n. sp., TOZER, 1967, p. 60.

Registered material. Holotype GSC 32184, three paratypes GSC 32185, GSC 32187, GSC 32188 (all GSC loc. 68193).

Occurrence. Lower Norian, Dawsoni Subzone 3. Pardonet Formation, northeastern British Columbia. GSC loc. 68193 (30).

Diagnosis. Omojuvavites attaining a diameter of about 50 mm; H about 50 per cent, W 40–50 per cent, U about 10 per cent of diameter. Venter subtabulate, defined by distinct shoulders. Ribs weak and simple on most of flank, stronger just inside the ventral shoulder and on the venter, strongly projected (about 40 degree) on the outer flank and venter. Ribs on venter slightly en echelon and interrupted at the median line on most of the conch, extending across the venter at the aperture where they form a blunt rostrum.

Measurements. Holotype GSC 32184 (Pl. 122, fig. 5): 48, 0.51, 0.51, 0.11. Paratype GSC 32185 (Pl. 122, fig. 3): 40, 0.50, 0.50, 0.11. Paratype GSC 32187 (Pl. 122, fig. 4): 37, 0.46, 0.41, 0.11.

Remarks. The holotype (Pl. 122, fig. 5), GSC 32185 (Pl. 122, fig. 3) and GSC 32187 (Pl. 122, fig. 4) have body chambers preserved and are virtually complete. None show approximation of septa. GSC 32188 (Pl. 122, fig. 2), 28 mm in diameter, has the distinctive whorl section of this species, but is nearly smooth. It is not complete. In GSC 32185 and GSC 32187, the suture line has two auxiliary lobes (Figs. 97c, d).

The most closely comparable species is *Omojuvavites rostratus* n. sp., which differs in having rounded ventral shoulders.

Genus *Indojuvavites* Diener, 1916b

Type species. Juvavites angulatus Diener.

Indojuvavites laurieri n. sp.

Plate 123, figures 2–5; Plate 127, figures 4, 5

Registered material. Holotype GSC 32257, two paratypes GSC 32258, GSC 32259 (all GSC loc. 45697). Paratype GSC 32260 (GSC loc. 83894). Hypotype GSC 71020* (GSC loc. 97560). Hypotype GSC 71021* (GSC loc. 97558).

Occurrence. Lower Norian, Magnus Subzone 1. Pardonet Formation, northeastern British Columbia. GSC locs. 45697 (10), 83894 (3), 97558 (1), 97560 (1).

Diagnosis. Indojuvavites about 35 mm in diameter; H about 55 per cent, W about 40 per cent, U about six per cent of diameter. Phragmocone ribs dense, strong, branching on inner and outer flank, tertiary ribs frequent. Ribs on body chamber somewhat weaker than on phragmocone. On phragmocone, ribs cross venter without interruption, on body chamber they are interrupted. Ventral projection of ribs moderate (about 45 degree).

Measurements. Holotype GSC 32257 (Pl. 123, fig. 4): 35, 0.55, 0.40, 0.06

Remarks. Three quarters of the outer whorl of the holotype (Pl. 123, fig. 4) appears to be body chamber. Ribbing is of diminished strength on the outer whorl suggesting that despite its small size it may have been mature. This specimen has the test preserved showing that the ribs cross the venter at the beginning of the outer whorl. On the last quadrant they are interrupted. None shows details of the suture line.

This species resembles *Indojuvavites angulatus* (Diener) (Krystyn, 1982, p. 55), which differs in having a somewhat larger umbilicus.

Indojuvavites brunneus n. sp.

Plate 123, figures 1a, b; Plate 127, figures 3, 7, 8; Figure 102 (p. 602)

Juvavites (*Gonionotites*) *belli* McLearn. McLEARN, 1941b, p. 96 (not of McLearn, 1940c, p. 114, Pl. 1, fig. 5).

Gonionotites belli McLearn. McLEARN, 1960a, p. 15, p. 95 (in part); TOZER, 1965c, p. 223; TOZER, 1967, p. 36, 57 (not of McLEARN, 1960a, p. 95, Pl. 14, figs. 2a–c).

Indojuvavites sp. cf. *I. angulatus* Diener. McLEARN, 1960a, p. 92, Pl. 12, figs. 5a, b.

Registered material. Holotype GSC 32189 (GSC loc. 9845). Three hypotypes GSC 35420, GSC 35421, GSC 72322* (all GSC loc. 50028). Hypotype GSC 12601 (McLearn, 1960a, Pl. 12, figs. 5a, b) (GSC loc. 9873). Hypotype GSC 71019 (GSC loc. 97559). Three topotypes GSC 85799*, GSC 85800*, GSC 85801* (all GSC loc. 97541).

Occurrence. Lower Norian, Magnus Subzone 1. Pardonet Formation, northeastern British Columbia. GSC locs. 9845 (1), 9873 (1), 50028 (10), 97541 (3), 97559 (1).

Diagnosis. Indojuvavites attaining a diameter of about 80 mm; H about 55 per cent, W about 40 per cent, U about 12 per cent of diameter. Phragmocone ribs strong, branching on inner and outer flank, tertiary ribs frequent. Body chamber smooth or with weak ribs. On phragmocone, ribs cross venter without interruption, on body chamber they are interrupted. Ventral projection of ribs moderate (about 45 degree).

Measurements. Hypotype GSC 35420 (Pl. 127, fig. 8): 82, 0.56, 0.39, 0.12.

Remarks. The holotype (Pl. 123, fig. 1) consists of an undistorted phragmocone and part of the body chamber, which is crushed. The contrast between the ribbed phragmocone and the smooth body chamber is marked. The complete suture line is not exposed, but the saddles are weakly indented and there are two small auxiliary lobes. GSC 85799 is a topotype, somewhat crushed, showing weak ribbing on the body chamber. Another topotype, GSC 85800, has a ribbed phragmocone preserved, like the core of the holotype. The suture line has broad weakly indented saddles and two auxiliary lobes. GSC 35420 (Pl. 127, fig. 8), the largest known specimen, has a weakly ribbed body chamber. Parts of the penultimate whorl are exposed showing ribbing much more prominent than on the outer whorl, much like that of the holotype and GSC 35421 (Pl. 127, fig. 7). GSC 35421, the steinkern of a complete phragmocone, with one eighth of a whorl of body chamber, has ribs that cross the venter on the

phragmocone, but are interrupted where the body chamber begins. The complete suture line is seen in GSC 72322. GSC 97559 (Pl. 127, fig. 3), the steinkern of the phragmocone, is somewhat like GSC 35421 (Pl. 127, fig. 7).

Compared to *Indojuvavites laurieri* n. sp., this species is both larger and more evolute and has a smoother body chamber. Also similar in most characters is *Epijuvavites transiens*(?) n. sp., but the ribs on that species meet on the venter to form a blunt rostrum, unlike the angular arrangement found in *I. brunneus*. *Gonionotites belli* McLearn (1940c, p. 114, Pl. 1, fig . 5), with which the holotype of *I. brunneus* was identified by McLearn (1960a, p. 15, 93), differs in lacking the angular arrangement of ribs on the venter and in the near or complete absence of tertiary ribs. The suture lines are also different, that of *Gonionotites belli* having the narrow elements and more numerous (at least three) auxiliary lobes that characterize *Gonionotites*, but not *Indojuvavites*.

Indojuvavites falcatus n. sp.

Plate 125, figures 6a–c; Figure 100b (p. 598)

Registered material. Holotype GSC 32265 (GSC loc. 82452).

Occurrence. Lower Norian, Magnus Subzone 2. Pardonet Formation, northeastern British Columbia. GSC loc. 82452 (3).

Diagnosis. Indojuvavites about 55 mm in diameter; H about 52 per cent, W about 35 per cent, U about 7 per cent of diameter. Phragmocone ribs densely arranged, strong, falcoid on outer flank, primary ribs stronger on inner than on outer flank, branching on inner and outer flank, tertiary ribs frequent.

Remarks. The holotype (Pl. 125, fig. 6) is nearly all phragmocone, preserved as steinkern. The phragmocone diameter is 37 mm indicating that the complete diameter was about 55 mm. At the beginning of the outer whorl some ribs can be traced across the venter forming the V-shaped pattern characteristic of *Indojuvavites*. Adorad the median line on the steinkern is nearly smooth, but small remnants of the test show that ribs cross the venter, but with diminished strength. The suture line has two auxiliary lobes below the umbilical shoulder (Fig. 100b).

Although the nature of the body chamber is not known, the characters of the phragmocone are distinctive, the falcoid curvature of the ribs and the strong primary ribs on the inner flank distinguishing this species from *Indojuvavites laurieri* n. sp. and *I. brunneus* n. sp.

Genus *Epijuvavites* Krystyn, 1982

Type species. Epijuvavites levis Krystyn.

Epijuvavites transiens n. sp.

Plate 122, figures 6–8; Figure 97a, b (p. 592)

Registered material. Holotype GSC 32193, two paratypes GSC 32191, GSC 32192 (all GSC loc. 68199).

Occurrence. Lower Norian, Magnus Zone, Subzone 1(?). Pardonet Formation, northeastern British Columbia. GSC loc. 68199 (4).

Diagnosis. Epijuvavites about 65 mm in diameter; H about 50 per cent, W about 33 per cent, U about 7 per cent of diameter. Venter arched, except near aperture, where it is broadly subtabulate. Phragmocone ribs bifurcate on inner and outer flank, and are of virtually even strength on the whole flank; tertiary ribs numerous. Ribs diminish in strength on the venter, but some can be traced across. Ribs moderately projected on the venter (about 45 degree). Suture line with one well developed auxiliary lobe.

Measurements. Holotype GSC 32193 (Pl. 122, fig. 8): at 44, 0.50, 0.34, 0.07. Paratype GSC 32191 (Pl. 122, fig. 7): 69, 0.52, 0.32, 0.07.

Remarks. The body chamber of GSC 32191 (Pl. 122, fig. 7) is smooth, suggesting maturity. The holotype (Pl. 122, fig. 8) has a shallow paulostome constriction near the last septum. The body chamber is at first ribbed, later smooth. It was probably not fully mature. GSC 32192 (Pl. 122, fig. 6) is mostly septate, has well defined ribbing, and is taken to indicate the nature of the phragmocone. The specimens are preserved mostly as steinkern, generally making it impossible to determine the exact nature of the ribbing at the venter. GSC 32192 (Pl. 122, fig. 6) has some of the test preserved and has ribs that cross the venter with diminished strength.

At first sight, the combination of a ribbed phragmocone and smooth body chamber lacking tuberculation suggests affinity with species of *Gonionotites*. However, the suture line of *Epijuvavites transiens* is less indented, with fewer elements compared to the suture of *Gonionotites* species. The

suture line of *E. transiens* suggests closer affinity with *Epijuvavites, Indojuvavites* and *Juvavites*. The closest resemblance is to *Epijuvavites levis* Krystyn (1982, p. 56), which differs in having denser, more delicate ribbing on the phragmocone.

Genus *Juvavites* Mojsisovics, 1879

Type species. Ammonites ehrlichi Hauer.

Juvavites subangulatus n. sp.

Plate 125, figures 1–5; Figure 100a (p. 598)

Registered material. Holotype GSC 32250, four paratypes GSC 32251–GSC 32254 (all GSC loc. 68191).

Occurrence. Lower Norian, Magnus Zone. Pardonet Formation, northeastern British Columbia. GSC locs. 68191 (9), 68198 (6).

Diagnosis. Juvavites attaining a diameter of at least 60 mm; H about 50 per cent, W about 35 per cent, U about six per cent of diameter. Ribs strong on phragmocone, branching at inner and outer flank with numerous tertiary ribs. Ribbing on body chamber weak or strong. Phragmocone ribs on surface of the test cross the venter with diminished strength. Projection of ribs moderate (45 degree) on inner whorls, becoming less projected on body chamber.

Measurements. Holotype GSC 32250 (Pl. 125, fig. 4): 62, 0.48, 0.34, 0.06.

Remarks. The holotype (Pl. 125, fig. 4) has the test preserved at the beginning of the outer whorl showing ribs, which, although low in relief compared with those of the flank, can neverthless be traced across the venter. On the steinkern, the ribbing is interrupted. The last two septa are visible and approximated, the body chamber is three quarters of a whorl, ribbing is reduced, and the venter broadens near the aperture. The specimen was probably mature. GSC 32251 (Pl. 125, fig. 1) and GSC 32252 (Pl. 125, fig. 2) are ribbed at a larger diameter than the holotype. GSC 32252 shows approximated septa, suggesting that the mature body chamber may have been more strongly ribbed than on the holotype. GSC 32253 (Pl. 125, fig. 3), the remains of a specimen that attained a diameter of about 100 mm—the largest known—has a distinctly ribbed body chamber.

This species is distinguished from the holotypes of *Epijuvavites transiens* n. sp. and *Indojuvavites brunneus* n. sp. by having a ribbed, instead of smooth, body chamber. Most specimens identified as *J. subangulatus* have ribs that meet on the venter at an obtuse angle compared with the more angular arrangement found in the species of *Indojuvavites*. GSC 32254 (Pl. 125, fig. 5), identified as a small example of *J. subangulatus,* has an unusually angular arrangement and closely resembles *Indojuvavites brunneus* at a comparable diameter. More than any other species, *Juvavites subangulatus* illustrates the close relationship between *Juvavites, Epijuvavites*, and *Indojuvavites*.

Juvavites gibbosus n. sp.

Plate 126, figures 7, 8

Juvavites magnus McLearn. TOZER, 1967, p. 60 (not of McLEARN, 1940a, p. 48).

Registered material. Holotype GSC 32256, paratype GSC 32255 (both GSC loc. 68191).

Occurrence. Lower Norian, Magnus Zone. Pardonet Formation, northeastern British Columbia. GSC loc. 68191 (2).

Diagnosis. Juvavites about 60 mm in diameter; H about 50 per cent, W about 45 per cent, U about 10 per cent of diameter. Ribbing strong on phragmocone and most of body chamber. Ribs branch at inner and outer flank and tertiary ribs are numerous. Ribs cross the venter with undiminished strength. Peripheral projection of ribs moderate (about 45 degree) on phragmocone, decreasing on the body chamber.

Measurements. Holotype GSC 32256 (Pl. 126, fig. 8): 58, 0.50, 0.40, 0.10.

Remarks. In the holotype (Pl. 126, fig. 8), the peristome is preserved. Strong ribbing is retained to within 9 mm, measured on the venter, of the aperture. The last septum is visible, but details of the suture line cannot be determined.

This species closely resembles *Juvavites subangulatus* n. sp. in the style of ribbing and curvature of ribs on the venter, but it differs in having thicker whorls and stronger ribs on the venter.

Juvavites magnus McLearn

Plate 123, figures 8a, b; Plate 124, figures 4a, b; Figure 98b (p. 594)

Juvavites magnus McLearn, 1940a, p. 48, Pl. 1, fig. 8; McLEARN, 1947a, p. 11; McLEARN, 1960a, p. 83, Pl. 9, figs. 1a–c (only); TOZER, 1967, p. 37, 57, Pl. 10, figs. 3a–c (not p. 60 = *Juvavites gibbosus* n. sp.).

Juvavites (*Anatomites*) sp. cf. *J.* (*A.*) *brocchii* Mojsisovics; McLEARN, 1960a, p. 88, Pl. 12, figs. 6a, b; TOZER, 1967, p. 57.

Registered material. Holotype GSC 8837 (McLearn, 1960a, Pl. 9, figs. 1a–c), topotype GSC 12597 (ibid., Pl. 12, figs. 6a, b) (both GSC loc. 9836). Hypotypes GSC 32241, GSC 32243 (both GSC loc. 83829).

Occurrence. Lower Norian, Magnus Subzone 2. Pardonet Formation, northeastern British Columbia. GSC locs. 9836 (4), 82452 (6), 82663 (3), 83829 (2), 98537 (1).

Diagnosis. Juvavites attaining a diameter of about 100 mm; H about 52 per cent, W about 45 per cent, U about 10 per cent of diameter. Ribbing very strong on phragmocone and most of body chamber; branching is on inner flank, with branching or intercalation on the outer flank, tertiary ribs numerous. Body chamber of last quadrant has simple ribs not separated by intercalated ribs. Ribs cross the venter with undiminished strength and weak (70–80 degree) projection.

Measurements. Hypotype GSC 32241 (Pl. 124, fig. 4): 95, 0.54, 0.49, 0.08. Hypotype GSC 32243 (Pl. 123, fig. 8): 88, 0.50, 0.42, 0.09.

Remarks. GSC 32243 (Pl. 123, fig. 8) and GSC 32241 (124, fig. 4) illustrate the mature stage, with strong simple ribs near the aperture. *Juvavites magnus* and the closely related species from the Caurinum Subzone (*J. concretus* McLearn, *J. biornatus* McLearn, and *J. levigatus* n. sp.) all differ from *Epijuvavites transiens* n. sp., *Juvavites subangulatus* n. sp., *Juvavites gibbosus* n. sp. and *Juvavites mclayi* McLearn in having ribs that are less projected where they cross the venter.

Juvavites concretus McLearn

Plate 123, figures 6a, b; Plate 124, figures 3a, b; Plate 126, figures 5, 6; Figure 98a, d (p. 594)

Juvavites concretus McLearn, 1940c, p. 113, Pl. 1, figs. 3, 4.

Juvavites magnus McLearn. McLEARN, 1960a, p. 83, Pl. 9, fig. 2; Pl. 10, figs. 2a, b, only (not of McLEARN, 1940a, p. 48).

Registered material. Holotype GSC 8818 (McLearn, 1960a, Pl. 9, fig. 2), paratype GSC 8819 (ibid., Pl. 10, figs. 2a, b) (both GSC loc. 9836). Hypotype GSC 32242 (GSC loc. 83829). Two hypotypes GSC 32245, GSC 32246 (both GSC loc. 64636). Hypotype GSC 32248 (GSC loc. 82452).

Occurrence. Lower Norian, Magnus Subzone 2. Pardonet Formation, northeastern British Columbia. GSC locs. 9836 (5), 64636 (30), 82452 (1), 83829 (5).

Diagnosis. Juvavites like *Juvavites magnus* McLearn, but with branched ribs on the body chamber.

Measurements. Hypotype GSC 32245 (Pl. 126, fig. 5): 60, 0.52, 0.43, 0.08. Hypotype GSC 32242 (Pl. 124, fig. 3): 85, 0.53, 0.40, 0.09.

Remarks. These specimens are possibly examples of *Juvavites magnus* that are not fully mature. They vary considerably in inflation, the holotype being appreciably thicker than GSC 32242 (Pl. 124, fig. 3) and GSC 32245 (Pl. 126, fig. 5), both of which are complete. Most of the specimens at GSC locality 64636 are small. *Juvavites gibbosus* n. sp. is somewhat similar, but differs in having the ribs more projected on the venter.

Juvavites biornatus McLearn

Plate 124, figures 2a, b; Figure 99b (p. 596)

Juvavites biornatus McLearn, 1940a, p. 48, Pl. 1, fig. 11; McLEARN, 1947a, p. 11; McLEARN, 1960a, p. 82, Pl. 11, figs. 4a, b; TOZER, 1967, p. 37, 57.

Registered material. Holotype GSC 8838 (McLearn, 1960a, Pl. 11, figs. 4a, b) (GSC loc. 9836). Hypotype GSC 32247 (GSC loc. 82452).

Occurrence. Lower Norian, Magnus Subzone 2. Pardonet Formation, northeastern British Columbia. GSC locs. 9836 (40), 82452 (25), 97540 (3).

Diagnosis. Juvavites like *J. magnus* McLearn, but smaller, generally less inflated, and with the simple ribs on the last quadrant separated by intercalated ribs.

Measurements. Holotype: 49, 0.51, 0.34, 0.10.

Remarks. The holotype (McLearn, 1960a, Pl. 11, figs. 4a, b) has a body chamber of one whorl. Only a small part of the last suture is visible. The venter is initially arched, becoming broader and flatter near the aperture. It was probably complete and mature. Most of the specimens identified with this species are like GSC 32247 (Pl. 124, fig. 2), and do not show the stage with single ribs. They have relatively dense ribbing on the phragmocone, essentially like that of the holotype.

Juvavites levigatus n. sp.

Plate 123, figures 7a–c; Plate 127, figures 6a–c; Figure 98c (p. 594)

Registered material. Holotype GSC 32249 (GSC loc. 82452). Hypotype GSC 32244 (GSC loc. 83829).

Occurrence. Lower Norian, Magnus Subzone 2. Pardonet Formation, northeastern British Columbia. GSC locs. 82452 (1), 83829 (1).

Diagnosis. Juvavites attaining a diameter of about 70 mm; H about 50 per cent, W about 45 per cent, U about 14 per cent of diameter. Ribbing strong on phragmocone, weak on body chamber. Ribs branch at inner and outer flank; tertiary ribs numerous. On phragmocone, ribs cross the venter with little or no projection

Measurements. Holotype GSC 32249 (Pl. 127, fig. 6): 71, 0.51, 0.44, 0.14.

The holotype (Pl. 127, fig. 6) has three quarters of a whorl of body chamber and has the peristome preserved. The last septum is visible, but the details of the suture line are not clear. Branched ribs, becoming increasingly weak adorad, are present on the whole of the body chamber. GSC 32244 (Pl. 123, fig. 7) acquired an almost perfectly smooth body chamber and may have been a small mature individual. The suture line is well preserved showing only one well developed auxiliary lobe (Fig. 98c).

The nature of the phragmocone indicates affinity with the contemporary species *Juvavites magnus* McLearn, *J. concretus* McLearn, and *J. biornatus* McLearn. *Juvavites levigatus* differs from all three in having an almost, or perfectly, smooth instead of ribbed, body chamber. Other juvavitids with smooth body chambers include *Indojuvavites brunneus* n. sp., *Epijuvavites transiens* n. sp. and *Juvavites subangulatus* n. sp., but these differ from *J. levigatus* in having ribs on the venter that are weaker and more projected.

Family DIDYMITIDAE Haug, 1894

Genus *Didymites* Mojsisovics, 1875a

Type species. Ammonites globosus Quenstedt.

Didymites quenstedti Mojsisovics

Plate 129, figures 10a, b; Figure 104k (p. 606)

Didymites quenstedti Mojsisovics, 1875a, p. 154, Pl. 59, figs. 5a, b; Pl. 60, fig. 8.

Didymites sp., TOZER, 1962a, Pl. 11, figs. 2a, b; TOZER, 1965c, p. 22; TOZER, 1967, p. 37, 60.

Registered material. Hypotype GSC 14307 (GSC loc. 42537).

Occurrence. Middle Norian, Rutherfordi Zone. Pardonet Formation, northeastern British Columbia. GSC locs. 42537 (1), 83836 (1), 83850 (1), 97529 (2), 98536 (2), 98875 (1).

Remarks. GSC 14307 (Pl. 129, fig. 10), the only large specimen showing the suture line, closely resembles Mojsisovics' figured specimen. The specimens from the other localities are mostly small. Although undoubtedly *Didymites,* they might represent other species.

Genus *Neodidymites* n. gen.

Type species. Neodidymites tatzreiteri n. sp.

Diagnosis. Small didymitid with slightly elliptical outline, a very small (occluded?) umbilicus, an arched venter, and a prominent ridge extending across the flank and venter immediately behind the peristome. Suture line serial, with at least four narrow bifid saddles and two well developed auxiliary lobes.

Species assigned. Neodidymites tatzreiteri n. sp.

Age. Middle Norian, Columbianus Zone.

Remarks. The bifid saddles clearly indicate affinity with *Didymites* Mojsisovics (1875a), which differs in lacking a ridge behind the peristome. There are also differences in the suture lines. The saddles of *Neodidymites* are narrow and uniformly bifid compared to those of *Didymites,* in which the lateral saddle is commonly not bifid, and quite unlike the external saddle. Also, the auxiliary lobes of *Didymites* are generally much smaller than the lateral lobes (L and U2), producing a normal suture line. The auxiliary

lobes of *Neodidymites* are different. Although smaller than U2, the decrease in size from L to U2, and then to the auxiliary lobes is regular, producing a serial, instead of normal, suture line.

Neodidymites tatzreiteri n. sp.

Plate 142, figures 4a–c; Figure 116b (p. 632)

Registered material. Holotype GSC 72193, two paratypes GSC 72194*, GSC 72195* (all GSC loc. 98885).

Occurrence. Middle Norian, Columbianus Subzone 1. Pardonet Formation, northeastern British Columbia. GSC loc. 98885 (6).

Diagnosis. Neodidymites about 19 mm in diameter, W about 65 per cent of diameter. Surface smooth.

Remarks. The holotype (Pl. 142, fig. 4) and GSC 72195* have almost exactly the same dimensions. Both are coiled with the same slight irregularity, there being an obtuse elbow about a quarter whorl behind the aperture. Both have parts of the peristome preserved, with a raised ridge behind. The exact nature of the umbilicus has not been determined, but it is certainly very small, probably occluded. The last septum of GSC 72195 is visible showing the body chamber to be a little less than one whorl. Both specimens were clearly complete and mature. GSC 72194* is a broken specimen showing the suture line on an inner whorl (Fig. 116b).

No comparable ammonoids have been described.

Etymology. The name is for Franz Tatzreiter who found the type specimens.

Family EPISCULITIDAE Spath, 1951

Genus *Parisculites* n. gen.

Type species. Lecanites mundus McLearn.

Diagnosis. Smooth serpenticone episculitid without constrictions. Growth lines strongly projected on the venter which they cross in the form of a blunt rostrum. Suture line goniatitic.

Species assigned. Lecanites mundus McLearn, *Ammonites obolinus* Dittmar.

Age. Middle Norian, Rutherfordi Zone.

Remarks. Similarities in the form of the growth lines where they cross the venter suggest a link with concentrically coiled species of *Episculites* Spath (1951) (e.g., *E. wrighti* n. sp.). However, *Episculites,* unlike *Parisculites,* is characteristically ribbed and many species of *Episculites* also differ in having constrictions. Most or all *Episculites* also differ in having indented lobes (see Tatzreiter, 1981, p. 94). Resemblances between the outer whorls of *Parisculites mundus* and *Tornquistites transiens* n. sp. may be significant, but *Parisculites* and other Episculitidae differ from *Tornquistites* Hyatt and Smith (1905) in having inner whorls with a rounded, not angular venter. *Timorisculites* Bando and Kobayashi (1981) differs in being more involute and in having a ceratitic suture line. As recognized by Spath (1951, p. 106), *Ammonites obolinus* Dittmar (Mojsisovics, 1893, p. 66) is an episculitid with a goniatitic suture line. It appears to be a representative of *Parisculites.* Dittmar's species was known only from a single specimen from the Hallstatt Limestone of the Feuerkogel. Regrettably the specimen seems to be lost.

Parisculites mundus (McLearn)

Plate 129, figures 13, 14; Figure 104g–i (p. 606)

Lecanites mundus McLearn, 1947a, Appendix p. 1, Pl. 4, figs. 2–5; McLEARN, 1960a, p. 47, Pl. 3, figs. 7a–c, 8.

Lecanites beattii McLearn, 1947a, Appendix p. 1, Pl. 4, fig. 6; McLEARN, 1960a, p. 47, Pl. 3, figs. 9a, b.

Registered material. Holotype GSC 9498 (McLearn, 1960a, Pl. 3, figs. 7a–c), paratype GSC 9499 (ibid., fig. 8), topotype (holotype *Lecanites beattii*) GSC 9500, two topotypes GSC 32114, GSC 32115 (all GSC loc. 9146).

Occurrence. Middle Norian, Rutherfordi Zone. Pardonet Formation, northeastern British Columbia. GSC locs. 9146 (12), 98536 (2).

Diagnosis. Parisculites about 20 mm in diameter; H about 35 per cent, W about 25 per cent, U 33–42 per cent of diameter. Inner whorls with ovoid section, outer more compressed.

Measurements. Holotype GSC 9498: 19, 0.32, 0.26, 0.42. Topotype GSC 32114 (Pl. 129, fig. 13): 22.5, 0.40, 0.27, 0.33.

Remarks. The holotype, GSC 32114 (Pl. 129, fig. 13) and GSC 32115 (Pl. 129, fig. 14) all have parts of the peristome preserved, which is inclined at an angle of about 45 degrees. The holotype body chamber is seven eighths of a whorl; of GSC 32215, one full whorl. GSC 32115 (Pl. 129, fig. 14) shows the inner whorls to be more inflated than the outer, with a whorl section like that of *Lecanites beattii.* The holotype of that taxon is incomplete, with only three quarters of a whorl of body chamber preserved. At maturity, the umbilical wall is very low, the flanks flat and the venter arched, defined by rounded shoulders. Growth striae are concave on the flank, and strongly projected on the venter. The goniatitic suture line is well displayed by the holotype, paratype and GSC 32114 (Figs. 104g–i).

Shape, suture line and in particular the projected nature of the growth lines on the venter indicate affinity with *Ammonites obolinus* Dittmar (see Mojsisovics, 1893, p. 66), which may differ only in being more involute.

Genus *Episculites* Spath, 1951

Type species. Ammonites decrescens Hauer.

Episculites browni (McLearn)

Plate 132, figures 11, 12; Figure 107a, b (p. 612)

Isculites browni McLearn, 1939b, p. 52, Pl. 1, fig. 3; McLEARN, 1947a, Pl. 4, fig. 7.

Episculites browni (McLearn). McLEARN, 1953a, p. 5; McLEARN, 1960a, p. 107, Pl. 18, figs. 3, 4a, b; TOZER, 1967, p. 59.

Isculites ornatus McLearn, 1947a, Appendix p. 1, Pl. 5, figs. 5, 6.

Episculites ornatus (McLearn). McLEARN, 1960a, p. 108, Pl. 18, figs. 7a, b; TOZER, 1967, p. 59.

Registered material. Holotype GSC 9409 (McLearn, 1960a, Pl. 18, figs. 4a, b), topotype GSC 9492 (holotype of *I. ornatus,* ibid., figs. 7a, b), two topotypes GSC 9513 (ibid., fig. 3), GSC 35412 (all GSC loc. 9741). Topotype GSC 32116 (GSC loc. 9744).

Occurrence. Middle Norian, Columbianus Zone, Subzone 1 or 2. Pardonet Formation, northeastern British Columbia. GSC locs. 9741 (7), 9744 (1).

Diagnosis. Episculites about 18 mm in diameter; H about 40 per cent, W about 50 per cent, U about 20 per cent of diameter. Last half whorl with excentric coiling. Body chamber not contracted in width, or very slightly contracted. Phragmocone smooth or with faint ribbing. Body chamber characteristically with ribs that branch frequently on the inner flank and cross the venter with strong projection. Constrictions shallow or absent.

Measurements. Holotype GSC 9409: 18, 0.36, 0.42, 0.22. Topotype GSC 9492: 15, 0.43, 0.53, 0.20. Topotype GSC 32116 (Pl. 132, fig. 11): 19, 0.37, 0.46, 0.22.

Remarks. The holotype and GSC 32116 (Pl. 132, fig. 11) are complete specimens with three quarters of a whorl of body chamber. GSC 9492, the holotype of *I. ornatus,* is probably also complete, but the well preserved test conceals the septa. The strength of ribbing on the body chamber varies. Smoothest is GSC 35412 (Pl. 132, fig. 12), a specimen referred to by McLearn (1960a, p. 107, line 9 from bottom). The holotype of *I. ornatus* has the most strongly ribbed body chamber and an almost perfectly smooth phragmocone. Examples with ribbing of intermediate strength are the holotype and GSC 32116 (Pl. 132, fig. 11). GSC 32116, which is another specimen referred to by McLearn (ibid., line 7 from bottom), has a body chamber slightly contracted in width, as does GSC 35412 (Pl. 132, fig. 12); the others do not. GSC 35412 has a trace of external nodes at the aperture. All other specimens have the ribs crossing the venter without any elaboration. External suture lines are shown by GSC 9513 and GSC 35412 (Figs. 107a, b).

Episculites teres (McLearn)

Plate 133, figures 10a, b; Plate 141, figures 1–3; Plate 142, figures 12, 13; Figure 108 (p. 614), Figure 115b–e (p. 630), Figure 116a (p. 632)

Isculites teres McLearn, 1947a, Appendix p. 1, Pl. 4, fig. 8.

Episculites teres (McLearn). McLEARN, 1960a, p. 108, Pl. 18, figs. 6a, b; TOZER, 1967, p. 59; TATZREITER, 1981, p. 95, Pl. 11, fig. 2.

Isculites corpulentus McLearn, 1947a, Appendix p. 1, Pl. 4, figs. 9, 10.

Episculites corpulentus (McLearn). McLEARN, 1960a, p. 109, Pl. 18, figs. 5a, b; TOZER, 1967, p. 59.

Parajuvavites sp., McLEARN, 1960a, p. 91, Pl. 12, figs. 1a, b.

Episculites sp., TOZER, 1967, p. 81.

Registered material. Holotype GSC 9493 (McLearn, 1960a, Pl. 18, figs. 6a, b) (GSC loc. 9744). Three topotypes GSC 9494 (holotype *I. corpulentus,* ibid., figs. 5a, b), GSC 12600, GSC 35414 (all GSC loc. 9741). Topotype GSC 35413 (GSC loc. 9745). Topotype GSC 85805* (GSC loc. 98869). Hypotype GSC 32117 (GSC loc. 19275). Two hypotypes GSC 32118, GSC 32119 (GSC loc. 19709).

Occurrence. Middle Norian, Columbianus Zone, Subzone 1 or 2. Pardonet Formation, northeastern British Columbia; Parson Bay Formation, Vancouver Island, British Columbia. GSC locs. 9741 (3), 9744 (1), 9745 (1), 19275 (1), 19709 (2), 98551 (2), 98869 (1).

Diagnosis. Episculites attaining a diameter of about 40 mm; H about 45 per cent, W about 40 to about 65 per cent of diameter, U about 20 per cent of diameter. Last half whorl with excentric coiling. Body chamber not contracted or very slightly contracted in width. Phragmocone and body chamber with faint, but regular ribbing, 15 to 20 ribs to a quadrant at the venter, which they cross with moderate projection. Well defined constrictions absent.

Measurements. Topotype GSC 12600 (Pl. 142, fig. 12): 34, 0.44, 0.38, 0.19. Topotype GSC 35413 (Pl. 142, fig. 13): 25, 0.32, 0.62, 0.16. Hypotype GSC 32118 (Pl. 141, fig. 3): 43, 0.42, 0.42, 0.25.

Remarks. The holotype of this species is wholly septate. GSC 12600 (Pl. 142, fig. 12), a complete specimen from the type locality, is taken to indicate the mature characters. This specimen, when identified as *Parajuvavites* sp. by McLearn (1960a, p. 91), showed no suture lines. Since then it has been broken showing the body chamber to be about one whorl in length and the phragmocone to have unindented saddles indicating a species of *Episculites,* not *Parajuvavites.* GSC 85805*, for which the original diameter was about 45 mm, is the largest known. The last formed septa are approximated and the length of the body chamber is about one whorl. GSC 35414 (Pl. 133, fig. 10), the specimen referred to by McLearn (1960a, p. 109, line 5), is evidently a nucleus of this species. GSC 35413 (Pl. 142, fig. 13), also described by McLearn (ibid., line 7), has part of the body chamber showing. It is appreciably more inflated than GSC 12600 (Pl. 142, fig. 12) and the body chamber is very slightly contracted in width. A feature of the holotype, which is a steinkern, is a slight flattening on the venter with the rib terminations somewhat elevated. A faint indication of this feature is shown by the holotype of *Isculites corpulentus,* which is also the steinkern of a phragmocone, and probably a nucleus of this species. The other specimens from the type locality do not show this feature. Of those from Vancouver Island GSC 32119 (Pl. 141, fig. 2) has a venter like the holotype; GSC 32117 (Pl. 141, fig. 1) has a smooth rounded venter. Specimens from the type locality appear to have smooth saddle walls; those from Vancouver Island have very small indentations (Figs. 115b, c).

This species may be described as a large version of *Episculites browni* (McLearn), but it differs not only in being larger, but also in having essentially similar ribbing on both the phragmocone and the body chamber.

Episculites crassus n. sp.

Plate 142, figures 10, 11

Registered material. Holotype GSC 71002, topotype GSC 71003 (both GSC loc. 97552).

Occurrence. Middle Norian, Columbianus Subzone 3. Pardonet Formation, northeastern British Columbia. GSC loc. 97552 (2).

Diagnosis. Episculites about 25 mm in diameter; H about 33 per cent, W up to about 60 per cent, U about 33 per cent of diameter. Last half whorl with excentric coiling. Ribs strong, some simple, some branching on the inner flank, crossing the venter with slightly diminished strength and little projection. Constrictions well defined.

Measurements. Holotype GSC 71002 (Pl. 142, fig. 11): 24, 0.33, 0.60, 0.33.

Remarks. The holotype (Pl. 142, fig. 11) is a complete specimen with the peristome preserved. The curvature of the umbilical seam suggests excentricity, but the extent of the egression cannot be determined owing to incomplete exposure of the inner whorls. What little is visible of the penultimate whorl is strongly ribbed like the outer whorl. Suture lines have not been seen, much of the test being preserved. The whole of the outer whorl is probably body chamber. GSC 71003 (Pl. 142, fig. 10) is provisionally placed in this species as a compressed variant.

The coiling and whorl section appears to be like that of some variants of *Episculites teres* (McLearn) (e.g., GSC 35413, Pl. 142, fig. 13), but no examples of that species have the strong ribs of *E. crassus.* The most strongly ribbed variants of *Episculites browni*

(McLearn) differ in having the ribbing restricted to the anterior part of the body chamber. Both *Episculites teres* and *E. browni* also differ in lacking deep constrictions and in having much stronger projection of the ribs on the venter.

Episculites wrighti n. sp.

Plate 136, figures 2a, b; Plate 141, figures 4a, b

Registered material. Holotype GSC 32120 (GSC loc. 74776). Paratype GSC 32121 (GSC loc. 46998).

Occurrence. Middle Norian, Columbianus Subzone 3. Pardonet Formation, northeastern British Columbia. GSC locs. 46998 (1), 74776 (1).

Diagnosis. Episculites about 30 mm in diameter; H about 35 per cent, W about 25 per cent, U about 33 per cent of diameter. Coiling concentric. Ribs strong on both phragmocone and body chamber, with frequent branching and intercalation near the umbilicus, crossing the venter with undiminished strength and slight projection. Constrictions well defined.

Measurements. Holotype GSC 32120 (Pl. 141, fig. 4): 33, 0.36, 0.24, 0.33.

Remarks. The holotype (Pl. 141, fig. 4) is probably a complete specimen, although the peristome is not certainly preserved. No sutures are visible and it is probable that the whole outer whorl is body chamber. The holotype shows ribs and constrictions on two full whorls; GSC 32121 (Pl. 136, fig. 2) on two and a half.

This species differs from all others in the Canadian faunas in having concentric coiling and a large umbilicus. The ribbing and constrictions invite comparison with *Episculites crassus* n. sp., but the mode of coiling is different.

Genus *Hypisculites* Spath, 1951

Type species. Isculites dieneri Pakuckas.

Hypisculites stelcki (McLearn)

Plate 136, figures 9a, b; Figure 110c (p. 620)

Daphnites (*Phormedites*?) *stelcki* McLearn, 1940a, p. 50, Pl. 2, figs. 9, 10.

Hypisculites stelcki (McLearn) McLEARN, 1953a, p. 6; McLEARN, 1960a, p. 109, Pl. 18, figs. 9a, b; TOZER, 1967, p. 57.

Registered material. Holotype GSC 8832 (McLearn, 1960a, Pl. 18, figs. 9a, b), two topotypes GSC 32122, GSC 35416* (all GSC loc. 9839). Hypotype GSC 85806* (GSC loc. 98870).

Occurrence. Middle Norian, Columbianus Subzone 2. Pardonet Formation, northeastern British Columbia. GSC locs. 9839 (10), 98870 (1).

Diagnosis. Hypisculites attaining diameter of about 40 mm; H about 35 per cent, W about 30 per cent, U about 30 per cent of diameter. Coiling somewhat excentric for at least one whorl. Ribs distinct, with frequent branching near the umbilicus, almost the same on phragmocone and body chamber. Umbilical tubercles are low bullate nodes. On last quadrant, umbilical nodes are absent and the external ridges and nodes are absent or barely perceptible.

Measurements. Holotype GSC 8832: 43, 0.38, 0.30, 0.28. Topotype GSC 35416*: 38, 0.35, 0.29, 0.34.

Remarks. In the holotype and GSC 35416 no septa are seen, probably indicating that the outer whorl is mostly body chamber. In both, sculpture of diminished strength is seen on the last quadrant; the specimens were probably mature. The outer whorls of both lack constrictions. The penultimate whorl of the holotype, although incompletely exposed, apparently has constrictions. In GSC 32122 (Pl. 136, fig. 9), 25 mm in diameter and more involute than the holotype, parts of the suture line are seen, and a body chamber of about three quarters of a whorl is preserved. It may have been an immature individual.

Hypisculites minor n. sp.

Plate 136, figures 8a, b; Figure 110b (p. 620)

Registered material. Holotype GSC 32123 (GSC loc. 46468).

Occurrence. Middle Norian, Columbianus Subzone 2. Pardonet Formation, northeastern British Columbia. GSC loc. 46468 (1).

Diagnosis. Hypisculites about 25 mm in diameter; H about 35 per cent, W about 33 per cent, U about 40 per cent of diameter. Coiling concentric. Ribs distinct on phragmocone and body chamber, low blunt umbilical nodes present on phragmocone and posterior half of body chamber. On posterior half of body chamber ribs increase by bifurcation at umbilical nodes, with some intercalation, there being about six umbilical nodes to 12–15 external nodes on a quadrant. On anterior half

of body chamber, umbilical bullae are absent, ribs are simple and external nodes become increasingly faint.

Measurements. Holotype GSC 32123 (Pl. 136, fig. 8): 23, 0.35, 0.33, 0.39.

Remarks. The holotype (Pl. 136, fig. 8), mostly preserved as steinkern, shows the last septum, and a body chamber of seven eighths of a whorl. It was probably complete and mature. One constriction is visible on the penultimate whorl.

This species differs from *Hypisculites dieneri* (Pakuckas) (1928, p. 171) in being more evolute, having less prominent umbilical nodes and in lacking constrictions on the outer whorl. It is also more evolute than *Hypisculites stelcki* (McLearn). The mode of coiling is probably also different, that of *Hypisculites stelcki* apparently being somewhat excentric, that of *H. minor* concentric.

Family PARATHISBITIDAE n. fam.

Discoidal or serpenticone, ribbed or smooth, some with slightly excentric coiling. Venter characteristically arched and carinate, but some venters have a sulcus impressed on the keel and are thus bicarinate. Ribbing and growth lines concave or straight on the flank, strongly projected at the margin forming a narrow rostrum. Tuberculation absent or in the form of blunt bullae or nodes at the umbilical margin. Body chamber about three quarters of a whorl. Suture line normal, ceratitic, with formula E, L, U2, U3, U2, I.

Genera included. Parathisbites Mojsisovics (1893), *Phormedites* Mojsisovics (1893), *Daphnites* Mojsisovics (1893), *Siculites* Gemmellaro (1904), *Jellinekites* Diener (1906).

Parathisbites, Phormedites, and *Jellinekites* are linked by similarities in their growth lines and in having a carinate venter. *Daphnites* differs in having a ventral sulcus, but there is nevertheless a resemblance between *Daphnites* and *Phormedites. Parathisbitidae* are distinguished from *Thisbitidae* by being more discoidal and particularly by the distinctive strong ventral projection of growth lines.

Age. Middle Norian.

Genus *Parathisbites* Mojsisovics, 1893

Type species. Ammonites scaphitiformis Hauer.

Parathisbites oineus McLearn

Plate 135, figures 4a–c; Plate 142, figures 16a, b; Figure 109b, c (p. 618)

Parathisbites oineus McLearn, 1947a, Appendix p. 1, Pl. 4, fig. 1; McLEARN, 1960a, p. 67, Pl. 6, figs. 11, 12; TOZER, 1965c, p. 222; TOZER, 1967, p. 58.

Registered material. Holotype GSC 9495 (McLearn, 1960a, Pl. 6, figs. 11a, b), topotype GSC 12589 (ibid., Pl. 6, fig. 12) (both GSC loc. 9762). Two hypotypes GSC 32309, GSC 32310* (both GSC loc. 83835). Hypotype GSC 72199 (GSC loc. 98877).

Occurrence. Middle Norian, Columbianus Subzone 1. Pardonet Formation, northeastern British Columbia. GSC locs. 9762 (100), 9764 (3),83835 (55), 97525 (2), 97526 (1), 98518 (2), 98543 (6), 98877 (1), 98878 (1), 98885 (1).

Measurements. Hypotype GSC 32309 (Pl. 135, fig. 4): 40, 0.47, 0.29, 0.13. Hypotype GSC 72199 (Pl. 142, fig. 16): 64, 0.50, 0.31, 0.13.

Remarks. GSC 32309 (Pl. 135, fig. 4) and GSC 72199 (Pl. 142, fig. 16) both have body chambers of three quarters of a whorl and are probably complete. GSC 72199 is the largest known specimen.

Parathisbites obtusus n. sp.

Plate 142, figures 15a, b

Registered material. Holotype GSC 71007 (GSC loc. 98542).

Occurrence. Middle Norian, Columbianus Subzone 1. Pardonet Formation, northeastern British Columbia. GSC loc. 98542 (1).

Diagnosis. Parathisbites at least 20 mm in diameter; H about 45 per cent, W about 25 per cent, U about 23 per cent of diameter. Some ribs simple, some merge on the inner flank, on last half whorl there are about 20 at the umbilicus, about 30 at the margin. Umbilical tuberculation absent. Ventral keel low and blunt.

Measurements. Holotype GSC 71007 (Pl. 142, fig. 15): 21, 0.43, 0.26, 0.23.

Remarks. The holotype has a body chamber of about five eighths of a whorl. The last three septa are visible, but are not approximated. Saddles are rounded, L

weakly indented, U2, as preserved, unidented. The specimen may have been immature, but approach of maturity is suggested by the large size of the umbilicus.

Parathisbites oineus McLearn is the most closely comparable species, but compared with *P. obtusus* differs in having a smaller umbilicus, ribs that branch on the outer flank, and a much more elevated keel.

Parathisbites pardoneti n. sp.

Plate 142, figures 7a–d

Registered material. Holotype GSC 71004 (GSC loc. 98518).

Occurrence. Middle Norian, Columbianus Subzone 1. Pardonet Formation, northeastern British Columbia. GSC loc. 98518 (1).

Diagnosis. Parathisbites at least 15 mm in diameter; H about 47 per cent, W about 40 per cent, U about 22 per cent of diameter. Whorl section quadrangular, keel blunt, rounded, not bordered by sulci. Ribs are thick and rounded, slightly bullate at the umbilical shoulder where most bifurcate; intercalated ribs also present producing nine ribs at the umbilicus, 25 at the margin.

Remarks. The holotype (Pl. 142, fig. 7) is incomplete, with only a quarter whorl of body chamber preserved. Parts of the suture line are visible. The external saddle is unindented, the lateral lobe (L) apparently very weakly indented.

The most closely similar species is *Parathisbites nodiger* Diener (1906, p. 35), which differs in having true bullae instead of bullate ribs at the umbilical margin.

Genus *Phormedites* Mojsisovics, 1893

Type species. Ceratites (*Phormedites*) *juvavicus* Mojsisovics.

Phormedites transiens n. sp.

Plate 142, figures 14a, b

Registered material. Holotype GSC 71008 (GSC loc. 98542).

Occurrence. Middle Norian, Columbianus Subzone 1. Pardonet Formation, northeastern British Columbia. GSC loc. 98542 (2).

Diagnosis. Phormedites about 25 mm in diameter; H about 48 per cent, W about 30 per cent, U about 20 per cent of diameter. Whorl section subquadranglar, with nearly flat flanks and the venter defined by distinct blunt shoulders. Venter with a low blunt keel.

Measurements. Holotype GSC 71008 (Pl. 142, fig. 14): 24, 0.48, 0.29, 0.21

Remarks. The holotype (Pl. 142, fig. 14) shows the last four septa followed by half a whorl of body chamber. The last two are approximated. The saddles are rounded, the lobes appear to be rounded, but were probably weakly indented. The specimen was probably complete and mature. Growth lines are strongly projected on the venter, joining in the form of a narrow rounded rostrum. This feature clearly indicates affinity with *Phormedites* and *Parathisbites*. The faint ribbing is like that of *Phormedites juvavicus* Mojsisovics (1893, p. 427), but the keel of *P. transiens* is much more pronounced, approaching the form encountered in *Parathisbites*.

Phormedites juvavicus Mojsisovics

Plate 130, figures 1, 2; Figure 105a (p. 608)

Phormedites juvavicus Mojsisovics, 1893, p. 427, Pl. 142, figs. 1a, b; PAKUCKAS, 1928, p. 193, Pl. 1, fig. 13.

Phormedites sp. cf. *P. juvavicus* Mojsisovics. TOZER, 1967, p. 60.

Registered material. Two hypotypes GSC 32307, GSC 32308 (GSC loc. 66027). Hypotype GSC 85807* (GSC loc. 97555).

Occurrence. Middle Norian, Columbianus Zone, Subzones 1, 2. Pardonet Formation, northeastern British Columbia. GSC locs. 66027 (3), 97555 (2).

Measurements. Hypotype GSC 32307 (Pl. 130, fig. 1): 34, 0.32, 0.29, 0.33. Hypotype GSC 32308 (Pl. 130, fig. 2): 26, 0.40, 0.34, 0.26. Hypotype GSC 85807*: 27, 0.37, 0.30, 0.28.

Remarks. Both GSC 32307 (Pl. 130, fig. 1) and GSC 32308 (Pl. 130, fig. 2) have about half a whorl of body chamber preserved and were probably almost complete. GSC 32307 has approximated septa and was probably mature; GSC 32308 does not have approximated septa and was probably immature, judging from the septa, and also the smaller umbilicus.

Mojsisovics (1893) knew this species from one specimen from the Hallstatt Limestone, in which the suture line is not seen. The close resemblance between GSC 32308 (Pl. 130, fig. 2) and the Hallstatt specimen leaves little doubt about the identification. The suture line of GSC 32308 has rounded saddles (Fig. 105a). The suture line of a specimen from Timor figured by Pakuckas (1928) has small indentations on the outer side of the external saddle. The presence or absence of these small indentations may not have taxonomic significance, possibly being related to interference between the septa and the strongly projected growth lines. This feature has been encountered in specimens of *Parathisbites oineus* McLearn. In GSC 85807 septa are not seen; it is probably mostly body chamber.

Family HALORITIDAE (Mojsisovics, 1893)

Genus *Parajuvavites* Mojsisovics, 1896

Type species. Parajuvavites blanfordi Mojsisovics.

Parajuvavites canadensis n. sp.

Plate 140, figures 1–9; Plate 141, figures 7, 8; Figure 114 (p. 628)

Parajuvavites sp. cf. *P. buddhaicus* Mojsisovics. McLEARN, 1960a, p. 91; TOZER, 1962a, Pl. 11, figs 6a, b; TOZER, 1967, p. 81.

Parajuvavites sp., Tozer, 1967, p. 55.

Registered material. Holotype GSC 32266, four paratypes GSC 32267–GSC 32270 (all GSC loc. 82454). Paratype GSC 32271 (GSC loc. 10739). Three paratypes GSC 32272–GSC 32274 (all GSC loc. 68305). Paratype GSC 14306 (GSC loc. 21431). Paratype GSC 32275 (GSC loc. 24352). Hypotype GSC 71006 (GSC loc. 97557).

Occurrence. Middle Norian, Columbianus Zone, Subzones 2, 3. Pardonet Formation, northeastern British Columbia; Parson Bay Formation, Vancouver Island, British Columbia. GSC locs. 10739 (1), 21431 (3), 24352 (2), 46998 (2), 64638 (1), 68305 (8), 82454 (17), 82662 (5), 97557 (2), 98549 (3), 98867 (1), 98909 (10).

Diagnosis. Parajuvavites about 35 to about 90 mm in diameter; H about 35–45 per cent, W about 30 per cent, U 12–20 per cent of diameter. Last half whorl with excentric coiling. Venter of phragmocone arched; on initial part of body chamber it is at first broadly arched, then narrowly arched, before finally broadening at the aperture. Ribs fairly prominent on phragmocone, less so on body chamber; branching is on the inner and outer flank with numerous tertiary ribs. Ribs cross the venter with diminished strength.

Measurements. Paratype GSC 32273 (Pl. 140, fig. 1): 34, 0.47, 0.32, 0.12. Paratype GSC 32272 (Pl. 140, fig. 2): 45, 0.45, 0.32, 0.15. Holotype GSC 32266 (Pl. 140, fig. 4): 52, 0.37, 0.29, 0.20. Paratype GSC 32268 (Pl. 140, fig. 9): 63, 0.41, 0.30, 0.17. Paratype GSC 32275 (Pl. 141, fig. 7): 80, 0.34, –, 0.20.

Remarks. Most of the specimens have little of the test preserved, but in those that do, it is thin, with the steinkern faithfully reproducing the sculpture. The measurements are of complete specimens with the venter broadened at the aperture, suggesting maturity. It appears that the small specimens have a proportionately smaller umbilicus than the large. Possibly more than one species is represented, one very small with a small umbilicus (Pl. 140, fig. 1), another larger (e.g., Pl. 140, fig. 9) with a large umbilicus. Against the recognition of more than one species, however, are specimens like GSC 32272 (Pl. 140, fig. 2) intermediate in diameter and in size of umbilicus. The close similarity between GSC 32267 (Pl. 140, fig. 8) and GSC 32275 (Pl. 141, fig. 7) justifies regarding the specimens from Vancouver Island as conspecific with those from northeastern British Columbia despite the fact that GSC 14306 (Pl. 141, fig. 8), from Vancouver Island, has more prominent ribbing than any specimens from the type locality. Suture lines are well preserved showing moderately indented elements and one auxiliary lobe.

Remarks. The mode of coiling, style of ribbing and suture line indicate close affinity with *Parajuvavites buddhaicus* Mojsisovics (1896, p. 600) and related species from the Himalayas, which may differ only in having stronger ribbing on the body chamber.

Genus *Halorites* Mojsisovics, 1879

Type species. Ammonites ramsaueri Hauer.

Halorites sp. indet.

Plate 141, figures 6a–e

Registered material. GSC 32276 (GSC loc. 68301).

Occurrence. Middle Norian, Columbianus Subzone 3. Pardonet Formation, northeastern British Columbia. GSC loc. 68301 (1).

Remarks. The specimen consists of the complete phragmocone (Pl. 141, fig. 6a) and part of the body chamber showing the excentric umbilicus (Pl. 141, fig. 6c). Ribbing on the venter is irregular, as in *Halorites procyon* Mojsisovics (1896, p. 582), to which the specimen might be referable. However, without the complete body chamber, specific determination is impossible.

Genus *Paraguembelites* Tozer, 1979

Type species. Paraguembelites ludingtoni Tozer.

Paraguembelites ludingtoni Tozer

Plate 145, figures 7–14; Figure 118b (p. 638)

Paraguembelites ludingtoni Tozer, 1979, p. 130, Pl. 16.1, figs. 21–23.

Registered material. Holotype GSC 32279, six paratypes GSC 32280–GSC 32285 (all GSC loc. 68304). Hypotype GSC 32287 (GSC loc. 68300).

Occurrence. Upper Norian, Cordilleranus Subzone 1. Pardonet Formation, northeastern British Columbia. GSC locs. 9325 (3), 68300 (25), 68304 (20), 97550 (1), 98534 (5), 98559 (20).

Diagnosis. Paraguembelites with angular outline, with obtuse elbow bend about a quarter whorl from the aperture. Diameter about 40 mm, phragmocone width about 30–40 per cent of diameter, umbilical width about seven per cent of diameter. About one quarter whorl with excentric coiling. Phragmocone with narrowly arched venter, ribbed with some branching at the inner and outer flank and some tertiary ribs. Ribs with barely perceptible to prominent node-spirals, about six spirals between the umbilicus and the external nodes, spirals on the inner flank less prominent than on the outer. About 10–20 external nodes on a quarter whorl. Ribs and nodes fade on the outer whorl and are wholly absent on the last half whorl, where the venter becomes more narrowly arched before widening at the aperture.

Remarks. GSC 32281 (Pl. 145, fig. 14) is complete with the peristome. On the side not illustrated, the steinkern reveals a furrow immediately behind the aperture. The umbilical seam is not perfectly preserved, but it appears that between half and one quarter of the last whorl is egressive. External nodes are present in the first half of the outer whorl; absent in the last half. On what is visible of the flanks there are no lateral nodes. Length of the body chamber in this specimen, which was evidently complete and mature, is three quarters of a whorl. The holotype (Pl. 145, fig. 12), GSC 32280 (Pl. 145, fig. 11) and GSC 32284 (Pl. 145, fig. 8) preserve parts of the body chamber and the egressive umbilical seam and, although incomplete, all three clearly had dimensions much like the complete specimen (Pl. 145, fig. 14). Because broken, they show more of the phragmocone, with traces of lateral nodes. GSC 32280 (Pl. 145, fig. 11) has an irregular outline, indicating that this feature was natural. GSC 32287 (Pl. 145, fig. 7) and GSC 32283 (Pl. 145, fig. 10) are well preserved phragmocones showing the lateral and external tuberculation. GSC 32287 has the most distantly spaced external nodes, about 10 on a quarter whorl; GSC 32283, the most closely spaced, about 20. GSC 32285 (Pl. 145, fig. 13) has a suture line with a very feebly individualized auxiliary lobe (Fig. 118b). The specimens from GSC localities 97550, 98534 and 98559 closely resemble those from the type locality.

Paraguembelites inflatus n. sp.

Plate 144, figures 14–18; Figure 117j, k (p. 636)

Registered material. Holotype GSC 32290, three paratypes GSC 32288, GSC 32289, GSC 32291 (all GSC loc. 68300). Paratype GSC 32286 (GSC loc. 68304).

Occurrence. Upper Norian, Cordilleranus Subzone 1. Pardonet Formation, northeastern British Columbia. GSC locs. 68300 (4), 68304 (1).

Diagnosis. Paraguembelites, as far as is known, like *P. ludingtoni* Tozer, but attains a larger size and has a much more inflated phragmocone, W being about 50–60 per cent of the diameter.

Remarks. Assuming the same ratio between size of phragmocone and that of the complete specimen, as in *Paraguembelites ludingtoni* the holotype of this species (Pl. 144, fig. 18), is the remains of an individual about 70 mm in diameter. The only example of *Paraguembelites inflatus* that has the body chamber preserved is GSC 32286 (Pl. 144, fig. 17). The full size of this specimen was less than 70 mm, but it is identified as *P. inflatus* because the dorsum has the impression of a phragmocone preserved, like GSC 32288 (Pl. 144, fig. 15).

Genus *Gnomohalorites* Tozer, 1979

Type species. Gnomohalorites southeri Tozer.

Gnomohalorites southeri Tozer

Plate 145, figures 2a, b

Halorites sp. cf. *H. americanus* Hyatt. TOZER, 1967, p. 80; SOUTHER, 1971, p. 79.

Gnomohalorites southeri Tozer, 1979, p. 132, Pl. 16.1, figs. 19a, b.

Registered material. Holotype GSC 32292 (GSC loc. 40429).

Occurrence. Upper Norian, Cordilleranus Zone. Sinwa Formation, Tulsequah area, British Columbia; Parson Bay Formation, Vancouver Island, British Columbia. GSC locs. 6987 (6), 40429 (4).

Diagnosis. Gnomohalorites with a densely tuberculate phragmocone, there being about eight nodes on each rib between the umbilicus and the venter.

Remarks. The holotype (Pl. 145, fig. 2) has about one quarter whorl of the body chamber preserved. On this there are 15 ribs at the venter. About five are simple and can be traced to the rounded umbilical shoulder. The remainder are intercalated on the inner flank. The first five ribs have about eight nodes, the second five have the nodes on the inner flank reduced in strength, the last five have nodes only on the outer flank. The reduction of the tuberculation presumably indicates that the body chamber was mature. Although the last septum is visible, details of the suture line have not been determined. The elements appear to be weakly indented.

Gnomohalorites cordilleranus Tozer

Plate 145, figures 3, 4; Figure 118c (p. 638)

Halorites sp. cf. *H. americanus* Hyatt. TOZER, 1967, p. 54, 77.

Gnomohalorites cordilleranus Tozer, 1979, p. 132, Pl. 16.1, figs. 18a, b.

Registered material. Holotype GSC 32277, paratype GSC 32278 (both GSC loc. 68300).

Occurrence. Upper Norian, Cordilleranus Subzone 1. Pardonet Formation, northeastern British Columbia; Tyaughton Group, southern British Columbia. GSC locs. 56410 (1), 68300 (2).

Diagnosis. Gnomohalorites with a moderately densely tuberculate phragmocone, there being about six nodes on each rib between the umbilicus and the venter.

Remarks. The holotype (Pl. 145, fig. 4) is wholly septate. GSC 32278 (Pl. 145, fig. 3) is a complete phragmocone with approximated septa and a very small part of the body chamber. Both have simple and bifurcating ribs on the flank, about 10 ribs to a quadrant at the venter, half of which are simple. The suture line of GSC 32278 is well preserved showing weakly indented elements (Fig. 118c).

This species may be a synonym of *Halorites americanus* Hyatt (Hyatt and Smith, 1905, p. 42), but the type of that species is not well enough preserved for the identity of the two taxa to be established.

Gnomohalorites yukonensis Tozer

Plate 145, figures 1a, b; Figure 118a (p. 638)

Halorites sp. indet., TOZER, 1958, p. 15.

Halorites sp. cf. *H. americanus* Hyatt. TOZER, 1962a, Pl. 12, figs. 17a, b; TOZER, 1967, p. 80.

Gnomohalorites yukonensis Tozer, 1979, p. 133.

Registered material. Holotype GSC 14262 (GSC loc. 23457).

Occurrence. Upper Norian, Cordilleranus Zone. Lewes River Group, Formation D, Laberge area, Yukon. GSC loc. 23457 (1).

Diagnosis. Gnomohalorites with a coarsely tuberculate phragmocone, there being only three or four large nodes on each rib between the umbilicus and the venter.

Remarks. The holotype (Pl. 145, fig. 1) is wholly septate. The nodes are much stronger than the ribs, most of which are simple. There are about seven nodes at the venter on the last quadrant. The nodes on successive ribs are not spirally arranged, but are exactly out of phase. This arrangement is also found in *G. southeri* and *G. cordilleranus,* but with their finer tuberculation it is much less obvious. Suture lines are fairly well preserved. The saddles are of somewhat irregular outline, but are barely indented (Fig. 118a).

Family METASIBIRITIDAE Spath, 1951

Genus *Metasibirites* Mojsisovics, 1896

Type species. Ammonites spinescens Hauer.

Metasibirites columbianus Tozer

Plate 146, figures 13a–d; Figure 119d (p. 640)

Metasibirites columbianus Tozer, 1979, p. 129, Pl. 16.1, figs. 20a–c.

Registered material. Holotype GSC 28927 (GSC loc. 68300).

Occurrence. Upper Norian, Cordilleranus Subzone 1. Pardonet Formation, northeastern British Columbia. GSC loc. 68300 (1).

Diagnosis. Metasibirites with phragmocone diameter of about 15 mm; at which H is about 38 per cent, W about 70 per cent, U about 40 per cent of diameter. Whorls depressed. Inner flank with simple bullate ribs (about 15 on half a whorl), from which stem two ribs that pass uninterrupted, with slight projection, across the venter.

Remarks. The holotype (Pl. 146, fig. 13) is entirely septate and is probably a complete phragmocone. Suture lines are not perfectly preserved, but there is no doubt that L is indented.

Resemblance to *Metasbirites spinescens* (Hauer) (Mojsisovics, 1893, p. 327) is obvious, but *M. columbianus* differs in having bullate ribs rather than spines on the flanks. The suture line of *M. spinescens* is not well preserved. It is generally believed to have unindented lobes, but this is not certain.

Metasibirites speratus n. sp.

Plate 146, figures 14a–c; Figure 119e (p. 640)

Registered material. Holotype GSC 71035 (GSC loc. 98559).

Occurrence. Upper Norian, Cordilleranus Subzone 1. Pardonet Formation, northeastern British Columbia. GSC loc. 98559 (1).

Diagnosis. Metasibirites at least 30 mm in diameter; H about 30 per cent, W about 42 per cent, U about 40 per cent of diameter. Whorl section ovoid. Inner flank with bullate primary ribs, about 15 on half a whorl, which bifurcate on flank; in addition there are a few intercalated ribs. Suture line weakly ammonitic.

Remarks. The holotype (Pl. 146, fig. 14) has a little more than a quarter whorl of the body chamber preserved, and is probably not complete. At the beginning and at the end of the outer whorl, the ribs pass over the venter without interruption. In between there is a segment where they are interrupted and projected adapically. This part seems to have been damaged and repaired in life. On the last half whorl there are 15 ribs at the umbilicus, 34 at the venter. Suture lines and the face of what is probably the last septum are fairly well preserved. The external lobe (E) has a small median saddle; the external saddle is weakly ammonitic and L is also indented (Fig. 119e).

The mode of coiling, style of ribbing, and number of elements in the suture line justify referring this species to *Metasibirites.* Compared with *Metasibirites spinescens* (Hauer) (Mojsisovics, 1893, p. 327) and *M. columbianus* Tozer, *M. speratus* has less inflated whorls and primary ribs forming low bullae instead of being spinose (*M. spinescens*) or having elevated bullae (*M. columbianus*). No other species of *Metasibirites* is known to have ammonitic suture lines. Most are believed to have an external lobe without a median saddle, and unindented saddles and lobes. Mojsisovics (1893, p. 328), when describing the suture line of *Metasibirites spinescens* as apparently goniatitic, notes that its original form may have been altered during preparation. The relief of *Metasibirites* ribs is considerable. If even partly reduced during preparation, a small median saddle and small denticulations in the lobes and saddles, like those preserved on *M. speratus,* would disappear and the suture line would become goniatitic. The suture line of *Metasibirites speratus* was prepared without reducing the relief of the ribs. Probably it indicates the natural condition of the *Metasibirites* suture line.

Genus *Tozeria* Tatzreiter, 1985

Type species. Tozeria hernsteini Tatzreiter.

Tozeria yukonensis n. sp.

Plate 147, figures 4a–c

Metasibirites sp., TOZER, 1967, p. 39, 80.

Registered material. Holotype GSC 28928 (GSC loc. 14860).

Occurrence. Upper Norian, Amoenum Zone. Lewes River Group, Whitehorse area, Yukon. GSC loc. 14860 (1).

Diagnosis. Tozeria with phragmocone diameter at least 9 mm, at which H is about 33 per cent, W about 70 per cent, U about 40 per cent of diameter. Whorls depressed hexagonal in section, attaining their maximum width near the broadly arched venter. Inner flank with simple ribs, about 15 on half a whorl. On outer flank, the ribs form spines, from which stem two ribs extending to median line, where they are interrupted, arranged en echelon, but not bullate.

Remarks. The holotype (Pl. 147, fig. 4) is entirely septate. The depressed whorl section, simple rectiradiate ribs on the inner flank, marginal spines and ribs, which are interrupted on the venter clearly indicate affinity with *Tozeria hernsteini* Tatzreiter (1985, p. 224). Most of the spines are broken, but a few are virtually complete. Details of the suture line are not preserved, but the face of the last preserved septum indicates a lobe formula of E, L, U2, U1, I, as in *Tozeria hernsteini. Tozeria yukonensis* differs from *T. hersteini* in having a more depressed whorl section and in lacking bullae where the ribs end on the venter.

Genus *Lissonites* Tozer, 1979

Type species. Lissonites canadensis Tozer.

Lissonites canadensis Tozer

Plate 146, figures 1–7, 9–12; Figure 119a (p. 640)

Lissonites canadensis Tozer, 1979, p. 129, Pl. 16.1, figs. 16a–d, Textfig. 16.1J.

Registered material. Holotype GSC 28932, four paratypes GSC 28929–GSC 28931, GSC 28933 (all GSC loc. 83818). Hypotype GSC 28934 (GSC loc. 83816). Five hypotypes GSC 28935, GSC 28936, GSC 28938, GSC 28939, GSC 28940 (all GSC loc. 83817).

Occurrence. Upper Norian, Cordilleranus Subzone 2. Pardonet Formation, northeastern British Columbia. GSC locs. 83816 (11), 83817 (20), 83818 (25), 83828 (5), 98545 (?6).

Diagnosis. Lissonites attaining a diameter of about 22 mm; H about 33 per cent, W about 35 per cent, U about 30 to 45 per cent of diameter. Sculpture as well as proportions highly variable. Ribs simple, branched or intercalated, interrupted at the mid-line or crossing the venter. Some variants, with ribs interrupted at the venter have faint external tuberculation; some also have marginal tuberculation, which is even fainter.

Measurements. Holotype GSC 28932 (Pl. 146, fig. 1): 20, 0.30, 0.38, 0.47. Hypotype GSC 28935 (Pl. 146, fig. 12): 16.0, 0.31, 0.34, 0.34. Hypotype GSC 28938 (Pl. 146, fig. 9): 13.5, 0.37, 0.41, 0.41. Hypotype GSC 28940 (Pl. 146, fig. 10): 14.5, 0.34, 0.42, 0.34.

Remarks. No two specimens are exactly alike. Tuberculation is never prominent. Faint lateral bullae, recalling the sculpture of *Metasibirites annulosus* Mojsisovics (1893, p. 330) are seen in GSC 28931 (Pl. 146, fig. 2), GSC 28930 (Pl. 146, fig. 5) and GSC 28929 (Pl. 146, fig. 6). Marginal tuberculation is clearly shown at the start of the outer whorl of the holotype (Pl. 146, fig. 1e), faintly by GSC 28931 (Pl. 146, fig. 2) and GSC 28930 (Pl. 146, fig. 5). External tuberculation is present on the holotype (Pl. 146, fig. 1), GSC 28931 (Pl. 146, fig. 2) and GSC 28930 (Pl. 146, fig. 5), but it is absent or barely perceptible on the others. There are thus only a few specimens, e.g., GSC 28931 (Pl. 146, fig. 2), that may be described as trituberculate, having traces of lateral bullae, marginal tubercles and external tubercles. The simple ribs, prominent ventral shoulders and subtabulate venter of GSC 28940 (Pl. 146, fig. 10), recalling the characters of some *Helictites,* at first sight suggest a different species, but the same style of ribbing is seen on the inner whorls of the holotype (Pl. 146, fig. 1) and GSC 28938 (Pl. 146, fig. 9). GSC 28936 (Pl. 146, fig. 7) is a variant with unusually dense ribbing. Several specimens have enough shell material preserved to show that the variation in ribbing on the venter is a feature of the test surface and not merely a difference between the steinkern and the test. GSC 28938 (Pl. 146, fig. 9) has all the ribs crossing the venter. The holotype (Pl. 146, fig. 1) has most, but not all, ribs interrupted. GSC 28933 (Pl. 146, fig. 3) has about half interrupted and half continuous; this specimen also has fine regular growth striae preserved. Suture lines showing an entire external lobe are exposed on GSC 28929, GSC 28931, GSC 28933, GSC 28935 and GSC 28936. GSC 28933 also shows the goniatitic lateral lobe (Fig. 119a). GSC 28929 (Pl. 146, fig. 6) has the septal surface exposed, indicating a five-lobe formula.

The sculpture and suture line undoubtedly indicate affinity with "*Sibirites*" *eichwaldi* var. *peruana* Lisson (1911, p. 2), a taxon in which Jaworski (1923) named two species, *Nevadites lissoni* Jaworski (ibid., p. 159) and *N. sutanensis* Jaworski (ibid., p. 163). Spath (1934, p. 37) pointed out that identification of these species as *Nevadites* was incorrect. *Anolcites dieneri* Jaworski (ibid., p. 166), which is also of this group,

was similarly misidentified. All the variations in ribbing and tuberculation encountered in *Lissonites canadensis* can be matched by specimens from Peru illustrated by Lisson and Jaworski, but none are as evolute as the holotype of *L. canadensis*. Specimens from Bulgaria identified as *Nevadites sutanensis* by Sacharieva-Kovatcheva (1967, p. 78) have no conspicuous tuberculation and resemble variants of *L. canadensis* like GSC 28935 (Pl. 146, fig. 12).

Lissonites pecki n. sp.

Plate 146, figures 8a–d

Registered material. Holotype GSC 28937 (GSC loc. 83817).

Occurrence. Upper Norian, Cordilleranus Subzone 2. Pardonet Formation, northeastern British Columbia. GSC loc. 83817 (1).

Diagnosis. Lissonites attaining a diameter of about 12 mm; H about 35 per cent, W about 40 per cent, U about 30 per cent of diameter. Most ribs branch on the inner flank; some intercalated ribs also present. On the phragmocone, distinct bullae are present where the ribs branch; these become less conspicuous on the body chamber. Ribs are interrupted on the venter.

Remarks. The holotype has about half a whorl of body chamber preserved and is probably nearly complete. On the phragmocone, the ribs are en echelon, where interrupted on the venter. The suture line is only partly visible. What can be seen indicates similarity to *Lissonites canadensis*. This species may be a variant of *Lissonites canadensis* Tozer, but differs from typical examples in being more involute and in having distinct bullae on the inner flank of the phragmocone.

Etymology. The name commemorates Don Peck.

Superfamily CHORISTOCERATACEAE Hyatt, 1900

Family CYCLOCELTITIDAE Tozer, 1979

Genus *Neotenoceras* n. gen.

Type species. Neotenoceras simplex n. sp.

Diagnosis. Smooth cyloceltitid. Suture line without median saddle in the external lobe (E).

Species assigned. Neotenoceras simplex n. sp.

Age. Upper Carnian, Welleri Zone.

Remarks. The very simple suture line, with a four-lobed formula (E, L, U, I), an entire E, and unindented lobes, suggests affinity with *Cycloceltites* Mojsisovics (1893). *Cycloceltites* and the only other genus of the family, *Ophiorhabdoceras* n. gen., differ from *Neotenoceras* in being ribbed. *Ophiorhabdoceras* also differs in having a median saddle in E.

Neotenoceras simplex n. sp.

Plate 104, figures 2a, b; Figure 83 (p. 556)

Registered material. Holotype GSC 85809, paratypes GSC 85810*, GSC 85811* (all GSC loc. C-157373).

Occurrence. Upper Carnian, Welleri Subzone 2. Peril Formation, Queen Charlotte Islands. GSC loc. C-157373 (4).

Diagnosis. Neotenoceras attaining a diameter of at least 20 mm; H about 33 per cent, W about 27 per cent, U about 43 per cent of diameter. Whorl section ovoid, without umbilical or ventral shoulders. Surface almost perfectly smooth with indistinct suggestion of blunt folds or ribs on the inner flank and faint growth lines, slightly convex on the flank, slightly projected on the venter.

Measurements. Holotype GSC 85809 (Pl. 104, fig. 2): 10.3, 0.34, 0.27, 0.43. Paratype GSC 85810: 15, 0.33, 0.27, 0.43.

Remarks. The holotype (Pl. 104, fig. 2) is the remains of a complete phragmocone with a little more than a quarter whorl of body chamber preserved. GSC 85811 has part of the body chamber preserved, but the limit of the phragmocone is not seen. It is the largest known specimen, the remains of an individual that attained a diameter of at least 20 mm. It is septate at a whorl height of 5 mm, showing a suture line like that of the holotype.

No comparable ammonoids have been described.

Genus *Ophiorhabdoceras* n. gen.

Diagnosis. Cycloceltitid with strong simple ribs crossing the venter without interruption or tuberculation. Suture line with a median saddle in the external lobe (E).

Species assigned. Ophiorhabdoceras canadense n. sp.

Age. Upper Norian, Cordilleranus Zone.

Remarks. Affinity with *Cycloceltites* is indicated by the simple lobe formula (E, L, U, I). *Ophiorhabdoceras* differs from *Cycloceltites* in having stronger, more uniform ribbing, which extends across the venter at a small diameter as well as on the outer whorl, and by having a suture line with a median saddle in E. The ribbing and suture line, but not the coiling, are as in the heteromorph genus *Rhabdoceras*. *Ophiorhabdoceras* may be regarded as a *Rhabdoceras* coiled throughout life instead of being coiled for not more than two whorls.

Ophiorhabdoceras canadense n. sp.

Plate 144, figures 20, 21; Figure 117b (p. 636)

Registered material. Holotype GSC 72328, paratype GSC 72327 (both GSC loc. 98558).

Occurrence. Upper Norian, Cordilleranus Subzone 1. Pardonet Formation, northeastern British Columbia. GSC loc. 98558 (2).

Diagnosis. Ophiorhabdoceras about 14 mm in diameter; H about 30 per cent, W about 33 per cent, U about 48 per cent of diameter. Outer whorl with about 30 ribs.

Measurements. Paratype GSC 72327 (Pl. 144, fig. 20): 13.5, 0.30, 0.30, 0.48. Holotype GSC 72328 (Pl. 144, fig. 21): 10, 0.30, 0.35, 0.48.

Remarks. The figure of the holotype (Pl. 144, fig. 21) is of the phragmocone. Three eighths of a whorl of body chamber is also preserved. The septal face of the phragmocone shows that the suture line has the formula E, L, U, I, like *Cycloceltites, Rhabdoceras, Peripleurites*, and *Choristoceras*. GSC 72327 (Pl. 144, fig. 20) has half a whorl of body chamber preserved, and is probably complete. It has a small median saddle in E and a perfectly rounded lateral lobe (L) (Fig. 117b).

No comparable ammonoids are known.

Genus *Cycloceltites* Mojsisovics, 1893

Type species. Celtites (Cycloceltites) arduini Mojsisovics.

Cycloceltites cowichanensis n. sp.

Plate 147, figures 11, 12; Figure 120d (p. 644)

Cycloceltites sp. cf. *C. arduini* Mojsisovics. TOZER, 1962a, Pl. 12, figs. 16a, b; TOZER, 1967, p. 39, 79; TOZER, 1979, Pl. 16.1, figs. 14, 15.

Registered material. Holotype GSC 17015, paratype GSC 28944 (both GSC loc. 23372).

Occurrence. Upper Norian, Crickmayi Zone. Sutton Formation, Vancouver Island, British Columbia. GSC loc. 23372 (2).

Diagnosis. Cycloceltites with H about 28 per cent, W about 28 per cent, U about 52 per cent of diameter. Venter smooth to a diameter of about 8 mm, crossed by ribs at a larger diameter. Ribs radial, of uneven strength. Suture line with deep external lobe (E), shallow lateral lobe (L).

Measurements. Holotype GSC 17015 (Pl. 147, fig. 11): 12.5, 0.28, 0.28, 0.52.

Remarks. In the holotype (Pl. 147, fig. 11), septa are visible on the first quarter of the outer whorl. The remainder is probably body chamber. Initially the outer whorl is without ribs on the venter; adorad they cross the venter. Auriculoids (parabolic nodes) are absent, but one rib shows a faint crescentic pattern at the margin. The distinctive external lobe of *Cycloceltites,* devoid of a median saddle, is visible in the holotype, also in GSC 28944 (Pl. 147, fig. 12, Fig. 120d).

The style of the ribbing and the suture line clearly indicate affinity to *Cycloceltites arduini* Mojsisovics (1893, p. 360), from which the new species differs in having a smaller umbilicus, by acquiring a ribbed venter at a smaller diameter, by the complete absence of branched ribs and by the absence of auriculoids.

Family RHABDOCERATIDAE Tozer, 1979

Genus *Rhabdoceras* Hauer, 1860

Type species. Rhabdoceras suessi Hauer.

Rhabdoceras suessi Hauer

Plate 144, figures 1–8; Plate 147, figures 1–3; Figure 117c–g (p. 636), Figure 120i, j (p. 644)

Rhabdoceras suessi Hauer, 1860, p. 125, Pl. 2, figs. 9–16; MOJSISOVICS, 1893, p. 571, Pl. 133, figs. 10–17 (13, 14 = var. *curvata*); GEMMEL-

LARO, 1904, p. 76, Pl. 18, figs. 45, 46; ARTHABER, 1905, Pl. 47, fig. 19; JANENSCH, 1906, p. 710, figs. 1, 2; JAWORSKI, 1915, p. 133, Pl. 45, figs. 14, 15; KUTASSY, 1927, p. 165, Pl. 6, figs. 8a–c; KUTASSY, 1936, p. 1041, Pl. 13, fig. 36; TOZER, 1958, p. 15; TOZER, 1962a, Pl. 12, figs. 18, 19a–c; ZAPFE, 1965, p. 300, Pl. 1, fig. 8; KUSHLIN, 1965, p. 139, fig. 1; TOZER, 1967, p. 38–40, 54, 55, 75, 77, 79, 80, Pl. 10, figs. 6, 7a–c; SACHARIEVA-KOVATCHEVA, 1967, p. 76, Pl. 5, fig. 9; WIEDMANN, 1972, p. 588, Pl. 3, figs. 3a, b; WIEDMANN, 1973, p. 238, Pl. 1, figs. 8a, b; TOZER, 1979, Pl. 16.1, figs. 8–10.

Rhabdoceras russelli Hyatt, 1892, p. 398; HYATT and SMITH, 1905, p. 203, Pl. 47, figs. 13–15; Pl. 56, fig. 26; SMITH, 1927, p. 99, Pl. 47, figs. 13–15; Pl. 56, fig. 26; SPATH, 1951, p. 86.

Rhabdoceras boreale Afitsky, 1965, p. 137, Textfig. 1; AFITSKY, 1970, p. 107, Pl. 3, figs. 1a, b.

Rhabdoceras laeve Kushlin, 1965, p. 140, Textfigs. 2a–d.

Rhabdoceras (Cyrtorhabdoceras) curvatum Mojsisovics. WIEDMANN, 1973, Pl. 1, figs. 8a, b.

Registered material. Two hypotypes GSC 14263, GSC 14264 (both GSC loc. 23457). Three hypotypes GSC 32311–GSC 32313 (all GSC loc. 68300). Hypotype GSC 32314 (GSC loc. 68304). Two hypotypes GSC 32315, GSC 32316 (both GSC loc. 64594). Hypotype GSC 32317 (GSC loc. 23370). Hypotype GSC 32318 (GSC loc. 56415). Hypotype GSC 32319 (GSC loc. 56414).

Occurrence. Upper Norian, Cordilleranus, Amoenum and Crickmayi zones. Pardonet Formation, northeastern British Columbia; Parson Bay Formation, Vancouver Island, British Columbia; Sutton Formation, Vancouver Island, British Columbia; Tyaughton Group, southern British Columbia; Lewes River Group, Formation D, Laberge area, Yukon. GSC locs. 6897 (2), 19672 (2), 23055 (1), 23072 (10), 23370 (3), 23372 (1), 23457 (2), 56414 (1), 56415 (1), 64594 (2), 68300 (8), 68304 (6), 98558 (20), 98887 (1).

Remarks. This species is known from numerous fragmentary specimens. No examples showing the initial coiled part, as described by Janensch (1906), are known from Canada. On the straight part, ribbing is variable in strength and density, some variants being virtually smooth, others strongly ribbed. Ribs are generally strongest on the flank, similar or slightly weaker on the venter and weakest on the dorsum. The ribs and growth striae are projected ventrally except at a small size, when they are annular. GSC 32311 (Pl. 144, fig. 6) has widely spaced ribs; GSC 32312 (Pl. 144, fig. 8), is densely ribbed and GSC 32313 (Pl. 144, fig. 5) is virtually smooth. These three were found together and are treated as variants of one species. The smooth variant resembles *Rhabdoceras laeve* Kushlin. Weak ribbing on the dorsum characterizes all the specimens except GSC 32319 (Pl. 147, fig. 2), a piece of the body chamber of the largest known specimen. Most showing the venter have rather strong projected ribs. GSC 14264 (Pl. 144, fig. 4), preserved as steinkern is an exception, with ribs on the venter much weaker than on the flank. GSC 14263 (Pl. 144, fig. 3) preserving part of an adapical part of the conch is nearly circular in section, with annular ribbing. Mojsisovics' illustrations of the suture line show a shallow E; those of Hyatt and Smith for *R. russelli* a deep E. The specimens from Canada show considerable variation with E being deep or shallow (Figs. 117c–g, 120i, j). Contrary to the judgement of Spath (1951, p. 86), the taxonomic significance of this character is discounted and *R. russelli* is placed in the synonymy. *Rhabdoceras boreale* shows slight curvature, rather like the var. *curvata* of Mojsisovics. Ribbing is much like specimens from Canada (e.g., GSC 32311, Pl. 144, fig. 6). *Rhabdoceras boreale* is included in the synonymy despite possible slight differences in the suture line.

Genus *Peripleurites* Mojsisovics, 1893

Type species. Choristoceras (Peripleurites) roemeri Mojsisovics.

Peripleurites roemeri Mojsisovics

Plate 144, figures 10–12; Figure 117a (p. 636)

Choristoceras (Peripleurites) roemeri Mojsisovics, 1893, p. 565, Pl. 133, figs. 8a–c, 9a, b.

Rhabdoceras curvatum Jaworski, 1923, p. 153, Pl. 6, figs. 1a–d (not *Rhabdoceras suessi* Hauer var. *curvata* MOJSISOVICS, 1893, p. 571, Pl. 133, figs. 13, 14).

Choristoceras (Peripleurites) peruvianum Wiedmann, 1973, p. 238, Pl. 1, figs. 6, 7a–c (for *Rhaboceras curvatum* JAWORSKI, 1923, p. 153).

Peripleurites roemeri Mojsisovics. TOZER, 1979, p. 127, Pl. 16.1, figs. 7a–c.

Registered material. Two hypotypes GSC 32320, GSC 32321 (both GSC loc. 68300). Hypotype GSC 71036 (GSC loc. 98530).

Occurrence. Upper Norian, Cordilleranus Subzone 1. Pardonet Formation, northeastern British Columbia; Stuhini Formation, northwestern British Columbia. GSC locs. 68300 (2), 95027 (3), 98530 (1).

Remarks. All known specimens are incomplete. This includes those from Austria and Peru, as well as those from Canada. The specimens from Canada give no indication of helicoid coiling, unlike those from Peru and Austria, which apparently depart from the planspiral form at a large size. Unusually good preservation is necessary to show this feature. GSC 32320 (Pl. 144, fig. 10) is mostly steinkern, partly phragmocone and partly body chamber. Ribbing is strong on the flank and venter, weak on the dorsum. The suture line is well preserved (Fig. 117a). GSC 32321 (Pl. 144, fig. 11) is a body chamber fragment with some of the test preserved. Ribbing is irregular. Both specimens have no trace of external nodes. GSC 71036 (Pl. 144, fig. 12) is crushed. It does not show the venter or suture lines. When Wiedmann (1973, p. 238) named *C. (P.) peruvianum*, he recognized that it closely resembled *P. roemeri,* but he provided no criteria for separating the two taxa.

Family COCHLOCERATIDAE Hyatt, 1900

Genus *Paracochloceras* Mojsisovics, 1893

Type species. Cochloceras canaliculatum Hauer.

Paracochloceras canaliculatum (Hauer)

Plate 147, figure 10

Cochloceras canaliculatum Hauer, 1860, p. 133, Pl. 2, figs. 22–28; JAWORSKI, 1915, p. 138, Pl. 45, figs. 20a, b; TOZER, 1979, Pl. 16.1, fig. 11.

Cochloceras (*Paracochloceras*) *canaliculatum* (Hauer) MOJSISOVICS, 1893, p. 578, Pl. 137, figs. 15, 16, 19–21.

Registered material. Hypotype GSC 32329 (GSC loc. 24333).

Occurrence. Upper Norian, Amoenum Zone. Parson Bay Formation, Vancouver Island, British Columbia. GSC loc. 24333 (1).

Remarks. GSC 32329 (Pl. 147, fig. 10) has distinct ribs on the outer part of the whorl, a well defined canal, and is nearly smooth on the umbilical part. The smooth part anterior to a well defined canal is taken to characterize this species. In GSC 32329 no septa are seen.

Paracochloceras suessi Mojsisovics

Plate 147, figures 7, 8

Cochloceras (*Paracochloceras*) *suessi* Mojsisovics, 1893, p. 581, Pl. 137, figs. 1–11, 13, 17, 18, 24; WIEDMANN 1973, p. 238, Pl. 1, figs. 11, 12.

Paracochloceras suessi Mojsisovics. TOZER, 1962a, Pl. 12, figs. 4a, b; TOZER, 1967, p. 39, 80; TOZER, 1970, Pl. 18, fig. 17.

Paracochloceras sp., TOZER, 1958, p. 19; TOZER, 1967, p. 80.

Registered material. Hypotype GSC 17016 (GSC loc. 23072). Hypotype GSC 32330 (GSC loc. 23429).

Occurrence. Upper Norian, Amoenum Zone. Parson Bay Formation, Vancouver Island, British Columbia; Unnamed rocks, Telegraph Creek area, British Columbia; Lewes River Group, Formation F, Laberge area, Yukon. GSC locs. 21828 (5), 23072 (3), 23429 (1), 95027 (1).

Remarks. Identified with this species are *Paracochloceras* with ribs of uniform strength on both sides of a well defined canal.

Paracochloceras amoenum Mojsisovics

Plate 147, figure 9; Figure 120e (p. 644)

Cochloceras (*Paracochloceras*) *amoenum* Mojsisovics, 1893, p. 579, Pl. 137, fig. 26.

Paracochloceras suessi (Mojsisovics). TOZER, 1967, p. 77 (not of MOJSISOVICS, 1893, p. 581).

Cochloceras amoenum Mojsisovics. TOZER, 1979, p. 127, Pl. 16.1, fig. 12.

Registered material. Hypotype GSC 32328 (GSC loc. 56405).

Occurrence. Upper Norian, Amoenum Zone. Tyaughton Group, southern British Columbia. GSC loc. 56405 (1).

Remarks. GSC 32328 (Pl. 147, fig. 9) has a canal, which is shallow and poorly defined compared to that in specimens identified as *P. canaliculatum* (Hauer) and *P. suessi* Mojsisovics. Ribs are distinct on the lateral side of the whorl, indistinct on the umbilical side. The suture line is partly exposed (Fig. 120e). The last whorl appears to be body chamber.

Family CHORISTOCERATIDAE Hyatt, 1900

Genus *Vandaites* Tozer, 1979

Type species. Choristoceras (Peripleurites) stuerzenbaumi Mojsisovics.

Vandaites suttonensis (Clapp and Shimer)

Plate 147, figures 13–18; Figure 120k–m (p. 644)

Choristoceras suttonensis Clapp and Shimer, 1911, p. 434, Pl. 40, figs. 4, 6; CLAPP, 1912, p. 69; TOZER, 1967, p. 39, 79.

Choristoceras suttonense Clapp and Shimer. SMITH, 1927, p. 98, Pl. 105, figs. 5, 6; TOZER, 1979, p. 134, Pl. 16.1, figs. 1–3; TOZER, 1980c, Pl. 63, figs. 3, 4.

Registered material. Holotype GSC 7813 (GSC loc. 13703). Two topotypes GSC 32322, GSC 32323 (both GSC loc. 23370). Two topotypes GSC 32324, GSC 32325 (both GSC loc. 23372). Topotype GSC 32326 (GSC loc. 23379).

Occurrence. Upper Norian, Crickmayi Zone. Sutton Formation, Vancouver Island, British Columbia. GSC locs. 13703 (1), 23370 (2), 23372 (5), 23379 (6), 23380 (4).

Remarks. This species is known only from fragments, most of less than a quarter whorl. GSC 32326 (Pl. 147, fig. 16) is the only one that has more than half a whorl preserved. Most have some or all of the test preserved. None have whorls in contact and there can be little doubt that the conch was an open spiral (criocone) (Fig. 120 m). GSC 32325 (Pl. 147, fig. 17), the largest fragment, is still septate. This indicates that the phragmocone probably attained a diameter of about 25 mm. GSC 32326 (Pl. 147, fig. 16) appears to be coiled in a plane spiral. Most of the other specimens do not have enough of the whorl preserved to give a clear indication of whether the coiling was plane or helicoid. GSC 32323 (Pl. 147, fig. 15) has slight inclination of the ribs on the venter in relation to the whorl sides, suggesting that this fragment was part of a low sinistrally helicoid conch. All specimens have an external sulcus. On the holotype (Pl. 147, fig. 13), and GSC 32322 (Pl. 147, fig. 18) the sulcus is bordered by raised, rounded nodes; on GSC 32324 (Pl. 147, fig. 14) and GSC 32325 (Pl. 147, fig. 17) the nodes are blunt and transverse; on GSC 32323 (Pl. 147, fig. 15) the venter is sulcate, but the adjacent ribs are barely nodose. In general, the external nodes are more pronounced on the steinkern than on the test surface. The ribs show no sign of marginal nodes. GSC 32324 (Pl. 147, fig. 14) has ribs preserved on the surface of the test on the dorsum. Specimens preserved as steinkern have a smooth dorsum. Complete suture lines showing the four-lobed formula are well preserved in the holotype and GSC 32325 (Figs. 120k, l).

With the description by Kollarova-Andrusovova (in Kollarova-Andrusovova and Kochanova, 1973) of new topotype material of *Vandaites boeckhi* (Mojsisovics) and *V. stuerzenbaumi* (Mojsisovics) from Drnava, Czekoslovakia, it appears that most examples of both species are coiled in what approaches a plane spiral, in a helicoid more depressed than seen in the specimen of *V. stuerzenbaumi* illustrated by Mojsisovics, (1893, Pl. 133, fig. 19). Because there is some evidence that "*Choristoceras*" *suttonense* is coiled as a depressed helix, it is now regarded as a species of *Vandaites,* because of the resemblance to *Vandaites boeckhi,* the more depressed of the two species from Drnava.

Genus *Choristoceras* Hauer, 1865

Type species. Choristoceras marshi Hauer.

Choristoceras crickmayi Tozer

Plate 147, figures 19–22; Figure 120a–c (p. 644)

Choristoceras marshi Hauer. TOZER, 1967, p. 42, 75, 76, Pl. 10, figs. 8, 9 (not of HAUER, 1865, p. 654).

Choristoceras crickmayi Tozer, 1979, p. 134, Pl. 16.1, figs. 4–6.

Choristoceras sp. cf. *C. crickmayi* Tozer. TOZER, 1980c, Pl. 63, figs. 5, 6.

Registered material. Holotype GSC 18912, hypotype GSC 61875 (Tozer, 1980c, Pl. 63, fig. 5) (both GSC loc. 56395). Two paratypes GSC 32327, GSC 34608 (both GSC loc. 10095). Hypotype GSC 18913 (GSC loc. 62392).

Occurrence. Upper Norian, Crickmayi Zone. Tyaughton Group, southern British Columbia. GSC locs. 10095 (3), 56395 (2), 62392 (2).

Diagnosis. Choristoceras attaining a diameter of about 40 mm, characteristically coiled with whorls in contact to a diameter of about 30 mm, but some variants may have one or more whorls detached. External nodes prominent, marginal nodes absent. Suture line with unindented lateral lobe (L).

Remarks. The holotype (Pl. 147, fig. 22) and GSC 32327 (Pl. 147, fig. 21) show the closely coiled stage. External nodes are well defined. GSC 34608 (Pl. 147, fig. 20) although crushed, seems to show the start of uncoiling. GSC 18913 (Pl. 147, fig. 19) has more than one whorl detached. Suture lines with unindented lobes are seen in the holotype, GSC 18913 and GSC 32327 (Figs. 120a–c).

This species closely resembles *Choristoceras marshi* Hauer (1865, p. 654), but differs in having a relatively shallow external lobe (E) and a lateral lobe, which is rounded instead of having a single large dent. Most specimens of *Choristoceras marshi* are coiled like the holotype of *C. crickmayi* (e.g., Wiedmann, 1973, Pl. 1, fig. 4). Other specimens from the type locality of *C. marshi* (e.g., Tozer, 1980c, Pl. 63, figs. 9a, b) are openly coiled, like GSC 18913 (Pl. 145, fig. 19). Both *Choristoceras marshi* and *C. crickmayi* evidently show comparable variation in the mode of coiling. As far as known, none depart from a plane spiral.

Choristoceras nobile Mojsisovics

Plate 148, figures 1–10

Choristoceras nobile Mojsisovics, 1893, p. 547, Pl. 133, figs. 21; Pl. 134, 9–14; TOZER, 1980c, Pl. 63, figs. 8a, b.

Choristoceras sp. cf. *C. nobile* Mojsisovics. PRINZ, 1985, p. 168, Pl. 1, fig. 6.

Registered material. Eight hypotypes GSC 85819–GSC 85826 (GSC loc. C–156962). Two hypotypes GSC 85827, GSC 85828 (GSC loc. C–157651).

Occurrence. Upper Norian, Crickmayi Zone. Sandilands Formation, Queen Charlotte Islands, British Columbia. GSC locs. C–156962 (10), C–157651 (2).

Remarks. The specimens are crushed and no suture lines are seen. At small diameters some, at least, have the whorls in contact (Pl. 148, fig. 8; Pl. 148, fig. 9). At larger diameters, the conch is criocone (Pl. 148, fig. 1; Pl. 148, fig. 3). Nodes on the venter are seen in one specimen (Pl. 148, fig. 10). The mode of coiling and sculpture is thus closely similar to that of specimens of *Choristoceras nobile* from the Zlambach beds of Austria.

Choristoceras rhaeticum Gümbel

Plate 148, figures 11–16

Crioceras rhaeticum Gümbel, 1861, p. 411.

Crioceras coronatum Schafhaeutl, 1863, p. 420, Pl. 77, fig. 1.

Crioceras debile Dittmar, 1864, p. 137, Pl. 3, fig. 2.

Choristoceras rhaeticum (Gümbel). MOJSISOVICS, 1893, p. 550, Pl. 135, figs. 1–4.

Registered material. Four hypotypes GSC 85829–GSC 85832 (GSC loc. C–157686). Hypotype GSC 85833 (GSC loc. C–156963).

Occurrence. Upper Norian, Crickmayi Zone. Sandilands Formation, Queen Charlotte Islands. GSC locs. C–156963 (1), C–157686 (5).

Remarks. All the specimens are crushed and in none are suture lines seen. The mode of coiling of GSC 85832 (Pl. 148, fig. 14, 15), GSC 85831 (Pl. 148, fig. 13), and GSC 85833 (Pl. 148, fig. 16) is like that of the specimen illustrated by Mojsisovics (1893, Pl. 135, fig. 2), with the inner whorls in contact and the outer crioconic. Detachment of the outer whorl of GSC 85829 (Pl. 148, fig. 11) was less. Owing to crushing, no specimens have the venter preserved, but the impressions of external nodes are well preserved in GSC 85830 (Pl. 148, fig. 12) and GSC 85832 (Pl. 148, fig. 14, 15).

Order PHYLLOCERATINA

Superfamily USSURITACEAE Hyatt, 1900

Family PALAEOPHYLLITIDAE Popov, 1958

Genus *Leiophyllites* Diener, 1915a

Type species. Monophyllites suessi Mojsisovics.

Leiophyllites sp. indet.

Plate 38, figure 5

Leiophyllites sp. indet., TOZER, 1965a, p. 6, 40, Pl. 2, fig. 10; TOZER, 1967, p. 21.

Registered material. GSC 18871 (GSC loc. 56234).

Occurrence. Spathian, Subrobustus Zone. Toad Formation, northeastern British Columbia. GSC loc. 56234 (1).

Genus *Stenophyllites* n. gen.

Type species. Leiophyllites(?) *kindli* McLearn.

Diagnosis. Smooth compressed evolute (U about 35–40 per cent of diameter) palaeophyllitid. Suture line with lobes, particularly E and the suspensive lobe, rather elaborately indented.

Species assigned. Stenophyllites kindlei (McLearn), *Leiophyllites stoecklini* Tozer.

Occurrence. Anisian, northeastern British Columbia, Iran.

Remarks. This genus is more evolute than *Ussuriphyllites* Zacharov (1967), more compressed than *Burijites* Zacharov (1978); and is more compressed and has a more divided suture line compared with *Leiophyllites* Diener (1915a).

Stenophyllites kindlei (McLearn)

Plate 46, figures 4–6; Figure 33e–g (p. 440)

Leiophyllites? *kindli* McLearn, 1946a, p. 10, Appendix II, p. 1, Pl. 2, fig. 4; McLEARN, 1948, p. 12, Pl. 2, fig. 4.

Leiophyllites kindlei McLearn. TOZER, 1967, p. 23, 71; McLEARN, 1969, p. 55, Pl. 1, figs. 9a, b.

Registered material. Holotype GSC 6443* (McLearn, 1969, Pl. 1, figs. 9a, b) (GSC loc. 10660). Hypotype GSC 32331 (GSC loc. 74719). Hypotype GSC 32332 (GSC loc. 42404). Hypotype GSC 32333 (GSC loc. 42403).

Occurrence. Lower Anisian, Caurus Zone. Toad Formation, northeastern British Columbia. GSC locs. 10660 (1), 10732 (12), 42401 (1), 42403 (1), 42404 (3), 74719 (2), 99580 (1).

Remarks. GSC 32332 (Pl. 46, fig. 6) and GSC 32333 (Pl. 46, fig. 5), with U about 35 per cent of diameter are involute variants, compared with GSC 32331 (Pl. 46, fig. 4), which has the proportions of the holotype (U about 40 per cent of diameter).

Family USSURITIDAE Hyatt, 1900

Genus *Ussurites* Hyatt, 1900

Type species. Monophyllites sichoticus Diener.

Ussurites muskwa McLearn

Plate 46, figures, 1–3; Figure 33c, d (p. 440)

Ussurites muskwa McLearn, 1946a, p. 10, Appendix II, p. 1, Pl. 3, figs. 3, 4; McLEARN, 1948, p. 13, Pl. 3, figs. 3, 4; TOZER, 1967, p. 23, 69, 71; McLEARN, 1969, p. 53, Pl. 13, figs. 1, 2.

Ussurites sp. cf. *U. muskwa* McLearn. TOZER, 1967, p. 71.

Registered material. Holotype GSC 6444 (McLearn, 1969, Pl. 13, figs. 1a, b), topotype GSC 32334 (both GSC loc. 10732). Hypotype GSC 21733 (ibid., Pl. 13, figs. 2a, b) (GSC loc. 10733). Hypotype GSC 32335 (GSC loc. 42404). Hypotype GSC 32336 (GSC loc. 74715).

Occurrence. Lower Anisian, Caurus Zone. Toad Formation, northeastern British Columbia. GSC locs. 10732 (14), 10733 (1), 42404 (1), 68203 (3), 74715 (1), 99581 (1).

Remarks. Identified with this species are *Ussurites* with lirae that are radial and not appreciably projected on the venter. Ribbing is faint. The inner whorls have marginal parabolic nodes. They are clearly visible on a topotype (Pl. 46, fig. 3), also on GSC 32335 (Pl. 46, fig. 2) and on the inner whorls of GSC 32336 (Pl. 46, fig. 1). Judging from GSC 32324, the maximum diameter at which they are present is about 30 mm. This specimen has 12 nodes on the outer whorl. On the adapical part they are prominent and closely spaced, adorad they become fainter and more distantly spaced.

Ussurites yabei Diener

Plate 48, figures 10a, b

Monophyllites (*Ussurites*) *yabei* Diener, 1915b, p. 22, Pl. 5, figs. 1, 2.

Ussurites yabei Diener. POPOV 1961a, p. 110, Pl. 16, fig. 5.

Ussurites sp. cf. *U. yabei* Diener. TOZER, 1967, p. 47.

Registered material. Hypotypes GSC 32337, GSC 32338* (both GSC loc. 51676).

Occurrence. Middle Anisian, Hagei Zone? Blaa Mountain Formation, Lower Shale Member, Ellesmere Island. GSC loc. 51676 (2).

Remarks. Identified with the species are *Ussurites* with prominent ribbing on the flank and lirae projected on the venter. GSC 32338* is an impression of whorls attaining a diameter of about 55 mm. It is probably the impression of the inner whorls of GSC 32337 (Pl. 46, fig. 10). GSC 32338* shows traces of monophyllic saddles.

Ussurites cameroni McLearn

Plate 62, figures 2–4; Figure 47a–c (p. 472)

Ussurites arthaberi var. *cameroni* McLearn, 1946a, p. 10, Appendix II, p. 1, Pl. 1, fig. 3; Pl. 2, fig. 1; McLEARN, 1948, p. 13, Pl. 1, fig. 3; Pl. 2, fig. 1; McLEARN, 1969, p. 54, Pl. 13, figs. 3–5; TOZER, 1967, p. 69.

Registered material. Holotype GSC 6694 (McLearn, 1969, Pl. 13, figs. 3a, b), paratype GSC 6445 (ibid., figs. 4a, b), both from Tetsa River Valley, exact locality unknown. Hypotype GSC 21734 (ibid., figs. 5a, b) (GSC loc. 10706). Two hypotypes GSC 32340, GSC 32341 (both GSC loc. 74724). Hypotype GSC 32342 (GSC loc. 68297).

Occurrence. Upper Anisian, Deleeni Zone. Toad Formation, northeastern British Columbia. GSC locs. 10706 (1), 68297 (1), 74724 (3), 74731 (1).

Remarks. This species closely resembles *Ussurites muskwa* McLearn, but differs in having somewhat thicker whorls with more convex flanks. As in *U. muskwa,* the lirae are not appreciably projected on the venter. Parabolic nodes (auriculoids) have not been observed on the specimens described by McLearn, but are present on GSC 32340 (Pl. 62, fig. 4), on GSC 32341 to a diameter of 32 mm, and on the inner whorls of GSC 32342 (Pl. 62, fig. 2).

Genus *Metatirolites* Mojsisovics, 1893

Type species. Ammonites foliaceus Dittmar.

Metatirolites withrowi n. sp.

Plate 71, figures 3, 4; Figure 54d (p. 490)

Registered material. Holotype GSC 32344, two paratypes GSC 32345, GSC 85808* (all GSC loc. 74758).

Occurrence. Ladinian, Poseidon Zone. Toad Formation, northeastern British Columbia. GSC loc. 74758 (7).

Diagnosis. Metatirolites about 20 mm in diameter; H about 20 per cent, W about 35 per cent, U about 35 per cent of diameter. Flanks flat, venter arched, growth striae radial, crossing the venter without projection. Spines or parabolic nodes (auriculoids) present at the margin.

Measurements. Holotype GSC 32344 (Pl. 71, fig. 4): 20, 0.35, 0.40, 0.35.

Remarks. The holotype (Pl. 71, fig. 4) has about half a whorl of body chamber preserved, on which there are six marginal nodes. GSC 32345 (Pl. 71, fig. 3), a phragmocone, has seven nodes on the outer whorl. The suture line is well preserved (Fig. 54d). GSC 85808* is a specimen 9 mm in diameter partly embedded in matrix. On one side, the last half whorl is exposed showing five marginal nodes. On the other side, at the place of a node there is a spine 1.5 mm long. This specimen shows that spines were present at an early growth stage. At a later stage it seems they were sloughed leaving the nodes as scars.

The whorl section and marginal nodes indicate that this species is congeneric with *Metatirolites foliaceus* (Dittmar) (Mojsisovics, 1893, p. 590). The suture line is basically similar, but may be a little more elaborate in the umbilical area. There is also a close resemblance to the inner whorls of *Ussurites muskwa* McLearn and *U. cameroni* McLearn described above. It is possible that *Metatirolites withrowi* is based on an immature example of a *Ussurites* or *Monophyllites.* This remains uncertain. However it is certain that the morphology of *Metatirolites* is closely similar to that of some *Ussuritidae.*

Genus *Monophyllites* Mojsisovics, 1879

Type species. Ammonites sphaerophyllus Hauer.

Monophyllites aonis Mojsisovics

Plate 71, figures 5a, b; Figure 54a (p. 490), Figure 63f (p. 508)

Monophyllites aonis Mojsisovics, 1882, p. 208, Pl. 78, figs. 3–5.

Registered material. Two hypotypes GSC 32346, GSC 32347* (both GSC loc. 74762). GSC 32348* (GSC loc. 68236).

Occurrence. Ladinian, Poseidon Zone, Maclearni Zone. Toad Formation, northeastern British Columbia. GSC locs. 68236 (2), 74762 (2).

Remarks. Identified with this species are *Monophyllites* with lirae moderately projected on the venter. The suture line has a monophyllic external saddle with a deep dent on the inner side, a lateral saddle virtually triangular in outline, with deep dents isolating the terminal leaflet, and two or three well developed auxiliary lobes. GSC 32348, for which only the suture line is illustrated (Fig. 63f) is the remains of a phragmocone about 67 mm in diameter.

Family DISCOPHYLLITIDAE Spath, 1927

Genus *Discophyllites* Hyatt, 1900

Type species. Lytoceras patens Mojsisovics.

Discophyllites taimyrensis Popov

Discophyllites taimyrensis Popov, 1961a, p. 112, Pl. 16, fig. 2.

Discophyllites sp. cf. *D. taimyrensis* Popov. TOZER, 1967, p. 31, 45.

Registered material. Hypotype GSC 32350* (GSC loc. 47535). Hypotype GSC 32351* (GSC loc. 47565).

Occurrence. Lower Carnian. Blaa Mountain Formation, Lower Shale Member, Axel Heiberg Island. GSC locs. 47535 (1), 47565 (1), 64727 (1), 64795 (1).

Remarks. The only specimens known from Canada are fragments. All have prominent lirae, which are not appreciably projected on the venter. GSC 32351* is a crushed body chamber fragment with a whorl height of more than 100 mm. GSC 32350*, a fragment showing the arched venter, has parts of the suture line preserved with the external saddle characteristic of *Discophyllites*. The prominent lirae are a feature of *D. taiymyrensis*.

Discophyllites ebneri (Mojsisovics)

Plate 111, figures 1a, b; Figure 89a (p. 570)

Phylloceras (Mojsvarites) ebneri Mojsisovics, 1896, p. 668, Pl. 19, fig. 6.

Discophyllites ebneri (Mojsisovics). SPATH, 1934, p. 318, figs. 107, d, e, 108; SILBERLING, 1959, p. 55, Pl. 8, figs. 1–4.

Discophyllites sp. cf. *D. ebneri* (Mojsisovics). WELTER, 1914, p. 202, Pl. 30, figs. 10, 11; TOZER, 1962a, Pl. 7, figs. 6a, b; SUTHERLAND BROWN, 1968, p. 60.

Discophyllites sp., TOZER, 1967, p. 60.

Registered material. Hypotype GSC 17014 (Tozer, 1962a, Pl. 7, figs. 6a, b) (GSC loc. 40982). Hypotype GSC 32352 (GSC loc. 68180).

Occurrence. Lower Norian, Kerri Zone. Pardonet Formation, northeastern British Columbia; Peril Formation, Queen Charlotte Islands, British Columbia. GSC locs. 40982 (1), 68180 (15).

Remarks. GSC 17014 (Tozer, 1962a, Pl. 7, figs. 6a, b) is a phragmocone 170 mm in diameter. The published illustration is not of the complete specimen.

In Nevada this species occurs in the Upper Carnian (Silberling, 1959, p. 18).

Genus *Rhacophyllites* Zittel, 1884

Type species. Ammonites neojurensis Quenstedt.

Rhacophyllites debilis (Hauer)

Plate 136, figures 3a, b; Plate 145, figures 6a, b; Plate 147, figures 6a, b; Figure 118d (p. 638), Figure 120n, o (p. 640)

Ammonites debilis Hauer, 1846, p. 10, Pl. 4, figs. 1–3.

Rhacophyllites debile (Hauer). MOJSISOVICS, 1873, p. 37, Pl. 22, fig. 13.

Rhacophyllites debilis (Hauer). MOJSISOVICS, 1902, p. 319, Pl. 17, fig. 2; Pl. 23, fig. 4; ARTHABER, 1927, p. 144, Textfig. 17; KUMMEL, 1960, p. 492, figs. 5, 15, 16; SACHARIEVA-KOVACHEVA, 1967, p. 97, Pl. 1, figs. 3, 4; SHEVYREV, 1968, p. 230, Pl. 21, figs. 5, 6.

Discophyllites debilis timorensis Welter, 1914, p. 204, Pl. 30, figs. 12, 13, Textfig. 77.

Rhacophyllites debilis timorensis (Welter). POPOV, 1961b, p. 205, Pl. 1, fig. 6; Pl. 2, fig. 5; Pl. 5, fig. 5; VOZIN and TIKHOMIROVA, 1964, p. 91, Pl. 50, figs. 1, 2.

Rhacophyllites sp., McLEARN, 1960a, p. 38, Pl. 19, figs. 2a, b; TOZER, 1958, p. 15; TOZER, 1962a, Pl. 11, figs. 1a, b; TOZER, 1967, p. 55 (in part).

Diphyllites debilis (Hauer). SPATH, 1934, p. 323.

Registered material. Hypotype GSC 13490 (McLearn, 1960a, Pl. 19, figs. 2a, b) (GSC loc. 9778). Hypotype GSC 14305 (GSC loc. 19275). Hypotype GSC 32353 (GSC loc. 23457). Hypotype GSC 32354* (GSC loc. 64594). Hypotype GSC 32355 (GSC loc. 13338).

Occurrence. Middle Norian, Columbianus Zone; Upper Norian, Cordilleranus and Amoenum zones. Pardonet Formation, northeastern British Columbia; Tyaughton Group, southern British Columbia; Parson Bay Formation, Vancouver Island, British Columbia; Lewes River Group, Formation D, Laberge area, Yukon. GSC locs. 9778 (2), 13338 (1), 19275 (1), 23457 (2), 64594 (1).

Genus *Tragorhacoceras* Spath, 1927

Type species. Phylloceras occultum Mojsisovics.

Tragorhacoceras occultum (Mojsisovics)

Plate 146, figures 18a, b; Figure 119b (p. 640)

Phylloceras occultum Mojsisovics, 1873, p. 38, Pl. 16, figs. 3–6.

Rhacophyllites occultus (Mojsisovics). MOJSISOVICS, 1902, p. 320; ARTHABER, 1905, Pl. 47, figs. 1a, b.

Tragorhacoceras occultum (Mojsisovics). SPATH, 1934, p. 324.

Registered material. Hypotype GSC 32356 (GSC loc. 68300).

Occurrence. Upper Norian, Cordilleranus Subzone 1. Pardonet Formation, northeastern British Columbia. GSC loc. 68300 (1).

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APPENDIX

GSC LOCALITIES AND FAUNAL LISTS

For each of the following GSC localities, reference is made to a map published in the National Topographic (NTS) system. The published maps referred to in the Arctic Islands are at a scale of 1:250 000 (Fig. 2); those in western Canada are at a scale of 1:50 000 (Fig. 3).

GSC loc. 6897. Upper Norian, Cordilleranus Subzone 1. Parson Bay Formation, *Monotis* beds, probably Malksope Inlet, Vancouver Island, NTS Kyuquot 92 L/3; V. Dolmage, 1920 (Dolmage, 1921, p. 14a; Tozer, 1967, p. 80).

Sagenites sp. indet.
Gnomohalorites southeri Tozer
Rhabdoceras suessi Hauer

GSC loc. 8849. Upper Carnian, Welleri Zone. Slocan Group, above Whitewater Deep mine workings, Slocan Mining Camp, NTS Rosebery 82 K/3; C.E. Cairnes, 1926 (Cairnes, 1934, p. 60).

Projuvavites sp. indet.

GSC loc. 9131. Ladinian, Meginae Subzone 2. Toad Formation ("Dark siltstones"), Beattie Ledge, north bank Peace River between Adams and Aylard creeks. Now flooded by water of Williston Lake, NTS Jones Peak (formerly Gold Bar) 94 B/2; F.H. McLearn, 1920 (McLearn, 1947b, p. 4; McLearn and Kindle, 1950, p. 45, Fig. 8).

Nitanoceras selwyni (McLearn)
Eosagenites gethingi (McLearn)
Indigirites boehmi n. sp.
Thanamites schooleri (McLearn)
Thanamites parvus (McLearn)
Protrachyceras sikanianum McLearn
Meginoceras meginae McLearn
Silenticeras hatae McLearn

GSC loc. 9144. Lower Norian, Dawsoni Zone Subzone 2. Pardonet Formation, talus block on north bank of Peace River, 2.4 km east of Schooler Creek, NTS Jones Peak, 94 B/2; F.H. McLearn, 1920 (McLearn, 1960a, p. 116).

Pseudocardioceras acutum (Mojsisovics)
Omojuvavites fuscus (McLearn)

GSC loc. 9146. Middle Norian, Rutherfordi Zone. Pardonet Formation, a little west of south face of McLay Spur, north side of Peace River, 3.2 km east of Schooler Creek, NTS Jones Peak, 94 B/2; F.H. McLearn, 1920 (McLearn, 1960a, p. 116).

Drepanites rutherfordi McLearn
Parisculites mundus (McLearn)

GSC loc. 9147. Lower Norian. Pardonet Formation, west part of south face of McLay Spur, north side of Peace River, 3.2 km east of Schooler Creek, NTS Jones Peak, 94 B/2; F.H. Mclearn, 1920 (McLearn, 1960a, p. 85).

Juvavites mclayi McLearn

GSC loc. 9157. Lower Norian, Kerri Subzone 2. Pardonet Formation, miscellaneous collection, Brown Hill, Peace River, NTS Jones Peak 94 B/2; F.H. McLearn, 1920 (McLearn, 1960a, p. 116).

Stikinoceras kerri McLearn
Gonionotites belli McLearn
Gonionotites spiekeri McLearn
Griesbachites humi (McLearn)
Griesbachites laevis n. sp.
Dimorphites pardonetiensis McLearn

GSC loc. 9161. Lower Norian, Dawsoni Subzone 1. Pardonet Formation, talus block, south bank of Peace River near west end of Pardonet Hill. NTS Mount Brewster 94 B/3; F.H. McLearn, 1917 (McLearn, 1960a, p. 116).

Wangoceras pax (Tozer)
Malayites bococki (McLearn)

GSC loc. 9163. Ladinian, Meginae Subzone 2. Toad Formation, as for GSC locality 9131 (Beattie Ledge); F.H. McLearn, 1917.

Nitanoceras selwyni (McLearn)
Eosagenites gethingi (McLearn)
Indigirites boehmi n. sp.
Protrachyceras sikanianum McLearn
Meginoceras meginae McLearn
Silenticeras hatae McLearn
Lobites pacianus McLearn

GSC loc. 9197. Ladinian, Meginae Subzone 2. Toad Formation, as for GSC locality 9131 (Beattie Ledge); F.H. McLearn, 1922.

Indigirites boehmi n. sp.
Thanamites schooleri (McLearn)
Thanamites parvus (McLearn)
Protrachyceras sikanianum McLearn
Silenticeras hatae McLearn

GSC loc. 9213. Ladinian, Meginae Subzone 2. Toad Formation, as for GSC locality 9131 (Beattie Ledge); C.M. Sternberg, 1930.

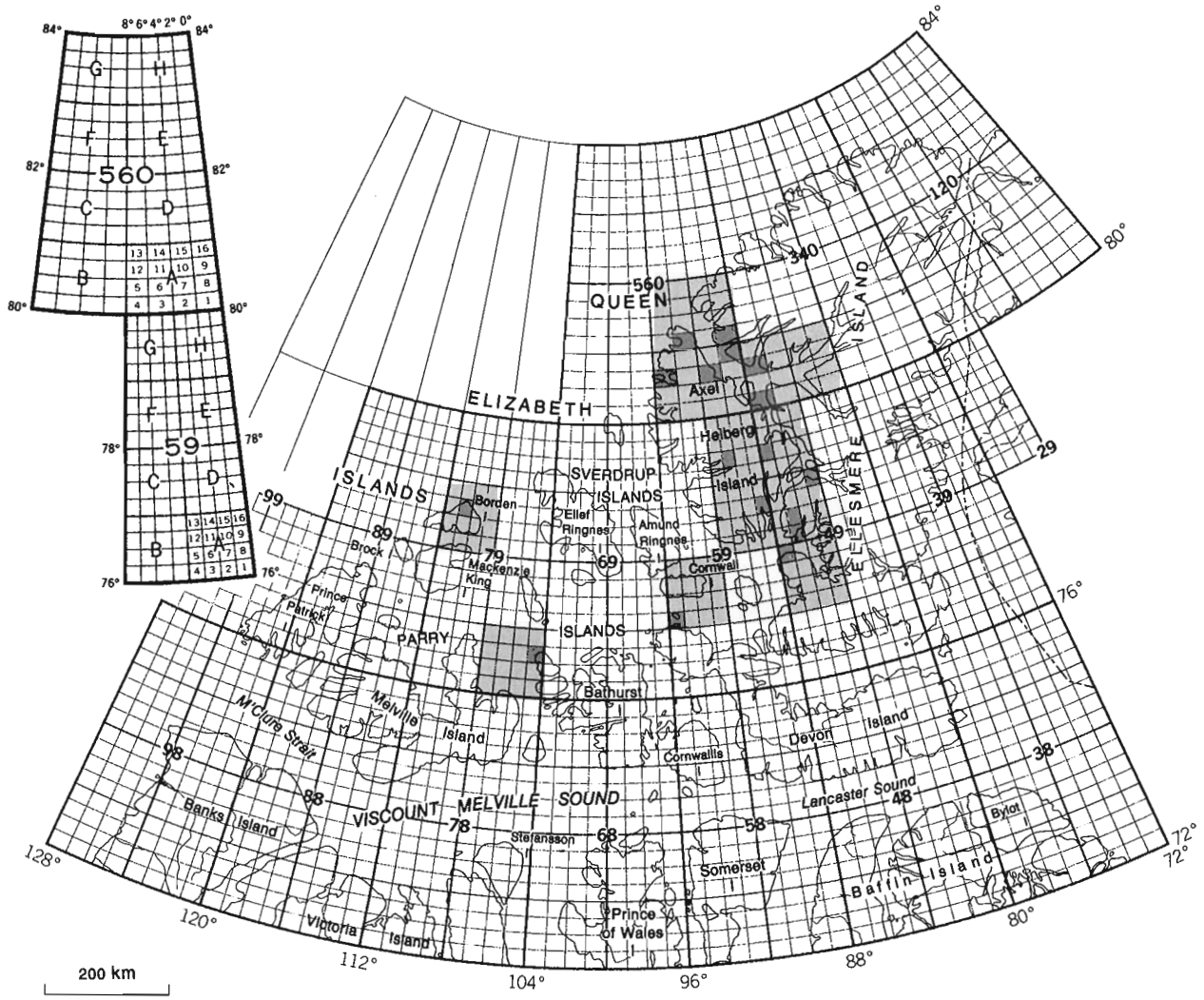
Nitanoceras selwyni (McLearn)
Indigirites boehmi n. sp.

Thanamites parvus (McLearn)
Meginoceras meginae McLearn
Silenticeras hatae McLearn

GSC loc. 9276. Ladinian, ?Maclearni Zone. Liard Formation ("Grey beds"), near top of steeply dipping section, Beattie Ledge, north bank of Peace River between Adams and Aylard creeks. Now flooded by waters of Williston Lake. NTS Jones Peak 98 B/2; C.M. Sternberg, 1930 (McLearn, 1947b, p. 4).
Meginoceras caurinum (McLearn)

GSC loc. 9325. Upper Norian, Cordilleranus Subzone 1. Pardonet Formation, 51 m below top of *Monotis* beds, Ne-parle-pas Rapids, Peace River, now covered by waters of Williston Lake, NTS Mount Brewster (formerly Ne-parle-pas Rapids) 94 B/2; F.H. McLearn, 1937 (McLearn, 1960a, p. 116).
Paraguembelites ludingtoni Tozer

GSC loc. 9338. Ladinian, Meginae Subzone 2. Toad Formation, as for GSC locality 9131 (Beattie Ledge); F.H. McLearn, 1937.
Nitanoceras selwyni (McLearn)
Eosagenites gethingi (McLearn)
Indigirites boehmi n. sp.
Thanamites schooleri (McLearn)
Thanamites parvus (McLearn)
Protrachyceras sikanianum McLearn
Meginoceras meginae McLearn
Silenticeras hatae McLearn



49C	Baumann Fiord	59E	Glacier Fiord	340B	Greely Fiord West
49F	Eureka Sound South	59H	Strand Fiord	560A	Bukken Fiord
49G	Eureka Sound North	79A	Domett Point	560D	Cape Stallworthy
59C	Cornwall Island	79F	Borden Island		

Figure 2. *Map areas, Arctic Canada.*

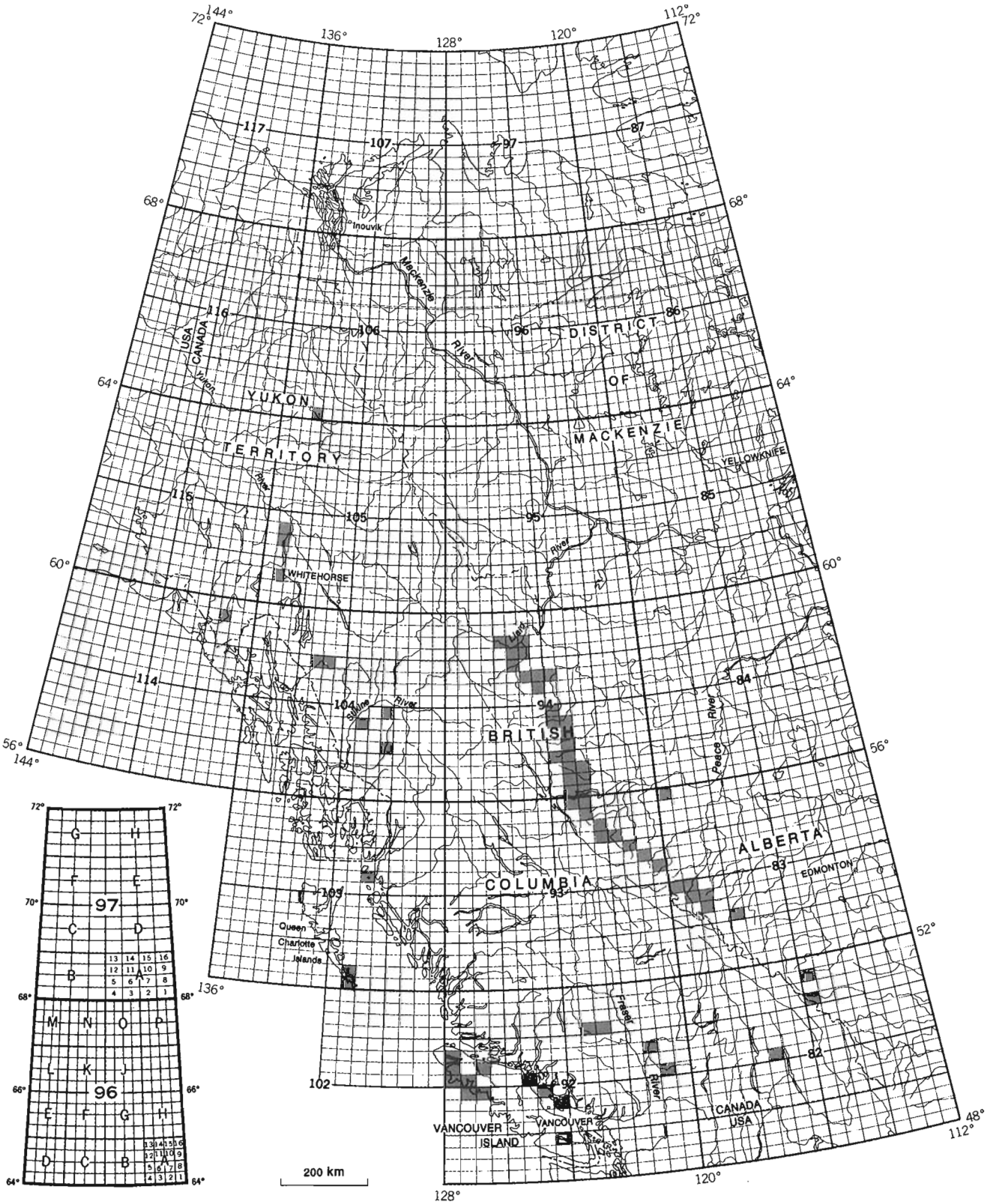


Figure 3. *Map areas, Western Canada.*

GSC loc. 9340. Ladinian, Meginae Subzone 2. Toad Formation, as for GSC locality 9131 (Beattie Ledge); F.H. McLearn, 1937.

Eosagenites gethingi (McLearn)
Indigirites boehmi n. sp.
Protrachyceras sikanianum McLearn

GSC loc. 9341. Ladinian, Meginae Subzone 2. Toad Formation, as for GSC locality 9131 (Beattie Ledge); F.H. McLearn, 1937.

Protrachyceras sikanianum McLearn
Lobites pacianus McLearn

GSC loc. 9360. Upper Carnian, Dilleri Zone. Ludington Formation, north bank of Peace River, about 1.2 km west of Point Creek. Now flooded by waters of Williston Lake, NTS Point Creek, 93 O/14; F.H. McLearn, 1937 (McLearn, 1960a, p. 6).

Discotropites sandlingensis (Hauer)

GSC loc. 9373. Lower Norian, Dawsoni Subzone 1. Pardonet Formation, talus block, Juvavites Gully, Pardonet Hill, NTS Mount Brewster, 94 B/3; F.H. McLearn, 1937 (McLearn, 1960a, p. 7).

Wangoceras pax (Tozer)
Malayites bococki (McLearn)

GSC loc. 9380. Middle Norian, Rutherfordi Zone. Pardonet Formation, probably not in place, near locality IX, about 15 m east of Juvavites Gully, Pardonet Hill, NTS Mount Brewster, 94 B/3; F.H. McLearn, 1937.

Cyrtopleurites bicrenatus (Hauer)

GSC loc. 9466. Middle Norian, Rutherfordi Zone. Pardonet Formation, "*Cyrtopleurites* beds", Brown Hill, NTS Jones Peak 94 B/2; F.H. McLearn, 1937 (McLearn, 1960a, p. 116).

Cyrtopleurites hersiliae Diener

GSC loc. 9467. Lower Norian, Dawsoni Subzone 2. Pardonet Formation, talus block, north side of Peace River below Jewitt Spur, NTS Jones Peak 94 B/2; F.H. McLearn, 1920 (McLearn, 1960a, Fig. 3, p. 116).

Malayites dawsoni McLearn

GSC loc. 9471. Middle Norian, Columbianus Subzone 3. Pardonet Formation, talus block in Tepee Rocks Coulee, NTS Jones Peak 94 B/2; F.H. McLearn, 1937 (McLearn, 1960a, p. 116).

Sagenites sp. indet.
Alloclionites dieneri n. sp.
Neohimavatites canadensis (McLearn)
Idaoceras maclearni n. sp.

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82 K/3 Roseberry

82 O/4 Banff
82 O/12 Barrier Mountain

83 E/7 Blue Creek
83 E/10 Adams Lookout
83 E/11 Hardscrabble Creek
83 E/13 Dry Canyon
83 E/14 Grand Cache

83 F/4 Miette

83 M/13 Bonanza

92 C/16 Cowichan Lake

92 E/14 Port Eliza
92 E/ 15 Zeballos

92 F/9 Texada Island

92 I/2 Merritt
92 I/11 Ashcroft

92 K/3 Quadra Island

92 L/3 Kyuquot
92 L/4 Brooks Peninsula
92 L/5 Mahatta Creek (formerly Neroutsos)
92 L/7 Nimpkish
92 L/12 Quatsino

92 O/2 Noaxe Creek (formerly Tyaughton Creek)
92 O/3 Warner Pass

93 I/8 Belcourt Lake (formerly Narraway River)
93 I/10 Wapiti Lake
93 I/14 Kinuseo Falls

93 O/1 Mount Reynolds
93 O/8 LeMoray Creek
93 O/10 Callazon Creek
93 O/14 Point Creek
93 O/15 Carbon Creek

93 P/4 Sukunka River

94 B/2 Jones Peak (formerly Gold Bar)
94 B/3 Mount Brewster (formerly Ne-parle-pas Rapids)
94 B/6 Emerslund Lakes (formerly Nabesche River)
94 B/7 Hackney Hills
94 B/10 Chowade River
94 B/11 Christina Falls
94 B/13 Mount Robb
94 B/14 Mount Laurier

94 D/8 Carruthers Pass
94 D/9 Johanson Lake
94 D/10 Moosevale Creek
94 D/15 Thorne Lake

94 G/3 Marion Lake
94 G/6 Mount Withrow
94 G/11 Minaker River
94 G/12 Richards Creek
94 G/13 Kluachesi Lake

94 J/12 Chischa River

94 K/8 Chlotapecta Creek
94 K/9 North Tetsa River (formerly Tetsa River)
94 K/10 Mount St. George (formerly Macdonald Creek)
94 K/14 Toad Hotsprings

94 N/2 Scaffold Creek
94 N/3 Eight Mile Creek
94 N/5 Mount Prudence
94 N/6 Grayling River
94 N/7 Toad River

103 B/3 Kunghit Island
103 B/6 Burnaby Island

103 F/14 Frederick Island

103 J/7 Melville Island

104 G/1 Iskut River
104 G/11 Yehiniko Lake
104 G/16 Klastline River

104 K/14 Inklin
104 K/15 Yeth Creek

105 D/11 Whitehorse

105 E/6 Lower Laberge
105 E/11 Frank Creek

106 D/1 Mount Westman

114 P/11 Carmine Mountain

GSC loc. 9473. Middle Norian, Magnus Subzone 2. Pardonet Formation, "*Pterotoceras - Cyrtopleurites magnificus* Beds", Brown Hill, NTS Jones Peak 94 B/2; F.H. McLearn, 1937 (McLearn, 1960a, p. 15, 25).

Acanthinites magnificus (McLearn)

GSC loc. 9478. Middle Norian, Columbianus Zone. Pardonet Formation, Brown Hill, NTS Jones Peak 94 B/2; F.H. McLearn, 1937 (McLearn, 1960a, p. 15).

Pseudosirenites pardoneti (McLearn)

GSC loc. 9481. Lower Norian, Kerri Subzone 2. Pardonet Formation, "*Stikinoceras* Zone", Brown Hill, NTS Jones Peak 94 B/2; F.H. McLearn, 1937 (McLearn, 1960a, p. 15).

Dimorphites pardonetiensis McLearn

GSC loc. 9556. Lower Norian, Dawsoni Subzone 2. Pardonet Formation, talus block, north side of Peace River below Jewitt Spur, NTS Jones Peak 94 B/2; F.H. McLearn, 1920 (McLearn, 1960a, Fig. 3).

Malayites dawsoni McLearn

GSC loc. 9632. Middle Norian, Columbianus Subzone 2?. Pardonet Formation, talus block, locality XIX, Pardonet Hill, NTS Mount Brewster 94 B/3; F.H. McLearn, 1938 (McLearn, 1960a, p. 7).

Pseudosirenites pardoneti (McLearn)
Parathetidites robustus n. sp.

GSC loc. 9636. Lower Norian, Kerri Zone. Pardonet Formation, "*Styrites ireneanus* Zone", locality X, Juvavites Gully, Pardonet Hill, NTS Mount Brewster 94 B/3; F.H. McLearn, 1938.

Griesbachites selwyni (McLearn)

GSC loc. 9638. Lower Norian, Kerri Subzone 1. Pardonet Formation, talus block between localities X and XI, Juvavites Gully, Pardonet Hill. NTS Mount Brewster 94 B/3; F.H. McLearn, 1938 (McLearn, 1960a, Fig. 2).

Thisbites custi McLearn
Thisbites petralis n. sp.

GSC loc. 9640. Lower Norian, Kerri Subzone 1. Pardonet Formation, "*Styrites ireneanus* Zone", near locality XI, Pardonet Hill, NTS Mount Brewster 94 B/3; F.H. McLearn, 1938 (McLearn, 1960a, p. 116).

Tropiceltites columbianus (McLearn)
Gonionotites gethingi McLearn
Gonionotites scapulatus n. sp.
Gonionotites spiekeri McLearn
Griesbachites pinensis n. sp.
Guembelites clavatus (McLearn)

GSC loc. 9643. Lower Norian, Kerri Zone. Pardonet Formation, talus block between localities XI and XII, Juvavites Gully, Pardonet Hill, NTS Mount Brewster 94 B/3; F.H. McLearn, 1938 (McLearn, 1960a, Fig. 2).

Metathisbites dawsoni (McLearn)

GSC loc. 9649. Lower Norian, Dawsoni Subzone 1. Pardonet Formation, talus block at locality XIII, Pardonet Hill, NTS Mount Brewster 94 B/3; F.H. McLearn, 1938 (McLearn, 1960a, Fig. 2, p. 117).

Malayites bococki (McLearn)

GSC loc. 9659. Lower Norian, Kerri Subzone 1. Pardonet Formation, "*Styrites ireneanus* Zone", between localities XI and XII, Juvavites Gully, Pardonet Hill, NTS Mount Brewster 94 B/3; F.H. McLearn, 1938 (McLearn, 1960a, Fig. 2, p. 117).

Discostyrites ireneanus (McLearn)
Guembelites clavatus (McLearn)

GSC loc. 9661. Lower Norian, Kerri Subzone 1. Pardonet Formation, "*Styrites ireneanus* Zone", as for GSC locality 9659; F.H. McLearn, 1938 (McLearn, 1960a, p. 117).

Tropiceltites columbianus (McLearn)
Guembelites clavatus (McLearn)

GSC loc. 9662. Lower Norian, Kerri Subzone 1. Pardonet Formation, talus block at locality XII, Juvavites Gully, Pardonet Hill, NTS Mount Brewster 94 B/3; F.H. McLearn, 1938 (McLearn, 1960a, Fig. 2, p. 117).

Tropiceltites columbianus (McLearn)
Thisbites custi McLearn

GSC loc. 9663. Lower Norian, Kerri Subzone 1. Pardonet Formation, "*Styrites ireneanus* Zone" at locality XII, Juvavites Gully, Pardonet Hill, NTS Mount Brewster 94 B/3; F.H. McLearn, 1938 (McLearn, 1960a, Fig. 2, p. 117).

Tropiceltites columbianus (McLearn)
Discostyrites ireneanus (McLearn)
Thisbites custi McLearn
Thisbites petralis n. sp.
Guembelites clavatus (McLearn)

GSC loc. 9672. Lower Norian, Kerri Subzone 1. Pardonet Formation, "*Styrites ireneanus* Zone", between localities XI and XII, Juvavites Gully, Pardonet Hill, NTS Mount Brewster 94 B/3; F.H. McLearn, 1938 (McLearn, 1960a, Fig. 2, p. 117).

Clionitites punctulus n. sp.
Tropiceltites columbianus (McLearn)
Discostyrites ireneanus (McLearn)
Thisbites custi McLearn

Thisbites robustus n. sp.
Gonionotites scapulatus n. sp.
Guembelites clavatus (McLearn)

GSC loc. 9687. Upper Carnian, Macrolobatus Zone. Pardonet Formation, locality V, Pardonet Hill, NTS Mount Brewster 94 B/3; F.H. McLearn, 1938 (McLearn, 1960a, Fig. 2). Described as in place in field note book (locality 38-63) and in McLearn (1947a, p. 4), but as talus in McLearn, 1960a, p. 117.
Anatropites cascadensis n. sp.
Margarijuvavites carlottensis (Whiteaves)

GSC loc. 9688. Upper Carnian, Macrolobatus Zone. Pardonet Formation, locality V, "*Tropites* bed", Pardonet Hill, NTS Mount Brewster 94 B/3; F.H. McLearn, 1938 (McLearn, 1960a, Fig. 2, p. 117).
Anatropites cascadensis n. sp.

GSC loc. 9691. Middle Norian, Dawsoni Subzone 1. Pardonet Formation, talus block above locality IX, Pardonet Hill, NTS Mount Brewster 94 B/3; F.H. McLearn, 1938 (McLearn, 1960a, Fig. 2, p. 117).
Malayites bococki (McLearn)

GSC loc. 9693. Middle Norian, Dawsoni Zone. Pardonet Formation talus northwest of locality III, Pardonet Hill, NTS Mount Brewster 94 B/3; F.H. McLearn, 1938 (McLearn, 1960a, p. 117).
Malayites sp.

GSC loc. 9694. Lower Norian, zone uncertain. Pardonet Formation, talus block northwest of locality III, Pardonet Hill, NTS Mount Brewster 94 B/3; F.H. McLearn, 1938 (McLearn, 1960a, p. 117).
Metathisbites? griphus n. sp.

GSC loc. 9695. Lower Norian, Dawsoni Subzone 1. Pardonet Formation, talus block, Juvavites Gully, Pardonet Hill, NTS Mount Brewster 94 B/3; F.H. McLearn, 1938 (McLearn, 1960a, Fig. 2, p. 117).
Wangoceras pax (Tozer)
Malayites bococki (McLearn)

GSC loc. 9699. Lower Norian, Dawsoni Subzone 1. Pardonet Formation, talus block, south bank of Peace River at Little Parle-Pas Rapids, now covered by waters of Williston Lake, NTS Mount Brewster 94 B/3; F.H. McLearn, 1938 (McLearn, 1960a, Fig. 2).
Wangoceras pax (Tozer)

GSC loc. 9719. Lower Norian, Kerri Subzone 2. Pardonet Formation, "*Stikinoceras* Zone", locality III, Pardonet Hill, NTS Mount Brewster 94 B/3; F.H. McLearn, 1938 (McLearn, 1960a, Fig. 2, p. 117).
Stikinoceras kerri McLearn
Gonionotites rarus McLearn
Griesbachites humi (McLearn)
Dimorphites pardonetiensis McLearn

GSC loc. 9722. Lower Norian, Dawsoni Subzone 2. Pardonet Formation, talus block near locality V, Pardonet Hill, NTS Mount Brewster 94 B/3; F.H. McLearn, 1938 (McLearn, 1960a, Fig. 2, p. 7).
Malayites dawsoni McLearn
Omojuvavites fuscus (McLearn)

GSC loc. 9729. Middle Norian, Columbianus Subzone 2. Pardonet Formation, talus block, Black Bear Section, NTS Mount Brewster 94 B/3; F.H. McLearn, 1938 (McLearn, 1960a, p. 117).
Pseudosirenites pardoneti (McLearn)
Himavatites multiauritus McLearn
Helictites pacalis n. sp.

GSC loc. 9741. Middle Norian, Columbianus Subzone 2. Pardonet Formation, "*Himavatites* zone", Black Bear Section, NTS Mount Brewster 94 B/3; F.H. McLearn, 1938 (McLearn, 1960a, p. 117). This locality was described as Black Bear Ridge by McLearn, but the fossils are from a smaller topographic feature, UTM 497700 E, 6216500 N, southeast of Black Bear Ridge of the NTS maps. (Tozer, 1967, p. 59).
Paragymnites symmetricus (Mojsisovics)
Pseudosirenites pardoneti (McLearn)
Pseudosirenites pressus (McLearn)
Himavatites sp. indet.
Distichites gethingi McLearn
Distichites canadensis McLearn
Helictites decorus McLearn
Helictites pacalis n. sp.
Episculites browni (McLearn)
Episculites teres (McLearn)

GSC loc. 9744. Middle Norian, Columbianus Subzone 2. Pardonet Formation, talus from "*Himavatites* Zone", Black Bear Section, as for GSC locality 9741; F.H. McLearn, 1938 (McLearn, 1960a, p. 117).
Pseudosirenites pardoneti (McLearn)
Himavatites multiauritus McLearn
Distichites gethingi McLearn
Distichites canadensis McLearn
Leiodistichites ursidens n. sp.
Helictites decorus McLearn
Helictites pacalis n. sp.
Episculites browni (McLearn)
Episculites teres (McLearn)

GSC loc. 9745. Middle Norian, Columbianus Subzone 2. Pardonet Formation, talus from "*Himavatites* Zone", Black Bear Section, as for GSC locality 9741; F.H. McLearn, 1938 (McLearn, 1960a, p. 117).

Pseudosirenites pardoneti (McLearn)
Pseudosirenites pressus (McLearn)
Himavatites multiauritus McLearn
Episculites teres (McLearn)

GSC loc. 9762. Middle Norian, Columbianus Subzone 1. Pardonet Formation, talus block east of locality XX, Pardonet Hill, NTS Mount Brewster 94 B/3; F.H. McLearn, 1938 (McLearn, 1960a, Fig. 2, p. 117).

Parathisbites oineus McLearn

GSC loc. 9764. Middle Norian, Columbianus Subzone 1. Pardonet Formation, "*Parathisbites oineus* Zone", locality XVI, Pardonet Hill, NTS Mount Brewster 94 B/3; F.H. McLearn, 1938 (McLearn, 1960a, Fig. 2, p. 117).

Parathisbites oineus McLearn

GSC loc. 9767. Middle Norian, Columbianus Subzone 2. Pardonet Formation, talus near locality XXII, Pardonet Hill, NTS Mount Brewster 94 B/3; F.H. McLearn, 1938 (McLearn, 1960, Fig. 2, p. 117).

Mesohimavatites columbianus (McLearn)

GSC loc. 9768. Middle Norian, Columbianus Subzone 4. Pardonet Formation, "*Himavatites* Zone", near locality XXIII in Western gully, Pardonet Hill, NTS Mount Brewster 94 B/3; F.H. McLearn, 1938 (McLearn, 1960a, Fig. 2, p. 117).

Alloclionites welteri n. sp.
Brouwerites maclearni n. sp.
Mesohimavatites caponicus n. sp.

GSC loc. 9771. Middle Norian, Columbianus Subzone 4. Pardonet Formation, talus at locality XXIII in Western gully, Pardonet Hill, NTS Mount Brewster 94 B/3; F.H. McLearn, 1938 (McLearn, 1960a, Fig. 2, p. 117).

Alloclionites welteri n. sp.

GSC loc. 9778. Upper Norian, Amoenum Zone. Pardonet Formation, above *Monotis* beds, Ne-parle-pas Rapids, of Peace River. Now covered by waters of Williston Lake. NTS Mount Brewster 94 B/3; F.H. McLearn, 1938 (McLearn, 1960a, p. 6).

Rhacophyllites debilis (Hauer)

GSC loc. 9781. Middle Norian, Columbianus Subzone 2. Pardonet Formation, "*Himavatites* Zone", above locality XX, Pardonet Hill, NTS Mount Brewster 94 B/3; F.H. McLearn, 1938 (McLearn, 1960a, Fig. 2, p. 118).

Pinacoceras parma Mojsisovics
Pseudosirenites pardoneti (McLearn)
Himavatites sp. indet.
Distichites gethingi McLearn
Eothetidites pardoneti n. sp.
Parathetidites exquisitus (McLearn)

GSC loc. 9782. Middle Norian, Columbianus Subzone 2. Pardonet Formation, talus block at locality XX, Pardonet Hill, NTS Mount Brewster 94 B/3; F.H. McLearn, 1938 (McLearn, 1960a, Fig. 2, p. 118).

Parathetidites exquisitus (McLearn)

GSC loc. 9784. Middle Norian, Columbianus Subzone 3. Pardonet Formation, "*Himavatites* Zone", south bank of of Peace River at locality XV. Now beneath waters of Williston Lake, NTS Mount Brewster 94 B/3; F.H. McLearn, 1938 (McLearn, 1960a, Fig. 2, p. 118).

Pseudosirenites bullatus n. sp.
Neohimavatites burlingi (McLearn)

GSC loc. 9797. Ladinian, Sutherlandi Subzone 2. Liard Formation ("Grey beds"), west slope of "East Glacier Spur", south side of Peace River, 6.5 km west of Carbon Creek, NTS Jones Peak 94 B/2; F.H. McLearn, 1938 (McLearn, 1947b, p. 6; McLearn and Kindle, 1950, p. 49; Tozer, 1967, p. 66).

Nathorstites macconnelli (Whiteaves)
Asklepioceras laurenci McLearn
Muensterites glaciensis (McLearn)
Frankites sutherlandi (McLearn)

GSC loc. 9799. Ladinian, Sutherlandi Subzone 2. Liard Formation, as for GSC locality 9797; F.H. McLearn, 1938.

Muensterites glaciensis (McLearn)

GSC loc. 9800. Ladinian, Sutherlandi Subzone 2. Liard Formation, as for GSC locality 9797; F.H. McLearn, 1938.

Asklepioceras laurenci McLearn

GSC loc. 9806. Ladinian, Sutherlandi Subzone 2. Liard Formation, as for GSC locality 9797; F.H. McLearn, 1938.

Asklepioceras laurenci McLearn
Frankites sutherlandi (McLearn)

GSC loc. 9811. Ladinian, Sutherlandi Subzone 2. Liard Formation, as for GSC locality 9797; F.H. McLearn, 1938.

Frankites sutherlandi (McLearn)

GSC loc. 9829. Middle Norian, Columbianus Subzone 3. Pardonet Formation, talus block, Brown Hill, Peace River, NTS Jones Peak, 94 B/3; F.H. McLearn, 1938 (McLearn, 1960a, p. 118).

Neohimavatites canadensis (McLearn)

GSC loc. 9830. Middle Norian, Columbianus Subzone 3. Pardonet Formation, as for GSC locality 9829, from another talus block; F.H. McLearn, 1938 (McLearn, 1960a, p. 118).

Neohimavatites canadensis (McLearn).

GSC loc. 9832. Lower Norian, Dawsoni Subzone 2. Pardonet Formation. Talus block, Brown Hill, Peace River, NTS Jones Peak 94 B/2; F.H. McLearn, 1938 (McLearn, 1960a, p. 118).

Malayites dawsoni McLearn

GSC loc. 9836. Lower Norian, Magnus Subzone 2. Pardonet Formation, "*Pterotoceras-Cyrtopleurites magnificus* beds", Brown Hill, Peace River, NTS Jones Peak 94 B/2; F.H. McLearn, 1938 (McLearn, 1960a, p. 118).

Dimorphotoceras caurinum (McLearn)
Dimorphotoceras arctum (McLearn)
Dimorphotoceras elegantulum (McLearn)
Dimorphotoceras ursinum n. sp.
Prodrepanites catenatus n. sp.
Acanthinites magnificus (McLearn)
Juvavites magnus McLearn
Juvavites concretus McLearn
Juvavites biornatus McLearn

GSC loc. 9838. Middle Norian, Rutherfordi Zone. Pardonet Formation, talus block, Brown Hill, Peace River, NTS Jones Peak, 94 B/2; F.H. McLearn, 1938 (McLearn, 1960a, p. 118).

Hauerites piceus n. sp.

GSC loc. 9839. Middle Norian, Columbianus Subzone 2. Pardonet Formation, " Zone", Brown Hill, Peace River, NTS Jones Peak 94 B/2; F.H. McLearn, 1938 (McLearn, 1960a, p. 118).

Himavatites sp. indet.
Hypisculites stelcki (McLearn)

GSC loc. 9840. Middle Norian, Rutherfordi Zone. Pardonet Formation, "*Cyrtopleurites* beds", Brown Hill, Peace River, NTS Jones Peak 94 B/2; F.H. McLearn, 1938 (McLearn, 1960a, p. 118).

Cyrtopleurites bicrenatus (Hauer)

GSC loc. 9841. Middle Norian, Rutherfordi Zone. Pardonet Formation, "*Cyrtopleurites* beds", Brown Hill, Peace River, NTS Jones Peak 94 B/2; F.H. McLearn, 1938 (McLearn, 1960a, p. 118).

Paragymnites symmetricus (Mojsisovics)
Acanthodrepanites dieneri n. sp.
Hauerites piceus n. sp.

GSC loc. 9842. Middle Norian, Rutherfordi Zone. Pardonet Formation, "*Drepanites* beds", below GSC localities 9840 and 9841, Brown Hill, Peace River, NTS Jones Peak 94 B/2; F.H. McLearn, 1938 (McLearn, 1960a, p. 118).

Drepanites rutherfordi (McLearn)

GSC loc. 9845. Middle Norian, Magnus Subzone 1. Pardonet Formation, "*Gonionotites belli* beds", Brown Hill, Peace River, NTS Jones Peak 94 B/2; F.H. McLearn, 1938 (McLearn, 1960a, p. 118).

Indojuvavites brunneus n. sp.

GSC locs. 9849, 9850. Lower Norian, Dawsoni Subzone 2. Pardonet Formation, "*Malayites* beds", Brown Hill, Peace River, NTS Jones Peak 94 B/2; F.H. McLearn, 1938 (McLearn, 1960a, p. 118).

Malayites dawsoni McLearn
Omojuvavites magnumbilicatus n. sp.

GSC loc. 9851. Lower Norian, Kerri Subzone 2. Pardonet Formation, "*Stikinoceras* Zone", Brown Hill, Peace River, NTS Jones Peak 94 B/2; F.H. McLearn, 1938 (McLearn, 1960a, p. 118).

Stikinoceras kerri McLearn
Griesbachites humi (McLearn)

GSC loc. 9854. Lower Norian, Kerri Subzone 2. Pardonet Formation, "*Stikinoceras* Zone", Brown Hill, Peace River, NTS Jones Peak 94 B/2; F.H. McLearn, 1938 (McLearn, 1960a, p. 118).

Gonionotites rarus McLearn
Griesbachites humi (McLearn)
Dimorphites pardonetiensis McLearn

GSC loc. 9856. Lower Norian, Kerri Zone. Pardonet Formation, "*Thisbites* beds", Brown Hill, Peace River, NTS Jones Peak 94 B/2; F.H. McLearn, 1938 (McLearn, 1960a, p. 118).

Metathisbites dawsoni (McLearn)

GSC loc. 9859. Lower Norian, Dawsoni Subzone 2. Pardonet Formation, talus block, Brown Hill, Peace River, NTS Jones Peak 94 B/2; F.H. McLearn, 1938 (McLearn, 1960a, p. 118).

Malayites dawsoni McLearn
Omojuvavites fuscus (McLearn)

GSC loc. 9860. Lower Norian, Dawsoni Subzone 2. Pardonet Formation, talus block, Brown Hill, Peace River, NTS Jones Peak 94 B/2; F.H. McLearn, 1938 (McLearn, 1960a, p. 118).

Pseudocardioceras idunae (Diener)

GSC loc. 9873. Lower Norian, Magnus Subzone 1. Pardonet Formation, west of shallow gully, south end of McLay Spur, 3.2 km east of Schooler Creek, NTS Jones Peak 94 B/2; F.H. McLearn, 1938 (McLearn, 1960a, p. 118).

Indojuvavites brunneus n. sp.

GSC loc. 10095. Upper Norian, Crickmayi Zone. Tyaughton Group, green sandstone and conglomerate unit, Tyaughton Group, 1300 m above Spruce Lake Creek, NTS Tyaughton Creek 92 O/2; C.H. Crickmay, 1939 (Tozer, 1967, p. 76; 1979).

Choristoceras crickmayi Tozer

GSC loc. 10141. Upper Norian, Amoenum Zone. Tyaughton Group, *Cassianella* beds, Tyaughton Creek at mouth of Spruce Lake Creek, NTS Tyaughton Creek 92 O/2; C.H. Crickmay, 1939 (Tozer, 1967, p. 77; 1979).

Placites polydactylus (Mojsisovics)

GSC loc. 10233. Middle Norian, Magnus Zone. Lewes River Group, Maunoir Butte, east of Yukon (Lewes) River, NTS Frank Creek 105 E/11; E.J. Lees, 1930 (Lees, 1934, p. 40).

Indojuvavites sp. indet.

GSC loc. 10657. Smithian, Tardus Zone. Toad Formation, *Wasatchites* bed, north bank Liard River 3.2 km below mouth of Toad River, NTS Toad River 94 N/7; E.D. Kindle, 1943 (McLearn, 1945; McLearn and Kindle, 1950, p. 40; Tozer, 1967, p. 40).

Kashmirites warreni (McLearn)
Prionites hollandi McLearn
Wasatchites tridentinus Spath
Wasatchites deleeni McLearn
Wasatchites procurvus McLearn
Anawasatchites tardus McLearn
Anawasatchites merrilli McLearn
Arctoprionites williamsi n. sp.

GSC loc. 10658. Smithian, Tardus Zone. Toad Formation, *Wasatchites* bed, northeast bank of Toad River, 4 km upstream from Liard River. NTS Toad River 94 N/7; E.D. Kindle, 1943 (McLearn, 1945; McLearn and Kindle, 1950, p. 40; Tozer, 1967, p. 40).

Kashmirites warreni (McLearn)
Wasatchites deleeni McLearn

GSC loc. 10659. Middle Anisian, Hagei Zone. Toad Formation, north bank of Liard River 2.3 km below Brimstone Creek, NTS Grayling River 94 N/6; E.D. Kindle, 1943 (McLearn and Kindle, 1950, p. 40; Tozer, 1967, p. 74; McLearn, 1969, p. 8).

Stenopopanoceras obesum (McLearn)
Buddhaites hagei (McLearn)

GSC loc. 10660. Lower Anisian, Caurus Zone, Subzones 1 and 2. Toad Formation, south bank of Liard River, 3.2 km below mouth of Toad River, NTS Toad River 94 N/7; E.D. Kindle, 1943 (McLearn and Kindle, 1950, p. 40; Tozer, 1967, p. 71; McLearn, 1969, p. 8).

Lenotropites caurus (McLearn)
Grambergia liardensis n. sp.
Grambergia nahwisi (McLearn)
Azarianites bufonis (McLearn)
Paracrochordiceras americanum McLearn
Discogymnites hollandi (McLearn)
Sturia sansovinii (Mojsisovics)
Stenophyllites kindlei (McLearn)

The holotype of *Intornites mactaggarti* (McLearn) is catalogued as being from this locality but is probably from GSC locality 10659.

GSC loc. 10692. Middle Anisian, Minor Zone. Toad Formation, talus, west of Mile Post 375 (km 595), Alaska Highway, NTS Tetsa River 94 K/9; F.H. McLearn, 1944.

Nicomedites arthaberi n. sp.

GSC loc. 10693. Upper Anisian, Deleeni Zone. Toad Formation, talus block west of Mile Post 375 (km 595), Alaska Highway, NTS Tetsa River 94 K/9; F.H. McLearn, 1944 (McLearn, 1969, p. 9).

Intornites canadensis (McLearn)
Eogymnotoceras deleeni (McLearn)
Anagymnites via alaska McLearn

GSC loc. 10694. Upper Anisian, Deleeni Zone. Toad Formation, talus, north side of Alaska Highway about 1.7 km west of Mile Post 375 (km 595), NTS Tetsa River 94 K/9; F.H. McLearn, 1944 (McLearn, 1969, p. 9).

Amphipopanoceras tetsa (McLearn)
Intornites canadensis (McLearn)
Eogymnotoceras deleeni (McLearn)
Gymnotoceras smithi n. sp.
Anagymnites via alaska McLearn

GSC loc. 10695. Middle and Upper Anisian, mixed collection. Toad Formation, talus from both sides of the Alaska Highway west of Mile Post 375 (km 595), NTS Tetsa River 94 K/9; F.H. McLearn, 1944 (McLearn, 1969, p. 10).

Amphipopanoceras tetsa (McLearn)
Intornites intornatus (McLearn)
Intornites canadensis (McLearn)
Eogymnotoceras deleeni (McLearn)
Anagymnites via alaska McLearn

GSC loc. 10696. Middle Anisian, Hayesi Zone (and ?Hagei Zone). Toad Formation, in place, west limb of anticline west of Mile Post 375 (km 595), Alaska Highway, NTS Tetsa River 94 K/9; F.H. McLearn, 1944 (locality 6, McLearn and Kindle, 1950, Fig. 7, p. 39; Tozer, 1967, p. 70; McLearn, 1969, p. 9).
Anagymnotoceras varium (McLearn)
Anagymnotoceras columbianum (McLearn)
Nicomedites moderatus (McLearn)
Intornites mactaggarti (McLearn)
Intornites intornatus (McLearn)

GSC loc. 10697. Middle Anisian, Hayesi Zone. Toad Formation, talus, Cameron Hill, north side of Alaska Highway 3.2 km west of Mile Post 375 (km 595), NTS Tetsa River 94 K/9; F.H. McLearn, 1944 (McLearn and Kindle, 1950, Fig. 7, p. 39; McLearn, 1969, p. 10).
Anagymnotoceras varium (McLearn)

GSC loc. 10698. Middle Anisian, Hayesi Zone. Toad Formation, Cameron Hill, north side of Alaska Highway 3.2 km west of Mile Post 375 (km 595), locality 2 (McLearn and Kindle, 1960, Fig. 7, p. 39), NTS Tetsa River 94 K/9; F.H. McLearn, 1944 (McLearn, 1969, p. 10).
Tetsaoceras hayesi (McLearn)
Anagymnotoceras ino (McLearn)

GSC loc. 10702. Middle Anisian, Minor Zone. Toad Formation, talus, Cameron Hill, north side of Alaska Highway 3.2 km west of Mile Post 375 (km 595), NTS Tetsa River 94 K/9; F.H. McLearn, 1944 (McLearn and Kindle, 1950, Fig. 7, p. 39; McLearn, 1969, p. 22).
Anagymnotoceras wrighti (McLearn)

GSC loc. 10706. Middle Anisian, Hayesi Zone. Toad Formation, talus blocks, Alaska Highway about 5 km west of Mile Post 375 (km 595), NTS Tetsa River 94 K/9; F.H. McLearn, 1944 (McLearn, 1969, p. 10).
Amphipopanoceras selwyni (McLearn)
Tetsaoceras angulatum (McLearn)
Tropigastrites(?) *costatus* n. sp.
Ussurites cameroni McLearn

GSC loc. 10712. Middle Anisian, Hayesi Zone. Toad Formation, Cameron Hill, near locality 2 (McLearn and Kindle, 1950, Fig. 7, p. 39) 3.2 km west of Mile Post 375 (km 595), NTS Tetsa River 94 K/9; F.H. McLearn, 1944 (McLearn, 1969, p. 9).
Amphipopanoceras medium (McLearn)

GSC loc. 10713. Middle Anisian, Hagei Zone. Toad Formation, talus 1.6 km west of Mile Post 375 (km 595), Alaska Highway, NTS Tetsa River 94 K/9; F.H. McLearn, 1944 (McLearn, 1969, p. 10).
Buddhaites hagei (McLearn)

GSC loc. 10717. Upper Anisian, Deleeni Zone. Toad Formation, McTaggart Creek, north side of Mount Wooliever, NTS Marion Lake 94 G/3; F.H. McLearn, 1944 (McLearn and Kindle, 1950, p. 10; McLearn, 1969, p. 11).
Intornites canadensis (McLearn)
Gymnotoceras smithi n. sp.

GSC loc. 10718. Anisian. Toad Formation, talus block near GSC locality 10717, McTaggart Creek; F.H. McLearn, 1944 (McLearn, 1969, p. 11).
Hollandites humi McLearn

GSC loc. 10719. Upper Anisian, Chischa Zone. Toad Formation, Hage Creek, north side of Mount Wooliever, NTS Marion Lake 94 G/3; F.H. McLearn, 1944 (McLearn and Kindle, 1950, p. 10; McLearn, 1969, p. 11).
Frechites chischa (Tozer)?

GSC loc. 10726. Upper Anisian, Deleeni Zone. Toad Formation, south side of Chischa River, 8 km above Muskwa River, NTS Chischa River 94 J/12; W.I. Wright, 1944 (McLearn, 1969, p. 10).
Intornites canadensis (McLearn)
Eogymnotoceras liardense (McLearn)

GSC loc. 10727. Upper Anisian, Deleeni Zone. Toad Formation, north side of Chischa River, 13 km above Muskwa River, NTS Chischa River 94 J/12; W.I. Wright, 1944 (McLearn, 1969, p. 10).
Eogymnotoceras beachi (McLearn)

GSC loc. 10731. Middle Anisian, Minor Zone?. Toad Formation, upper part of McTaggart Creek, north side of Mount Wooliever, NTS Marion Lake 94 G/3; F.H. McLearn, 1944 (McLearn and Kindle, 1950, p. 37; McLearn, 1969, p. 11).
Ptychites wrighti McLearn

GSC loc. 10732. Lower Anisian, Caurus Zone. Toad Formation, Cameron Hill (McLearn and Kindle, 1950, Fig. 7, p. 39), north side of Alaska Highway, 3.2 km west of Mile Post 375 (km 595), NTS Tetsa River 94 K/9; F.H. McLearn, 1944 (Tozer, 1967, p. 71; McLearn, 1969, p. 8).
Stenopopanoceras normale (McLearn)
Grambergia tetsaensis (McLearn)
Paracrochordiceras americanum McLearn

Columbisculites maclearni n. sp.
Stenophyllites kindlei (McLearn)
Ussurites muskwa McLearn

GSC loc. 10733. Lower Anisian, Caurus Zone. Toad Formation, south side of Chischa River, 9.5 km above Muskwa River, NTS Chischa River 94 J/12; W.I. Wright, 1944 (Tozer, 1967, p. 71; McLearn, 1969, p. 10).
Grambergia mackenzii (McLearn)
Ussurites muskwa McLearn

GSC loc. 10735. Anisian. Toad Formation, Chlotapecta Creek, northeast British Columbia, exact locality unknown; W.I. Wright, 1944 (McLearn, 1969, p. 11, 29).
Frechites kindlei McLearn

GSC loc. 10736. Lower Anisian, Caurus Zone. Toad Formation, north side of Chischa River, 9.5 km above Muskwa River, NTS Chischa River 94 J/12; W.I. Wright, 1944 (Tozer, 1967, p. 71; McLearn, 1969, p. 10).
Lenotropites caurus (McLearn)
Grambergia mackenzii (McLearn)

GSC loc. 10739. Middle Norian, Columbianus Subzone 2. Pardonet Formation, " Zone", about 15 m below top of section, Sikanni Chief River, below Chicken Creek, NTS Mount Withrow 94 G/6; F.H. McLearn, 1944 (McLearn, 1960a, p. 20, 118).
Mesohimavatites columbianus (McLearn)
Parajuvavites canadensis n. sp.

GSC loc. 10740. Middle Norian, Columbianus Zone, Subzone 3. Pardonet Formation, talus, as for GSC locality 10739; F.H. McLearn, 1944 (McLearn, 1960a, p. 20, 118).
Eosteinmannites nitidus n. sp.
Neohimavatites canadensis (McLearn)

GSC loc. 10741. Middle Norian, Columbianus Subzone 4. Pardonet Formation, " Zone", about 4 m below top of section, as for GSC locality 10739; F.H. McLearn, 1944 (McLearn, 1960a, p. 118).
Mesohimavatites caponicus n. sp.

GSC loc. 10742. Middle Norian, Columbianus Subzone 4. Pardonet Formation, talus, probably from GSC locality 10741, as for GSC locality 10739; F.H. McLearn, 1944 (McLearn, 1960a, p. 118).
Mesohimavatites caponicus n. sp.

GSC loc. 10750. Middle Norian, Columbianus Subzone 4. Pardonet Formation, upper 1.5 m of section, as for GSC locality 10739; C.O. Hage, 1943 (McLearn, 1960, p. 20, 118).
Alloclionites welteri n. sp.

GSC loc. 10781. Ladinian, Meginae Zone. Liard Formation, near Mile Post 386 (east of km 615), Alaska Highway, NTS Macdonald Creek 94 K/10; F.H. McLearn, 1944 (McLearn, 1947b, p. 9; McLearn and Kindle, 1950, p. 43; Tozer, 1967, p. 67).
Indigirites boehmi n. sp.
Meginoceras tetsa (McLearn)
Meginoceras aylardi (McLearn)

GSC loc. 10790. Ladinian, Meginae Zone. Toad Formation ("Dark siltstones"), Hage Creek, locality 6, McLearn and Kindle, 1950, Fig. 6, p. 37), north side of Mount Wooliever, NTS Marion Lake 94 G/3; F.H. McLearn, 1944 (McLearn, 1947b, p. 8; Tozer, 1967, p. 67) (=GSC loc. 74748).
Indigirites stolleyi n. sp.
Meginoceras tetsa (McLearn)
Silenticeras bamberi n. sp.
Lobites pacianus McLearn

GSC loc. 13248. Lower Norian, Kerri Subzone 2. Unnamed formation, 2.5 km north of Dutch Charlies Riffle on Stikine River, locality 14, GSC Map 309A, NTS 104 G/11 Yehiniko Lake; F.A. Kerr, 1926 (Kerr, 1948, p. 82).
Stikinoceras kerri McLearn

GSC loc. 13338. Upper Norian, Amoenum Zone. Tyaughton Group, *Cassianella* beds, north of Tyaughton Creek, NTS Warner Pass 92 O/3; C.E. Cairnes, 1937.
Rhacophyllites debilis (Hauer)

GSC loc. 13522. Miscellaneous collection, of Peace River Foothills (McLearn, 1960, p. 118).
Dimorphotoceras caurinum (McLearn)

GSC loc. 13703. Upper Norian, Crickmayi Zone. Sutton Formation, south side of Cowichan Lake 4.8 km northwest of mouth of Sutton Creek, NTS Cowichan Lake 92 C/16; C.H. Clapp, 1908, 1909 (Clapp and Shimer, 1911; Clapp, 1912, p. 61; Fyles 1955, p. 23; Tozer, 1967, p. 78).
Vandaites suttonensis (Clapp and Shimer)

GSC loc. 13712. Lower Norian, Kerri Subzone 2. Parson Bay Formation ("Bonanza Group"), probably 45 m above top of Quatsino Formation, south fork of Tsulton River, NTS Nimpkish 92 L/7; H.C. Gunning, 1931 (Tozer, 1967, p. 81).
Stikinoceras kerri McLearn

GSC loc. 14841. Upper Anisian, Deleeni Zone. Toad Formation, 3.2 km west of Mile Post 375 (km 595), Alaska Highway, NTS Tetsa River 94 K/9; P.K. Sutherland, 1948 (McLearn, 1969, p. 9).

Eogymnotoceras deleeni (McLearn)
Gymnotoceras smithi n. sp.

GSC loc. 14860. Upper Norian, Amoenum Zone. Lewes River Group, 4.5 km northeast of north end of Fish Lake, NTS Whitehorse 105 D/11; J.G. Fyles 1946 (Wheeler, 1961, p. 35; Tozer, 1967, p. 80).

Tozeria yukonensis n. sp.

GSC loc. 16002. Ladinian, Sutherlandi Subzone 2. Toad Formation ("Dark siltstones"), south side of Mount Stearns, NTS Mount Laurier 94 B/14; P.K. Sutherland, 1948.

Daxatina canadensis (Whiteaves)

GSC loc. 16008. Middle Anisian, Hayesi Zone. Toad Formation, 1.2 km up "Four Falls Creek" from Bat Creek, NTS Kluachesi Lake 94 G/1; P.K. Sutherland, 1948 (McLearn, 1969, p. 11).

Amphipopanoceras selwyni (McLearn)
Intornites intornatus (McLearn)
Anagymnotoceras varium (McLearn)
Nicomedites moderatus (McLearn)
Czekanowskites pinguis (McLearn)

GSC loc. 17123. Upper Carnian, Dilleri Zone? Karmutsen Group, at elevation of 650 m on northeast-trending ridge leading from Tahsis Inlet to Mount Leiner, NTS Zeballos 92 E/15; J.W. Hoadley, 1949 (Hoadley, 1953, p. 17).

Shastites vulcanus n. sp.

GSC loc. 18667. Upper Carnian, Dilleri Zone. Nicola Group, 3.2 km east of railway bridge that crosses Thompson River south of Basque Station, NTS Ashcroft, 92 I/11; S. Duffel (Duffel and McTaggart, 1951, p. 30).

Spirogmoceras shastense (Smith)
Pleurotropites gabbi (Smith)
Discotropites sandlingensis (Hauer)

GSC loc. 19275. Middle Norian, Columbianus Subzone 2. Parson Bay Formation, rocky point on north side of Esperanza Inlet about 1.5 km east of Peculiar Point, NTS Port Eliza 92 E/14; J.A. Jeletzky, 1950 (Tozer, 1967, p. 81).

Steinmannites pacificus n. sp.
Episculites teres (McLearn)
Rhacophyllites debilis (Hauer)

GSC loc. 19672. Upper Norian. Parson Bay Formation, about 1.5 km east of base of Peculiar Point on rocky tidal bench immediately southeast of small rocky point 200 m west of GSC locality 19275, NTS Port Eliza 92 E/14; J.A. Jeletzky, 1951.

Rhabdoceras suessi Hauer

GSC loc. 19678. Middle Norian, Columbianus Subzone 2. Parson Bay Formation, on small island about 1.5 km east of east base of Peculiar Point, NTS Port Eliza 92 E/14; J.A. Jeletzky, 1951 (Tozer, 1967, p. 81).

Pinacoceras parma Mojsisovics
Himavatites multiauritus McLearn

GSC loc. 19709. Middle Norian, Columbianus Subzone 2. Parson Bay Formation, as for GSC locality 19678 (east of Peculiar Point); J.A. Jeletzky, 1951.

Distichites canadensis McLearn
Episculites teres (McLearn)

GSC loc. 20236. Upper Carnian, Welleri Subzone 1. Quatsino Limestone, larger wooded island immediately south of Amos Island in Kyuquot Sound, NTS Kyuquot 92 L/3; J.A. Jeletzky, 1951 (Tozer, 1967, p. 82).

Tardeceras parvum Hyatt and Smith
Projuvavites brockensis (Smith)

GSC loc. 20255. Middle Norian, Columbianus Zone? Parson Bay Formation, 10 m below *Monotis subcircularis* beds, 47 m south of bluff on west tip of Union Island, NTS Kyuquot 92 L/3; J.A. Jeletzky, 1951 (Tozer, 1967, p. 81).

Clydonites pacificus n. sp.

GSC loc. 21430. Middle Norian, Columbianus Zone, Subzone 1? Parson Bay Formation, west coast Amos Island about 550 m west-northwest of south tip of the island, NTS Kyuquot 92 L/3; J.A. Jeletzky, 1952 (Tozer, 1967, p. 81).

Pleurodistichites hindei (Mojsisovics)

GSC loc. 21431. Middle Norian, Columbianus Zone, Subzone 2? Parson Bay Formation, about 5 m above GSC locality 21430, west coast Amos Island, NTS Kyuquot 92 L/3; J.A. Jeletzky, 1952 (Tozer, 1967, p. 81).

Parajuvavites canadensis n. sp.

GSC loc. 21828. Upper Norian, Amoenum Zone. Parson Bay Formation, easternmost point of Walters Island overlooking passage into Walters Cove, NTS Kyuquot 92 L/3; J.A. Jeletzky, 1952.

Paracochloceras suessi Mojsisovics

GSC loc. 22270. Upper Carnian, Welleri Zone. Quatsino Limestone, 950 m southeast of Izard Point, Ououkinsh Inlet, Vancouver Island, NTS Brooks Peninsula 92 L/4; J.A. Jeletzky, 1952.

Pamphagosirenites pamphagus (Dittmar)

GSC loc. 22691. Upper Carnian, Dilleri Zone. Open Bay Formation, Open Bay, Quadra Island, NTS Quadra Island 92 K/3; H.C. Gunning, 1944 (Mathews, 1947, p. 36, 89).

Sympolycyclus gunningi n. sp.
Tropites keiliformis n. sp.

GSC loc. 22692. Upper Carnian, Dilleri Zone. Open Bay Formation, as for GSC locality 22691; H.C. Gunning, 1944.

Sympolycyclus gunningi n. sp.
Leconteiceras californicum (Hyatt and Smith)
Gymnotropites americanus Hyatt and Smith.

GSC loc. 22693. Upper Carnian, Dilleri Zone. Open Bay Formation, as for GSC locality 22691; H.C. Gunning 1944.

Discotropites sandlingensis (Hauer)

GSC loc. 23055. Upper Norian. Parson Bay Formation, northwest shore of Malksope Inlet, on pronounced rocky point 600 m northeast of entrance to channel between Bunsby Islands and Vancouver Island, NTS Kyuquot 92 L/3; J.A. Jeletzky, 1953.

Rhabdoceras suessi Hauer

GSC loc. 23066. Upper Carnian, Welleri Subzone 1. Quatsino Limestone, about 460 m southeast of Izard Point, Ououkinsh Inlet, Vancouver Island, NTS Brooks Peninsula 92 L/4; J.A. Jeletzky, 1953.

Trachysagenites sp. indet.
Tropites izardi n. sp.
Projuvavites brockensis (Smith)

GSC loc. 23072. Upper Norian, Amoenum Zone. Parson Bay Formation, northwest shore of Walters Island about half way between extreme north and west points of island, NTS Kyuquot 92 L/3; J.A. Jeletzky, 1953.

Rhabdoceras suessi Hauer
Paracochloceras suessi Mojsisovics

GSC loc. 23147. Upper Carnian, Dilleri Zone. Quatsino Limestone?, northwest side of northeast peninsula of largest of Hisnit Islands, Ououkinsh Inlet, NTS Kyuquot 92 L/3; J.A. Jeletzky, 1953.

Trachysagenites sp. indet.
Hisnitites janmulleri n. sp.
Pleurotropites gracilis (Smith)
Pleurotropites gabbi (Smith)

GSC loc. 23161. Upper Carnian, Welleri Subzone 1. Quatsino Limestone, southeast end of second largest island at mouth of Power River, Ououkinsh Inlet, NTS Kyuquot 92 L/3; J.A. Jeletzky, 1953.

Discotropites smithi Kutassy
Homerites semiglobosus (Hauer)

GSC loc. 23266. Lower Norian, Kerri Subzone 2. Quatsino Limestone, not in place, about 800 m northeast of Kenny Point, Rupert Inlet, Vancouver Island, NTS Quatsino 92 L/12; J.A. Jeletzky, 1953.

Stikinoceras kerri McLearn

GSC loc. 23370. Upper Norian, Crickmayi Zone. Sutton Formation, unit 1 (Tozer, 1967, p. 79), south side of Cowichan Lake 5 km northwest of mouth of Sutton Creek, NTS Cowichan Lake 92 C/16; E.T. Tozer, 1953.

Rhabdoceras suessi Hauer
Vandaites suttonensis (Clapp and Shimer)

GSC loc. 23372. Upper Norian, Crickmayi Zone. Sutton Formation, talus from unit 1, as for GSC locality 23370; E.T. Tozer, 1953.

Cycloceltites cowichanensis n. sp.
Rhabdoceras suessi Hauer
Vandaites suttonensis (Clapp and Shimer)

GSC loc. 23374. Upper Norian, Crickmayi Zone. Sutton Formation, unit 3 (Tozer, 1867, p. 79), south side Cowichan Lake, 5 km northeast of mouth of Sutton Creek, NTS Cowichan Lake 92 C/16; E.T. Tozer, 1953.

Megaphyllites sp, indet.
Placites polydactylus (Mojsisovics)

GSC loc. 23379. Upper Norian, Crickmayi Zone. Sutton Formation, as for GSC locality 23374.

Vandaites suttonensis (Clapp and Shimer)

GSC loc. 23380. Upper Norian, Crickmayi Zone. Sutton Formation, as for GSC locality 23374.

Vandaites suttonensis (Clapp and Shimer)

GSC loc. 23406. Middle Norian, Magnus Zone. Lewes River Group, Formation D, Maunoir Butte, east of Yukon (Lewes) River, locality 7 (Tozer, 1958, Fig. 2), NTS Frank Creek 105 E/11; E.T. Tozer, 1953 (Tozer, 1967, p. 81).

Sirenotibetites? sp. indet.
Arietoceltites lewesensis n. sp.
Indojuvavites sp. indet.

GSC loc. 23429. Upper Norian, Amoenum Zone. Lewes River Group, Formation F, east side of Lake Laberge, locality 12 (Tozer, 1958, Fig. 2), NTS Lower

Laberge 105 E/6; E.T. Tozer, 1953 (Tozer, 1967, p. 80).

Paracochloceras suessi Mojsisovics

GSC loc. 23457. Upper Norian, Cordilleranus Zone. Lewes River Group, Formation D, 5.5 km northeast of Povoas Mountain, locality 9 (Tozer, 1958, Fig. 2), NTS Lower Laberge 105 E/6; E.T. Tozer, 1953 (Tozer, 1967, p. 80).

Gnomohalorites yukonensis Tozer
Rhabdoceras suessi Hauer
Rhacophyllites debilis (Hauer)

GSC loc. 23849. Smithian, Romunderi Zone. Sulphur Mountain Formation, Vega Member, northeast side of Llama Mountain, locality 32, GSC Map 1139A, NTS Grand Cache 83 E/14; E.J.W. Irish, 1953 (Irish, 1965, p. 172, 179).

Euflemingites cirratus (White).

GSC loc. 23939. Upper Carnian, Dilleri Zone. Quatsino Limestone?, as for GSC locality 23147; J.A. Jeletzky, 1953.

Hisnitites janmulleri n. sp.
Pleurotropites gracilis (Smith)
Pleurotropites gabbi (Smith)

GSC loc. 24033. Upper Carnian, Dilleri Zone. Karmutsen Group, northeast shore of small bay overlooking Amos Island, on northwest shore of Union Island, NTS Kyuquot 92 L/3; J.A. Jeletzky, 1953 (Tozer, 1967, p. 82).

Pleurotropites gracilis (Smith)

GSC loc. 24333. Upper Norian, Amoenum Zone. Parson Bay Formation, east side of bay on east side of Julian Cove, Quatsino Sound, NTS Neroutsos 92 L/5; J.A. Jeletzky, 1954.

Paracochloceras canaliculatum (Hauer)

GSC loc. 24335. Upper Carnian, Welleri Subzone 2. Quatsino Limestone, Quatsino Sound, at top of sharp point about 900 m southwest of Stewart Point, NTS Quatsino 92 L/12; J.A. Jeletzky, 1954.

Discotropites theron (Dittmar)
Hoplotropites circumspinatus (Mojsisovics)
Goniojuvavites kellyi (Smith)

GSC loc. 24351. Middle Norian, Columbianus Zone. Parson Bay Formation, west shore of Amos Island, NTS Kyuquot 92 L/3; J.A. Jeletzky, 1954 (Tozer, 1967, p. 81).

Steinmannites sp. indet.

GSC loc. 24352. Middle Norian, Columbianus Subzone 3. Parson Bay Formation, west shore of Amos Island, NTS Kyuquot 92 L/3; J.A. Jeletzky, 1954.

Leislingites vancouverensis n. sp.
Parajuvavites canadensis n. sp.

GSC loc. 25118. Upper Anisian, Deleeni Zone. Sulphur Mountain Formation, Llama Member, ridge south of Walton Creek, locality 28, GSC Map 1139A, NTS Adams Lookout 83 E/10; E.J.W. Irish, 1954 (Irish 1965, p. 171, 179; Tozer, 1967, p. 72).

Eogymnotoceras deleeni (McLearn)
Ptychites trochleaeformis (Lindstroem)

GSC loc. 25868. Upper Carnian, Welleri Zone. Schei Point Formation, 1.6 km south of Lyall Point, Cameron Island, NTS Domett Point 79 A; Y.O. Fortier, 1955 (Fortier et al., 1963, p. 642; Tozer, 1961, p. 17; 1967, p. 44).

Paratropites arcticus n. sp.

GSC loc. 26107. Ladinian or Lower Carnian. Blaa Mountain Formation, Lower Calcareous Member, locality M (Fortier et al., 1963, Fig. 24, p. 372), Raanes Peninsula, Ellesmere Island, NTS Eureka Sound South 49 F; E.T. Tozer, 1955 (Fortier et al., 1963, p. 385).

Stolleyites intermedius (Frebold)

GSC loc. 26109. Dienerian, Sverdrupi Subzone 2. Blind Fiord Formation, locality L (Fortier et al., 1963, Fig. 24, p. 372), Raanes Peninsula, Ellesmere Island, NTS Eureka Sound South 49 F; E.T. Tozer, 1955 (Fortier et al., 1963, p. 384).

Vavilovites sverdrupi (Tozer)

GSC loc. 26110. Ladinian, Poseidon Zone? Schei Point Formation, *Daonella frami* bed, Bjorne Peninsula, Ellesmere Island, locality E (Fortier et al., 1963, Fig. 23, p. 365), Bjorne Peninsula, Ellesmere Island, NTS Baumann Fiord 49 C; E.T. Tozer, 1955 (Tozer, 1961, p. 14; 1963c, p. 5; 1967, p. 45; Fortier et al., 1963, p. 368).

Longobardites sp. indet.
Istreites nanuk (Tozer)
Protrachyceras sp. indet.

GSC locs. 26111–26115. Ladinian, Poseidon Zone. Schei Point Formation, from individual loose blocks derived from *Daonella frami* bed, as for GSC locality 26110; E.T. Tozer, 1955.

Istreites nanuk (Tozer)

GSC loc. 26124. Upper Carnian, Welleri Zone. Schei Point Formation, locality F (Fortier et al., 1963, Fig. 23, p. 365), Bjorne Peninsula Ellesmere Island, NTS Baumann Fiord 49 C; E.T. Tozer, 1955 (Tozer, 1961, p. 84).

Arctosirenites southeri n. sp.

GSC loc. 26167. Upper Carnian, Welleri Zone. Blaa Mountain Formation, 1030 m below top, Buchanan Lake, Axel Heiberg Island; J.G. Souther, 1955 (Tozer, 1961, p. 84; Fortier et al., 1963, p. 432; Tozer, 1967, p. 44).

Arctosirenites southeri n. sp.

GSC loc. 26168. Upper Carnian, Welleri Zone. Blaa Mountain Formation, 1000 m below top, Buchanan Lake, Axel Heiberg Island, NTS Eureka Sound N; J.G. Souther, 1955 (Tozer, 1961, p. 88; 1967, p. 44; Fortier et al., 1963, p. 432).

Jovites borealis Tozer

GSC loc. 26450. Middle Norian, Columbianus Subzone 3. Heiberg Formation, 4.8 km east of head of Wolf Fiord, Axel Heiberg Island, NTS Glacier Fiord 59 E; B.F. Glenister, 1955 (Fortier et al., 1963, p. 477; Tozer, 1967, p. 44).

Neohimavatites peregrinus n. sp.

GSC loc. 28427. Lower Carnian, Nanseni Zone. Blaa Mountain Formation, Middle Shale Member, about 85 m above base, section on coast of Svartefjeld Peninsula, Ellesmere Island, 10 km northwest of Confederation Point, NTS Greely Fiord West 340 B; R. Thorsteinsson and E.T. Tozer, 1956 (Tozer, 1961, p. 20, 79).

Sirenites nanseni Tozer

GSC loc. 28428. Upper Carnian. Blaa Mountain Formation, Upper Calcareous Member, section as for GSC locality 28427.

Sirenites yakutensis Kiparisova

GSC loc. 28429. Upper Carnian, probably Welleri Zone. Blaa Mountain Formation, about 1000 m from top, Buchanan Lake, Axel Heiberg Island, NTS Eureka Sound North; E.T. Tozer, 1956.

Sirenites serotinus n. sp.

Yakutosirenites pentastichus (Vozin)

GSC loc. 28435. Upper Carnian, Welleri Subzone 2. Blaa Mountain Formation, *Jovites* bed, Buchanan Lake, as for GSC locality 26168; E.T. Tozer, 1956.

Jovites borealis Tozer

GSC loc. 28436. Upper Carnian, Welleri Subzone 1. Blaa Mountain Formation, about 100 m below *Jovites* bed (28435), Buchanan Lake, Axel Heiberg Island, NTS Eureka Sound North 49 G; E.T. Tozer, 1956 (Tozer, 1961, p. 20, 84).

Arctosirenites canadensis Tozer

GSC loc. 28438. Upper Carnian, Welleri Subzone 2. Blaa Mountain Formation, Buchanan Lake, as for GSC locality 26168; E.T. Tozer, 1956.

Jovites borealis Tozer

GSC loc. 28439. Lower Carnian, Nanseni Zone. Blaa Mountain Formation, Middle Shale Member, Svartefjeld Peninsula, Ellesmere Island, 25 km northwest of Confederation Point, NTS Bukken Fiord 560 A; R. Thorsteinsson and E.T. Tozer, 1956 (Tozer, 1961, p. 79).

Sirenites nanseni Tozer

GSC loc. 28440. Lower Griesbachian, Boreale Zone. Blind Fiord Formation, about 65 m above base, Svartefjeld Peninsula, 22 km northwest of Confederation Point, locality 174, GSC Map 1310A, NTS Bukken Fiord 560A; R. Thorsteinsson and E.T. Tozer, 1956 (Tozer, 1961, p. 12, 47).

Otoceras boreale Spath

GSC loc. 28441. Lower Griesbachian, Boreale Zone. Blind Fiord Formation, Svartefjeld Peninsula, talus, as for GSC locality 28440.

Otoceras boreale Spath

GSC loc. 28442. Ladinian. Blaa Mountain Formation, Lower Shale Member, Svartefjeld Peninsula, Ellesmere Island, 24 km northwest of Confederation Point, NTS Bukken Fiord 560A; R. Thorsteinsson and E.T. Tozer, 1956 (Tozer, 1961, p. 90, 92).

Stolleyites intermedius (Frebold)

Sphaerocladiscites martini (Smith)

GSC loc. 28448. Lower Griesbachian, Boreale Zone. Blind Fiord Formation, about 75 m above base, Svartefjeld Peninsula, section as for GSC locality 28440; R. Thorsteinsson and E.T. Tozer, 1956 (Tozer, 1961, p. 12, 47).

Otoceras boreale Spath

GSC loc. 28454. Upper Carnian, Welleri Zone. Blaa Mountain Formation, about 100 m below *Jovites* bed (28435), Buchanan Lake, Axel Heiberg Island; E.T. Tozer, 1956.

Arctoarpadites costatus (Tozer)

GSC loc. 28455. Smithian, Romunderi Zone. Blind Fiord Formation, section on north flank of Hare Fiord Diapir, NTS Greely Fiord West 340 B; E.T. Tozer, 1956.

Melagathiceras crassum (Tozer)

GSC loc. 28469. Lower Carnian, Nanseni Zone. Blaa Mountain Formation, Middle Shale Member, Blaa Mountain, east limb of anticline, NTS Greely Fiord West 340 B; E.T. Tozer, 1956 (Tozer, 1961, p. 79).

Sirenites nanseni Tozer

GSC loc. 28569. Lower Carnian, Nanseni Zone. Blaa Mountain Formation, Middle Shale Member about 200 m above base, section as for GSC locality 28427, Svartefjeld Peninsula, Ellesmere Island; R. Thorsteinsson and E.T. Tozer 1956 (Tozer, 1961, p. 20, 79).

Sirenites nanseni Tozer

GSC loc. 28680. Smithian, Romunderi Zone. Blind Fiord Formation. *Meekoceras* bed, about 570 m above base, cliff facing Nansen Sound, 6 km northwest of Confederation Point, Svartefjeld Peninsula, Ellesmere Island, NTS Greely Fiord West 340 B; R. Thorsteinsson and E.T. Tozer, 1956 (Tozer, 1961, p. 12; 1967, p. 49).

Kashmirites borealis (Tozer)
Melagathiceras crassum (Tozer)
Meekoceras gracilitatis White
Euflemingites romunderi Tozer
Anaxenaspis kraffti n. sp.
Arctoceras blomstrandi (Lindstroem)
Paranannites spathi (Frebold)

GSC locs. 28681, 28682. Smithian, Romunderi Zone. Blind Fiord Formation, talus from *Meekoceras* bed (28680), Svartefjeld Peninsula.

Kashmirites borealis (Tozer)
Melagathiceras crassum (Tozer)
Thermalites canadensis (Tozer)
Meekoceras gracilitatis White
Euflemingites romunderi Tozer
Anaxenaspis kraffti n. sp.
Arctoceras blomstrandi (Lindstroem)
Pseudosageceras longilobatum Kiparisova

GSC loc. 28941. Upper Carnian, Welleri Subzone 1. Unnamed formation (Map unit 7), 5 km southwest of junction of More Creek and Iskut River, NTS Iskut River 104 G/1; J.G. Souther, 1956 (Tozer, 1967. p. 82; Souther, 1972, p. 31).

Pamphagosirenites pacificus n. sp.
Homerites semiglobosus (Hauer)
Margaritropites johnsoni (Smith)
Margaritropites kokeni (Smith)
Jovites ellipticus n. sp.

GSC loc. 30339. Lower Anisian, Caurus Zone. Schei Point Formation, near base of unit 2 (Tozer, 1961, p. 15), Exmouth Island, north summit, NTS Cornwall Island 59 C; E.T. Tozer, 1957.

Pearylandites troelseni Kummel
Lenotropites undulatus (Spath)

GSC loc. 30341. Upper Anisian, Chischa Zone. Schei Point Formation, near base of unit 3 (Tozer, 1961, p. 15), Exmouth Island, north summit, NTS Cornwall Island 59 C; E.T. Tozer, 1957.

Frechites laqueatus (Lindstroem)
Ptychites trochleaeformis (Lindstroem)

GSC loc. 30353. Ladinian, Sutherlandi Zone. Schei Point Formation, about 90 m above base, north coast of Table Island, NTS Cornwall Island 59 C; E.T. Tozer, 1957 (Tozer, 1961. p. 92).

Nathorstites macconnelli (Whiteaves)

GSC loc. 30357. Lower Carnian, Nanseni Zone. Schei Point Formation, south side of Hat Island, east of fault, NTS Eureka Sound South 49 F; E.T. Tozer, 1957 (Tozer, 1961, p. 16).

Sirenites nanseni Tozer

GSC loc. 30359. Lower Carnian, Nanseni Zone. Schei Point Formation, talus from GSC locality 30357, Hat Island; E.T. Tozer, 1957.

Sirenites nanseni Tozer

GSC loc. 30369. Upper Carnian, Welleri Zone. Schei Point Formation, unit 5 (Tozer, 1961, p. 15), cliff near Cape Ursula, Table Island, NTS Cornwall Island 59 C; E.T. Tozer, 1957.

Orthoceltites belcheri n. sp.
Sirenites serotinus n. sp.
Jovites borealis Tozer

GSC loc. 32215. Lower Griesbachian, Boreale Zone. Blind Fiord Formation, south side of Arthaber Creek, 5 km southeast of mouth of creek, Axel Heiberg Island, NTS Bukken Fiord 560 A; R. Thorsteinsson, 1957 (Tozer, 1961, p. 47).

Otoceras boreale Spath

GSC loc. 32220. Lower Carnian, Nanseni Zone. Blaa Mountain Formation, Middle Shale Member, cliffs facing Otto Fiord, 2.5 km east of Cape St. Andrew, Svartefjeld Peninsula, Ellesmere Island, NTS Bukken Fiord 560 A; R. Thorsteinsson 1957.

Sirenites nanseni Tozer

GSC loc. 32363. Spathian, Subrobustus Zone. Blind Fiord Formation, cliffs facing Otto Fiord 3 km east of Cape St. Andrew, Svartefjeld Peninsula, Ellesmere Island, NTS Bukken Fiord 560 A; R. Thorsteinsson 1957 (Tozer, 1965a, p. 3; 1967, p. 47).

Olenikites canadensis Tozer
Olenikites bombus n. sp.
Olenikites triton n. sp.
Svalbardiceras freboldi Tozer

GSC loc. 32364. Upper Griesbachian, Commune Zone. Blind Fiord Formation, south coast of Bjarnason Island, NTS Bukken Fiord 560 A; R. Thorsteinsson, 1957.

Ophiceras commune Spath

GSC loc. 32365. Smithian, Tardus Zone. Blind Fiord Formation, south side of Arthaber Creek, 5 km southeast of mouth of creek, Axel Heiberg Island, NTS Bukken Fiord 560 A; R. Thorsteinsson, 1957 (Tozer, 1961, p. 31; 1967, p. 49).

Xenoceltites subevolutus Spath
Wasatchites perrini Mathews
Anawasatchites tardus McLearn
Anawasatchites dawsoni n. sp.

GSC loc. 32366. Dienerian, Sverdrupi Subzone 3. Blind Fiord Formation, talus, south side of Arthaber Creek, 5 km southeast of mouth of creek, Axel Heiberg Island, NTS Bukken Fiord 560 A; R. Thorsteinsson, 1957 (Tozer, 1961, p. 50).

Heibergites heibergensis (Tozer)

GSC loc. 32367. Dienerian. Blind Fiord Formation, talus, south side of Arethaber Creek, 5 km southeast of mouth of creek, Axel Heiberg Island, NTS Bukken Fiord 560 A; R. Thorsteinsson, 1957.

Heibergites heibergensis (Tozer)
Pseudosageceras multilobatum Noetling
Bukkenites nitidus n. sp.

GSC loc. 32368. Dienerian, Candidus Zone. Blind Fiord Formation, south side of Arthaber Creek, 5 km southeast of mouth of creek, Axel Heiberg Island, NTS Bukken Fiord 560 A; R. Thorsteinsson, 1957 (Tozer, 1961, p. 58).

Proptychites candidus Tozer

GSC loc. 32369. Lower Carnian, Nanseni Zone. Blaa Mountain Formation, Middle Shale Member, cliffs facing Nansen sound about 35 km northwest of Confederation Point, Svartefjeld Peninsula, Ellesmere Island, NTS Bukken Fiord 560 A; R. Thorsteinsson, 1957 (Tozer, 1961, p. 79).

Sirenites nanseni Tozer

GSC loc. 32371. Smithian, Romunderi Zone. Blind Fiord Formation. *Meekoceras* Bed, as for GSC locality 28680; R. Thorsteinsson, 1957.

Melagathiceras crassum (Tozer)
Meekoceras gracilitatis White
Arctoceras blomstrandi (Lindstroem)
Pseudosageceras longilobatum Kiparisova

GSC loc. 32373. Upper Griesbachian, Strigatus Zone. Blind Fiord Formation, south side of Arthaber Creek, 5 km southeast of mouth of creek, Axel Heiberg Island, NTS Bukken Fiord 560 A; R. Thorsteinsson, 1957 (Tozer, 1961, p. 56).

Bukkenites incisus n. sp.
Bukkenites nitidus n. sp.
Bukkenites strigatus (Tozer)
Bukkenites macilentus n. sp.

GSC loc. 34001. Lower Griesbachian, Boreale Zone. Blind Fiord Formation, south coast of Bjarnason Island, NTS Bukken Fiord 560 A; R. Thorsteinsson, 1957 (Tozer, 1961, p. 47).

Otoceras boreale Spath

GSC loc. 35611. Upper Carnian, Welleri Zone. Schei Point Formation, 1.5 km south of Lyall Point, Cameron Island, NTS Domett Point 79 A; E.T. Tozer, 1958.

Paratropites arcticus n. sp.
Arctotropites richardsi (Tozer)

GSC loc. 36399. Ladinian, Sutherlandi Zone. Toad Formation, Tetsa River, 14 km south of Mile Post 382, Alaska Highway, NTS Tetsa River 94 K/9; B.R. Pelletier, 1958.

Lobites ellipticus (Hauer)

GSC loc. 36420. Ladinian, Maclearni Zone. Liard Formation, gully off north Tetsa River about 9 km above forks with Tetsa River, NTS Tetsa River 94 K/9; B.R. Pelletier, 1958.

Nathorstites maclearni n. sp.
Anolcites papillatus n. sp.

GSC loc. 36446. Lower Anisian, Caurus Zone. Toad Formation, unnamed creek flowing into Tetsa River southeast of Mile Post 375 (km 595), Alaska Highway, NTS Tetsa River 94 K/9; B.R. Pelletier, 1958 (McLearn, 1969, p. 9).

Lenotropites tardus McLearn

GSC loc. 36484. Ladinian, Sutherlandi Subzone 2. Toad Formation, south fork of Tetsa River, NTS Tetsa River 94 K/9; B.R. Pelletier, 1958.

Frankites sutherlandi (McLearn)
Daxatina canadensis (Whiteaves)

GSC loc. 36657. Middle Anisian, Hagei Zone. Toad Formation, Chischa River, 14 km south of Alaska Highway, NTS Tetsa River 94 K/9; B.R. Pelletier, 1958 (McLearn, 1969, p. 10).
Buddhaites hagei (McLearn)

GSC loc. 36732. Smithian, Romunderi Zone. Sulphur Mountain Formation, Mystery Lake, NTS Miette 83 F/4; E.W. Mountjoy, 1957 or 1958.
Euflemingites cirratus (White)
Arctoceras blomstrandi (Lindstroem)

GSC loc. 37218. Upper Carnian. Schei Point Formation, 22 km south of Cape Malloch, Borden Island, NTS Borden Island 79 F; R. Thorsteinsson, 1958 (Tozer and Thorsteinsson, 1964, p. 119).
Sirenites serotinus n. sp.

GSC loc. 37975. Upper Carnian or Lower Norian. Blaa Mountain Formation, Upper Shale Member, 15 km northwest of Eureka, Fosheim Peninsula, Ellesmere Island, locality 138, GSC Map Slidre Fiord, 1298A, NTS Greely Fiord West 340 B; R. Thorsteinsson, 1956 (Tozer, 1961, p. 96).
Rhacophyllites sp. indet.

GSC loc. 39915. Lower Norian, Dawsoni Subzone 2. Pardonet Formation, east side of Pardonet Hill, NTS Mount Brewster 94 B/3; E.J.W. Irish, 1959.
Malayites dawsoni McLearn

GSC loc. 40084. Ladinian, Sutherlandi Subzone 2. Toad Formation, Chischa River, 2.5 km above junction with Henry Creek, NTS Chlotapecta Creek 94 K/8; B.R. Pelletier, 1959.
Frankites sutherlandi (McLearn)
Daxatina megabrotheus n. sp.

GSC loc. 40088. Upper Anisian, Chischa Zone. Toad Formation, 4.3 m below top of unit 8, section 6 (Pelletier, 1960, p. 22), Chischa River, near west end of canyon 13 km above junction with Muskwa River, NTS Chischa River 94 J/12; B.R. Pelletier, 1959 (Tozer, 1967, p. 69) (=GSC loc. 74726).
Parapopanoceras malmgreni (Lindstroem)
Frechites chischa (Tozer)
Pleurofrechites subsidens n. sp.
Tozerites polygyratus (Smith)

GSC loc. 40109. Middle Anisian, Hagei Zone. Toad Formation, Chlotapecta Creek, 16 km east of Rocky Mountain Front, NTS Chlotapecta Creek 94 K/8; B.R. Pelletier, 1959 (Tozer, 1967, p. 72).
Alanites laevis n. sp.
Intornites intornatus (McLearn)
Hollandites pelletieri McLearn
Buddhaites hagei (McLearn)

GSC loc. 40110. Middle Anisian, Hayesi Zone. Toad Formation, 3 m above GSC locality 40109, Chlotapecta Creek; B.R. Pelletier, 1959.
Intornites intornatus (McLearn)
Nicomedites moderatus (McLearn)

GSC loc. 40295. Lower Norian, Kerri Subzone 2. Pardonet Formation, headwaters of east fork of Carbon Creek, NTS Callazon Creek, 93 O/10; J.E. Muller, 1959 (probably=GSC locality 84198).
Guembelites jandianus Mojsisovics

GSC loc. 40429. Upper Norian, Cordilleranus Zone. Sinwa Formation, *Monotis* beds, at elevation of 1500 m, 7.5 km north of west end of King Salmon Lake, NTS Yeth Creek 104 K/15; J.G. Souther, 1959.
Gnomohalorites southeri Tozer

GSC loc. 40982. Upper Carnian or Lower Norian. Peril Formation, west shore of Huston Inlet, Moresby Island, NTS 103 B/6, Burnaby Island; A. Sutherland Brown. (Sutherland Brown, 1968, p. 60).
Discophyllites ebneri (Mojsisovics)

GSC loc. 42297. Ladinian, Sutherlandi Subzone 2. Liard Formation, east side of tributary of North Tetsa River, 1 km south of Alaska Highway bridge (BM 3356), NTS Tetsa River 94 K/9; E.T. Tozer, 1960.
Nathorstites macconnelli (Whiteaves)
Frankites sutherlandi (McLearn)

GSC loc. 42300. Ladinian, Meginae Subzone 3. Liard Formation, talus on Alaska Highway, 7 km east of Summit Lake, NTS MacDonald Creek 94 K/10, locality described by McLearn (1947b, p. 9); E.T. Tozer, 1960.
Indigirites boehmi n. sp.
Meginoceras aylardi (McLearn)

GSC loc. 42306. Upper Carnian, Welleri Subzone 1. Loose block from Pardonet Formation or Ludington Formation, in stream bed on west side of mountain on south side of Alaska Highway near Mile Post 428 (km 680), NTS Toad Hotsprings 94 K/14; E.T. Tozer, 1960 (Tozer, 1967, p. 62).
Arctosirenites columbianus n. sp.
Discotropites smithi Kutassy
Margaritropites johnsoni (Smith)
Bacchites hyatti (Smith)
Projuvavites brockensis (Smith)
Projuvavites strongi (Smith)

GSC loc. 42308. Lower Carnian, Obesum Zone. Ludington Formation, col northwest of summit of Ewe Mountain, NTS Eight Mile Creek 94 N/3; E.T. Tozer, 1960 (Tozer, 1967, p. 63).

Austrotrachyceras obesum (Tozer)

GSC loc. 42311. Lower Carnian, Nanseni Zone. Ludington Formation, about 100 m stratigraphically above GSC locality 42308 (Obesum Zone), near summit of Ewe Mountain, NTS Eight Mile Creek, 94 N/3; E.T. Tozer, 1960 (Tozer, 1967, p. 63).

Clionitites arietinus n. sp.
Sirenites nanseni Tozer
Sirenites ovinus n. sp.

GSC loc. 42316. Ladinian, Sutherlandi Subzone 2. Ludington Formation, east face of Ewe Mountain, NTS Eight Mile Creek 94 N/3; E.T. Tozer, 1960 (Tozer, 1967, p. 63).

Daxatina canadensis (Whiteaves)

GSC loc. 42320. Upper Carnian, Welleri Subzone 2. Baldonnel Formation, loose block, about 1 km south of summit of Mount McLearn, NTS Eight Mile Creek 94 N/3; E.T. Tozer, 1960 (Tozer, 1967, p. 61).

Discotropites theron (Dittmar)
Paratropites teres n. sp.
Hoplotropites? *globosus* n. sp.
Hoplotropites(?) intermedius n. sp.
Goniojuvavites kellyi (Smith)

GSC loc. 42321. Upper Carnian, Welleri Subzone 2. Baldonnel Formation, as for GSC locality 42320, another block; E.T. Tozer, 1960.

Discotropites theron (Dittmar)

GSC loc. 42322. Upper Carnian, Welleri Subzone 2. Baldonnel Formation, as for GSC locality 42320, another block; E.T. Tozer, 1960.

Paratropites teres n. sp.
Goniojuvavites kellyi (Smith)

GSC locs. 42323, 42325. Upper Carnian, Welleri Subzone 2. Baldonnel Formation, as for GSC locality 42320, two other blocks; E.T. Tozer, 1960.

Goniojuvavites kellyi (Smith)

GSC loc. 42327. Lower Norian, Dawsoni Subzone 2. Pardonet Formation, 1 km southwest of summit of Mount McLearn, NTS Eight Mile Creek 94 N/3; E.T. Tozer, 1960 (Tozer, 1967, p. 60).

Malayites dawsoni McLearn

GSC loc. 42328. Lower Norian, Dawsoni Subzone 2. Pardonet Formation, loose block derived from GSC locality 42327; E.T. Tozer, 1960.

Malayites dawsoni McLearn
Omojuvavites magnumbilicatus n. sp.
Omojuvavites minor n. sp.

GSC loc. 42329. Lower Norian, Dawsoni Subzone 2. Pardonet Formation, loose block derived from GSC locality 42327; E.T. Tozer, 1960.

Pseudocardioceras idunae (Diener)

GSC loc. 42333. Ladinian, Sutherlandi Subzone 2. Toad Formation, talus, south side of Liard River, Middle Canyon, 1.5 km below Boiler Canyon, NTS Grayling River 94 N/6; E.T. Tozer, 1960.

Nathorstites macconnelli (Whiteaves)

GSC loc. 42334. Ladinian, Sutherlandi Subzone 2. Toad Formation, 115 m below Cretaceous contact, Middle Canyon, 1.5 km below Boiler Canyon, NTS Grayling River 94 N/6; E.T. Tozer, 1960.

Nathorstites macconnelli (Whiteaves)

GSC loc. 42335. Ladinian, Sutherlandi Subzone 2. Toad Formation, 100 m below Cretaceous contact, Middle Canyon, locality and section as for GSC locality 42334; E.T. Tozer, 1960.

Nathorstites macconnelli (Whiteaves)
Daxatina canadensis (Whiteaves)
Sympolycyclus antiquus n. sp.
Lobites sp. indet.

GSC loc. 42337. Middle Anisian, Hagei Zone. Toad Formation, south side of Liard River, 3.2 km below mouth of Toad River, NTS Toad River 94 N/7; E.T. Tozer, 1960 (McLearn and Kindle, 1950, p. 40; Tozer, 1971, p. 1017).

Intornites intornatus (McLearn)
Buddhaites hagei (McLearn)

GSC loc. 42338. Lower Anisian, Caurus Subzone 2. Toad Formation, locality and section as for GSC locality 42337, upper bed of Caurus Zone, 0.75 m below GSC locality 42337; E.T. Tozer, 1960 (Tozer, 1967. p. 71).

Lenotropites tardus McLearn
Grambergia nahwisi (McLearn)
Discogymnites hollandi (McLearn)
Sturia sansovinii (Mojsisovics)

The remains of the *Sturia,* a large specimen, were seen in 1960 but not collected. In 1982, a large piece was collected from this bed by Murray Journeay while he was working for P.B. Read. The piece collected by Murray was from the same specimen collected by E.D. Kindle at GSC locality 10660 in 1943 (Tozer, 1984, p. 96).

GSC loc. 42339. Lower Anisian, Caurus Subzone 1. Toad formation, locality and section as for GSC localities 42337 and 42338, from beds below GSC locality 42338; E.T. Tozer (1960).

Lenotropites caurus (McLearn)
Grambergia liardensis n. sp.
Azarianites bufonis (McLearn)

GSC loc. 42340. Smithian, Tardus Zone. Toad Formation, *Wasatchites* bed (15 cm), north side of Liard River about 3 km below mouth of Toad River; E.T. Tozer, 1960 (McLearn, 1945; McLearn and Kindle, 1950, p. 40; Tozer, 1967, p. 74).

Kashmirites warreni (McLearn)
Anasibirites crickmayi Mathews
Wasatchites perrini Mathews
Wasatchites deleeni McLearn
Wasatchites macconnelli n. sp.
Anawasatchites tardus McLearn
Anawasatchites merrilli McLearn
Anawasatchites spathi n. sp.
Anawasatchites dawsoni n. sp.
Arctoprionites williamsi n. sp.

GSC loc. 42342. Smithian, Tardus Zone. Toad Formation, talus from *Wasatchites* bed at GSC locality 42340; E.T. Tozer, 1960.

Kashmirites warreni (McLearn)
Wasatchites perrini Mathews
Wasatchites deleeni McLearn
Anawasatchites tardus McLearn
Anawasatchites merrilli McLearn
Arctoprionites williamsi n. sp.

GSC loc. 42343. Lower Anisian, Caurus Zone. Toad Formation, talus from section on Liard River 3.2 km below mouth of Toad River, NTS Toad River 94 N/7; E.T. Tozer, 1960.

Grambergia nahwisi (McLearn)

GSC loc. 42349. Lower Anisian, Caurus Zone. Toad Formation, concretion from black shale unit (McLearn and Kindle, 1950, p. 40), north side of Liard River, 2.5 km below mouth of Brimstone Creek, NTS Grayling River 94 N/6; E.T. Tozer, 1960 (Tozer, 1967, p. 71).

Lenotropites caurus (McLearn)

GSC loc. 42350. Ladinian, Sutherlandi Subzone 2. Liard Formation, near top of unit 6 (Section 6, Pelletier, 1961, p. 25), east limb of anticline, north side of Liard River, Fossil Gate Canyon, 35 km (22 miles) below Devils's Portage, 2 km above Hell Gate Rapids, NTS Grayling River 94 N/6; E.T. Tozer 1960.

This is probably the locality where R.G. McConnell collected the type specimens of *Popanoceras mcconnelli* and *Popanoceras mcconnelli* var. *lenticulare* when he descended the Liard River in 1887 (McConnell, 1891; Tozer, 1984, p. 52). The specimens are described as coming from "Liard River, 30 miles below Devil's Portage". Devils Portage does not appear on the current NTS maps but the position is shown on the map accompanying McConnell's report (McConnell, 1891, sheet 4). The portage circumvents the unnavigable canyon, which extends downstream for about 3 km from the mouth of Deer River (NTS Mount Prudence 94 N/5). McConnell's map is sufficiently detailed that most features, e.g., Boiler Canyon, can be recognized on today's maps. Comparisons show that the scale on McConnell's map is somewhat inaccurate. For example, Boiler Canyon ends about 32 km (20 miles) below the Portage on the NTS maps; 45 km (28 miles) on McConnell's map. This accounts for the discrepancy in the locality for *Popanoceras mcconnelli* being 35 km (22 miles) below the Portage on the contemporary map, but 48 km ("30 miles") below on McConnell's map and in Whiteaves' (1889, p. 138) description.

Nathorstites macconnelli (Whiteaves)

GSC loc. 42351. Ladinian, Sutherlandi Subzone 2. Liard Formation, unit 6, section as for GSC locality 42350 (Section 6, Fossil Gate); E.T. Tozer, 1960.

Nathorstites macconnelli (Whiteaves)
Zestoceras enode (Tozer)
Frankites sutherlandi (McLearn)
Lobites ellipticus (Hauer)

GSC loc. 42352. Ladinian, Sutherlandi Subzone 2. Liard Formation, lower part of unit 6, section as for GSC locality 42350 (Section 6, Fossil Gate); E.T. Tozer, 1960.

Frankites sutherlandi (McLearn)

GSC loc. 42354. Ladinian, Sutherlandi Subzone 2. Liard Formation, lower part of unit 6, section as for GSC locality 42350 (Section 6, Fossil Gate); E.T. Tozer, 1960.

Frankites sutherlandi (McLearn)
Muensterites delicatulus (McLearn)

GSC loc. 42355. Ladinian, Maclearni Subzone 2. Liard Formation, 6 m below top of unit 1, section as for GSC locality 42350 (Section 6, Fossil Gate), on west limb of anticline (Pelletier, 1961, p. 26); E.T. Tozer, 1960 (Tozer, 1963b, p. 32; 1967, p. 66).

Nathorstites maclearni n. sp.
Protrachyceras sikanianum McLearn
Liardites whiteavesi Tozer

Anolcites angustus n. sp.
Anolcites gemmatus n. sp.
Maclearnoceras maclearni Tozer
Clionitites? venerabilis n. sp.

GSC loc. 42360. Smithian, Tardus Zone. Toad Formation *Wasatchites* bed (15 cm), bluff 800 m north of Liard River, 2.4 km below Toad River, NTS Toad River 94 N/7; E.T. Tozer, 1960.
Kashmirites warreni (McLearn)
Anasibirites kummeli n. sp.
Prionites hollandi McLearn
Wasatchites perrini Mathews
Wasatchites tridentinus Spath
Wasatchites deleeni McLearn
Wasatchites procurvus McLearn
Wasatchites macconnelli n. sp.
Anawasatchites tardus McLearn
Anawasatchites merrilli McLearn
Anawasatchites kindlei n. sp.
Anawasatchites spathi n. sp.
Anawasatchites dawsoni n. sp.

GSC loc. 42363. Smithian, Tardus Zone. Toad Formation, about 1.5 m above *Wasatchites* bed, north bank of Toad River, 3.2 km above Liard River, NTS Toad River 94 N/7; E.T. Tozer, 160 (Tozer, 1967, p. 74).
Xenoceltites subevolutus Spath

GSC loc. 42364. Smithian, Tardus Zone. Toad Formation, *Wasatchites* bed, section as for GSC locality 42363; E.T. Tozer, 1960 (=GSC loc. 10658).
Kashmirites warreni (McLearn)
Prionites hollandi McLearn
Wasatchites perrini Mathews
Wasatchites deleeni McLearn,
Wasatchites procurvus McLearn
Wasatchites macconnelli n. sp.
Anawasatchites tardus McLearn
Anawasatchites merrilli McLearn
Anawasatchites spathi n. sp.
Anawasatchites dawsoni n. sp.
Arctoprionites williamsi n. sp.

GSC loc. 42369. Smithian, Tardus Zone. Toad Formation, loose block from *Wasatchites* bed, north side of Liard River at mouth of Toad River, NTS Toad River 94 N/7; E.T. Tozer, 1960 (Tozer, 1967, p. 74).
Anawasatchites tardus McLearn
Pseudosageceras plicatum n. sp.

GSC loc. 42372. Dienerian, Candidus Zone. Grayling Formation, 34 m above contact with Permian Fantasque Formation, south side of Dunedin River, 3.6 km above forks, NTS Tetsa River 94 K/9; E.T. Tozer, 1960 (Tozer, 1963a, p. 2; 1967, p. 75).
Meekophiceras columbianum (Tozer)
Pleurogyronites kraffti n. sp.
Proptychites mulleri Tozer
Proptychites kummeli Tozer
Proptychites newelli Tozer
Dunedinites pinguis Tozer

GSC loc. 42377. Upper Carnian, Welleri Subzone 2. Pardonet Formation, east side of mountain on south side of Alaska Highway west of One Forty One Creek, near Mile Post 428 (km 680), NTS Toad Hotsprings 94 K/14; E.T. Tozer, 1960 (Tozer, 1967, p. 61).
Discotropites theron (Dittmar)
Jovites bosnensis Mojsisovics
Goniojuvavites kellyi (Smith)

GSC loc. 42378. Upper Carnian, Welleri Subzone 2. Pardonet Formation, as for GSC locality 42377, from 1.5 m interval at about the same stratigraphic level as GSC locality 42377.
Sympolycyclus kellyi (Smith)
Tropites bufonis n. sp.
Discotropites theron (Dittmar)
Goniojuvavites kellyi (Smith)

GSC loc. 42379. Upper Carnian, Welleri Subzone 2. Pardonet Formation, as for GSC locality 42377, from bed 3 m below GSC locality 42377; E.T. Tozer, 1960.
Jovites bosnensis Mojsisovics
Goniojuvavites kellyi (Smith)

GSC loc. 42380. Upper Carnian, Welleri Subzone 2. Pardonet Formation, talus at GSC locality 42377; E.T. Tozer, 1960.
Hoplotropites? globosus n. sp.

GSC loc. 42384. Upper Carnian, Welleri Subzone 1. Ludington Formation, talus, west side of mountain on south side of Alaska Highway west of One Forty One Creek, near Mile Post 428 (km 680), NTS Toad Hotsprings 94 K/14; E.T. Tozer, 1960.
Discotropites smithi Kutassy
Homerites semiglobosus (Hauer)
Projuvavites brockensis (Smith)

GSC loc. 42385. Upper Carnian, Welleri Subzone 2. Pardonet Formation, in situ, as for GSC locality 42384.
Goniojuvavites kellyi (Smith)

GSC loc. 42386. Upper Carnian, Welleri Subzone 2. Pardonet Formation, as for GSC locality 42377, from single block, probably from stratigraphic level of GSC locality 42377.
Sympolycyclus kellyi (Smith)

Paratropites teres n. sp.
Discotropites theron (Dittmar)
Hoplotropites auctus (Dittmar)

GSC loc. 42388. Upper Carnian, Welleri Subzone 2. Pardonet Formation, as for GSC locality 42377, at, or about, the stratigraphic level of GSC locality 42377.
Discotropites theron (Dittmar)
Hoplotropites auctus (Dittmar)
Goniojuvavites kellyi (Smith)

GSC loc. 42389. Upper Carnian, Welleri Subzone 2. Pardonet Formation, as for GSC locality 42377, at, or about, the stratigraphic level of GSC locality 42377.
Klamathites sp. indet.
Sympolycyclus kellyi (Smith)
Tropites bufonis n. sp.
Discotropites theron (Dittmar)
Hoplotropites auctus (Dittmar)
Jovites bosnensis Mojsisovics
Goniojuvavites kellyi (Smith)

GSC loc. 42393. Ladinian, Meginae Subzone 2. Toad Formation ("Dark siltstones"), Beattie Ledge, north bank of Peace River between Adams and Ayland creeks. Now submerged beneath Williston Lake. NTS Jones Peak 94 B/2; E.T. Tozer, 1960 (McLearn, 1940b, 1947 b, p. 4; McLearn and Kindle, p. 45, Fig. 8; Tozer, 1967, p. 67).
Indigirites boehmi n. sp.
Thanamites parvus (McLearn)
Protrachyceras sikanianum McLearn

GSC loc. 42394. Ladinian, Meginae Subzone 2. Toad Formation ("Dark siltstones"), Beattie Ledge, as for GSC locality 42393, stratigraphically above GSC locality 42393; E.T. Tozer, 1960.
Indigirites boehmi n. sp.
Protrachyceras sikanianum McLearn
Meginoceras meginae McLearn
Lobites pacianus McLearn

GSC loc. 42395. Ladinian, Meginae Zone, Subzone 2. Toad Formation ("Dark siltstones"), Beattie Ledge, as for GSC locality 42393, stratigraphically above GSC localities 42393 and 42394; E.T. Tozer, 1960.
Nitanoceras selwyni (McLearn)
Indigirites boehmi n. sp.
Thanamites schooleri (McLearn)
Protrachyceras sikanianum McLearn
Meginoceras meginae McLearn
Silenticeras hatae McLearn

GSC loc. 42397. Dienerian, Sverdrupi Subzone 2. Sulphur Mountain Formation, Vega Member, road cut on west side of Stoney Squaw Mountain, NTS Banff 82 O/4; E.T. Tozer, 1960.
Vavilovites sverdrupi (Tozer)

GSC loc. 42398. Upper Carnian, Welleri Subzone 2. Baldonnel Formation, loose block, as for GSC locality 42320, south of Mount McLearn, NTS Eight Mile Creek 94 N/3; E.T. Tozer, 1960 (Tozer, 1967, p. 61).
Hoplotropites? intermedius n. sp.

GSC loc. 42400. Middle Anisian, Hagei Zone. Toad Formation, from one talus block, as for GSC locality 10659, north side of Liard River, 2.3 km below mouth of Brimstone Creek, NTS Grayling River 94 N/6; E.T. Tozer, 1960 (McLearn and Kindle, 1950, p. 40; Tozer, 1967, p. 40).
Intornites mactaggarti (McLearn)
Anagymnotoceras tozeri McLearn
Gymnites compressus n. sp.

GSC loc. 42401. Lower Anisian, Caurus Zone. Toad Formation, from another block at GSC locality 42400; E.T. Tozer, 1960.
Stenophyllites kindlei (McLearn)

GSC loc. 42402. Middle Anisian, Hagei Zone. Toad Formation, from another block at GSC locality 42400; E.T. Tozer, 1960.
Stenopopanoceras obesum (McLearn)
Intornites mactaggarti (McLearn)
Hollandites liardensis n. sp.

GSC loc. 42403. Lower Anisian, Caurus Zone. Toad Formation, from another block at GSC locality 42400; E.T. Tozer, 1960.
Grambergia tetsaensis McLearn
Stenophyllites kindlei (McLearn)

GSC loc. 42404. Lower Anisian, Caurus Zone. Toad Formation, from another block at GSC locality 42400; E.T. Tozer, 1960.
*Stenophyllites kindlei (*McLearn)
Ussurites muskwa McLearn

GSC loc. 42406. Middle Anisian, Hagei Zone. Toad Formation, from another block at GSC locality 42400; E.T. Tozer, 1960.
Stenopopanoceras angulatum n. sp.
Stenopopanoceras obesum (McLearn)
Intornites mactaggarti (McLearn)

GSC loc. 42407. Middle Anisian, Hayesi Zone. Toad Formation, from another block at GSC locality 42400; E.T. Tozer, 1960.
Arctohungarites liardensis n. sp.

GSC loc. 42408. Middle Anisian, Hayesi Zone. Toad Formation, from another block at GSC locality 42400; E.T. Tozer, 1960.

Amphipopanoceras selwyni (McLearn)
Intornites intornatus (McLearn)
Czekanowskites pinguis (McLearn)
Tetsaoceras angulatum (McLearn)

GSC loc. 42409. Middle Anisian, Hagei Zone. Toad Formation, from another block at GSC locality 42400; E.T. Tozer, 1960.

Intornites mactaggarti (McLearn)
Buddhaites hagei (McLearn)

GSC loc. 42410. Middle Anisian, Hayesi Zone. Toad Formation, from another block at GSC locality 42400; E.T. Tozer, 1960.

Czekanowskites acuteplicatus n. sp.
Tetsaoceras hayesi (McLearn)
Arctohungarites liardensis n. sp.

GSC loc. 42413. Middle Anisian, Hayesi Zone. Toad Formation, about 1 km west of Mile Post 375 (km 595), Alaska Highway, NTS Tetsa River, 94 K/9; E.T. Tozer, 1960, about the same for GSC localities 10696 and 68294 (Tozer, 1967, p. 70).

Czekanowskites pinguis (McLearn)
Arctohungarites liardensis n. sp.

GSC loc. 42444. Lower Norian, Kerri Subzone 1. Pardonet Formation, south end of ridge between Peck and Carbon creeks, 55°43′N, 122°52′W, NTS Callazon Creek 93 O/10; J.E. Muller, 1960.

Gonionotites scapulatus n. sp.
Dimorphites pardonetiensis McLearn
Guembelites clavatus (McLearn)

GSC loc. 42519. Lower Norian, Dawsoni Subzone 2. Pardonet Formation, Crying Girl Prairie Creek, 1.6 km northeast of Graham River, NTS Hackney Hills 94 B/7; E. J.W. Irish, 1960.

Malayites dawsoni McLearn

GSC loc. 42535. Ladinian, Meginae Zone. Toad Formation, south of Graham River, 56°19′30″N, 122°44′30″W, NTS Hackney Hills 94 B/7; E.J.W. Irish, 1960 (Tozer, 1967, p. 68).

Indigirites stolleyi n. sp.
Protrachyceras sikanianum McLearn
Meginoceras tetsa (McLearn)
Silenticeras bamberi n. sp.
Lobites pacianus McLearn

GSC loc. 42537. Middle Norian, Rutherfordi Zone. Pardonet Formation, Crying Girl Prairie Creek, 1.6 km northeast of Graham River, NTS Hackney Hills 94 B/7; E.J.W. Irish, 1960 (Tozer, 1965c, p. 222; 1967, p. 60).

Drepanites rutherfordi McLearn
Hauerites piceus n. sp.
Didymites quenstedti Mojsisovics

GSC loc. 42538. Smithian, Tardus Zone. Toad Formation, 5.5 km east of junction of Horn Creek and Graham River, NTS Christina Falls 94 B/11; E.J.W. Irish, 1960.

Xenoceltites subevolutus Spath

GSC loc. 43695. Upper Carnian, Dilleri Zone. King Salmon Formation, elevation 1350 m on east ridge of King Salmon Mountain, NTS Inklin 104 K/14; J.G. Souther, 1960 (Tozer, 1967, p. 82; Souther, 1971, p. 78).

Spirogmoceras shastense (Smith)
Discotropites sandlingensis (Hauer)

GSC loc. 45651. Ladinian, Meginae Subzone 1. Sulphur Mountain Formation, Llama Member, 2.5 km northeast of south end of Hook Lake, NTS Kinuseo Falls 93 I/14; Triad Oil Company.

Eosagenites gethingi (McLearn)
Meginoceras triviale n. sp.

GSC loc. 45655. Upper Anisian, Chischa Zone. Sulphur Mountain Formation, Llama Member, talus, 2.5 km northeast of south end of Hook Lake, NTS Kinuseo Falls 93 I/14; Triad Oil Company.

Frechites hamatus n. sp.

GSC loc. 45697. Lower Norian, Magnus Subzone 1. Pardonet Formation, 2.8 km southeast of summit of Mount Laurier, NTS Mount Laurier 94 B/14; Triad Oil Company.

Indojuvavites laurieri n. sp.

GSC loc. 45745. Lower Carnian, Desatoyense Zone. Liard Formation, 4 km northeast of Clearwater Lake, NTS Callazon Creek 93 O/10; Triad Oil Company (Tozer, 1967, p. 64).

Coroceras nasutum (Mojsisovics)
Trachyceras desatoyense Johnston

GSC loc. 45751. Lower Carnian, Desatoyense Zone. Liard Formation, section as for GSC locality 45745, northeast of Clearwater Lake, 90 m below GSC locality 45745; Triad Oil Company.

Clionitites reesidei (Johnston)

GSC loc. 46459. Middle Norian, Rutherfordi Zone. Pardonet Formation, Crying Girl Prairie Creek, 1.6 km northeast of Graham River, NTS Hackney Hills 94 B/7; B.R. Pelletier, 1961 (Pelletier, 1964, p. 88).

Drepanites rutherfordi McLearn

GSC loc. 46467. Middle Norian, Rutherfordi Zone. Pardonet Formation, from one talus block, Crying Girl Prairie Creek, 1.6 km northeast of Graham River, NTS Hackney Hills 94 B/7; B.R. Pelletier, 1961 (Pelletier, 1964, p. 88).

Cyrtopleurites hersiliae Diener
Hauerites astrictus n. sp.

GSC loc. 46468. Middle Norian, Columbianus Subzone 2. Pardonet Formation, Crying Girl Prairie Creek, 1.6 km northeast of Graham River, NTS Hackney Hills 94 B/7; B.R. Pelletier, 1961 (Pelletier, 1964, p. 88).

Mesohimavatites parvus n. sp.
Hypisculites minor n. sp.

GSC loc. 46470. Dienerian, Sverdrupi Subzone 2. Toad Formation, unit 2, Section 6 (Pelletier, 1963, p. 24), south side of Needham Creek 5 km southwest of junction with Graham River, NTS Nabesche River 94 B/6; B.R. Pelletier, 1961 (Tozer, 1963a, p. 15).

Vavilovites sverdrupi (Tozer)

GSC loc. 46471. Smithian, Romunderi Zone. Toad Formation, Needham Creek, section as for GSC locality 46470, 28 m above GSC locality 46470; B.R. Pelletier, 1961 (Tozer, 1963a, p. 27).

Thermalites needhami (Tozer)
Arctoceras blomstrandi (Lindstroem)

GSC loc. 46484. Ladinian, Matutinum Zone. Sulphur Mountain Formation, Llama Member, unit 3, section 11 (Pelletier, 1963, p. 41), east flank of high hill (elevation 6483 ft.) 13 km north of Lower Blue Lake, NTS Wapiti Lake 93 I/10; B.R. Pelletier, 1961 (Tozer, 1967. p. 68).

Longobardites murrayensis n. sp.
Pleurofrechites fellersi n. sp.
Ptychites hamatus n. sp.
Eoprotrachyceras matutinum Tozer

GSC loc. 46499. Middle Anisian, Hayesi Zone. Toad Formation, 10 m above base of unit 2, section 3 (Pelletier, 1963, p. 16), west flank of hill 1.5 km north of Alaska Highway 4 km northwest of junction of Tetsa and North Tetsa rivers, NTS Tetsa River 94 K/9; B.R. Pelletier, 1961.

Amphipopanoceras medium (McLearn)

GSC loc. 46512. Middle Anisian, Hayesi Zone. Toad Formation, section as for GSC locality 46499 north of Alaska Highway, 1.7 m above base of unit 2, 8.4 m below GSC locality 46499; B.R. Pelletier, 1961.

Intornites intornatus (McLearn)
Anagymnotoceras columbianum (McLearn)
Gymnites compressus n. sp.

GSC loc. 46960. Ladinian, Sutherlandi Subzone 2. Toad Formation, east face Mount Ludington, NTS Nabesche River 94 B/6; E.J.W. Irish, 1961.

Asklepioceras laurenci McLearn

GSC loc. 46998. Middle Norian, Columbianus Subzone 3. Pardonet Formation, spur on west side of Mount Ludington, NTS Nabesche River 94 B/6; E.J.W. Irish, 1961 (Tozer, 1967, p. 55).

Alloclionites dieneri n. sp.
Steinmannites sp. indet.
Leislingites quadratus n. sp.
Parajuvavites canadensis n. sp.
Episculites wrighti n. sp.

GSC loc. 47004. Middle Norian, Columbianus Subzone 4. Pardonet Formation, east-trending ridge north of Blue Grave Creek, east of saddle east of central ridge, 2.4 km east of headwaters of Horseshoe Creek, NTS Chowade River 94 B/10; E.J.W. Irish, 1961.

Alloclionites welteri n. sp.
Mesohimavatites caponicus n. sp.

GSC loc. 47005. Lower Norian, Dawsoni Subzone 1. Pardonet Formation, about 5 km north of Emerslund Lakes, NTS Nabesche River 94 B/6; E.J.W. Irish, 1961.

Norosirenites krystyni n. sp.
Malayites bococki (McLearn)

GSC loc. 47134. Upper Norian, Cordilleranus Zone. Map Unit 16, GSC Map 1282A, near triangulation station, 64°14′N, 134°20′W, NTS Mount Westman 106 D/1; L.H. Green, 1961 (Tozer, 1967, p. 84; Green, 1972, p. 81).

Nannosteinmannites yukonensis n. sp.

GSC loc. 47486. Ladinian, Maclearni Subzone 2. Liard Formation, unit 17, section 1 (Pelletier, 1961, p. 7), hill on north side of Alaska Highway opposite lower bridge across North Tetsa River, NTS Tetsa River 94 K/9; B.R. Pelletier, 1960.

Nathorstites maclearni n. sp.
Liardites whiteavesi Tozer

GSC loc. 47524. Lower Griesbachian, Boreale Zone. Blind Fiord Formation, talus near south coast of Bjarnason Island, NTS Bukken Fiord 560 A; E.T. Tozer, 1961.

Otoceras boreale Spath

GSC loc. 47525. Upper Griesbachian. Blind Fiord Formation, talus near south coast of Bjarnason Island, NTS Bukken Fiord 560 A; E.T. Tozer, 1961.

Ophiceras greenlandicum Spath

Ophiceras commune Spath
Ophiceras subsakuntala Spath
Wordieoceras wordiei (Spath)
Discophiceras wordiei (Spath)
Bukkenites strigatus (Tozer)
Bukkenites nanus n. sp.

GSC loc. 47526. Smithian, Romunderi Zone. Blind Fiord Formation, about 215 m above highest Permian exposure, section 157, GSC Map 1310A, near south coast of Bjarnason Island, NTS Bukken Fiord 560 A; E.T. Tozer, 1961 (Tozer, 1967, p. 50).
Euflemingites cirratus (White)
Anaxenaspis dieneri n. sp.
Arctoceras blomstrandi (Lindstroem)

GSC loc. 47527. Upper Griesbachian, Commune Zone. Blind Fiord Formation, section as for GSC locality 47526 (157), Bjarnason Island, 78 m above highest Permian exposure; E.T. Tozer, 1961 (Tozer, 1967, p. 52).
Wordieoceras wordiei (Spath)

GSC loc. 47530. Upper Griesbachian, Strigatus Zone. Blind Fiord Formation, section as for GSC locality 47526 (157), Bjarnason Island, 97 m above highest Permian exposure; E.T. Tozer, 1961; (Tozer, 1967, p. 52).
Bukkenites strigatus (Tozer)

GSC loc. 47531. Smithian, Tardus Zone. Blind Fiord Formation, *Wasatchites* bed, about 670 m above base of formation, about 100 m above *Meekoceras* bed, cliff facing Nansen Sound 6 km northwest of Confederation Point, section as for GSC locality 28680, NTS Greely Fiord West 340 B; R. Thorsteinsson, 1961 (Tozer, 1967, p. 48).
Kashmirites warreni (McLearn)
Anawasatchites tardus McLearn

GSC loc. 47534. Smithian, Tardus Zone(?) Blind Fiord Formation, about 450 m above base, section on west side of Lindstroem Creek, north side of Otto Fiord, Ellesmere Island, NTS Cape Stallworthy 560 D; R. Thorsteinsson and E.T. Tozer, 1961 (Tozer, 1967, p. 50).
Arctoceras gigas n. sp.

GSC loc. 47535. Lower Carnian. Blaa Mountain Formation, Lower Shale Member, northeast side Griesbach Creek. Axel Heiberg Island, NTS Bukken Fiord, 560 A; E.T. Tozer, 1961 (Tozer, 1967, p. 45).
Discophyllites taimyrensis Popov

GSC loc. 47538. Lower Griesbachian, Boreale Zone. Blind Fiord Formation, 44 m above base, section 1.5 km from mouth of Griesbach Creek, on southwest side of creek, section 160 (GSC Map 1310A), Axel Heiberg Island, NTS Bukken Fiord 560 A; E.T. Tozer, 1961 (Tozer, 1967, p. 53).
Otoceras boreale Spath

GSC loc. 47539. Lower Griesbachian, Concavum Zone. Blind Fiord Formation, talus from lowest beds, section as for GSC locality 47538 (160, Griesbach Creek); E.T. Tozer, 1961.
Otoceras concavum Tozer

GSC loc. 47543. Dienerian, Sverdrupi Subzone 2. Blind Fiord Formation, about 250 m above base, section as for GSC locality 47534 (Lindstroem Creek); R. Thorsteinsson and E.T. Tozer, 1961 (Tozer, 1963a, p. 14; 1965b, p. 2).
Vavilovites sverdrupi (Tozer)

GSC loc. 47544. Spathian, Subrobustus Zone. Blind Fiord Formation, section on north side of Spath Creek (SCN), 3.2 km northeast of Cape St. Andrew, Svartefjeld Peninsula, Ellesmere Island, locality 171, GSC Map 1310A, NTS Bukken Fiord 560 A; R. Thorsteinsson and E.T. Tozer, 1961 (Tozer, 1965a, p. 4; 1967, p. 47).
Popovites borealis Tozer
Zenoites arcticus Tozer
Olenikites canadensis Tozer
Olenikites bombus n. sp.
Olenikites triton n. sp.
Svalbardiceras freboldi Tozer

GSC loc. 47545. Spathian, Subrobustus Zone. Blind Fiord Formation, section as for GSC locality 47544, north side of Spath Creek (SCN), about 8 m below GSC locality 47544; R.Thorsteinsson and E.T. Tozer, 1961.
Olenikites bombus n. sp.
Keyserlingites subrobustus (Mojsisovics)

GSC loc. 47547. Smithian, Tardus Zone. Blind Fiord Formation, *Wasatchites* bed, 614 m above base of formation, 67 m above *Meekoceras* bed (GSC loc. 28680), Smith Creek, Ellesmere Island, section 180, GSC Map 1311A, NTS Greely Fiord West 340 B; E.T. Tozer, 1961.
Arctoprionites nodosus (Frebold)

GSC loc. 47548. Lower Griesbachian, Boreale Zone. Blind Fiord Formation, from a single talus block 3 km west of the head of Blind Fiord, Raanes Peninsula, Ellesmere Island, NTS Eureka Sound South 49 F; E.T. Tozer, 1961 (Tozer, 1967, p. 53).
Vishnuites kummeli n. sp.
Otoceras boreale Spath

GSC loc. 47550. Lower Anisian, Caurus Zone. Blaa Mountain Formation, Lower Shale Member, section as for GSC localities 47544 and 47545 (SCN), north side of Spath Creek, 52 m above GSC locality 47545 (Subrobustus Zone); R. Thorsteinsson and E.T. Tozer, 1961 (Tozer, 1967, p. 48).

Lenotropites ellesmerensis n. sp.

GSC loc. 47551. Dienerian, Candidus Zone. Blind Fiord Formation, about 122 m above base, ravine on southwest side of Arthaber Creek, 5.5 km above mouth of creek, section on east side of ravine, Axel Heiberg Island, NTS Bukken Fiord 560 A; E.T. Tozer, 1961 (Tozer, 1967, p. 52).

Meekophiceras franklini n. sp.

Proptychites candidus Tozer

GSC loc. 47553. Upper Griesbachian, Strigatus Zone. Blind Fiord Formation, about 60 m above base, section as for GSC locality 47551, southwest side of Arthaber Creek; E.T. Tozer, 1961.

Bukkenites strigatus (Tozer)

GSC loc. 47554. Dienerian, Sverdrupi Zone. Blind Fiord Formation, about 150 m above base, section as for GSC locality 47551 but on west side of ravine; E.T. Tozer, 1961.

Heibergites heibergensis (Tozer)

GSC loc. 47558. Smithian, Romunderi Zone. Blind Fiord Formation, talus from upper part, northeast side of Griesbach Creek, Axel Heiberg Island, NTS Bukken Fiord 560 A; R. Thorsteinsson, 1961.

Anaxenaspis welteri n. sp.

GSC loc. 47559. Smithian. Blind Fiord Formation, about 230 m above base, section 1.5 km from mouth of Griesbach Creek, on northeast side of creek, section 160 (GSC Map 1310A), Axel Heiberg Island, NTS Bukken Fiord; E.T. Tozer, 1961.

Arctoceras gigas n. sp.

GSC loc. 47565. Lower Carnian. Blaa Mountain Formation, Lower Shale Member, section as for GSC locality 47559 (160), northeast side of Griesbach Creek, Axel Heiberg Island; E.T. Tozer, 1961 (Tozer, 1967, p. 45).

Discophyllites taimyrensis Popov

GSC loc. 47567. Lower Carnian, Nanseni Zone. Blaa Mountain Formation, section above cliffs north of Spath Creek, 3.5 km northeast of Cape St. Andrew, Svartefjeld Peninsula, Ellesmere Island, NTS Bukken Fiord 560 A; E.T. Tozer, 1961.

Sirenites nanseni Tozer

GSC loc. 47570. Upper Griesbachian, Strigatus Zone. Blind Fiord Formation, 78.6 m above highest Permian exposure, section as for GSC locality 47526 (157), Bjarnason Island; E.T. Tozer, 1961 (Tozer, 1967, p. 52).

Bukkenites strigatus (Tozer)

GSC loc. 47571. Upper Griesbachian, Commune Zone. Blind Fiord Formation, 78.3 m above highest Permian exposure, section as for GSC locality 47526 (157), Bjarnason Island; E.T. Tozer, 1961.

Tompophiceras extremum (Spath)

GSC loc. 47575. Dienerian, Candidus Zone. Blind Fiord Formation, about 120 m above base, section as for GSC locality 47554, ravine on southwest side of Arthaber Creek; E.T. Tozer, 1961.

Proptychites candidus Tozer

GSC loc. 47578. Lower Griesbachian, Boreale Zone. Blind Fiord Formation, 70 m above highest Permian exposure, section as for GSC locality 47526 (157); E.T. Tozer, 1961.

Hypophiceras gracile (Spath)

Otoceras boreale Spath

GSC loc. 47580. Lower Anisian, Caurus Zone. Blaa Mountain Formation, Lower Shale Member, section as for GSC localities 47544, 47545 and 47550, Spath Creek (SCN) about 3 m above GSC locality 47550 (Caurus Zone); R. Thorsteinsson and E.T. Tozer, 1961 (Tozer, 1967, p. 48).

Lenotropites undulatus (Spath)

GSC loc. 47584. Dienerian, Sverdrupi Subzone 3. Blind Fiord Formation, talus, southwest side of Griesbach Creek about 1.5 km above mouth, Axel Heiberg Island, NTS Bukken Fiord 560 A; R. Thorsteinsson, 1961.

Kingites discoidalis n. sp.

GSC loc. 47590. Lower Griesbachian, Boreale Zone. Blind Fiord Formation, north of Lightfoot River, Axel Heiberg Island, locality 167, GSC Map 1310A, NTS Bukken Fiord 560 A; E.T. Tozer, 1961.

Otoceras boreale Spath

GSC loc. 47607. Upper Griesbachian, Strigatus Zone. Blind Fiord Formation, 90.2 m above highest Permian exposure, section as for GSC locality 47526 (157), Bjarnason Island; E.T. Tozer, 1961.

Bukkenites strigatus (Tozer)

GSC loc. 47610. Upper Griesbachian, Strigatus Zone. Blind Fiord Formation, 89 m above highest Permian

exposure, section as for GSC locality 47526 (157), Bjarnason Island; E.T. Tozer, 1961.

Wordieoceras wordiei (Spath)

GSC loc. 47611. Upper Griesbachian, Strigatus Zone. Blind Fiord Formation, about 88 m above highest Permian exposure, 20 cm below GSC locality 47610, section as for GSC locality 47526 (157), Bjarnason Island; E.T. Tozer, 1961.

Bukkenites strigatus (Tozer)

GSC loc. 47619. Upper Carnian, Welleri Subzone 1. Blaa Mountain Formation, Middle Shale Member, upper Griesbach Creek, Axel Heiberg Island, NTS Bukken Fiord 560 A; E.T. Tozer, 1961.

Arctosirenites canadensis Tozer

GSC loc. 47620. Lower Griesbachian, Concavum Zone. Blind Fiord Formation, 12 m above base, northeast side of Griesbach Creek, 3.2 km above junction with Camp Five Creek, Axel Heiberg Island, NTS Bukken Fiord 560 A; E.T. Tozer, 1961 (Tozer, 1967, p. 54).

Otoceras concavum Tozer

GSC loc. 47621. Dienerian, Sverdrupi Subzone 2. Blind Fiord Formation, about 245 m above base, section as for GSC locality 47534, Lindstroem Creek; R. Thorsteinsson and E.T. Tozer, 1961 (Tozer, 1963a, p. 15; 1965b, p. 3; 1967, p. 49).

Vavilovites sverdrupi (Tozer)

GSC loc. 47622. Lower Griesbachian, Boreale Zone Blind Fiord Formation. about 60 m above base, section as for GSC locality 47534, Lindstroem Creek; R. Thorsteinsson and E.T. Tozer, 1961 (Tozer, 1965b, p. 3).

Otoceras boreale Spath

GSC loc. 47623. Smithian. Blind Fiord Formation, about 440 m above base, section as for GSC locality 47534, Lindstroem Creek; R. Thorsteinsson and E.T. Tozer, 1961 (Tozer, 1965b, p. 3; 1967, p. 50).

Arctoceras blomstrandi (Lindstroem)

GSC loc. 47643. Smithian. Blind Fiord Formation, 32 km southeast of Cape Stallworthy, Axel Heiberg Island, locality 155, GSC Map 1305A, NTS Cape Stallworthy 560 D; R. Thorsteinsson, 1961.

Arctoceras gigas n. sp.

GSC loc. 47801. Smithian, Romunderi Zone. Blind Fiord Formation, about 365 m above base, section as for GSC locality 47534, Lindstroem Creek; R. Thorsteinsson and E.T. Tozer, 1961 (Tozer, 1965b, p. 3; 1967, p. 50).

Melagathiceras crassum (Tozer)

Euflemingites romunderi Tozer

GSC loc. 48847. Dienerian, Candidus Zone. Toad Formation, 12.5 m above Permian, tributary on west side of upper Chowade River, 56°44′15″N, 123°29′00″W, NTS Christina Falls 94 B/11; Shell Oil Company, 1960 (Tozer, 1963a, p. 23).

Proptychites candidus Tozer

GSC loc. 48848. Dienerian, Candidus Zone. Toad Formation, 20 m above base, section as for GSC locality 48847, Chowade River; Shell Oil Company, 1960 (Tozer, 1963a, p. 23).

Proptychites candidus Tozer

GSC loc. 48850. Smithian, Romunderi Zone. Toad Formation, 55 m above Permian, south side of Needham Creek 5 km southwest of junction with Graham River, NTS Nabesche River 94 B/6; Shell Oil Company, 1960 (Tozer, 1963a, p. 3).

Thermalites needhami (Tozer)

GSC loc. 48861. Smithian, Romunderi Zone. Blind Fiord Formation. *Meekoceras* bed, as for GSC locality 28680, Svartefjeld Peninsula, Ellesmere Island; R. Thorsteinsson, 1961.

Meekoceras gracilitatis White

GSC loc. 49998. Ladinian, Sutherlandi Subzone 2. Toad Formation, unit 12, section 12 (Pelletier, 1964, p. 69), west side of mountain (triangulation station 7591), between Halfway River and Fiddes Creek, NTS Mount Laurier 94 B/14; B.R. Pelletier, 1962.

Nathorstites macconnelli (Whiteaves)

Frankites sutherlandi (McLearn)

GSC loc. 50006. Ladinian, Meginae Subzone 1. Toad Formation, unit 7, section 10 (Pelletier, 1964, p. 60), hill 6.5 km northeast of Mount Stearns, NTS Marion Lake 94 G/3; B.R. Pelletier, 1962.

Meginoceras triviale n. sp.

GSC loc. 50028. Lower Norian, Magnus Subzone 1. Pardonet Formation, 18 m above base of unit 27, section as for GSC locality 50005, section 10 (Pelletier, 1964, p. 60); B.R. Pelletier, 1962.

Indojuvavites brunneus n. sp.

GSC loc. 50042. Ladinian, Maclearni Subzone 1. Toad Formation, 73 m above base of unit 7, section 9 (Pelletier, 1964, p. 53), south side of Mount Withrow, NTS Marion Lake 94 G/3; B.R. Pelletier, 1962.

Nathorstites maclearni n. sp.

Anolcites impolitus n. sp.

GSC loc. 50043. Ladinian, Meginae Subzone 3. Toad Formation, 52 m above base of unit 7, section as for GSC locality 50042, Mount Withrow; B.R. Pelletier, 1962.

Indigirites boehmi n. sp.
Meginoceras aylardi (McLearn)

GSC loc. 50045. Ladinian, Meginae Subzone 2. Toad Formation, 44 m above base of unit 7, section as GSC locality 50042, Mount Withrow; B.R. Pelletier, 1962.

Indigirites boehmi n. sp.
Drumoceras tuberculatum n. sp.

GSC loc. 51207. Upper Norian, Cordilleranus Subzone 1. Pardonet Formation, unit 12, section 15 (Pelletier, 1964, p. 83), west side of Mount Ludington, NTS Nabesche River 94 B/6; B.R. Pelletier, 1962 (Tozer, 1967, p. 55; 1979).

Nassichukites dimidiatus Tozer

GSC loc. 51265. Upper Carnian, Welleri Subzone 1. Ludington Formation, west spur of mountain, near summit, 8 km northeast of Mount Laurier, 56°50′15″N, 123°25′30″W, NTS Mount Laurier 94 B/14; E.J.W. Irish, 1962 (Irish, 1970, p. 59).

Discotropites smithi Kutassy
Homeroceras grandis n. sp.
Bacchites hyatti (Smith)

GSC loc. 51588. Lower Griesbachian, Boreale Zone. Blind Fiord Formation, 81 m above highest Permian exposure, col 2.5 km west of head of Blind Fiord, Raanes Peninsula, Ellesmere Island, NTS Eureka Sound South 49 F; E.T. Tozer, 1962 (Tozer, 1967, p. 53).

Hypophiceras gracile (Spath)
Otoceras boreale Spath

GSC loc. 51591. Upper Griesbachian, Commune Zone. Blind Fiord 110 m above highest Permian exposure, section as for GSC locality 51588, west of Blind Fiord; E.T. Tozer, 1962.

Tompophiceras extremum (Spath)

GSC loc. 51592. Upper Griesbachian, Commune Zone. Blind Fiord Formation, 137 m above highest Permian exposure, section as for GSC locality 51588, west of Blind Fiord; E.T. Tozer, 1962.

Ophiceras commune Spath

GSC loc. 51593. Upper Griesbachian, Strigatus Zone. Blind Fiord Formation, about 240 m above highest Permian exposure, section as for GSC locality 51588, west of Blind Fiord; E.T. Tozer, 1962.

Bukkenites incisus n. sp.

GSC loc. 51599. Spathian, Subrobustus Zone. Blind Fiord Formation, 218 m below contact with Blaa Mountain Formation, bluff 5 km west of mouth of Willow River, Raanes Peninsula, Ellesmere Island, locality 152, GSC Map 1300A, NTS Eureka Sound South 49 F; E.T. Tozer, 1962 (Tozer, 1965a, p. 5).

Keyserlingites subrobustus (Mojsisovics)

GSC loc. 51603. Spathian, Subrobustus Zone. Blind Fiord formation, talus from GSC locality 51599; E.T. Tozer, 1962.

Keyserlingites subrobustus (Mojsisovics)

GSC loc. 51605. Griesbachian. Blind Fiord Formation, talus, 13 km northwest of head of Blind Fiord, Raanes Peninsula, Ellesmere Island, NTS Eureka Sound South 49 F; E.T. Tozer, 1962.

Tompophiceras extremum (Spath)
Otoceras boreale Spath

GSC loc. 51616. Ladinian, Poseidon Zone? Schei Point Formation, *Daonella frami* bed, as for GSC locality 26110, Bjorne Peninsula, Ellesmere Island; R. Thorsteinsson and E.T. Tozer, 1962.

Longobardites sp. indet.
Istreites nanuk (Tozer)

GSC loc. 51643. Middle Norian, Columbianus Subzone 3. Heiberg Formation, as for GSC locality 26450, east of Wolf Fiord, Axel Heiberg Island; E.T. Tozer, 1962 (Tozer, 1967, p. 44).

Neohimavatites peregrinus n. sp.

GSC loc. 51650. Upper Carnian, Welleri Subzone 2. Blaa Mountain Formation, *Jovites* bed, as for GSC locality 26168, Buchanan Lake, Axel Heiberg Island; R. Thorsteinsson and E.T. Tozer, 1962.

Jovites borealis Tozer

GSC loc. 51664. Upper Griesbachian, Strigatus Zone. Blind Fiord Formation, about 105 m above base, section on bluffs south of Otto Fiord 15 km east of Cape St. Andrew, Svartefjeld Peninsula, Ellesmere Island, between GSC localities 175 and 176 (GSC Map 1310A), NTS Bukken Fiord 560 A; E.T. Tozer, 1962.

Bukkenites strigatus Tozer

GSC loc. 51665. Dienerian, Candidus Zone. Blind Fiord Formation, about 165 m above base, section as for GSC locality 51664, south of Otto Fiord; E.T. Tozer, 1962.

Ambites ferruginus n. sp.

GSC loc. 51666. Dienerian, Sverdupi Subzone 2. Blind Fiord Formation, about 260 m above base, section as for GSC locality 51664, south of Otto Fiord; E.T. Tozer, 1962.

Vavilovites sverdrupi (Tozer)

GSC loc. 51670. Dienerian, Sverdrupi Subzone 2. Blind Fiord Formation, 25 km east of Cape St. Andrew, Svartefjeld Peninsula, Ellesmere Island, about 800 m south of locality 178, GSC Map 1310A, NTS Bukken Fiord 560 A; E.T. Tozer, 1962.

Vavilovites sverdrupi (Tozer)

GSC loc. 51672. Smithian. Blind Fiord Formation, fossils on surface of one bed near contact with Blaa Mountain Formation. Cliffs facing Nansen Sound 8 km southeast of Cape St. Andrew, Svartefjeld Peninsula, Ellesmere Island, locality 173, (GSC Map 1310A), NTS Bukken Fiord 560 A; E.T. Tozer, 1962 (Tozer, 1967, p. 49).

Arctoceras blomstrandi (Lindstroem)
Paranannites spathi (Frebold)
Prionites hollandi McLearn

GSC loc. 51676. Middle Anisian, Hagei Zone. Blaa Mountain Formation, Lower Shale Member, 1025 m above Permian, section as for GSC locality 47547 (180), Smith Creek, Ellesmere Island; E.T. Tozer, 1962 (Tozer, 1967, p. 49).

Anagymnotoceras tozeri McLearn
Ussurites yabei Diener

GSC loc. 51677. Middle Anisian, Hagei Zone. Blaa Mountain Formation, Lower Shale Member, section as GSC localities 47547 and 51676 (180), Smith Creek, 4 m above GSC locality 51676; E.T. Tozer, 1962.

Anagymnotoceras tozeri McLearn

GSC loc. 51689. Upper Griesbachian, Strigatus Zone. Blind Fiord Formation, 100 m above base, section south of Diener Creek, 11 km east of Cape St. Andrew, Svartefjeld Peninsula, Ellesmere Island, section 179 (GSC Map 1310A), NTS Bukken Fiord 560 A; E.T. Tozer, 1962 (Tozer, 1967, p. 51).

Wordieoceras wordiei (Spath)
Bukkenites nitidus n. sp.

GSC locs. 51691, 51692. Dienerian, Candidus Zone. Blind Fiord Formation, 137 m above base, section as for GSC locality 51689 (179), south of Diener Creek; E.T. Tozer, 1962.

Proptychites candidus Tozer

GSC loc. 51693. Dienerian, Candidus Zone. Blind Fiord Formation, 139 m above base, section as for GSC locality 51689 (179), south of Diener Creek; E.T. Tozer, 1962.

Proptychites candidus Tozer
Ambites ferruginus n. sp.

GSC loc. 51694. Dienerian, Candidus Zone. Blind Fiord Formation, 143 m above base, section as for GSC locality 51689 (179), south of Diener Creek; E.T. Tozer, 1962.

Proptychites candidus Tozer
Ambites ferruginus n. sp.

GSC loc. 51695. Dienerian, Sverdrupi Subzone 2. Blind Fiord Formation, 290 m above base, section as for GSC locality 51689 (179), south of Diener Creek; E.T. Tozer, 1962.

Vavilovites obtusus n. sp.

GSC loc. 52233. Middle Norian, Columbianus Subzone 4. Pardonet Formation, east limb of syncline south of Nevis Creek, 57°01'N, 123°21'W, NTS Mount Withrow 94 G/6; D.F. Stott, 1962 (Tozer, 1967, p. 60; Stott, 1973, p. 142).

Brouwerites stotti n. sp.

GSC loc. 52932. Lower Anisian, Caurus Zone. Sulphur Mountain Formation, lowest part of Whistler Member, northwest side of Vega Peak, NTS Blue Creek 83 E/7; D.W. Gibson, 1962.

Lenotropites caurus (McLearn)

GSC loc. 53340. Upper Carnian, Welleri Subzone 1. Quatsino Limestone, southeast side of cove 1.6 km northwest of Mocino Point, Vancouver Island, NTS Neroutsos 92 L/5; Shell Oil Company, 1962.

Trachysagenites sp. indet.
Discotropites smithi Kutassy

GSC loc. 55007. Upper Anisian, Deleeni Zone. Sulphur Mountain Formation, Llama Member, locality as for GSC locality 25118, ridge south of Walton Creek; Sinclair Oil Company, 1962 (Tozer, 1967, p. 72).

Eogymnotoceras deleeni (McLearn)
Ptychites trochleaeformis (Lindstroem)

GSC loc. 55448. Smithian, Hedenstroemi Zone. Bjorne Formation, talus from upper 200 m, about 6 km south of Ammonite Mountain, Bjorne Peninsula, Ellesmere Island, NTS Baumann Fiord 49 C; Round Valley Oil Company, 1961.

Hedenstroemia hedenstroemi (Keyserling)

GSC loc. 55470. Upper Griesbachian, Commune Zone. Blind Fiord Formation, 13 km northwest of head of

Blind Fiord, Raanes Peninsula, Ellesmere Island, NTS Eureka Sound south 49 F; Round Valley Oil Company, 1961.

Tompophiceras extremum (Spath)

GSC loc. 55479. Upper Carnian. Blaa Mountain Formation, Upper Calcareous Member, west side of Blaa Mountain, Ellesmere Island, NTS Greely Fiord West 340 B; Round Valley Oil Company, 1961.

Sirenites serotinus n. sp.

GSC loc. 55512. Smithian, Romunderi Zone. Blind Fiord Formation, *Meekoceras* bed, 547 m above base of formation, section as for GSC locality 47547, Smith Creek, Ellesmere Island; Round Valley Oil Company, 1961 (Tozer, 1967, p. 53).

Meekoceras gracilitatis White
Euflemingites romunderi Tozer
Arctoceras blomstrandi Lindstroem

GSC loc. 56166. Smithian, Romunderi Zone. Toad Formation, 58 m above top of Fantasque Formation, south side of Needham Creek 5 km southwest of junction with Graham River, NTS Nabesche River 94 B/6; E.T. Tozer, 1963 (Tozer, 1967, p. 74).

Juvenites laevis n. sp.
Thermalites needhami (Tozer)
Meekoceras haydeni (Smith)
Euflemingites cirratus (White)

GSC loc. 56169. Smithian, Romunderi Zone. Toad Formation, talus concretion at GSC locality 56166, Needham Creek; E.T. Tozer, 1963.

Arctoceras blomstrandi (Lindstroem)

GSC loc. 56170. Smithian, Romunderi Zone. Toad Formation, talus concretion at GSC locality 56166, Needham Creek; E.T. Tozer, 1963.

Prionolobus lucinus n. sp.

GSC loc. 56171. Smithian, Romunderi Zone. Toad Formation, talus concretion at GSC locality 56166, Needham Creek; E.T. Tozer, 1963.

Thermalites needhami (Tozer)
Paranannites aspenensis Hyatt and Smith

GSC loc. 56172. Smithian, Romunderi Zone. Toad Formation, talus concretion at GSC locality 56166, Needham Creek; E.T. Tozer, 1963.

Melagathiceras depressum (Smith)
Euflemingites cirratus (White)
Oxyussuria canadensis n. sp.

GSC loc. 56173. Smithian, Romunderi Zone. Toad Formation, talus concretion at GSC locality 56166, Needham Creek; E.T. Tozer, 1963.

Kashmirites columbianus n. sp.
Thermalites needhami (Tozer)
Euflemingites cirratus (White)

GSC loc. 56174. Smithian, Romunderi Zone. Toad Formation, talus concretion at GSC locality 56166, Needham Creek; E.T. Tozer, 1963.

Kashmirites columbianus n. sp.
Paranannites aspenensis Hyatt and Smith

GSC loc. 56178. Spathian, Subrobustus Zone. Toad Formation, about 130 m above top of Fantasque Formation, north side of Needham Creek, continuation of section at GSC locality 56166; E.T. Tozer, 1963 (Tozer, 1965a, p. 8; 1967, p. 74).

Popovites occidentalis Tozer
Procarnites modestus Tozer

GSC loc. 56180. Dienerian, Candidus Zone. Toad Formation, 13.7 m above top of Fantasque Formation, section on tributary of west side of upper Chowade River (UCR), 56°44′15″N, 123°29′00″W, NTS Christina Falls 94 B/11; E.T. Tozer, 1963 (Tozer, 1967, p. 73).

Proptychites candidus Tozer
Ambites fuliginatus n. sp.

GSC loc. 56181. Dienerian, Candidus Zone. Toad Formation, talus concretion at GSC locality 56180 (UCR); E.T. Tozer, 1963.

Proptychites candidus Tozer
Ambites fuliginatus n. sp.

GSC locs. 56182, 56183. Dienerian, Candidus Zone. Toad Formation, talus concretions at GSC locality 56180 (UCR); E.T. Tozer, 1963.

Prionolobus welteri n. sp.

GSC loc. 56194. Spathian, Subrobustus Zone. Toad Formation, talus concretion from bed about 100 m above top of Fantasque Formation, section as for GSC locality 56180 (UCR), west of upper Chowade River; E.T. Tozer, 1963 (Tozer, 1965a, p. 7; 1967, p. 73).

Monacanthites monoceros Tozer

GSC loc. 56195. Spathian, Subrobustus Zone. Toad Formation, talus concretion as for GSC locality 56194 (UCR); E.T.Tozer, 1963.

Popovites occidentalis Tozer
Procarnites modestus Tozer

GSC loc. 56196. Spathian, Subrobustus Zone. Toad Formation, talus concretion as for GSC locality 56194 (UCR); E.T. Tozer, 1963.

Metadagnoceras pulchrum Tozer

GSC loc. 56198. Spathian, Subrobustus Zone. Toad Formation, talus concretion as for GSC locality 56194 (UCR); E.T. Tozer, 1963.

Popovites occidentalis Tozer
Procarnites modestus Tozer

GSC loc. 56202. Dienerian, Candidus Zone. Toad Formation, 15.8 m above Fantasque Formation, section on south branch of North Gully (SNG) (Tozer, 1965a, p. 5), west face of ridge 11 km north of Mount Laurier, 56°52′20″N, 123°31′30″W, NTS Mount Robb 94 B/13; E.T. Tozer, 1963 (Tozer, 1967, p. 73).

Ambites fuliginatus n. sp.

GSC loc. 56203. Dienerian, Candidus Zone. Toad Formation, 24.4 m above Fantasque Formation, section as for GSC locality 56202 (SNG); E.T. Tozer, 1963.

Pleurambites frechi n. sp.

GSC loc. 56204. Dienerian, Candidus Zone. Toad Formation, horizon as for GSC locality 56203 (SNG), 24.4 m above Fantasque Formation, section as for GSC locality 56202; E.T. Tozer, 1963.

Proptychites candidus Tozer
Ambites fuliginatus n. sp.

GSC loc. 56205. Dienerian, Sverdrupi Subzone 2. Toad Formation, 27.4 m above Fantasque Formation, section as for GSC locality 56202 (SNG); E.T. Tozer, 1963.

Vavilovites sverdrupi (Tozer)

GSC loc. 56206. Dienerian, Sverdrupi Zone. Toad Formation, 30 m above Fantasque Formation, section as for GSC locality 56202 (SNG); E.T. Tozer, 1963.

Flemingites reticulatus n. sp.

GSC loc. 56209. Dienerian, Sverdrupi Zone. Toad Formation, 26.8 m above Fantasque Formation, section as for GSC locality 56202 (SNG); E.T. Tozer, 1963.

Tellerites sp. indet.

GSC loc. 56218. Dienerian, Candidus Zone. Toad Formation, 21.5 m above Fantasque Formation, section on main part of North Gully (MNG) (Tozer, 1965a, p. 5), west face of ridge 11 km north of Mount Laurier, 56°52′20″N, 123°31′30″W, NTS Mount Robb 94 B/13; E.T. Tozer, 1963 (Tozer, 1967, p. 73).

Pleurambites frechi n. sp.

GSC loc. 56220. Dienerian, Candidus Zone. Toad Formation, 24.4 m above Fantasque Formation, section as for GSC locality 56218 (MNG); E.T. Tozer, 1963.

Proptychites candidus Tozer

GSC loc. 56222. Dienerian, Sverdrupi Subzone 2. Toad Formation, 30.5 m above Fantasque Formation, section as for GSC locality 56218 (MNG); E.T. Tozer, 1963.

Vavilovites sverdrupi (Tozer)

GSC loc. 56223. Dienerian, Sverdrupi Zone. Toad Formation, 30.8 m above Fantasque Formation, section as for GSC locality 56218 (MNG); E.T. Tozer, 1963.

Xenodiscoides calnani n. sp.
Flemingites reticulatus n. sp.

GSC loc. 56224. Dienerian, Sverdrupi Zone. Toad Formation, 30.8 m above Fantasque Formation, section as for GSC locality 56218 (MNG); E.T. Tozer, 1963.

Flemingites reticulatus n. sp.

GSC loc. 56225. Dienerian, Sverdrupi Subzone 1. Toad Formation, 28.6 m above Fantasque Formation, section as for GSC locality 56218 (MNG); E.T. Tozer, 1963.

Koninckites dimidiatus n. sp.

GSC loc. 56226. Dienerian, Sverdrupi Zone. Toad Formation, 33.5 m above Fantasque Formation, section as for GSC locality 56218 (MNG); E.T. Tozer, 1963.

Prionolobus koninckii n. sp.

GSC loc. 56228. Dienerian, Sverdrupi Zone. Toad Formation, 28.6 m above Fantasque Formation, section as for GSC locality 56218 (MNG); E.T. Tozer, 1963.

Wyomingites scapulatus n. sp.

GSC loc. 56230. Dienerian, Candidus Zone. Toad Formation, 27.4 m above Fantasque Formation, section as for GSC locality 56218 (MNG); E.T. Tozer, 1963.

Pleurambites frechi n. sp.

GSC loc. 56231. Dienerian, Candidus Zone. Toad Formation, 23.2 m above Fantasque Formation, section as for GSC locality 56218 (MNG); E.T. Tozer, 1963.

Ambites fuliginatus n. sp.

GSC loc. 56233. Dienerian, Sverdrupi Subzone 2. Toad Formation, about 30 m above Fantasque Formation, not in place, section as for GSC locality 56218 (MNG); E.T. Tozer, 1963.

Vavilovites sverdrupi (Tozer)
Wyomingites scapulatus n. sp.

GSC loc. 56234. Spathian, Subrobustus Zone. Toad Formation, 131.0 m above Fantasque Formation, section as for GSC locality 56218 (MNG); E.T. Tozer, 1963 (Tozer, 1965a, p. 6).

Popovites occidentalis Tozer
Isculitoides minor Tozer
Cordillerites bicarinatus (Tozer)
Leiophyllites sp. indet.

GSC loc. 56235. Spathian, Subrobustus Zone. Toad Formation, 128.6 m above Fantasque Formation, section as for GSC locality 56218 (MNG); E.T. Tozer, 1963 (Tozer, 1965a, p. 6).

Keyserlingites subrobustus (Mojsisovics)

GSC loc. 56237. Spathian, Subrobustus Zone. Toad Formation, 126.2 m above Fantasque Formation, section as for GSC locality 56218 (MNG); E.T. Tozer, 1963 (Tozer, 1965, p. 6).

Procarnites modestus Tozer

GSC loc. 56240. Spathian, Subrobustus Zone. Toad Formation, about 130 m above Fantasque Formation, section in Middle Gully (MG) (Tozer, 1965a, p. 5), west face of ridge 11 km north of Mount Laurier, 56°52′20″N, 123°31′30″W, NTS Mount Robb 94 B/13; E.T. Tozer, 1963 (Tozer, 1967, p. 73).

Sulioticeras intermedius (Tozer)
Popovites occidentalis Tozer
Monacanthites monoceros Tozer

GSC loc. 56241. Spathian, Subrobustus Zone. Toad Formation, about 125 m above Fantasque Formation, section as for GSC locality 56240 (MG); E.T. Tozer, 1963.

Prosphingites czekanowskii Mojsisovics

GSC loc. 56242. Spathian, Subrobustus Zone. Toad Formation, about 130 m above Fantasque Formation, section in south Gully (SG) (Tozer, 1965a, p. 5), west face of ridge 11 km north of Mount Laurier, 56°52′20″N, 123°31′30″W, NTS Mount Robb 94 B/13; E.T. Tozer, 1963 (Tozer, 1967, p. 73).

Procarnites modestus Tozer

GSC loc. 56243. Spathian, Subrobustus Zone. Toad Formation, about 125 m above Fantasque Formation, section as for GSC locality 56242 (SG); E.T. Tozer, 1963.

Isculitoides minor Tozer

GSC loc. 56245. Ladinian, Sutherlandi Subzone 1. Toad Formation, northeast face of Mountain 8 km northeast of Mount Laurier, below main cliff, 56°50′15″N, 123°25′30″W, NTS Mount Laurier 94 B/14; E.T. Tozer, 1963.

Frankites glaber n. sp.

GSC loc. 56250. Upper Carnian, Welleri Subzone 1. Ludington Formation, west spur of Mountain 8 km northeast of Mount Laurier, near summit, 56°50′15″N, 123°25′30″W, NTS Mount Laurier 94 B/14; E.T. Tozer, 1963.

Discotropites smithi Kutassy
Homeroceras grandis n. sp.
Bacchites hyatti (Smith)

GSC loc. 56254. Spathian, Subrobustus Zone. Toad Formation, talus concretion as for GSC locality 56194 (UCR); E.T. Tozer, 1963.

Procarnites modestus Tozer

GSC loc. 56257. Spathian, Subrobustus Zone. Toad Formation, talus concretion as for GSC locality 56194 (UCR); E.T. Tozer, 1963.

Procarnites modestus Tozer

GSC loc. 56258. Spathian, Subrobustus Zone. Toad Formation, talus concretion as for GSC locality 56194 (UCR); E.T. Tozer, 1963.

Svalbardiceras chowadei Tozer

GSC loc. 56259. Spathian, Subrobustus Zone. Toad Formation, talus concretion as for GSC locality 56194 (UCR); E.T. Tozer, 1963.

Popovites occidentalis Tozer
Isculitoides minor Tozer

GSC loc. 56261. Spathian, Subrobustus Zone. Toad Formation, talus concretion as for GSC locality 56194 (UCR); E.T. Tozer, 1963.

Keyserlingites subrobustus (Mojsisovics)

GSC loc. 56262. Spathian, Subrobustus Zone. Toad Formation, talus concretion as for GSC locality 56194 (UCR); E.T. Tozer, 1963.

Popovites occidentalis Tozer

GSC loc. 56263. Spathian, Subrobustus Zone. Toad Formation, talus concretion as for GSC locality 56194 (UCR); E.T. Tozer, 1963.

Svalbardiceras chowadei Tozer

GSC loc. 56264. Spathian, Subrobustus Zone. Toad Formation, 99 m above Fantasque Formation, section as for GSC locality 56180 (UCR); E.T. Tozer, 1963.

Popovites occidentalis Tozer

GSC loc. 56265. Spathian, Subrobustus Zone. Toad Formation, 100.5 m above Fantasque Formation, section as for GSC locality 56180 (UCR); E.T. Tozer, 1963.

Popovites occidentalis Tozer
Isculitoides minor Tozer
Svalbardiceras chowadei Tozer

GSC loc. 56279. Smithian, Romunderi Zone. Toad Formation, talus concretion at GSC locality 56166, Needham Creek; E.T. Tozer, 1963.

Gyronites recentis n. sp.
Euflemingites cirratus (White)
Anaxenaspis sp. indet.
Oxyussuria canadensis n. sp.

GSC loc. 56280. Spathian, Subrobustus Zone. Toad Formation, talus concretion at GSC locality 56218 (MNG); E.T. Tozer, 1963.

Procarnites modestus Tozer

GSC loc. 56395. Upper Norian, Crickmayi Zone. Tyaughton Group, green sandstone and conglomerate unit, north side of Tyaughton Creek, 1.4 km upstream from mouth of Spruce Lake Creek, NTS Tyaughton Creek 92 O/2; E.T. Tozer, 1963.

Choristoceras crickmayi Tozer

GSC loc. 56405. Upper Norian, Amoenum Zone. Tyaughton Group *Cassianella* beds, on ridge, 1675 m northwest of summit of Castle Peak, NTS Tyaughton Creek 92 O/2; E.T. Tozer, 1963.

Paracochloceras amoenum Mojsisovics

GSC loc. 56410. Upper Norian, Cordilleranus Zone. Tyaughton Group, 1.5 m above *Monotis subcircularis* bed, on ridge about 2.4 km northwest of summit of Castle Peak, NTS Tyaughton Creek 92 O/2; E.T. Tozer, 1963.

Gnomohalorites cordilleranus Tozer

GSC locs. 56414, 56415. Upper Norian, Amoenum Zone. Tyaughton Group, *Cassianella* beds, head of "Last Creek", tributary of Tyaughton Creek, 51°05′20″, 123°00′30″W, NTS Warner Pass 92 O/3; E.T. Tozer, 1963.

Rhabdoceras suessi Hauer

GSC loc. 58385. Middle Anisian. Sulphur Mountain Formation, talus from lower part of Whistler Member, headwaters of Monaghan Creek, NTS Hardscrabble Creek 83 E/11; D. W. Gibson, 1963 (Tozer, 1967, p. 71; Gibson, 1968, p. 69).

Intornites intornatus (McLearn)
Tetsaoceras hayesi (McLearn)
Anagymnotoceras wrighti (McLearn)
Buddhaites hagei (McLearn)

GSC loc. 62392. Upper Norian, Crickmayi Zone. Tyaughton Group, green sandstone and conglomerate unit, east of Spruce Lake, 51°02′N, 122°58′W, NTS Tyaughton Creek 92 O/2; H.W. Tipper, 1964.

Choristoceras crickmayi Tozer

GSC loc. 64594. Upper Norian, Amoenum Zone? Pardonet Formation, 10 m above highest *Monotis* bed, south side of Peace River at Ne-parle-pas Rapids, now flooded by waters of Williston Lake, NTS Mount Brewster (formerly Ne-parle-pas Rapids) 94 B/3; E.T. Tozer, 1964 (Tozer, 1965c, p. 222; 1967, p. 55).

Rhabdoceras suessi Hauer
Rhacophyllites debilis (Hauer)

GSC loc. 64595. Upper Norian, Amoenum Zone? Pardonet Formation, 13 m above highest *Monotis* bed, section as for GSC locality 64594; E.T. Tozer, 1964.

Placites polydactylus (Mojsisovics)

GSC loc. 64597. Lower Norian, Kerri Subzone 1. Pardonet Formation, northeast side of Pardonet Hill, locality 3 (Tozer, 1965c, Fig. 1), NTS Mount Brewster 94 B/3; E.T. Tozer, 1964 (See also 64623).

Discostyrites ireneanus (McLearn)
Thisbites custi McLearn

GSC loc. 64598. Lower Norian, Kerri Subzone 1. Pardonet Formation, northeast side of Pardonet Hill, near locality 3 (Tozer, 1965c, Fig. 1), NTS Mount Brewster 94 B/3; E.T. Tozer, 1964.

Guembelites clavatus (McLearn)

GSC loc. 64602. Lower Norian, Dawsoni Subzone 2. Pardonet Formation, talus, northeast side of Pardonet Hill, locality 8 (Tozer, 1965c, Fig. 1), NTS Mount Brewster 94 B/3; E.T. Tozer, 1964.

Malayites dawsoni McLearn

GSC loc. 64605. Lower Norian, Dawsoni Subzone 2. Pardonet Formation, section high on the west side of Pardonet Hill, locality 10 (Tozer, 1965c, Fig. 1), NTS Mount Brewster 94 B/3; E.T. Tozer, 1964 (Tozer, 1967, p. 58).

Malayites dawsoni McLearn

GSC loc. 64606. Lower Norian, Dawsoni Subzone 1. Pardonet Formation, about 15 m below GSC locality 64605, section high on the west side of Pardonet Hill, between localities 6 and 10 (Tozer, 1965c, Fig. 1), NTS Mount Brewster 94 B/3; E.T. Tozer, 1964 (Tozer, 1967, p. 58).

Wangoceras pax (Tozer)
Malayites bococki (McLearn)

GSC loc. 64607. Lower Norian, Kerri Subzone 2. Pardonet Formation, below GSC locality 64606, section high on the west side of Pardonet Hill, locality 6 (Tozer, 1965c, Fig. 1), NTS Mount Brewster 94 B/3; E.T. Tozer, 1964.

Stikinoceras kerri McLearn

GSC locs. 64616, 64617. Upper Carnian, Macrolobatus Zone. Pardonet Formation, at or near base, below GSC locality 64607, section high on the west side of Pardonet Hill, locality 2 (Tozer, 1965c, Fig. 1; 1967, p. 58); E.T. Tozer, 1964.

Anatropites pardoneti n. sp.
Thisbites selwyni n. sp.

GSC loc. 64623. Lower Norian, Kerri Subzone 1. Pardonet Formation, locality and bed as for GSC locality 64597, northeast side of Pardonet Hill; E.T. Tozer, 1964.

Guembelites clavatus (McLearn)

GSC loc. 64625. Lower Norian, Kerri Zone? Pardonet Formation, 10 m below *Malayites dawsoni* bed (GSC loc. 64626), northeast side of Pardonet Hill, locality 8 (Tozer, 1965c, Fig. 1), NTS Mount Brewster 94 B/3; E.T. Tozer, 1964.

Metathisbites? *griphus* n. sp.

GSC loc. 64626. Lower Norian, Dawsoni Subzone 2. Pardonet Formation, northeast side of Pardonet Hill, locality 8 (Tozer, 1965c, Fig. 1), NTS Mount Brewster 94 B/3; E.T. Tozer, 1964.

Malayites dawsoni McLearn

GSC loc. 64627. Upper Carnian, Macrolobatus Zone. Pardonet Formation, locality and bed as for GSC locality 64616, west side of Pardonet Hill; E.T. Tozer, 1964.

Anatropites pardoneti n. sp.

GSC loc. 64628. Upper Carnian, Macrolobatus Zone. Pardonet Formation, locality as for GSC localities 64616 and 64627, west side of Pardonet Hill, from stratigraphic level 0.6 m higher; E.T. Tozer, 1964 (Tozer, 1967, p. 61).

Anatropites cascadensis n. sp.
Thisbites selwyni n. sp.
Gonionotites nobilis n. sp.
Griesbachites auctoris n. sp.

GSC loc. 64629. Lower Norian, Kerri Subzone 2. Pardonet Formation, locality as for GSC locality 64607, west side of Pardonet Hill, from about the same stratigraphic level; E.T. Tozer, 1964 (Tozer, 1967, p. 58).

Gonionotites rarus McLearn

GSC loc. 64630. Upper Carnian, Dilleri Zone. Ludington Formation, north side of Peace River, 2.5 km west of mouth of Point Creek, now flooded by waters of Williston Lake, NTS Point Creek 93 O/14; E.T. Tozer, 1964 (McLearn, 1960, p. 6).

Discotropites sandlingensis (Hauer)

GSC loc. 64632. Lower Norian, Kerri Subzone 2. Pardonet Formation, talus block in Juvavites Gully, Pardonet Hill, NTS Mount Brewster 94 B/3; E.T. Tozer, 1964.

Metathisbites dawsoni (McLearn)
Guembelites jandianus Mojsisovics

GSC loc. 64634. Middle Norian, Columbianus Subzone 4. Pardonet Formation, *Eomonotis pinensis* beds, west side of Monotis Gully, Pardonet Hill, locality 13 (Tozer, 1965c, Fig. 1), NTS Mount Brewster 94 B/3; E.T. Tozer, 1964.

Sagenites sp. indet.
Alloclionites welteri n. sp.
Mesohimavatites caponicus n. sp.

GSC loc. 64636. Lower Norian, Magnus Subzone 2. Pardonet Formation, talus block on "Black Bear Ridge" of McLearn (1960, p. 12), north side of Peace River, opposite Pardonet Hill, NTS Mount Brewster 94 B/3; E.T. Tozer, 1964.

Dimorphotoceras caurinum (McLearn)
Dimorphotoceras ursinum n. sp.
Juvavites concretus McLearn

GSC loc. 64638. Middle Norian, Columbianus Subzone 3. Pardonet Formation, "Black Bear Ridge" of McLearn (1960a, p. 12), north side of Peace River opposite Pardonet Hill, NTS Mount Brewster 94 B/3; E.T. Tozer, 1964.

Paragymnites symmetricus (Mojsisovics)
Steinmannites sp. indet.

Eosteinmannites ursensis n. sp.
Neohimavatites peregrinus n. sp.
Parajuvavites canadensis n. sp.

GSC loc. 64643. Middle Norian, Columbianus Subzone 4. Pardonet Formation, *Eomonotis pinensis* beds, west side of Pardonet Hill, locality 11 (Tozer, 1965c, Fig. 1), NTS Mount Brewster 94 B/3; E.T. Tozer, 1964.
Pseudosirenites falcatus n. sp.

GSC loc. 64645. Middle Norian, Columbianus Subzone 4. Pardonet Formation, *Eomonotis pinensis* beds, west side of Pardonet Hill, locality 12 (Tozer, 1965c, Fig. 1), NTS Mount Brewster 94 B/3; E.T. Tozer, 1964.
Brouwerites maclearni n. sp.

GSC loc. 64650. Upper Carnian, Welleri Subzone 1. Ludington Formation, upper part of "Lima Gully" (McLearn, 1960, Fig. 2), locality 1 (Tozer, 1965c, Fig. 1), Pardonet Hill, NTS Mount Brewster 94 B/3; E.T. Tozer, 1964 (Tozer, 1965c, p. 220).
Discotropites smithi Kutassy

GSC loc. 64653. Lower Norian, Kerri Subzone 2. Pardonet Formation, talus block, west spur of Brown Hill, NTS Jones Peak 94 B/2; E.T. Tozer, 1964.
Stikinoceras kerri McLearn

GSC loc. 64654. Lower Norian, Kerri Subzone 2. Pardonet Formation, *Stikinoceras* bed, west slope, west spur of Brown Hill, NTS Jones Peak 94 B/2; E.T. Tozer, 1964 (McLearn, 1960, p. 15; Tozer, 1967, p. 57).
Stikinoceras kerri McLearn
Gonionotites spiekeri McLearn
Gonionotites rarus McLearn
Griesbachites humi (McLearn)
Dimorphites pardonetiensis McLearn

GSC loc. 64663. Middle Norian, Rutherfordi Zone. Pardonet Formation, about 300 m north of "Twin Spruce Gully", west slope, west spur of Brown Hill, NTS Jones Peak 94 B/2; E.T. Tozer, 1964.
Carinacanthites calypso (Mojsisovics)
Hauerites piceus n. sp.

GSC loc. 64664. Lower Norian, Dawsoni Subzone 1. Pardonet Formation, 6 m above *Stikinoceras* bed (GSC loc. 64666), section about 550 m north of Twin Spruce Gully, west slope, west spur Brown Hill, NTS Jones Peak 94 B/2; E.T. Tozer, 1964.
Norosirenites krystyni n. sp.
Wangoceras pax (Tozer)

GSC loc. 64666. Lower Norian, Kerri Subzone 2. Pardonet Formation, *Stikinoceras* bed, as for GSC locality 64654, Brown Hill; E.T. Tozer, 1964.
Stikinoceras kerri McLearn
Gonionotites rarus McLearn
Griesbachites humi (McLearn)
Griesbachites laevis n. sp.
Dimorphites pardonetiensis McLearn

GSC loc. 64715. Dienerian, Sverdrupi Subzone 2. Blind Fiord Formation, sea cliff 32 km southeast of Cape Stallworthy, Axel Heiberg Island, locality 156 (GSC Map 1305A), NTS Cape Stallworthy 560 D; E.T. Tozer, 1964 (Tozer, 1967, p. 51).
Vavilovites sverdrupi (Tozer)

GSC loc. 64716. Dienerian, Sverdrupi Subzone 3. Blind Fiord Formation, as for GSC locality 64715, southeast of Cape Stallworthy, 7.5 m above GSC locality 64715; E.T. Tozer, 1964 (Tozer, 1967, p. 51).
Kingites discoidalis n. sp.
Heibergites heibergensis (Tozer)

GSC loc. 64717. Dienerian, Sverdrupi Zone. Blind Fiord Formation, as for GSC locality 64715, southeast of Cape Stallworthy, 4.5 m above GSC locality 64715; E.T. Tozer, 1964 (Tozer, 1967, p. 51).
Kingites thulensis n. sp.

GSC loc. 64718. Smithian. Blind Fiord Formation, 32 km southeast of Cape Stallworthy, Axel Heiberg Island, locality 155 (GSC Map 1305A), NTS Cape Stallworthy 560 D; E.T. Tozer, 1964 (Tozer, 1967, p. 48).
Arctoceras gigas n. sp.

GSC loc. 64719. Spathian, Pilaticus Zone. Blind Fiord Formation, section as for GSC locality 64718, southeast of Cape Stallworthy, about 30 m above GSC locality 64718; E.T. Tozer, 1964 (Tozer, 1967, p. 48).
Olenikites pilaticus Tozer
Ammonoid indet.

GSC locs. 64723, 64725. Dienerian, Sverdrupi Subzone 2. Blind Fiord Formation, 134 m above base, Griesbach Creek, Axel Heiberg Island, section 161 (GSC Map 1310A), NTS Bukken Fiord 560 A; E.T. Tozer, 1964 (Tozer, 1967, p. 50).
Vavilovites sverdrupi (Tozer)

GSC loc. 64727. Lower Carnian. Blaa Mountain Formation, Lower Shale Member, about 12 m above *Daonella frami* bed, Griesbach Creek, Axel Heiberg Island, section 160 (GSC Map 1310A), NTS Bukken Fiord 560 A; E.T. Tozer, 1964 (Tozer, 1967, p. 45).
Discophyllites taimyrensis Popov

GSC loc. 64729. Dienerian, Candidus Zone. Blind Fiord Formation, about 90 m above base, 3.2 km west of Camp Five Creek, Axel Heiberg Island, NTS Bukken Fiord 560 A; E.T. Tozer, 1964.

Proptychites candidus Tozer
Meekophiceras franklini n. sp.

GSC loc. 64730. Dienerian, Candidus Zone. Blind Fiord Formation, about 90 m above base, section 3 km west of Camp Five Creek, Axel Heiberg Island, section 159 (GSC Map 1310A), NTS Bukken Fiord 560 A; E.T. Tozer, 1964.

Proptychites candidus Tozer
Meekophiceras franklini n. sp.

GSC loc. 64731. Dienerian, Sverdrupi Subzone 3. Blind Fiord Formation, about 150 m above base, section as for GSC locality 64730 (158); E.T. Tozer, 1964.

Heibergites heibergensis (Tozer)
Pseudosageceras multilobatum Noetling

GSC loc. 64732. Lower Griesbachian, Concavum Zone. Blind Fiord Formation, talus from lower 18 m, Griesbach Creek, Axel Heiberg Island, NTS Bukken Fiord, 560 A; E.T. Tozer, 1964.

Otoceras concavum Tozer

GSC loc. 64733. Lower Griesbachian, Concavum Zone. Blind Fiord Formation, 13.4 m above base, Greisbach Creek, Axel Heiberg Island, section 161 (GSC Map 1310A), NTS 560 A; E.T. Tozer, 1964 (Tozer, 1967, p. 53).

Otoceras concavum Tozer

GSC loc. 64734. Lower Griesbachian, Concavum Zone. Blind Fiord Formation, 13.7 m above base, section as for GSC locality 64733 (161); E.T. Tozer, 1964.

Otoceras concavum Tozer

GSC loc. 64735. Lower Griesbachian, Concavum Zone. Blind Fiord Formation, 14.3 m above base, section as for GSC locality 64733 (161); E.T. Tozer, 1964.

Otoceras concavum Tozer

GSC loc. 64744. Upper Griesbachian, Commune Zone. Blind Fiord Formation, 53.3 m above base, section as for GSC locality 64733 (161); E.T. Tozer, 1964.

Ophiceras greenlandicum Spath

GSC loc. 64745. Upper Griesbachian, Commune Zone. Blind Fiord Formation, 54.2 m above base, section as for GSC locality 64733 (161); E.T. Tozer, 1964.

Ophiceras commune Spath

GSC loc. 64746. Upper Griesbachian, Commune Zone. Blind Fiord Formation, 55.5 m above base, section as for GSC locality 64733 (161); E.T. Tozer, 1964.

Ophiceras subsakuntala Spath

GSC loc. 64747. Upper Griesbachian, Commune Zone. Blind Fiord Formation, 55.8 m above base, section as for GSC locality 64733 (161); E.T. Tozer, 1964.

Ophiceras subsakuntala Spath

GSC loc. 64750. Upper Griesbachian, Commune Zone. Blind Fiord Formation, 57.3 m above base, section as for GSC locality 64733 (161); E.T. Tozer, 1964.

Discophiceras wordiei (Spath)

GSC loc. 64762. Upper Griesbachian, Commune Zone. Blind Fiord Formation, 65.2 m above base, section as for GSC locality 64733 (161); E.T. Tozer, 1964.

Wordieoceras wordiei (Spath)

GSC loc. 64763. Upper Griesbachian, Strigatus Zone. Blind Fiord Formation, 65.5 m above base, section as for GSC locality 64733 (161); E.T. Tozer, 1964.

Bukkenites strigatus (Tozer)

GSC loc. 64764. Dienerian, Sverdrupi Subzone 3. Blind Fiord Formation, about 150 m above base, section 5 km west of Camp Five Creek, Axel Heiberg Island, section 158 (GSC Map 1310A) NTS Bukken Fiord 560 A; E.T. Tozer, 1964.

Pseudosageceras multilobatum Noetling

GSC loc. 64765. Upper Griesbachian, Strigatus Zone. Blind Fiord Formation, talus from beds about 85 m above base, section as for GSC locality 64764 (158); E.T. Tozer, 1965.

Bukkenites nitidus n. sp.
Bukkenites strigatus (Tozer)
Bukkenites incisus n. sp.

GSC loc. 64766. Lower Griesbachian, Boreale Zone. Blind Fiord Formation, about 40 m above base, section as for GSC locality 64764 (158); E.T. Tozer, 1964.

Otoceras boreale Spath

GSC loc. 64767. Upper Griesbachian, Strigatus Zone. Blind Fiord Formation, about 92 m above base, 16.7 m above GSC locality 64773, section as for GSC locality 64764 (158); E.T. Tozer, 1964.

Wordieoceras wordiei (Spath)

GSC loc. 64768. Upper Griesbachian, Strigatus Zone. Blind Fiord Formation, about 90 m above base, 16.1 m above GSC locality 64773, section as for GSC locality 64764 (158); E.T. Tozer, 1964.

Bukkenites strigatus (Tozer)

GSC loc. 64769. Upper Griesbachian, Strigatus Zone. Blind Fiord Formation, about 86 m above base, 10.9 m above GSC locality 64773, section as for GSC locality 64764 (158); E.T. Tozer, 1964.

Wordieoceras wordiei (Spath)

GSC loc. 64770. Upper Griesbachian, Strigatus Zone. Blind Fiord Formation, about 85 m above base, 10.6 m above GSC locality 64773, section as for GSC locality 64764 (158); E.T. Tozer, 1964.

Bukkenites strigatus (Tozer)

GSC loc. 64771. Upper Griesbachian, Strigatus Zone. Blind Fiord Formation, about 84 m above base, 9.1 m above GSC locality 64773, section as for GSC locality 64764 (158); E.T. Tozer, 1964.

Bukkenites macilentus n. sp.

GSC loc. 64772. Upper Griesbachian, Commune Zone. Blind Fiord Formation, about 77 m above base, 1.5 m above GSC locality 64773, section as for GSC locality 64764 (158); E.T. Tozer, 1964.

Wordieoceras wordiei (Spath)

GSC loc. 64773. Upper Griesbachian, Commune Zone. Blind Fiord Formation, about 75 m above base, section as for GSC locality 64764 (158); E.T. Tozer, 1964.

Wordieoceras wordiei (Spath)

GSC loc. 64774. Lower Griesbachian, Concavum Zone. Blind Fiord Formation, 15.2 m above base, Griesbach Creek, Axel Heiberg Island, section 160 (GSC Map 1310A), NTS Bukken Fiord 560 A; E.T. Tozer, 1964 (Tozer, 1967, p. 53).

Otoceras concavum Tozer

GSC loc. 64775. Lower Griesbachian, Concavum Zone. Blind Fiord Formation, 12.2 m above base, section as for GSC locality 64774 (160); E.T. Tozer, 1964.

Otoceras gracile n. sp.

GSC loc. 64776. Lower Griesbachian, Concavum Zone. Blind Fiord Formation, 12.8 m above base, section as for GSC locality 64774 (160); E.T. Tozer, 1964.

Otoceras concavum Tozer

GSC loc. 64777. Lower Griesbachian, Concavum Zone. Blind Fiord Formation, 13.4 m above base, section as for GSC locality 64774 (160); E.T. Tozer, 1964.

Otoceras concavum Tozer

GSC loc. 64778. Lower Griesbachian, Concavum Zone. Blind Fiord Formation, 13.7 m above base, section as for GSC locality 64774 (160); E.T. Tozer, 1964.

Otoceras concavum Tozer

GSC loc. 64779. Lower Griesbachian, Concavum Zone. Blind Fiord Formation, 15.2 m above base, section as for GSC locality 64774 (160); E.T. Tozer, 1964.

Otoceras concavum Tozer

GSC loc. 64780. Lower Griesbachian, Concavum Zone. Blind Fiord Formation, 15.8 m above base, section as for GSC locality 64774 (160); E.T. Tozer, 1964.

Otoceras concavum Tozer

GSC loc. 64781. Lower Griesbachian, Concavum Zone. Blind Fiord Formation, 17.0 m above base, section as for GSC locality 64774 (160); E.T. Tozer, 1964.

Otoceras concavum Tozer

GSC loc. 64782. Lower Griesbachian, Boreale Zone. Blind Fiord Formation, 32.9 m above base, section as for GSC locality 64774 (160); E.T. Tozer, 1964.

Otoceras boreale Spath

GSC loc. 64783. Lower Griesbachian, Boreale Zone. Blind Fiord Formation, 36.6 m above base, section as for GSC locality 64744 (160); E.T. Tozer, 1964.

Otoceras boreale Spath

GSC loc. 64787. Lower Carnian, Nanseni Zone. Blaa Mountain Formation, Middle Shale Member, about 1.5 km east of mouth of Griesbach Creek, NTS Bukken Fiord 560 A; E.T. Tozer, 1964.

Sirenites nanseni Tozer

GSC loc. 64792. Smithian, Romunderi Zone. Blind Fiord Formation, 215 m above base, section as for GSC locality 64774 (160); E.T. Tozer, 1964.

Euflemingites cirratus (White)

GSC loc. 64795. Lower Carnian. Blaa Mountain Formation, Lower Shale Member, 2.7 m below Lower Calcareous Member, section as for GSC locality 64774 (160); E.T. Tozer, 1964.

Discophyllites taimyrensis Popov

GSC loc. 64856. Dienerian, Sverdrupi Subzone 3. Blind Fiord Formation, talus at GSC locality 64764, west of Camp Five Creek; E.T. Tozer, 1964.

Heibergites heibergensis (Tozer)

Pseudosageceras multilobatum Noetling

GSC loc. 64863. Dienerian, Sverdrupi Subzone 2. Blind Fiord Formation, about 135 m above base, Griesbach Creek, Axel Heiberg Island, upstream from section 161 (GSC Map 1310A), NTS Bukken Fiord 560 A; E.T. Tozer, 1964.

Vavilovites sverdrupi (Tozer)

GSC loc. 65935. Middle Norian, Columbianus Subzone 3. Pardonet Formation, section 64-14 (Stott, 1969, p. 125), north of Besa River, 57°30'N, 123°35'W. NTS Richards Creek 94 G/12; D.F. Stott, 1964.

Eosteinmannites nitidus n. sp.
Neohimavatites burlingi (McLearn)

GSC loc. 66027. Middle Norian, Columbianus Subzone 1. Pardonet Formation, north of Nevis Creek, 57°23'N, 123°23'W, NTS Mount Withrow, 94 G/6; D. F. Stott, 1964 (Tozer, 1967, p. 60).

Pseudosirenites pardoneti (McLearn)
Distichites gethingi McLearn
Pleurodistichites stotti Tozer
Phormedites juvavicus Mojsisovics

GSC loc. 68179. Upper Carnian, Welleri Subzone 2. Baldonnel Formation, near summit of mountain 2.5 km northwest of summit of Mount McLearn, NTS Eight Mile Creek 94 N/3; E.T. Tozer, 1965.

Hoplotropites marii (Gemmellaro)

GSC loc. 68180. Lower Norian, Kerri Subzone 2. Pardonet Formation, section 1.2 km southwest of summit of Mount McLearn, NTS Eight Mile Creek 94 N/3; E.T. Tozer, 1965 (Tozer, 1967, p. 59–61).

Pterosirenites auritus Tozer
Clionitites punctulus n. sp.
Clionitites laevis n. sp.
Styrites communis Mojsisovics
Tropiceltites columbianus (McLearn)
Tropiceltites inflatus n. sp.
Metathisbites dawsoni (McLearn)
Stikinoceras kerri McLearn
Griesbachites humi (McLearn)
Griesbachites borealis n. sp.
Dimorphites pardonetiensis McLearn
Guembelites jandianus Mojsisovics
Discophyllites ebneri (Mojsisovics)

GSC loc. 68181. Lower Norian, Kerri Subzone 1. Pardonet Formation, section as for GSC locality 68180, about 8 m below GSC locality 68180 (Subzone 2); E.T. Tozer, 1965.

Tornquistites transiens n. sp.
Thisbites custi McLearn

GSC loc. 68183. Smithian, Romunderi Zone. Toad Formation, talus from bed below GSC locality 68184 (Tardus Zone), north side of Liard River 300 m above Rapids of the Drowned, NTS Grayling River 94 N/6; E.T. Tozer, 1965 (Tozer, 1967, p. 74).

Euflemingites cirratus (White)

GSC loc. 68184. Smithian, Tardus Zone. Toad Formation, in situ, as for GSC locality 68183, near Rapids of the Drowned, E.T. Tozer, 1965 (Tozer, 1967, p. 74).

Anasibirites robustus Welter

GSC loc. 68190. Lower Norian, Dawsoni Subzone 2. Pardonet Formation, section in gully 2.8 km northwest of summit of Mount McLearn, NTS Eight Mile Creek 94 N/3; E.T. Tozer, 1965 (Tozer, 1967, p. 59, 60).

Malayites dawsoni McLearn

GSC loc. 68191. Lower Norian, Magnus Zone. Pardonet Formation, section northwest of Mount McLearn, about 21 m above GSC locality 68190 (Dawsoni Zone); E.T. Tozer, 1965.

Juvavites subangulatus n. sp.
Juvavites gibbosus n. sp.

GSC loc. 68193. Lower Norian, Dawsoni Subzone 3. Pardonet Formation, section northwest of Mount McLearn, about 3 m above GSC locality 68190 (Subzone 2); E.T. Tozer, 1965.

Omojuvavites rostratus n. sp.
Omojuvavites ventroplicatus n. sp.
Discomalayites carinatus n. sp.

GSC loc. 68198. Lower Norian, Magnus Zone. Pardonet Formation, section northwest of Mount McLearn, from about the same level as GSC locality 68191; E.T. Tozer, 1965.

Juvavites subangulatus n. sp.

GSC loc. 68199. Lower Norian, Magnus Subzone 1. Pardonet Formation, section northwest of Mount McLearn, about 20 m above GSC locality 68190 (Dawsoni Zone); E.T. Tozer, 1965.

Epijuvavites transiens n. sp.

GSC loc. 68200. Lower Norian, Dawsoni Subzone 2. Pardonet Formation, section northwest of Mount McLearn, talus block from GSC locality 68190; E.T. Tozer, 1965 (Tozer, 1967, p. 60).

Malayites dawsoni McLearn
Pseudocardioceras acutum (Mojsisovics)

GSC loc. 68202. Upper Carnian, Macrolobatus Zone. Pardonet Formation, section as for GSC localities 68180 and 68181, southwest of Mount McLearn, about 15 m below GSC locality 68180 (Kerri Subzone 1); E.T. Tozer, 1965.

Anatropites maclearni n. sp.
Anatropites sulfurensis n. sp.
Gonionotites avarus n. sp.
Gonionotites nobilis n. sp.
Hadrothisbites taylori n. sp.

GSC loc. 68203. Lower Anisian, Caurus Subzone 1. Toad Formation, 202 m below Cretaceous contact, section on east limb of anticline immediately west of Mile Post 375 (km 595) (375E), Alaska Highway, NTS Tetsa River 94 K/9; E.T. Tozer, 1965 (Tozer, 1967, p. 69).

Groenlandites kummeli n. sp.
Lenotropites caurus (McLearn)
Lenotropites? tricarinatus n. sp.
Grambergia tetsaensis McLearn
Ussurites muskwa McLearn

GSC loc. 68204. Middle Anisian, Hayesi Zone. Toad Formation, 180 m below Cretaceous contact, section as for GSC locality 68203 (375E); E.T. Tozer, 1965 (Tozer, 1967, p. 69).

Amphipopanoceras selwyni (McLearn)
Czekanowskites pinguis (McLearn)

GSC loc. 68208. Upper Carnian, Dilleri Zone. Ludington Formation, about 200 m above GSC locality 68209, northeast spur of Mount McLearn, NTS Eight Mile Creek 94 N/3; E.T. Tozer, 1965 (Tozer, 1967, p. 64).

Parahauerites sp. indet.
Spirogmoceras shastense (Smith)
Trachystenoceras gabbi (Hyatt and Smith)
Tropites dilleri Smith
Pleurotropites gracilis (Smith)
Pleurotropites gabbi (Smith)
Paratropites sulfurensis n. sp.
Discotropites sandlingensis (Hauer)

GSC loc. 68209. Lower Carnian, Obesum Zone. Ludington Formation, talus near base of section on northeast spur of Mount McLearn, NTS Eight Mile Creek 94 N/3; E.T. Tozer, 1965; (Tozer, 1967, p. 64).

Sirenites sp. indet.
Austrotrachyceras obesum (Tozer)

GSC loc. 68212. Lower Norian, Magnus Subzone 2. Pardonet Formation, 1.2 km southwest of summit of Mount McLearn, about 15 m above level of GSC locality 42327 (Dawsoni Zone); E.T. Tozer, 1965.

Dimorphotoceras ursinum n. sp.

GSC loc. 68215. Lower Carnian, Nanseni Zone. Ludington Formation, about 120 m above GSC locality 68217 (Desatoyense Zone) ridge between Mount McLearn and Ewe Mountain, 3.5 km northnortheast of triangulation station 6536, NTS Eight Mile Creek 94 N/3; E.T. Tozer, 1965 (Tozer, 1967, p. 63, 64).

Sirenites nanseni Tozer

GSC loc. 68217. Lower Carnian, Desatoyense Zone. Ludington Formation, ridge between Mount McLearn and Ewe Mountain, as for GSC locality 68215; E.T. Tozer, 1965 (Tozer, 1967, p. 63).

Trachyceras desatoyense Johnston

GSC loc. 68220. Upper Carnian, Welleri Subzone 2. Pardonet Formation, about 2.8 km southwest of summit of Mount Prudence, NTS Mount Prudence 94 N/5; E.T. Tozer, 1965.

Discotropites theron (Dittmar)
Projuvavites kellyi (Smith)

GSC loc. 68221. Upper Carnian, Macrolobatus Zone. Pardonet Formation, section as for GSC locality 68220, southwest of Mount Prudence, from stratigraphically higher beds; E.T. Tozer, 1965.

Anatropites maclearni n. sp.
Euisculites krystyni n. sp.

GSC loc. 68224. Upper Anisian, Deleeni Zone. Toad Formation, 150 m below Cretaceous contact, section as for GSC locality 68203 (375E), Alaska Highway; E.T. Tozer, 1965 (Tozer, 1967, p. 69).

Amphipopanoceras tetsa (McLearn)
Intornites canadensis (McLearn)
Eogymnotoceras deleeni (McLearn)

GSC loc. 68226. Lower Anisian, Mulleri Zone. Toad Formation, 206 m below Cretaceous contact, section as for GSC locality 68203, Alaska Highway (375E); E.T. Tozer, 1965 (Tozer, 1967, p. 69).

Stenopopanoceras falcatum n. sp.
Groenlandites silberlingi n. sp.
Grambergia tetsaensis McLearn
Paradanubites shevyrevi n. sp.
Paracrochordiceras benderi n. sp.
Caucasites mulleri n. sp.
Gymnites procerus n. sp.

GSC loc. 68228. Upper Anisian, Deleeni Zone. Toad Formation, bed 3, 7.6 m below top of section on west limb of anticline immediately west of Mile Post 375 (km 595) (375W), Alaska Highway, NTS Tetsa River 94 K/9; E.T. Tozer, 1965 (Tozer, 1967, p. 70).

Amphipopanoceras acutum Popov
Intornites canadensis (McLearn)
Eogymnotoceras beachi (McLearn)

GSC loc. 68229. Ladinian, Sutherlandi Subzone 2. Toad Formation, 104 m below Cretaceous contact, section on north side of Liard River at Boiler Canyon, NTS Grayling River 94 N/6; E.T. Tozer, 1965 (Tozer, 1967, p. 65).

Nathorstites macconnelli (Whiteaves)
Daxatina canadensis (Whiteaves)
Lobites ellipticus (Hauer)

GSC loc. 68230. Ladinian, Sutherlandi Subzone 2. Toad Formation, talus in Boiler Canyon, probably from GSC locality 68229; E.T. Tozer, 1965.

Daxatina canadensis (Whiteaves)
Lobites ellipticus (Hauer)

GSC loc. 68231. Ladinian, Sutherlandi Subzone 2. Toad Formation, 140 m below Cretaceous contact, section as for GSC locality 68229, Boiler Canyon; E.T. Tozer, 1965.

Nathorstites macconnelli (Whiteaves)
Asklepioceras laurenci McLearn
Daxatina canadensis (Whiteaves)

GSC loc. 68232. Ladinian, Sutherlandi Subzone 2. Toad Formation, 143 m below Cretaceous contact, section as for GSC locality 68229, Boiler Canyon; E.T. Tozer, 1965.

Frankites sutherlandi (McLearn)

GSC loc. 68233. Ladinian, Sutherlandi Subzone 2. Toad Formation, 155 m below Cretaceous contact, section as for GSC locality 68229, Boiler Canyon; E.T. Tozer, 1965.

Frankites sutherlandi (McLearn)

GSC loc. 68234. Ladinian, Sutherlandi Subzone 1. Toad Formation, 180 m below Cretaceous contact, section as for GSC locality 68229, Boiler Canyon; E.T. Tozer, 1965.

Nitanoceras compressum n. sp.
Frankites glaber n. sp.

GSC loc. 68236. Ladinian, Maclearni Subzone 3. Toad Formation, 262 m below Cretaceous contact, section as for GSC locality 68229, Boiler Canyon; E.T. Tozer, 1965.

Nitanoceras compressum n. sp.
Hungarites inermis n. sp.
Gymnites sp. indet.
Nathorstites maclearni n. sp.
Protrachyceras sikanianum McLearn
Otoarpadites auritus n. sp.
Anolcites anguinus n. sp.
Zestoceras nitidum n. sp.
Maclearnoceras ensio n. sp.
Asklepioceras exilis n. sp.
Asklepioceras altilis n. sp.
Lobites pacianus McLearn
Monophyllites aonis Mojsisovics.

GSC loc. 68237. Ladinian, Maclearni Subzone 2. Toad Formation, 263.5 m below Cretaceous contact, section as for GSC locality 68229, Boiler Canyon; E.T. Tozer, 1965.

Protrachyceras sikanianum McLearn
Anolcites angustus n. sp.
Anolcites rasilis n. sp.
Lobites pacianus McLearn

GSC loc. 68242. Ladinian, Maclearni Subzone 1. Toad Formation, 332 m below Cretaceous contact, section as for GSC locality 68229, Boiler Canyon; E.T. Tozer, 1965.

Nathorstites maclearni n. sp.
Meginoceras effervescens n. sp.
Anolcites impolitus n. sp.
Anolcites politus n. sp.

GSC loc. 68243. Ladinian, Meginae Subzone 2. Toad Formation, 404 m below Cretaceous contact, section as for GSC locality 68229, Boiler Canyon; E.T. Tozer, 1965 (Tozer, 1967, p. 65).

Nitanoceras selwyni (McLearn)
Indigirites boehmi n. sp.
Protrachyceras sikanianum McLearn
Meginoceras meginae McLearn
Silenticeras liardense n. sp.
Lobites pacianus McLearn

GSC loc. 68244. Ladinian, Meginae Subzone 2. Toad Formation, talus block in Boiler Canyon, probably from GSC locality 68243; E.T. Tozer, 1965.

Meginoceras meginae McLearn
Silenticeras liardense n. sp.

GSC loc. 68245. Ladinian, Meginae Subzone 2. Toad Formation, talus block in Boiler Canyon, probably from GSC locality 68243; E.T. Tozer, 1965.

Silenticeras hatae McLearn
Lobites pacianus McLearn

GSC loc. 68248. Ladinian, Meginae Subzone 2. Toad Formation, 402 m below Cretaceous contact, section as for GSC locality 68229, Boiler Canyon; E.T. Tozer, 1965.

Nitanoceras selwyni (McLearn)
Indigirites boehmi n. sp.
Protrachyceras sikanianum McLearn
Meginoceras meginae McLearn

GSC loc. 68251. Ladinian, Meginae Subzone 2. Toad Formation, 372 m below Cretaceous contact, section as

for GSC locality 68229, Boiler Canyon; E.T. Tozer, 1965.

Meginoceras meginae McLearn

GSC loc. 68252. Ladinian, Maclearni Zone. Toad Formation, 300 m below Cretaceous contact, section as for GSC locality 68229, Boiler Canyon; E.T. Tozer, 1965.

Nathorstites maclearni n. sp.

GSC loc. 68260. Ladinian, Sutherlandi Subzone 2. Toad Formation, 46.3 m below Cretaceous contact, section on south side of Liard River, Middle Canyon, 1.6 m below Boiler Canyon, NTS Grayling River 94 N/7; E.T. Tozer, 1965 (Tozer, 1967, p. 66) (=section for GSC loc. 42333, etc.).

Nathorstites macconnelli (Whiteaves)

GSC loc. 68261. Ladinian, Sutherlandi Subzone 2. Toad Formation, 81.7 m below Cretaceous contact, section as for GSC locality 68260, Middle Canyon; E.T. Tozer, 1965.

Nathorstites macconnelli (Whiteaves)

GSC loc. 68263. Ladinian, Sutherlandi Subzone 2. Toad Formation, 97.5 m below Cretaceous contact, section as for GSC locality 68260, Middle Canyon; E.T. Tozer, 1965.

Nathorstites macconnelli (Whiteaves)

GSC loc. 68264. Ladinian, Sutherlandi Subzone 2. Toad Formation, 98.4 m below Cretaceous contact, section as for GSC locality 68260, Middle Canyon; E.T. Tozer, 1965.

Nathorstites macconnelli (Whiteaves)
Daxatina canadensis (Whiteaves)

GSC loc. 68265. Ladinian, Sutherlandi Subzone 2. Toad Formation, 100.0 m below Cretaceous contact, section as for GSC locality 68260, Middle Canyon; E.T. Tozer, 1965.

Nathorstites macconnelli (Whiteaves)

GSC loc. 68266. Ladinian, Sutherlandi Subzone 2. Toad Formation, 102.1 m below Cretaceous contact, section as for GSC locality 68260, Middle Canyon; E.T. Tozer, 1965.

Nathorstites macconnelli (Whiteaves)
Frankites sutherlandi (McLearn)

GSC loc. 68267. Ladinian, Sutherlandi Subzone 2. Toad Formation, 74.9 m below Cretaceous contact, section as for GSC locality 68260, Middle Canyon; E.T. Tozer, 1965.

Frankites sutherlandi (McLearn)
Daxatina laubei n. sp.

GSC loc. 68269. Ladinian, Sutherlandi Subzone 2. Toad Formation, 114.3 m below Cretaceous contact, section as for GSC locality 68260, Middle Canyon; E.T. Tozer, 1965.

Nathorstites macconnelli (Whiteaves)
Frankites sutherlandi (McLearn)

GSC loc. 68271. Ladinian, Maclearni Subzone 1. Toad Formation, about 200 m below Cretaceous contact, section as for GSC locality 68260, Middle Canyon; E.T. Tozer, 1965.

Nathorstites maclearni n. sp.

GSC loc. 68272. Ladinian, Sutherlandi Subzone 2. Toad Formation, 52.4 m below Cretaceous contact, section as for GSC locality 68260, Middle Canyon; E.T. Tozer, 1965.

Daxatina canadensis (Whiteaves)

GSC loc. 68273. Dienerian, Candidus Zone. Grayling Formation, about 35 m above base, tributary of Tuchodi River, 58°22′00″N, 124°19′50″W, NTS Chlotapecta Creek 94 K/8; E.T. Tozer, 1965.

Ambites fuliginatus n. sp.

GSC loc. 68274. Dienerian, Candidus Zone. Grayling Formation, about 40 m above base, section as for GSC locality 68273, Tuchodi tributary; E.T. Tozer, 1965.

Proptychites candidus Tozer
Ambites fuliginatus n. sp.

GSC loc. 68275. Dienerian, Candidus Zone. Grayling Formation, about 35 m above base, section as for GSC locality 68273, Tuchodi tributary; E.T. Tozer, 1965.

Pleurambites frechi n. sp.

GSC loc. 68277. Ladinian, Meginae Subzone 1. Toad Formation, about 370 m below top of section on west-facing bluff (Tuchodi Bluff), 16 km southeast of Mount Mary Henry, 14 km north of eastern of the Tuchodi Lakes, NTS Chlotapecta Creek 94 K/8; E.T. Tozer, 1965 (Tozer, 1967, Fig. 16, p. 68).

Meginoceras triviale n. sp.

GSC loc. 68278. Ladinian, Sutherlandi Subzone 2. Toad Formation, about 280 m below top of section as for GSC locality 68277, Tuchodi Bluff; E.T. Tozer, 1965.

Frankites sutherlandi (McLearn)

GSC loc. 68279. Ladinian, Sutherlandi Subzone 2. Toad Formation, about 200 m below top of section as for GSC locality 68277, Tuchodi Bluff; E.T. Tozer, 1965.

Nathorstites macconnelli (Whiteaves)

Muensterites helenae (Renz)
Muensterites glaciensis (McLearn)
Frankites sutherlandi (McLearn)

GSC loc. 68280. Ladinian, Sutherlandi Subzone 2. Toad Formation, about 135 m below top of section as for GSC locality 68277, Tuchodi Bluff; E.T. Tozer, 1965.
Nathorstites macconnelli (Whiteaves)
Lobites ellipticus (Hauer)

GSC loc. 68284. Ladinian, Poseidon Zone. Toad Formation, about 470 m below top of section as for GSC locality 68277, Tuchodi Bluff; E.T. Tozer, 1965.
Indigirites freboldi n. sp.
Tuchodiceras poseidon (Tozer)
Tuchodiceras costatum n. sp.
Gymnites? sp. indet.

GSC loc. 68285. Ladinian, Poseidon Zone. Toad Formation, about 470 m below top of section as for GSC locality 68277, Tuchodi Bluff; E.T. Tozer, 1965.
Indigirites freboldi n. sp.
Tuchodiceras poseidon (Tozer)
Arctoptychites lingulatus n. sp.

GSC loc. 68286. Ladinian, Poseidon Zone. Toad Formation, about 440 m below top of section as for GSC locality 68277, Tuchodi Bluff; E.T. Tozer, 1965.
Indigirites freboldi n. sp.
Tuchodiceras poseidon (Tozer)
Protrachyceras sikanianum McLearn

GSC loc. 68288. Ladinian, Poseidon Zone. Toad Formation, about 470 m below top of section as for GSC locality 68277, Tuchodi Bluff; E.T. Tozer, 1965.
Tuchodiceras poseidon (Tozer)

GSC loc. 68289. Ladinian, Poseidon Zone. Toad Formation, about 480 m below top of section as for GSC locality 68277, Tuchodi Bluff; E.T. Tozer, 1965.
Indigirites freboldi n. sp.
Tuchodiceras poseidon (Tozer)
Tuchodiceras costatum n. sp.
Arctoptychites lingulatus n. sp.
Protrachyceras sikanianum McLearn

GSC loc. 68292. Ladinian, Maclearni Subzone 1. Toad Formation, about 340 m below top of section as for GSC locality 68277, Tuchodi Bluff; E.T. Tozer, 1965.
Nathorstites maclearni n. sp.
Protrachyceras sikanianum McLearn
Anolcites impolitus n. sp.

GSC loc. 68294. Middle Anisian, Hayesi Zone. Toad Formation, bed 1, 10.2 m below top of section as for GSC locality 68228 on Alaska Highway (375W); E.T. Tozer, 1965 (Tozer, 1967, Fig. 17, p. 70).
Amphipopanoceras selwyni (McLearn)
Intornites intornatus (McLearn)
Czekanowskites pinguis (McLearn)
Hollandites macconnelli (McLearn)
Anagymnotoceras varium (McLearn)
Nicomedites moderatus (McLearn)
Intornites canadensis (McLearn)

GSC loc. 68295. Middle Anisian, Minor Zone. Toad Formation, bed 2, section as for GSC locality 68228 on Alaska Highway (375W); E.T. Tozer, 1965 (Tozer, 1967, p. 70).
Stenopopanoceras celere n. sp.
Amphipopanoceras selwyni (McLearn)
Amphipopanoceras inconstans (Dagys and Ermakova)
Intornites williamsi n. sp.
Hollandites minor n. sp.
Hollandites spivaki McLearn
Anagymnotoceras wrighti (McLearn)
Nicomedites arthaberi n. sp.
Ptychites guloensis n. sp.
Proarcestes sp. indet.

GSC loc. 68297. Upper Anisian, Deleeni Zone. Toad Formation, bed 4, section as for GSC locality 68228 on Alaska Highway E.T. Tozer, 1965 (Tozer, 1967, p. 70).
Amphipopanoceras tetsa (McLearn)
Intornites canadensis (McLearn)
Eogymnotoceras deleeni (McLearn)
Ussurites cameroni McLearn

GSC loc. 68300. Upper Norian, Cordilleranus Subzone 1. Pardonet Formation, spur on west side of Mount Ludington, NTS Nabesche River 94 B/6; E.T. Tozer, 1965 (Tozer, 1967, p. 54; 1979).
Nassichukites dimidiatus Tozer
Paraguembelites ludingtoni Tozer
Paraguembelites inflatus n. sp.
Gnomohalorites cordilleranus Tozer
Metasibirites columbianus Tozer
Rhabdoceras suessi Hauer
Peripleurites roemeri Mojsisovics
Tragorhacoceras occultum (Mojsisovics)

GSC loc. 68301. Middle Norian, Columbianus Subzone 3. Pardonet Formation, section as for GSC locality 68300, Mount Ludington, from lower 1 m of 1.5 m bed immediately below GSC locality 68300; E.T. Tozer, 1965 (Tozer, 1967, p. 55).
Pseudosirenites bullatus n. sp.
Neohimavatites peregrinus n. sp.

Leislingites quadratus n. sp.
Leislingites politus n. sp.
Halorites sp. indet.

GSC loc. 68302. Middle Norian, Columbianus Subzone 3. Pardonet Formation, section as for GSC locality 68300, Mount Ludington, from full thickness of 1.5 m bed immediately below GSC locality 68300; E.T. Tozer, 1965 (Tozer, 1967, p. 55).
Pseudosirenites bullatus n. sp.
Leislingites quadratus n. sp.
Leislingites politus n. sp.

GSC loc. 68303. Middle Norian, Columbianus Subzone 3. Pardonet Formation, section as for GSC locality 68300, Mount Ludington, from top of 1.5 m bed immediately below GSC locality 68300; E.T. Tozer, 1965.
Alloclionites dieneri n. sp.
Pseudothetidites brysonis (Diener)
Leislingites quadratus n. sp.

GSC loc. 68304. Upper Norian, Cordilleranus Subzone 1. Pardonet Formation, section and bed as for GSC locality 68300, Mount Ludington; E.T. Tozer, 1965.
Paragymnites symmetricus (Mojsisovics)
Sagenites sp. indet.
Paraguembelites ludingtoni Tozer
Paraguembelites inflatus n. sp.
Rhabdoceras suessi Hauer

GSC loc. 68305. Middle Norian, Columbianus Subzone 3. Pardonet Formation, section as for GSC locality 68300, Mount Ludington, from top 0.5 m of 1.5 m bed immediately below GSC locality 68300; E.T. Tozer, 1965.
Neohimavatites canadensis (McLearn)
Parajuvavites canadensis n. sp.

GSC loc. 68308. Lower Norian, Dawsoni Subzone 2. Pardonet Formation, cut on north side of BC Railway line about 180 m west of west end of bridge 1.2 km west of Silver Sands Creek, NTS Callazon Creek 93 O/10; E.T. Tozer, 1965.
Malayites dawsoni McLearn

GSC loc. 68347. Ladinian, Maclearni Subzone 1. Toad Formation, talus block in Boiler Canyon, Liard River, NTS Grayling River, 94 N/6; E.T. Tozer, 1965.
Anolcites impolitus n. sp.

GSC loc. 68350. Lower Griesbachian, Boreale Zone. Bjorne Formation, west of head of Trold Fiord, Ellesmere Island, NTS Eureka Sound south, 49 F; R. Thorsteinsson, 1962.
Otoceras boreale Spath

GSC loc. 68351. Ladinian, Meginae Subzone 2. Toad Formation, talus block in Boiler Canyon, Liard River, NTS Grayling River, 94 N/6; E.T. Tozer, 1965.
Indigirites boehmi n. sp.
Indoceltites transiens n. sp.

GSC loc. 68360. Upper Carnian, Welleri Subzone 2. Baldonnel Formation, locality as for GSC locality 42320, south of summit of Mount McLearn; E.T. Tozer, 1965 (Tozer, 1967, p. 61).
Hoplotropites auctus (Dittmar)
Goniojuvavites kellyi (Smith)

GSC loc. 68361. Lower Carnian, probably Nanseni Zone. Ludington Formation, Ewe Mountain, NTS Eight Mile Creek 94 N/3; Union Oil Company, 1959.
Striatosirenites striatofalcatus (Hauer)

GSC loc. 68363. Ladinian, Sutherlandi Subzone 2. Toad Formation, talus block, Boiler Canyon, Liard River, NTS Grayling River 94 N/6; E.T. Tozer, 1965.
Nathorstites macconnelli (Whiteaves)
Zestoceras cerastes n. sp.
Daxatina canadensis (Whiteaves)

GSC loc. 68364. Ladinian, Sutherlandi Zone, probably Subzone 2. Toad Formation, talus block, Boiler Canyon, Liard River, NTS Grayling River 94 N/6; E.T. Tozer, 1965.
Zestoceras enode (Tozer)
Lobites ellipticus (Hauer)

GSC loc. 68872. Dienerian, Sverdrupi Subzone 1. Sulphur Mountain Formation, head of Panther River, NTS Barrier Mountain 82 O/12; E. W. Mountjoy, 1965.
Koninckites dimidiatus n. sp.

GSC loc. 69190. Upper Carnian, Welleri Subzone 1. Peril Formation, Blue Jay Cove, Burnaby Island, Queen Charlotte Islands, NTS Jedway 103 B/6; A. Sutherland Brown, 1965 (Tozer, 1967, p. 82; Sutherland Brown, 1968, p. 60).
Homerites semiglobosus (Hauer)
Bacchites hyatti (Smith)

GSC loc. 74715. Lower Anisian, Caurus Subzone 1. Toad Formation, section and locality as for GSC locality 68203 (375E), Alaska Highway; E.T. Tozer, 1966.
Azarianites bufonis (McLearn)
Ussurites muskwa McLearn

GSC loc. 74719. Lower Anisian, Caurus Zone. Toad Formation, 36 m above base of unit 5 (Section 6, Pelletier, 1960, p. 21), east end of canyon on Chischa

River, 14.5 km above Muskwa River, ("Second Canyon"), NTS Chischa River 94 J/12; E.T. Tozer, 1966.

Groenlandites canadensis n. sp.
Lenotropites tardus McLearn
Grambergia tetsaensis McLearn
Grambergia mackenzii (McLearn)
Stenophyllites kindlei (McLearn)

GSC loc. 74720. Lower Anisian, Caurus Zone. Toad Formation, 40.5 m above base of unit 5, section as for GSC locality 74719 (Second Canyon); E.T. Tozer, 1966.

Lenotropites caurus (McLearn)

GSC loc. 74722. Middle Anisian, Hayesi Zone. Toad Formation, 44 m above base of unit 5, section as for GSC locality 74719 (Second Canyon); E.T. Tozer, 1966.

Amphipopanoceras selwyni (McLearn)
Intornites intornatus (McLearn)
Anagymnotoceras varium (McLearn)

GSC loc. 74724. Upper Anisian, Deleeni Zone. Toad Formation 56 m above base of unit 5, section as for GSC locality 74719 (Second Canyon); E.T. Tozer, 1966.

Amphipopanoceras tetsa (McLearn)
Intornites canadensis (McLearn)
Eogymnotoceras liardense (McLearn)
Gymnotoceras smithi n. sp.
Tropigymnites haueri n. sp.
Ussurites cameroni McLearn

GSC loc. 74726. Upper Anisian, Chischa Zone. Toad Formation, 78 m above base of unit 5, section as for GSC locality 74719 (Second Canyon); E.T. Tozer, 1966 (= GSC loc. 40088).

Parapopanoceras? torelli (Mojsisovics)
Longobardites murrayensis n. sp.
Frechites chischa (Tozer)
Pleurofrechites subsidens n. sp.
Tozerites polygyratus (Smith)

GSC loc. 74731. Upper Anisian, Deleeni Zone. Toad Formation, south side of Chischa River, near east entrance to canyon 8 km above Muskwa River, ("First Canyon"), NTS Chischa River 94 J/12; E.T. Tozer, 1966.

Intornites canadensis (McLearn)
Eogymnotoceras liardense (McLearn)
Ussurites cameroni McLearn

GSC loc. 74732. Lower Anisian, Caurus Zone. Toad Formation, section on south side of Chischa River below waterfall in western part of First Canyon, 9.5 km above Muskwa River, NTS Chischa River 94 J/12 W; E.T. Tozer, 1966.

Groenlandites canadensis n. sp.
Lenotropites tardus McLearn
Grambergia tetsaensis McLearn

GSC loc. 74733. Lower Anisian, Caurus Subzone 2. Toad Formation, section as for GSC locality 74732, south side of First Canyon, 3.3 m above GSC locality 74732; E.T. Tozer, 1966.

Lenotropites caurus (McLearn)
Grambergia mackenzii (McLearn)
Discogymnites hollandi (McLearn)

GSC loc. 74735. Lower Anisian, Caurus Zone. Toad Formation, section as for GSC locality 74732, south side of First Canyon, 5.8 m above GSC locality 74732; E.T. Tozer, 1966.

Lenotropites caurus (McLearn)

GSC loc. 74736. Middle Anisian, Hagei Zone. Toad Formation, section as for GSC locality 74732, south side of First Canyon, 7.3 m above GSC locality 74732; E.T. Tozer, 1966.

Stenopopanoceras angulatum n. sp.
Intornites intornatus (McLearn)
Hollandites dieneri n. sp.
Buddhaites hagei (McLearn)

GSC loc. 74737. Middle Anisian, Hayesi Zone. Toad Formation, section as for GSC locality 74732, south side of First Canyon, 9.7 m above GSC locality 74732; E.T. Tozer, 1966.

Amphipopanoceras selwyni (McLearn)
Intornites intornatus (McLearn)
Tetsaoceras hayesi (McLearn)
Anagymnotoceras varium (McLearn)

GSC loc. 74738. Middle Anisian, Hayesi Zone. Toad Formation, probably the same bed as GSC locality 74737, section on north side of Chischa River below waterfall in western part of First Canyon, 9.5 km above Muskwa River, NTS Chischa River 94 J/12; E.T. Tozer, 1966.

Nicomedites moderatus (McLearn)

GSC loc. 74739. Middle Anisian, Hagei Zone. Toad Formation, section as for GSC locality 74738, probably the same bed as GSC locality 74736, north side of First Canyon, 2.7 m below GSC locality 74738; E.T. Tozer, 1966.

Hollandites dieneri n. sp.
Buddhaites hagei (McLearn)

GSC loc. 74740. Lower and Middle Anisian, Caurus and Hagei Zones. Toad Formation, from 1 m bed,

section as for GSC locality 74738, north side of First Canyon, 4.2 m below GSC locality 74738; E.T. Tozer, 1966.

Pearylandites peregrinus n. sp.
Grambergia mackenzii (McLearn)
Intornites mactaggarti (McLearn)
Japonites wrighti n. sp.
Discogymnites hollandi (McLearn)

GSC loc. 74741. Lower Anisian, Caurus Subzone 2. Toad Formation, section as for GSC locality 74738, probably the same bed as GSC locality 74733; E.T. Tozer, 1966.

Groenlandites amplus n. sp.
Grambergia mackenzii (McLearn)

GSC loc. 74742. Lower Anisian, Caurus Zone. Toad Formation, section as for GSC locality 74738, north side of First Canyon, 8.2 m below GSC locality 74738; E.T. Tozer, 1966.

Lenotropites tardus McLearn

GSC loc. 74748. Ladinian, Meginae Zone. Toad Formation, Hage Creek, north side of Mount Wooliever, NTS Marion Lake 94 G/3; E.T. Tozer, 1966. Locality 6, (McLearn and Kindle, 1950, p. 37, 46; Tozer, 1967, p. 67) (=GSC loc. 10790).

Protrachyceras sikanianum McLearn
Meginoceras tetsa (McLearn)
Silenticeras bamberi n. sp.
Lobites pacianus McLearn

GSC loc. 74755. Ladinian, Poseidon Zone. Toad Formation, about 170 m below Maclearni Zone (GSC loc. 50042), section in west gully, south side of Mount Withrow, NTS Marion Lake 94 G/3; E.T. Tozer, 1966.

Indigirites freboldi n. sp.

GSC loc. 74757. Ladinian, Poseidon Zone. Toad Formation, talus, Mount Withrow, probably from GSC locality 74755; E.T. Tozer, 1966.

Tuchodiceras poseidon (Tozer)

GSC loc. 74758. Ladinian, Poseidon Zone. Toad Formation, about 190 m below Maclearni Zone (GSC loc. 50042), section as for GSC locality 74755, west gully Mount Withrow, NTS Marion Lake 94 G/3; E.T. Tozer, 1966.

Eonathorstites dieneri n. sp.
Ptychites hamatus n. sp.
Protrachyceras sikanianum McLearn
Metatirolites withrowi n. sp.

GSC loc. 74762. Ladinian, Poseidon Zone. Toad Formation. *Monophyllites* bed, about 60 m below *Drumoceras* beds (GSC locs. 74765, 74766), section in east gully, south side of Mount Withrow, NTS Marion Lake 94 G/3; E.T. Tozer, 1966.

Monophyllites aonis Mojsisovics

GSC loc. 74765. Ladinian, Meginae Subzone 2. Toad Formation, lower *Drumoceras* bed, section as for GSC locality 74762, east gully, Mount Withrow; E.T. Tozer, 1966.

Indigirites boehmi n. sp.
Drumoceras anodosum n. sp.

GSC loc. 74766. Ladinian, Meginae Subzone 2. Toad Formation, upper *Drumoceras* bed, section as for GSC locality 74762, east gully, Mount Withrow; E.T. Tozer, 1966.

Indigirites boehmi n. sp.
Meginoceras meginae McLearn
Drumoceras tuberculatum n. sp.

GSC loc. 74767. Ladinian, Meginae Subzone 3. Toad Formation. *Meginoceras aylardi* bed, about 9 m above upper *Drumoceras* bed (GSC loc. 74766), section as for GSC locality 74762, east gully, Mount Withrow; E.T. Tozer, 1966.

Indigirites boehmi n. sp.
Meginoceras aylardi (McLearn)

GSC loc. 74768. Ladinian, Meginae Subzone 2. Toad Formation, about 30 m below Maclearni Zone (GSC loc. 50042), section as for GSC locality 74755, west gully, Mount Withrow; E.T. Tozer, 1966.

Indigirites boehmi n. sp.
Drumoceras tuberculatum n. sp.

GSC loc. 74769. Ladinian, Meginae Subzone 1. Toad Formation, about 58 m below Maclearni Zone (GSC loc. 50042), section as for GSC locality 74755, west gully, Mount Withrow; E.T. Tozer, 1966.

Meginoceras triviale n. sp.

GSC loc. 74772. Ladinian, Sutherlandi Subzone 2. Toad Formation, Fourth Gully, Mount Wright (McLearn and Kindle, 1950, p. 49), south side of Mount Stearns, NTS Mount Laurier 94 B/14; E.T. Tozer, 1966.

Nathorstites macconnelli (Whiteaves)

GSC loc. 74773. Ladinian, Sutherlandi Subzone 2. Toad Formation, Third Gully, Mount Wright (McLearn and Kindle, 1950, p. 49), south side of Mount Stearns, NTS Mount Laurier 94 B/14; E.T. Tozer, 1966.

Nathorstites macconnelli (Whiteaves)
Frankites sutherlandi (McLearn)

GSC loc. 74774. Ladinian, Sutherlandi Subzone 2. Toad Formation, Third Gully, Mount Wright (McLearn and Kindle, 1950, p. 49), south side of Mount Stearns, NTS Mount Laurier 94 B/14; E.T. Tozer, 1966.

Nathorstites macconnelli (Whiteaves)

GSC loc. 74775. Middle Norian, Columbianus Subzone 2. Pardonet Formation 25 m above base, section in First Gully, Mount Wright (McLearn and Kindle, 1950, p. 56), south side of Mount Stearns, NTS Mount Laurier 94 B/14; E.T. Tozer, 1966.

Mesohimavatites columbianus (McLearn)

GSC loc. 74776. Middle Norian, Columbianus Subzone 3. Pardonet Formation, 28 m above base, section as for GSC locality 74755; E.T. Tozer, 1966.

Alloclionites jeanneti n. sp.
Episculites wrighti n. sp.

GSC loc. 74777. Middle Norian, Columbianus Subzone 3. Pardonet Formation, 30 m above base, section as for GSC locality 74775; E.T. Tozer, 1966.

Neohimavatites peregrinus n. sp.
Leislingites quadratus n. sp.

GSC loc. 79255. Upper Carnian, Dilleri Zone? Karmutsen Group, south of Crescent Beach, Texada Island, 49°45′25″N, 124°37′40″W, NTS Powell River 92 F/15; J.E. Muller, 1967.

Shastites vulcanus n. sp.

GSC loc. 79257. Upper Carnian, Dilleri Zone? Karmutsen Group, between Mouat and Davie bays, Texada Island. 49°37′02″N, 124°25′40″W, NTS Texada Island 92 F/9; J.E. Muller, 1967.

Shastites vulcanus n. sp.

GSC loc. 79383. Ladinian, Sutherlandi Subzone 2. Toad Formation, section as for GSC localities 68277 and 68279 (Tuchodi Bluff), probably from GSC locality 68279; D.W. Gibson, 1967.

Muensterites glaciensis (McLearn)

GSC loc. 79387. Lower Carnian, Nanseni Zone. Ludington Formation, 28 km south 38 km east of Mount Rothenburg, NTS Eight Mile Creek 94 N/3; D.W. Gibson, 1967.

Sirenites nanseni Tozer

GSC loc. 82452. Lower Norian, Magnus Subzone 2. Pardonet Formation, unit 43, section 1 (Gibson, 1971, p. 36), south of Halfway River, 56°56′50″N, 123°24′30″W, NTS Mount Laurier 94 B/14; E.T. Tozer, 1968 (=GSC loc. 82663).

Dimorphotoceras caurinum (McLearn)
Dimorphotoceras ursinum n. sp.
Indojuvavites falcatus n. sp.
Juvavites magnus McLearn
Juvavites concretus McLearn
Juvavites biornatus McLearn
Juvavites levigatus n. sp.

GSC loc. 82454. Middle Norian, Columbianus Subzone 2 or 3. Pardonet Formation, unit 44, section as for GSC locality 82452, south of Halfway River; E.T. Tozer, 1968 (=GSC loc. 82662).

Parajuvavites canadensis n. sp.

GSC loc. 82455. Middle Norian, Columbianus Subzone 3. Pardonet Formation, unit 44, section as for GSC localities 82452 and 82454, 0.6 m above GSC locality 82454; E.T. Tozer, 1968.

Pseudosirenites bullatus n. sp.
Neohimavatites canadensis (McLearn)
Leislingites politus n. sp.

GSC loc. 82608. Smithian, Romunderi Zone. Toad Formation, from lower 3 m of unit 1, section 4 (Gibson, 1971, p. 58), east spur of Mount Ludington, NTS Nabesche River 94 B/6; D.W. Gibson, 1968.

Euflemingites cirratus (White)

GSC loc. 82609. Smithian, Tardus Zone. Toad Formation, section as for GSC locality 82608, about 18 m above GSC locality 82608; D.W. Gibson, 1968.

Anasibirites crickmayi Mathews

GSC loc. 82612. Ladinian, Sutherlandi Subzone 2. Toad Formation, unit 11, section as for GSC locality 82608; D.W. Gibson, 1968.

Asklepioceras laurenci McLearn

GSC loc. 82645. Ladinian, Sutherlandi Subzone 2. Toad Formation, 56°40′N, 123°17′W, NTS Christina Falls 94 B/11; D.W. Gibson, 1968.

Nathorstites macconnelli (Whiteaves)
Asklepioceras laurenci McLearn
Frankites sutherlandi (McLearn)
Lobites ellipticus (Hauer).

GSC loc. 82662. Middle Norian, Columbianus Subzone 2 or 3. Pardonet Formation, unit 44, section 1 (Gibson 1971, p. 36), south of Halfway River, 56°56′50″N, 123°24′30″W, NTS Mount Laurier 94 B/14; D.W. Gibson, 1968 (=GSC loc. 82454).

Parajuvavites canadensis n. sp.

GSC loc. 82663. Lower Norian, Magnus Subzone 2. Pardonet Formation, unit 43, section as GSC locality 82662, south of Halfway River; D.W. Gibson, 1968.

Juvavites magnus McLearn

GSC loc. 82852. Upper Carnian, Dilleri Zone. Quatsino Limestone or Karmutsen Group, Hisnit Islands, 50°10′02″N, 127°28′23″W, west coast of Vancouver Island, NTS Kyuquot 92 L/3; J.E. Muller, 1968 (Probably = GSC locs. 23147, 23939).

Hisnitites janmulleri n. sp.
Pleurotropites gracilis (Smith)
Pleurotropites sp. indet.

GSC loc. 82936. Upper Carnian, Welleri Subzone 1. Quatsino Limestone, southeast side of cove in Klaskino Inlet 1.5 km northwest of Mocino Point, Vancouver Island, NTS Neroutsos 92 L/5; J.A. Jeletzky, 1968.

Pamphagosirenites pacificus n. sp.
Trachysagenites sp. indet.
Tropites izardi n. sp.
Tardeceras parvum Hyatt and Smith
Bacchites hyatti (Smith)
Projuvavites brockensis (Smith)

GSC loc. 82974. Upper Norian, Amoenum Zone. Parson Bay Formation, near-shore reef 0.8 km northnortheast of Mushroom Point, 49°56′05″N, 127°13′20″W, NTS Port Eliza 92 E/14; J.E. Muller, 1968.

Sagenites sp. indet.

GSC loc. 83816. Upper Norian, Cordilleranus Subzone 2. Pardonet Formation, *Monotis ochotica* beds, 1.5 m below contact with Bocock Formation, upper part of unit 34, section 7 (Gibson, 1971, p. 74), near summit of ridge between headwaters of Ducette and Eleven Mile Creeks, 55°47′30″N, 122°56′10″W, NTS Carbon Creek 93 O/15; E.T. Tozer, 1969.

Lissonites canadensis Tozer

GSC loc. 83817. Upper Norian, Cordilleranus Subzone 2. Pardonet Formation, loose block derived from GSC locality 83816; E.T. Tozer 1969.

Lissonites canadensis Tozer
Lissonites pecki n. sp.

GSC loc. 83818. Upper Norian, Cordilleranus Subzone 2. Pardonet Formation, loose block derived from GSC locality 83816; E.T. Tozer, 1969.

Lissonites canadensis Tozer

GSC loc. 83824. Lower Carnian, Desatoyense Zone. Liard Formation, about 560 m above base of Triassic section, ridge 4 km northeast of Clearwater Lake, NTS Callazon Creek NTS 93 O/10; E.T. Tozer, 1969. Probably the same bed as GSC locality 45751.

Stolleyites sp. indet.
Clionitites callazonensis n. sp.
Clionitites reesidei (Johnston)
Daxatina limpida n. sp.
Coroceras sp. indet.

GSC loc. 83826. Lower Norian, Kerri Subzone 1. Pardonet Formation, about 4.5 m above base, near head of Carbon Creek, 55°43′N, 122°52′W, NTS Callazon Creek 93 O/10; E.T. Tozer, 1969. Probably the same bed as GSC locality 42444.

Pinacoceras sp. indet.
Pterosirenites auritus Tozer
Gonionotites spiekeri McLearn
Griesbachites pinensis n. sp.
Guembelites clavatus (McLearn)
Dimorphites pardonetiensis McLearn

GSC loc. 83828. Upper Norian, Cordilleranus Subzone 2. Pardonet Formation, *Monotis ochotica* beds, near contact with Bocock Formation, about 6.5 km northeast of Bocock Peak, NTS Carbon Creek 93 O/15; E.T. Tozer, 1969.

Lissonites canadensis n. sp.

GSC loc. 83829. Lower Norian, Magnus Subzone 2. Pardonet Formation, 53.0 m below contact with Fernie Group, section 5 (Gibson, 1971, p. 66), Crying Girl Prairie Creek, 1.6 km northeast of Graham River, NTS Hackney Hills, 94 B/7; E.T. Tozer, 1969.

Sirenotibetites cornutus n. sp.
Juvavites magnus McLearn
Juvavites concretus McLearn
Juvavites levigatus n. sp.

GSC loc. 83830. Lower Norian, Magnus Zone. Pardonet Formation, 51.8 m below contact with Fernie Group, section as for GSC locality 83829 (Crying Girl); E.T. Tozer, 1969.

Neotibetites minor n. sp.

GSC loc. 83831. Middle Norian, Rutherfordi Zone. Pardonet Formation, 50.6 m below contact with Fernie Group, section as for GSC locality 83829 (Crying Girl); E.T. Tozer, 1969.

Cyrtopleurites bicrenatus (Hauer)
Drepanites rutherfordi McLearn

GSC loc. 83834. Middle Norian, Columbianus Subzone 2. Pardonet Formation, 43.3 m below contact with Fernie Group, section as for GSC locality 83829 (Crying Girl); E.T. Tozer, 1969. (= GSC loc. 97555).

Mesohimavatites parvus n. sp.

GSC loc. 83835. Middle Norian, Columbianus Subzone 1b. Pardonet Formation, 44.2 m below contact with Fernie Group, section as for GSC locality 83829 (Crying Girl); E.T. Tozer, 1969.

Pseudosirenites pardoneti (McLearn)
Himavatites planiplicatus n. sp.
Distichites columbianus n. sp.
Distichites gethingi McLearn
Eothetidites lacrimosus n. sp.
Parathisbites oineus McLearn

GSC loc. 83836. Middle Norian, Rutherfordi Zone. Pardonet Formation, talus, Crying Girl Prairie Creek, probably from GSC localities 83831 or 83849; E.T. Tozer, 1969.

Drepanites rutherfordi McLearn
Didymites quenstedti Mojsisovics

GSC loc. 83838. Middle Norian, Rutherfordi Zone. Pardonet Formation, unit 21, section 9 (Gibson, 1971, p. 95), west side of ridge east of headwaters of Carbon Creek, 55°41′30″N, 122°46′00″W, NTS Callazon Creek 93 O/10; E.T. Tozer, 1969.

Cyrtopleurites hersiliae Diener

GSC loc. 83847. Middle Norian, Columbianus Subzone 4. Pardonet Formation, *Eomonotis pinensis* beds, 33.8 m below contact with Fernie Group, section as for GSC locality 83829; E.T. Tozer, 1969.

Mesohimavatites caponicus n. sp.?

GSC loc. 83848. Middle Norian, Columbianus Subzone 3. Pardonet Formation, *Eomonotis typica* beds, 41.1 m below contact with Fernie Group, section as for GSC locality 83829 (Crying Girl); E.T. Tozer, 1969.

Leislingites politus n. sp.

GSC loc. 83849. Middle Norian, Rutherfordi Zone. Pardonet Formation, 49.7 m below contact with Fernie Group, section as for GSC locality 83829 (Crying Girl); E.T. Tozer, 1969.

Cyrtopleurites bicrenatus (Hauer)
Drepanites rutherfordi McLearn

GSC loc. 83850. Middle Norian, Rutherfordi Zone. Pardonet Formation, talus in Crying Girl Prairie Creek, probably from GSC locality 83831; E.T. Tozer, 1969.

Drepanites rutherfordi McLearn
Didymites quenstedti Mojsisovics

GSC loc. 83852. Upper Anisian, Chischa Zone. Sulphur Mountain Formation, Llama Member, loose block, section on east limb of syncline 18 km northwest of Wapiti Lake, 54°41′30″N, 120°59′45″W, NTS Wapiti Lake 93 I/10; E.T. Tozer, 1969.

Frechites chischa (Tozer)
Ptychites hamatus n. sp.

GSC loc. 83860. Ladinian, Poseidon Zone. Sulphur Mountain Formation, Llama Member, section on east limb of syncline 18 km northwest of Wapiti Lake, 54°41′30″N, 120°59′45″W, NTS Wapiti Lake 93 I/10; E.T. Tozer, 1969.

Tuchodiceras poseidon (Tozer)

GSC loc. 83861. Ladinian, Poseidon Zone. Sulphur Mountain Formation, Llama Member, loose block from GSC locality 83860, section northwest of Wapiti Lake; E.T. Tozer, 1969.

Tuchodiceras poseidon (Tozer)
Protrachyceras sikanianum McLearn

GSC loc. 83862. Ladinian, Matutinum Zone. Sulphur Mountain Formation, about 45 m below GSC locality 83860 (Poseidon Zone), section as for GSC locality 83860, northwest of Wapiti Lake; E.T. Tozer, 1969.

Pleurofrechites fellersi n. sp.
Eoprotrachyceras matutinum Tozer

GSC loc. 83867. Upper Anisian, Chischa Zone. Sulphur Mountain Formation, about 6 m below GSC locality 83862 (Matutinum Zone), section as for GSC locality 83860, northwest of Wapiti Lake; E.T. Tozer, 1969.

Pleurofrechites lineatus n. sp.
Ptychites hamatus n. sp.

GSC loc. 83868. Lower Carnian, Desatoyense Zone. Liard Formation, section on east spur of Mountain (Triangulation Station 5969), 4 km northeast of Clearwater Lake, 55°38′30″N, 122°50′30″W, NTS Callazon Creek 93 O/10; E.T. Tozer, 1969.

Daxatina limpida n. sp.

GSC loc. 83870. Lower Carnian, Desatoyense Zone. Liard Formation, 67 m above GSC locality 83868, northeast of Clearwater Lake; E.T. Tozer, 1969.

Silenticeras involutum n. sp.

GSC loc. 83872. Lower Carnian, Desatoyense Zone. Liard Formation, 135 m above GSC locality 83868, northeast of Clearwater Lake; E.T. Tozer, 1969.

Trachyceras aonoides Mojsisovics

GSC loc. 83873. Middle Anisian, Minor Zone. Sulphur Mountain Formation, loose concretion on bed near base of Whistler Member, section 2.4 km northeast of

south end of Hook Lake, NTS Kinuseo Falls 93 I/14; E.T. Tozer, 1969.

Intornites williamsi n. sp.
Ptychites guloensis n. sp.

GSC loc. 83874. Upper Anisian, Chischa Zone. Sulphur Mountain Formation, Llama Member, loose block from bed about 15 m above base of member, section as for GSC locality 83873, Hook Lake; E.T. Tozer, 1969.

Pleurofrechites lineatus n. sp.

GSC loc. 83875. Upper Anisian, Chischa Zone. Sulphur Mountain Formation, Llama Member, loose block from bed about 15 m above base of member, section as for GSC locality 83873, Hook Lake; E.T. Tozer, 1969.

Parapopanoceras malmgreni (Lindstroem)
Longobardites murrayensis n. sp.
Frechites chischa (Tozer)
Pleurofrechites subsidens n. sp.
Ptychites hamatus n. sp.
Tozerites polygyratus (Smith)

GSC loc. 83878. Upper Anisian, Chischa Zone. Sulphur Mountain Formation, Llama Member, loose block from bed about 15 m above base of member, section as for GSC locality 83873, Hook Lake; E.T. Tozer, 1969.

Ptychites hamatus n. sp.

GSC loc. 83882. Upper Anisian, Chischa Zone. Sulphur Mountain Formation, Llama Member, about 14.5 m above base of member, section as for GSC locality 83873, Hook Lake; E.T. Tozer, 1969. Probably the same bed as GSC locality 45655.

Frechites hamatus n. sp.
Pleurofrechites lineatus n. sp.

GSC loc. 83883. Upper Anisian, Chischa Zone. Sulphur Mountain Formation, Llama Member, about 15 m above base of member, section as for GSC locality 83873, Hook Lake; E.T. Tozer, 1969.

Pleurofrechites lineatus n. sp.

GSC loc. 83884. Upper Anisian, Chischa Zone. Sulphur Mountain Formation, Llama Member, about 17 m above base of member, section as for GSC locality 83873, Hook Lake; E.T. Tozer, 1969.

Pleurofrechites lineatus n. sp.

GSC loc. 83889. Upper Anisian, Chischa Zone. Sulphur Mountain Formation, Llama Member, loose block, probably from GSC locality 83884; E.T. Tozer, 1969.

Pleurofrechites lineatus n. sp.

GSC loc. 83890. Upper Anisian, Chischa Zone. Sulphur Mountain Formation, Llama Member, loose block from bed about 15 m above base of member, section as for GSC locality 83873, Hook Lake; E.T. Tozer, 1969.

Parapopanoceras malmgreni (Lindstroem)
Longobardites murrayensis n. sp.
Frechites chischa (Tozer)
Paranevadites sp. indet.

GSC loc. 83892. Lower Norian, Dawsoni Subzone 2. Pardonet Formation, on ridge below summit of mountain on spur of Mount Laurier, 2.8 km southeast of Mount Laurier summit, NTS Mount Laurier 94 B/14; E.T. Tozer, 1969.

Malayites dawsoni McLearn

GSC loc. 83894. Lower Norian, Magnus Subzone 1. Pardonet Formation, locality as for GSC locality 83892, from stratigraphically higher beds; E.T. Tozer, 1969.

Indojuvavites laurieri n. sp.

GSC loc. 83896. Middle Norian, Rutherfordi Zone. Pardonet Formation, 3.2 km north of Carbon Peak, NTS Jones Peak 94 B/2; G. C. Taylor, 1969.

Metaclionites taylori n. sp.
Hauerites piceus n. sp.

GSC loc. 84198. Lower Norian, Kerri Subzone 2. Pardonet Formation, from basal metre, unit 16, section 9 (Gibson, 1971a, p. 95), headwaters of east fork Carbon Creek, 55°41′30″N, 122°46′15″W, NTS Callazon Creek 93 O/10; D.W. Gibson, 1969.

Metathisbites dawsoni (McLearn)
Guembelites jandianus Mojsisovics

GSC loc. 84200. Lower Carnian, Obesum Zone. Liard Formation, unit 40, section 8 (Gibson, 1971a, p. 82), ridge about 6 km north of Clearwater Lake, 55°40′15″N, 122°55′W, NTS Callazon Creek 93 O/10; D.W. Gibson, 1969.

Austrotrachyceras obesum (Tozer)

GSC loc. 84212. Lower Carnian, Desatoyense Zone. Liard Formation, unit 23, section as for GSC locality 84200, north of Clearwater Lake, 214 m stratigraphically below GSC locality 84200 (Obesum Zone); D.W. Gibson, 1969.

Trachyceras desatoyense Johnston

GSC loc. 84219. Ladinian, Maclearni Subzone 3. Sulphur Mountain Formation, Llama Member, 237 m above Permian, bluff at headwaters of Lean-to Creek,

55°04′30″N, 121°59′45″W, NTS Sukunka River 93 P/4; D.W. Gibson and E.T. Tozer, 1969.

Hungarites inermis n. sp.
Anolcites anguinus n. sp.

GSC loc. 84220. Ladinian, Poseidon Zone. Sulphur Mountain Formation, Llama Member, 196 m above Permian, section as for GSC locality 84219 (Lean-to Creek); D.W. Gibson, 1969.

Tuchodiceras poseidon (Tozer)

GSC loc. 84246. Ladinian, Meginae Zone. Sulphur Mountain Formation, Llama Member, unit 22, section 3 (Gibson, 1972, p. 56), west side of cirque valley below Watson Peak, 55°14′15″N, 122°06′15″W, NTS Mount Reynolds 93 O/1; D.W. Gibson, 1969.

Protrachyceras sikanianum McLearn
Silenticeras bamberi n. sp.

GSC loc. 84247. Ladinian, Poseidon Zone. Sulphur Mountain Formation, Llama Member, unit 20, section as for GSC locality 84246, Watson Peak, 38 m below GSC locality 84246 (Meginae zone); D.W. Gibson, 1969.

Tuchodiceras poseidon (Tozer)

GSC loc. 84250. Ladinian, Poseidon Zone. Sulphur Mountain Formation, Llama Member, unit 20, section as for GSC locality 84246, Watson Peak, 29 m below GSC locality 84246 (Meginae zone); D.W. Gibson, 1969.

Tuchodiceras poseidon (Tozer)

GSC loc. 84262. Ladinian, Sutherlandi Zone, subzone 2. Sulphur Mountain Formation, Llama Member, ridge between headwaters of Brazion Creek and North Burnt River, 55°19′00″N, 122°13′56″W, NTS LeMoray Creek 93 O/8; D.W. Gibson, 1969.

Frankites sutherlandi (McLearn)

GSC loc. 84264. Ladinian, Meginae Zone. Sulphur Mountain Formation, Llama Member, section as for GSC locality 84262, Brazion Creek, from lower stratigraphic level; D.W. Gibson, 1969.

Protrachyceras sikanianum McLearn
Silenticeras bamberi n. sp.

GSC loc. 84265. Ladinian, Sutherlandi Subzone 2. Sulphur Mountain Formation, Llama Member, unit 14, section 1 (Gibson, 1972, p. 34), ridge above small pond on northeast side of mountain near headwaters of North Burnt River, 55°17′45″N, 122°09′45″W, NTS LeMoray Creek 93 O/8; D.W. Gibson, 1969.

Nathorstites macconnelli (Whiteaves)
Frankites sutherlandi (McLearn)
Daxatina canadensis (Whiteaves)

GSC loc. 84267. Lower Carnian, Desatoyense Zone. Liard Formation, unit 4, section 10 (Gibson, 1971a, p. 102), 76 m above base of section, cliff face east of Callazon Creek, 55°35′30″N, 122°45′15″W, NTS Callazon Creek 93 O/10; D.W. Gibson, 1969.

Badiotites scapulatus n. sp.

GSC loc. 84268. Lower Carnian. Liard Formation, unit 2, section as for GSC locality 84267, Callazon Creek, 50 m above base of section; D.W. Gibson, 1969.

Trachyceras? sp. indet.

GSC loc. 84269. Lower Carnian, Desatoyense Zone. Liard Formation, unit 3, section as for GSC locality 84267, Callazon Creek, 67 m above base of section; D.W. Gibson, 1969.

Trachyceras desatoyense Johnston

GSC loc. 84271. Lower Carnian, Desatoyense Zone. Liard Formation, unit 2, section as for GSC locality 84267, Callazon Creek, 44 m above base of section; D.W. Gibson, 1969.

Protrachyceras? sp.
Clionitites callazonensis n. sp.
Clionitites reesidei (Johnston)
Daxatina limpida n. sp.

GSC loc. 85533. Ladinian, Subasperum Zone. Sulphur Mountain Formation, Llama Member, unit 16, section 10 (Gibson, 1972, p. 103), ridge at west end of Casket Mountain, 53°49′N, 119°58′30″W, NTS Dry Canyon 83 E/13; D.W. Gibson, 1970.

Pleurofrechites fellersi n. sp.
Eoprotrachyceras gibsoni n. sp.

GSC loc. 85547. Smithian, Tardus Zone. Sulphur Mountain Formation, Vega-Phroso Member, unit 8, section 8 (Gibson, 1972, p. 87), Meosin Mountain, NTS Narraway River 93 I/8; D.W. Gibson, 1970.

Anasibirites crickmayi Mathews

GSC loc. 85548. Middle Anisian, Hayesi Zone. Sulphur Mountain Formation, Whistler Member, unit 14, section 8 (Gibson, 1972, p. 87), Meosin Mountain, NTS Narraway River 93 I/8; D.W. Gibson, 1970.

Amphipopanoceras selwyni (McLearn)
Anagymnotoceras varium (McLearn)

GSC loc. 85550. Upper Anisian, Chischa Zone. Sulphur Mountain Formation, Llama Member, unit 17, section as GSC locality 85548; D.W. Gibson, 1970.

Parapopanoceras sp. indet.
Frechites chischa (Tozer)

GSC loc. 85556. Dienerian, Sverdrupi Zone. Sulphur Mountain Formation, Vega-Phroso Member, 4.5 m above base of unit 4, section 6 (Gibson, 1972, p. 73), Mount Becker, 54°30′45″N, 120°39′30″W, NTS Wapiti Lake 93 I/10; D.W. Gibson, 1970.

Xenodiscoides calnani n. sp.

GSC loc. 85588. Ladinian, Meginae Subzone 1. Sulphur Mountain Formation, Llama Member, unit 15, section 5 (Gibson, 1972, p. 67), 6.5 km east of south end of Hook Lake, NTS Kinuseo Falls 93 I/14; D.W. Gibson, 1970.

Eosagenites gethingi (McLearn)
Protrachyceras sikanianum McLearn
Meginoceras triviale n. sp.
Silenticeras gibsoni n. sp.

GSC loc. 86284. Upper Carnian, Welleri Subzone 1. Quatsino Limestone, about 53 m above base, southeast side of cove north of Klaskino Inlet, 1.5 km northeast of Mocino Point, Vancouver Island, NTS Neroutsos 92 L/5; E.T. Tozer, 1970. Probably the same bed as GSC localities 53340 and 82936.

Pamphagosirenites pacificus n. sp.
Tardeceras parvum Hyatt and Smith
Projuvavites brockensis (Smith)

GSC loc. 86293. Upper Carnian, Dilleri Zone. Quatsino Limestone, about 40 m above base, about 13 m below GSC locality 86284 (Welleri Zone); E.T. Tozer, 1970.

Tropites dilleri Smith
Pleurotropites gabbi (Smith)
Indonesites sphaericus (Smith)

GSC loc. 88732. Dienerian, Candidus Zone. Grayling Formation, about 35 m above base, tributary of Tuchodi River, 58°22′00″W, 124°19′50″W, NTS Chlotapecta Creek 94 K/8; U. Wissner, 1961. Probably the same bed as GSC localities 68273 or 68274.

Pleurambites frechi n. sp.
Ambites fuliginatus n. sp.
Ambites wissneri n. sp.

GSC loc. 88733. Dienerian, Candidus Zone. Grayling Formation, talus from GSC locality 88732; U. Wissner, 1961.

Ambites fuliginatus n. sp.

GSC loc. 89548. Middle Anisian, Hayesi Zone. Toad Formation, Toad River, 59°11′N, 124°43′W, NTS Scaffold Creek 94 N/2; U. Wissner, 1959.

Amphipopanoceras medium McLearn
Intornites intornatus (McLearn)
Tetsaoceras hayesi (McLearn)
Anagymnotoceras varium (McLearn)
Nicomedites moderatus (McLearn)
Gymnites? *perplanus* (Meek)

GSC loc. 89675. Smithian, Hedenstroemi Zone. Blind Fiord Formation, 46 m below 4 m gabbro sill, northeast side of Griesbach Creek, Axel Heiberg Island, NTS Bukken Fiord, 560 A; Canada Cities Service Ltd., 1972. Evidently about 25 m below GSC locality 64792 (Romunderi Zone).

Hedenstroemia hedenstroemi (Keyserling)

GSC loc. 89714. Upper Carnian, Welleri Subzone 1. Blaa Mountain Formation, section on east side of Thompson Glacier, Axel Heiberg Island, NTS Strand Fiord 59 H; Canada Cities Services Ltd., 1972.

Arctosirenites canadensis Tozer

GSC loc. 89716. Upper Carnian, Welleri Zone. Blaa Mountain Formation, section as for GSC locality 89714, Thompson Glacier, about 100 m above GSC locality 89714.

Paratropites arcticus n. sp.

GSC loc. 89782. Ladinian, Meginae Zone. Toad Formation, hill south of Muskwa River, 57°53′N, 123°54′W, NTS Kluachesi Lake 94 G/13; E.W. Bamber.

Silenticeras bamberi n. sp.

GSC loc. 89783. Ladinian, Sutherlandi Subzone 2. Liard Formation, 30 m below Cretaceous contact, north side of Liard River, 3.2 km above Hell Gate Rapids, NTS Grayling River 94 N/6, section as for GSC locality 42350; Shell Oil Company, 1959.

Frankites sutherlandi (McLearn)
Daxatina megabrotheus n. sp.

GSC loc. 89784. Ladinian, Sutherlandi Subzone 2. Liard Formation, 15 m below Cretaceous contact, section as for GSC locality 89783 (42350); Shell Oil Company, 1959.

Zestoceras enode (Tozer)

GSC loc. 90808. Lower Norian, Kerri Zone. Nicola Group, from a 4–5 m lens of massive limestone interbedded with andesite, 1.7 km north 49 km west of centre of Hamilton Lake, 50°06′34″N, 120°39′01″W, NTS Merritt, 92 I/2; V. Preto, 1973 (Preto, 1979, p. 35).

Tibetitid, n. gen.

GSC loc. 91845. Lower Norian, Kerri Zone. Nicola Group, 2.15 km north 44 km west of centre of Hamilton Lake, 50°06′45″N, 120°39′08″W, NTS Merritt, 92 I/2; V. Preto and K. E. Northcote, 1974 (Preto, 1979, p. 35).

Stikinoceras kerri McLearn

GSC loc. 91897. Upper Carnian, Dilleri Zone. Nicola Group, near Basque, 50°35′N, 121°17′W, NTS Ashcroft 92 I/11; W.J. McMillan, 1975 (McMillan, 1974).

Spirogmoceras shastense (Smith).

GSC loc. 91898. Upper Carnian, Dilleri Zone. Nicola Group, near Basque, 50°35′N, 121°17′W, NTS Ashcroft 92 I/11; W.J. McMillan, 1975.

Spirogmoceras shastense (Smith)
Pleurotropites gabbi (Smith)

GSC loc. 94736. Upper Carnian, Welleri Subzone 1. Ludington Formation, 1.5 km north 77 km west of Mount Laurier Summit, NTS Mount Robb 94 B/13; E.T. Tozer, 1976.

Discotropites smithi Kutassy
Jovites ellipticus n. sp.
Projuvavites sp.

GSC loc. 94738. Upper Carnian, Macrolobatus Zone. Ludington Formation, spur of Mount Laurier, 4.2 km north 76 km east of Mount Laurier summit, NTS Mount Laurier, 94 B/14; E.T. Tozer, 1976.

Anatropites cupressus n. sp.
Anatropites maclearni n. sp.
Anatropites silberlingi n. sp.
Anatropites ausoniformis n. sp.
Gonionotites avarus n. sp.

GSC loc. 94741. Lower Norian, Kerri Subzone 2. Pardonet Formation, section on northwest spur of peak 9500, south 62E of Mount Laurier summit, NTS Mount Laurier West, 94 B/14; E.T.Tozer, 1976.

Stikinoceras kerri McLearn
Gonionotites rarus McLearn

GSC loc. 95027. Upper Norian, Amoenum Zone. Stuhini Formation, Klastline River, 5.5 km southeast of Tsazia Mountain, NTS Klastline River, 104 G/16; H.W. Tipper, 1977.

Peripleurites roemeri Mojsisovics
Paracochloceras suessi Mojsisovics

GSC loc. 97524. Lower Norian, Kerri Subzone 2. Pardonet Formation, *Stikinoceras* bed, west slope, west spur of Brown Hill, NTS Jones Peak 94 B/2; E.T. Tozer party, 1980 (=GSC loc. 64654).

Stikinoceras kerri McLearn
Griesbachites borealis n. sp.

GSC loc. 97525. Middle Norian, Columbianus Subzone 1. Pardonet Formation, 40.3 m above base, section on north shore of Williston Lake, Peace River, at Brown Hill, immediately east of Tepee Rocks Coulee, NTS Jones Peak 94 B/2; E.T. Tozer party, 1980.

Himavatites sp. indet.
Parathisbites oineus McLearn

GSC loc. 97526. Middle Norian, Columbianus Subzone 1. Pardonet Formation, 39.7 m above base, section as for GSC locality 97525, Brown Hill; E.T. Tozer party, 1980.

Himavatites sp. indet.
Parathisbites oineus McLearn

GSC loc. 97528. Middle Norian, Columbianus Subzone 1. Pardonet Formation, 38.2 m above base, section as for GSC locality 97525, Brown Hill; E.T. Tozer, party, 1980.

Ectolcites childerhosei n. sp.
Himavatites sp. indet.
Eothetidites lacrimosus n. sp.

GSC loc. 97529. Middle Norian, Rutherfordi Zone. Pardonet Formation, 37.0 m above base, section as for GSC locality 97525, Brown Hill; E.T. Tozer party, 1980.

Cyrtopleurites bicrenatus (Hauer)
Hauerites astrictus n. sp.
Didymites quenstedti Mojsisovics

GSC loc. 97530. Middle Norian, Rutherfordi Zone. Pardonet Formation, 36.2 m above base, section as for GSC locality 97525, Brown Hill; E.T. Tozer party, 1980.

Cyrtopleurites hersiliae Diener

GSC loc. 97531. Middle Norian, Rutherfordi Zone. Pardonet Formation, 35.7 m above base, section as for GSC locality 97525, Brown Hill; E.T. Tozer party, 1980.

Cyrtopleurites bicrenatus (Hauer)
Drepanites rutherfordi McLearn

GSC loc. 97532. Middle Norian, Rutherfordi Zone. Pardonet Formation, 35.0 m above base, section as for GSC locality 97525, Brown Hill; E.T. Tozer party, 1980.

Acanthodrepanites dieneri n. sp.

GSC loc. 97533. Middle Norian, Rutherfordi Zone. Pardonet Formation, 33.3 m above base, section as for GSC locality 97525, Brown Hill; E.T. Tozer party, 1980.

Drepanites rutherfordi McLearn
Didymites quenstedti Mojsisovics

GSC loc. 97534. Middle Norian, Rutherfordi Zone. Pardonet Formation, 31.0 m above base, section as for GSC locality 97525, Brown Hill; E.T. Tozer party, 1980.

Drepanites rutherfordi McLearn
Hauerites piceus n. sp.

GSC loc. 97536. Middle Norian, Rutherfordi Zone. Pardonet Formation, 30.0 m above base, section as for GSC locality 97525, Brown Hill; E.T. Tozer party, 1980.

Drepanites rutherfordi McLearn

GSC locs. 97539, 97540. Lower Norian, Magnus Subzone 2. Pardonet Formation, 26.2 m above base, section as for GSC locality 97525, Brown Hill, E.T. Tozer party, 1980.

Dimorphotoceras caurinum McLearn
Juvavites biornatus McLearn

GSC loc. 97541. Lower Norian, Magnus Subzone 1. Pardonet Formation, 23.5 m above base, section as for GSC locality 97525, Brown Hill; E.T. Tozer party, 1980.

Indojuvavites brunneus n. sp.

GSC loc. 97542. Lower Norian, Dawsoni Subzone 3. Pardonet Formation, 22.5 m above base, section as for GSC locality 97525, Brown Hill; E.T. Tozer party, 1980.

Discomalayites carinatus n. sp.

GSC loc. 97543. Lower Norian, Dawsoni Subzone 2. Pardonet Formation, 21.0 m above base, section as for GSC locality 97525, Brown Hill; E.T. Tozer party, 1980.

Malayites dawsoni McLearn
Pseudocardioceras acutum (Mojsisovics)
Omojuvavites magnumbilicatus n. sp.
Omojuvavites minor n. sp.

GSC loc. 97544. Lower Norian, Dawsoni Subzone 2. Pardonet Formation, 14.2 m above base, section as for GSC locality 97525, Brown Hill; E.T. Tozer party, 1980. Repetition by faulting of GSC locality 97543?

Malayites dawsoni McLearn
Pseudocardioceras acutum (Mojsisovics)

GSC loc. 97546. Lower Norian, Dawsoni Subzone 1. Pardonet Formation, about 7 m above base, section on Brown Hill; E.T. Tozer party, 1980 (=GSC loc. 64664).

Norosirenites krystyni n. sp.
Wangoceras pax (Tozer)

GSC loc. 97547. Lower Norian, Kerri Subzone 2. Pardonet Formation 2.0 m above base, section as for GSC locality 97546 (Brown Hill); E.T. Tozer party 1980.

Stikinoceras kerri McLearn

GSC loc. 97548. Lower Norian, Kerri Subzone 1. Pardonet Formation, at base, section as for GSC locality 97525, Brown Hill; E.T. Tozer party 1980.

Guembelites clavatus (Mclearn)

GSC loc. 97550. Upper Norian, Cordilleranus Subzone 1. Pardonet Formation, talus block from bed about 5 m below the top of the *Monotis* beds, section in railway cut west of bridge 1.2 km west of Silver Sands Creek, NTS Callazon Creek 93 O/10; E.T. Tozer party, 1980 (Tozer, 1982a, p. 385).

Paraguembelites ludingtoni n. sp.

GSC loc. 97552. Middle Norian, Columbianus Subzone 3. Pardonet Formation, 38.0 m below contact with Fernie Group, section in Crying Girl Prairie Creek, 1.6 km northeast of Graham River, NTS Hackney Hills 94 B/7, as for GSC localities 42537, 46468, section as for GSC locality 83829 (Crying Girl); E.T. Tozer party, 1980.

Alloclionites dieneri n. sp.
Neohimavatites peregrinus n. sp.
Episculites crassus n. sp.

GSC loc. 97554. Middle Norian, Columbianus Subzone 3. Pardonet Formation, 41.0 m below contact with Fernie Group, section as for GSC locality 97552 (Crying Girl); E.T. Tozer party, 1980.

Neohimavatites canadensis (McLearn)

GSC loc. 97555. Middle Norian, Columbianus Subzone 2. Pardonet Formation, 43.3 m below contact with Fernie Group, section as for GSC locality 97552 (Crying Girl), same bed as GSC locality 83834; E.T. Tozer party, 1980.

Mesohimavatites parvus n. sp.
Mesohimavatites costatus n. sp.
Distichites gethingi McLearn
Leiodistichites ursidens n. sp.
Phormedites juvavicus Mojsisovics

GSC loc. 97556. Middle Norian, Columbianus Subzone 4. Pardonet Formation, talus from *Eomonotis pinensis* beds, section as for GSC locality 97552 (Crying Girl Prairie Creek), E.T. Tozer party, 1980.

Mesohimavatites caponicus n. sp.

GSC loc. 97557. Middle Norian, Columbianus Subzone 2. Pardonet Formation, about 1 m above GSC locality 97555, about 42 m below contact with Fernie Group, section as for GSC locality 97552 (Crying Girl); E.T. Tozer party, 1980.

Himavatites apinnatus n. sp.
Leiodistichites ursidens n. sp.
Leislingites semiviatus n.sp
Parajuvavites canadensis n. sp.

GSC loc. 97558. Lower Norian, Magnus Subzone 1. Pardonet Formation, 1.5 m below *Juvavites magnus* bed (GSC loc. 83829), 54.5 m below contact with Fernie Group, section as for GSC locality 97552 (Crying Girl); E.T. Tozer party, 1980.

Oxytibetites welteri n. sp.
Indojuvavites laurieri n. sp.

GSC loc. 97559. Lower Norian, Magnus Subzone 1. Pardonet Formation, 2.5 m below *Juvavites magnus* bed (GSC loc. 83829), 55.5 m below contact with Fernie Group, section as for GSC locality 97552 (Crying Girl); E.T. Tozer party, 1980.

Indojuvavites brunneus n. sp.

GSC loc. 97560. Lower Norian, Magnus Subzone 1. Pardonet Formation, about 5 m below *Juvavites magnus* bed (GSC loc. 83829), 58 m below contact with Fernie Group, section as for GSC locality 97552 (Crying Girl); E.T. Tozer party, 1980.

Indojuvavites laurieri n. sp.

GSC loc. 97561. Upper Carnian. Otuk Formation, left (east) bank, Rackla River, 800 m below stream draining Kathleen Lakes, NTS Mount Westman 106 D/1; E.T. Tozer party, 1980.

Epiceratites yukonensis n. sp.
Sirenites serotinus n. sp.
Acanthotropites racklaensis n. sp.

GSC loc. 97576. Lower Norian, Dawsoni Subzone 2. Pardonet Formation, loose block from bed at GSC locality 97543, section as for GSC locality 97525, Brown Hill; E.T. Tozer party, 1980.

Malayites dawsoni McLearn
Dryojuvavites orchardi n. sp.

GSC loc. 97580. Middle Norian, Rutherfordi Zone. Pardonet Formation, 4 m above *Juvavites magnus* bed (GSC loc. 83829), 49.0 m below contact with Fernie Group, section as for GSC locality 97552 (Crying Girl); E.T. Tozer party, 1980.

Cyrtopleurites bicrenatus (Hauer)
Hauerites piceus n. sp.
Heraclites canadensis n. sp.

GSC loc. 98500. Upper Norian, Amoenum Zone. Pardonet Formation, *Rhacophyllites* beds, Ne-parlepas section (GSC loc. 98886), same bed as GSC locality 98887; E.T. Tozer party, 1981.

Placites polydactylus (Mojsisovics)

GSC loc. 98501. Upper Norian, Amoenum Zone. Pardonet Formation, *Rhacophyllites* beds, Ne-parlepas section (GSC loc. 98886), same bed as GSC locality 98886, E.T. Tozer party, 1981.

Placites polydactylus (Mojsisovics)

GSC loc. 98510. Lower Norian, Kerri Subzone 2. Pardonet Formation, 33 m above base, section immediately west of Juvavites Gully, Pardonet Hill, NTS Mount Brewster 94 B/3; E.T. Tozer party, 1981.

Stikinoceras kerri McLearn

GSC loc. 98511. Lower Norian, Kerri Subzone 2. Pardonet Formation, 32.5 m above base, section as for GSC locality 98510, west of Juvavites Gully; E.T. Tozer party, 1981.

Stikinoceras kerri McLearn
Gonionotites rarus McLearn

GSC loc. 98512. Lower Norian, Kerri Subzone 1. Pardonet Formation, 3.6 m above base, section as for GSC locality 98510, west of Juvavites Gully; E.T. Tozer party, 1981.

Thisbites custi McLearn

GSC loc. 98513. Lower Norian, Kerri Subzone 1. Pardonet Formation, 3.8 m above base, section as for GSC locality 98510, west of Juvavites Gully; E.T. Tozer party, 1981.

Tropiceltites columbianus (McLearn)
Thisbites custi McLearn

GSC loc. 98514. Lower Norian, Kerri Subzone 1. Pardonet Formation, 4.4 m above base, section as for GSC locality 98510, west of Juvavites Gully; E.T. Tozer party, 1981.

Discostyrites ireneanus (McLearn)
Guembelites clavatus (McLearn)

GSC loc. 98515. Lower Norian, Kerri Subzone 1. Pardonet Formation, 6.4 m above base, section as for GSC locality 98510, west of Juvavites Gully; E.T. Tozer party, 1981.

Pterosirenites auritus Tozer
Tropiceltites columbianus (McLearn)

GSC loc. 98518. Middle Norian, Columbianus Subzone 1. Pardonet Formation, west of First Gully west of Juvavites gully, near locality XVI (McLearn, 1960, Fig. 2, p. 7), NTS Mount Brewster 94 B/3; E.T. Tozer party, 1981.

Pseudosirenites pardoneti (McLearn)
Himavatites sp. indet.
Distichites gethingi McLearn
Pleurodistichites sp. indet.
Helictites minor n. sp.
Parathisbites oineus McLearn
Parathisbites pardoneti n. sp.

GSC loc. 98521. Middle Norian, Columbianus Subzone 4. Pardonet Formation, *Eomonotis pinensis* beds, 13.4 m below base of *Monotis subcircularis* beds, west side of Pardonet Hill, NTS Mount Brewster 94 B/3; E.T. Tozer party, 1981.

Alloclionites welteri n. sp.

GSC loc. 98522. Middle Norian, Columbianus Subzone 3. Pardonet Formation, *Eomonotis* bed, 24.3 m below base of *Monotis subcircularis* beds, section as for GSC locality 98521, west side of Pardonet Hill; E.T. Tozer party, 1981.

Neohimavatites peregrinus n. sp.

GSC loc. 98525. Middle Norian, Columbianus Subzone 2. Pardonet Formation, near locality XX of McLearn (1960a, Fig. 2, p. 7), west side of Pardonet Hill, NTS Mount Brewster 94 B/3; E.T. Tozer party, 1981.

Pseudosirenites pardoneti (McLearn)
Mesohimavatites columbianus (McLearn)

GSC loc. 98530. Upper Norian, Cordilleranus Zone. Pardonet Formation, 25 m above base of *Monotis* beds, west side of Pardonet Hill, NTS Mount Brewster 94 B/3; E.T. Tozer party, 1981.

Peripleurites roemeri Mojsisovics

GSC loc. 98534. Upper Norian, Cordilleranus Subzone 1. Pardonet Formation, *Monotis* beds, about 18 m below top of formation, section on north side of Williston Lake, 3.5 km northeast of mouth of Nabesche River, NTS Mount Brewster 94 B/3; E.T. Tozer party, 1981. This is known as the Black Bear section, following McLearn (1960a, p. 12), despite the fact that it is southeast of Black Bear Ridge of the NTS map (Tozer, 1967, p. 59).

Paraguembelites ludingtoni Tozer

GSC loc. 98536. Middle Norian, Rutherfordi Zone. Pardonet Formation, about 50 m above base, McLay Spur section, immediately east of Childerhose Coulee. NTS Jones Peak 94 B/2; E.T. Tozer party, 1981.

Cyrtopleurites bicrenatus (Hauer)
Drepanites rutherfordi McLearn
Hauerites piceus n. sp.
Parisculites mundus (McLearn)
Didymites quenstedti Mojsisovics

GSC loc. 98537. Lower Norian, Magnus Subzone 2. Pardonet Formation, about 48 m above base, section as for GSC locality 98536, McLay Spur; E.T. Tozer party, 1981.

Juvavites magnus McLearn

GSC loc. 98538. Lower Norian, Dawsoni Subzone 2. Pardonet Formation, about 18 m above base, section as for GSC locality 98536, McLay Spur; E.T. Tozer party, 1981.

Malayites dawsoni McLearn

GSC loc. 98540. Middle Norian, Columbianus Subzone 1. Pardonet Formation, about 55 m above base, section as for GSC locality 98536, McLay Spur; E.T. Tozer party, 1981.

Pseudosirenites pardoneti (McLearn)
Distichites gethingi McLearn

GSC loc. 98541. Middle Norian, Columbianus Subzone 1. Pardonet Formation, about 58 m above base, section as for GSC locality 98536, McLay Spur; E.T. Tozer party, 1981.

Himavatites sp. indet.
Distichites gethingi McLearn

GSC loc. 98542. Middle Norian, Columbianus Subzone 1c. Pardonet Formation, from a single large concretion, 1.5 m above GSC locality 98885, west side of small cove at Childerhose Coulee on north side of Williston Lake, NTS Mount Brewster 94 B/2; E.T. Tozer party, 1981.

Pseudosirenites pardoneti (McLearn)
Himavatites planiplicatus n. sp.
Distichites columbianus n. sp.
Distichites canadensis McLearn
Pleurodistichites stotti Tozer
Parathisbites obtusus n. sp.
Phormedites transiens n. sp.

GSC loc. 98543. Middle Norian, Columbianus Subzone 1b. Pardonet Formation, from another concretion, level and locality as for GSC locality 98542, Childerhose Coulee; E.T. Tozer party, 1981.

Parathisbites oineus McLearn

GSC loc. 98545. Upper Norian, Cordilleranus Subzone 2. Pardonet Formation, *Monotis* beds, 2 m below top of formation, Black Bear section, as for GSC locality 98534; E.T. Tozer party, 1981.

Lissonites sp. indet.

GSC loc. 98549. Middle Norian, Columbianus Subzone 2. Pardonet Formation, 42.5 m below top, Black Bear section, as for GSC locality 98534; E.T. Tozer party, 1981.

Eosteinmannites orientalis n. sp.
Himavatites apinnatus n. sp.
Helictites decorus McLearn
Parajuvavites canadensis n. sp.

GSC loc. 98550. Middle Norian, Columbianus Subzone 2. Pardonet Formation, 50 m below top, Black Bear section, as for GSC locality 98534; E.T. Tozer party, 1981.

Pseudosirenites pardoneti (McLearn)
Pseudosirenites pressus (McLearn)
Distichites canadensis McLearn
Leiodistichites ursidens n. sp.
Helictites decorus McLearn

GSC loc. 98551. Middle Norian, Columbianus Subzone 2. Pardonet Formation, 51.5 m below top, Black Bear section, as for GSC locality 98534; E.T. Tozer party, 1981.

Pseudosirenites pardoneti McLearn
Himavatites multiauritus McLearn
Helictites decorus McLearn
Episculites teres (McLearn)

GSC loc. 98552. Middle Norian, Columbianus Subzone 2. Pardonet Formation, 52 m below top, Black Bear section, as for GSC locality 98534; E.T. Tozer party, 1981.

Pseudosirenites pardoneti (McLearn)
Mesohimavatites columbianus (McLearn)
Distichites canadensis McLearn
Leiodistichites ursidens n. sp.
Helictites decorus McLearn

GSC loc. 98558. Upper Norian, Cordilleranus Subzone 1. Pardonet Formation, *Monotis* beds, large loose block near topographic cairn 6266, between Ducette and Eleven Mile Creeks, NTS Carbon Creek 93 O/15; E.T. Tozer party, 1981.

Ophiorhabdoceras canadense n. sp.
Rhabdoceras suessi Hauer

GSC loc. 98559. Upper Norian, Cordilleranus Subzone 1. Pardonet Formation *Monotis* beds, another block, locality as for GSC locality 98558; E.T. Tozer party, 1981.

Paraguembelites ludingtoni Tozer
Metasibirites speratus n. sp.

GSC loc. 98561. Lower Norian, Kerri Subzone 2. Pardonet Formation, 16.5 m above base, section as for GSC locality 98510, west of Juvavites Gully, Pardonet Hill; E.T. Tozer party, 1981.

Stikinoceras kerri McLearn

GSC loc. 98562. Lower Norian, Kerri Subzone 2. Pardonet Formation, 35 m above base, section as for GSC locality 98510, west of Juvavites Gully, Pardonet Hill; E.T. Tozer party, 1981.

Stikinoceras kerri McLearn
Griesbachites humi (McLearn)
Dimorphites pardonetiensis McLearn

GSC loc. 98863. Smithian, Romunderi Zone. Sulphur Mountain Formation, Ganoid Range, 6.5 km southeast of west end of Wapiti Lake, NTS Wapiti Lake 93 I/10; D.W. Gibson, 1970.

Kashmirites columbianus n. sp.
Meekoceras haydeni (Smith)
Euflemingites cirratus (White)
Oxyussuria canadensis n. sp.
Paranannites aspenensis Hyatt and Smith

GSC loc. 98867. Middle Norian, Columbianus Subzone 2. Pardonet Formation, 42.5 m below top, Black Bear section, as for GSC locality 98534; E.T. Tozer party 1982 (=GSC loc. 98549).

Himavatites multiauritus McLearn
Helictites decorus McLearn
Parajuvavites canadensis n. sp.

GSC loc. 98868. Middle Norian, Columbianus Subzone 2. Pardonet Formation, 50 m below top, Black Bear section, as for GSC locality 98534; E.T. Tozer party, 1982 (=GSC loc. 98550).

Pseudosirenites pardoneti (McLearn)
Himavatites multiauritus McLearn
Leiodistichites ursidens n. sp.
Helictites decorus McLearn

GSC loc. 98869. Middle Norian, Columbianus Subzone 2. Pardonet Formation, 51.5 m below top, Black Bear section, as for GSC locality 98534; E.T. Tozer party, 1982 (=GSC loc. 98551).

Pseudosirenites pardoneti (McLearn)
Himavatites multiauritus McLearn
Leiodistichites beachi n. sp.
Helictites decorus McLearn
Episculites teres (McLearn)

GSC loc. 98870. Middle Norian, Columbianus Subzone 2. Pardonet Formation, 52 m below top, Black Bear section, as for GSC locality 98534; E.T. Tozer party, 1982 (=GSC loc. 98552).

Pseudosirenites pardoneti (McLearn)
Mesohimavatites columbianus (McLearn)
Parathetidites laevis n. sp.
Hypisculites stelcki (McLearn)

GSC loc. 98875. Middle Norian, Rutherfordi Zone. Pardonet Formation, about 50 m above base, section as for GSC locality 98536, McLay Spur; E.T. Tozer party, 1982 (=GSC loc. 98536).

Didymites quenstedti Mojsisovics

GSC loc. 98876. Middle Norian, Rutherfordi Zone. Pardonet Formation, concretionary bed 30 cm below GSC locality 98875, about 49 m above base of formation, section as for GSC locality 98536, McLay Spur; E.T. Tozer party, 1982.

Metaclionites taylori n. sp.
Drepanites rutherfordi McLearn
Hauerites piceus n. sp.

GSC loc. 98877. Middle Norian, Columbianus Subzone 1b. Pardonet Formation, about 54 m above base, section as for GSC locality 98536, McLay Spur; E.T. Tozer party, 1982.

Eothetidites lacrimosus n. sp.
Parathisbites oineus McLearn

GSC loc. 98878. Middle Norian, Columbianus Subzone 1b. Pardonet Formation, about 54 m above base, section as GSC locality 98536, McLay Spur, bed as for GSC locality 98877, collected down dip; E.T. Tozer party, 1982.

Pseudosirenites pardoneti (McLearn)
Distichites gethingi McLearn
Eothetidites lacrimosus n. sp.
Parathisbites oineus McLearn

GSC loc. 98879. Middle Norian, Columbianus Subzone 2. Pardonet Formation, section as for GSC locality 98542, Childerhose Coulee, 2 m above GSC locality 98542 (Subzone 1c); E.T. Tozer party, 1982,

Himavatites apinnatus n. sp.
Mesohimavatites columbianus (McLearn)

GSC loc. 98880. Lower Norian, Kerri Subzone 1. Pardonet Formation, high on west side of Pardonet Hill, near locality 2 (Fig. 1, Tozer, 1965c, p. 219), from bed probably stratigraphically between GSC locality 64628 (Macrolobatus Zone) and GSC locality 64607 (Subzone 2); E.T. Tozer party, 1982.

Pterosirenites auritus Tozer
Gonionotites gethingi McLearn
Dimorphites pardonetiensis McLearn
Guembelites clavatus (McLearn)

GSC loc. 98885. Middle Norian, Columbianus Subzone 1a. Pardonet Formation, section as for GSC locality 98542, Childerhose Coulee, 50 cm below bed with *Eothetidites lacrimosus* (Subzone 1b, not collected), 1.5 m below GSC locality 98542 (Subzone 1c); E.T. Tozer party, 1982.

Pseudosirenites pardoneti (McLearn)
Himavatites sp. indet.
Ectolcites childerhosei n. sp.
Neodidymites tatzreiteri n. sp.
Parathisbites oineus McLearn

GSC loc. 98886. Upper Norian, Amoenum Zone. Pardonet Formation, *Rhacophyllites* beds, 6 m from top of formation, 13 m above top of *Monotis* beds, Ne-parle-pas section, in small cove on south side of Williston Lake, 3.5 km southwest of Ne-parle-pas Point, NTS Mount Brewster, 94 B/3; E.T. Tozer party, 1982.

Placites polydactylus (Mojsisovics)
Pinacoceras parma Mojsisovics
Arcestes syngonus Mojsisovics

GSC loc. 98887. Upper Norian, Amoenum Zone. Pardonet Formation, *Rhacophyllites* beds, topmost bed of formation, 19 m above top of *Monotis* beds, Ne-parle-pas section, as for GSC locality 98886; E.T. Tozer party, 1982.

Rhabdoceras suessi Hauer

GSC loc. 98899. Lower Norian, Kerri Subzone 2. Pardonet Formation, 32.5 m above base, section as for GSC locality 98510, west of Juvavites Gully, Pardonet Hill; E.T. Tozer party, 1982.

Gonionotites rarus McLearn

GSC loc. 98900. Lower Norian, Kerri Subzone 2. Pardonet Formation, 31.5 m above base, section as for GSC locality 98510, west of Juvavites Gully, Pardonet

Hill; E.T. Tozer party, 1982.
Griesbachites selwyni (McLearn)
Dimorphites pardonetiensis McLearn
Guembelites jandianus Mojsisovics
Stikinoceras kerri McLearn

GSC loc. 98901. Lower Norian, Kerri Subzone 2. Pardonet Formation, 25.5 m above base, section as for GSC locality 98510, west of Juvavites Gully, Pardonet Hill; E.T. Tozer party, 1982.
Pinacoceras sp. indet.

GSC loc. 98902. Ladinian, Meginae Zone. Liard Formation, north side of Alaska Highway, 7 km east of Summit Lake, NTS MacDonald Creek 94 K/10, locality described by McLearn (1947b, p. 9); E.T. Tozer party, 1982.
Nitanoceras selwyni (McLearn)
Indigirites stolleyi n. sp.
Silenticeras bamberi n. sp.
Lobites pacianus McLearn

GSC loc. 98903. Ladinian, Meginae Zone. Liard Formation, locality as for GSC locality 98902, north side of Alaska Highway, from bed about 1 m below GSC loc. 98902; E.T. Tozer party, 1982.
Meginoceras tetsa (McLearn)
Silenticeras bamberi n. sp.

GSC loc. 98906. Ladinian, Meginae Subzone 3. Liard Formation, about 300 m east of GSC locality 98902, north side of Alaska Highway, from stratigraphically higher beds, locality described by McLearn, 1947b, p. 9 (=GSC loc. 42300); E.T. Tozer party, 1982.
Indigirites boehmi n. sp.
Lobites pacianus McLearn

GSC loc. 98907. Lower Anisian, Caurus Subzone 1. Toad Formation, bed as GSC localities 68203 and 74715, section on Alaska Highway (375E); E.T. Tozer party, 1982.
Lenotropites caurus (McLearn)

GSC loc. 98909. Middle Norian, Columbianus Subzone 3. Pardonet Formation, 38 m below top, Black Bear section, as for GSC locality 98534; E.T. Tozer party, 1982.
Pseudosirenites bullatus n. sp.
Alloclionites dieneri n. sp.
Steinmannites sp. indet.
Leislingites quadratus n. sp.
Thetidites nudus n. sp.
Parajuvavites canadensis n. sp.

GSC loc. 99565. Middle Anisian, Minor Zone. Toad Formation, from concretions with *Enteropleura bittneri,* east side of Toad River immediately below canyons, 59°11′30″N, 124°41′50″W, NTS Scaffold Creek 94 N/2; E.T. Tozer and M.J. Orchard, 1983.
Amphipopanoceras selwyni McLearn
Intornites williamsi n. sp.
Nicomedites arthaberi n. sp.
Ptychites guloensis n. sp.

GSC loc. 99566. Upper Anisian, Deleeni Zone. Toad Formation, section on Toad River, as for GSC locality 99565, from concretions 5 m above GSC locality 99565; E.T. Tozer and M.J. Orchard, 1983.
Eogymnotocereas beachi (McLearn)

GSC loc. 99578. Middle Anisian, Hagei Zone. Toad Formation, south side of Liard River, section below mouth of Toad River, locality and bed as for GSC locality 42337, NTS Toad River 94 N/7; E.T. Tozer and M.J. Orchard, 1983.
Intornites intornatus (McLearn)
Buddhaites hagei (McLearn)

GSC loc. 99579. Lower Anisian, Caurus Subzone 2. Toad Formation, section on Toad River, as for GSC locality 99578, 70 cm below GSC locality 99578, locality and bed as for GSC locality 42338; E.T. Tozer and M.J. Orchard, 1983.
Grambergia nahwisi (McLearn)
Sturia sansovinii (Mojsisovics)

GSC loc. 99580. Lower Anisian, Caurus Zone. Toad Formation, section on Liard River as for GSC locality 99578, 1.2 m below GSC locality 99578; E.T. Tozer and M.J. Orchard, 1983.
Stenophyllites kindlei (McLearn)

GSC loc. 99581. Lower Anisian, Caurus Subzone 1. Toad Formation, section on Liard River as for GSC locality 99578, 4.2 m below GSC locality 99578; E.T. Tozer and M.J. Orchard, 1983.
Lenotropites caurus (McLearn)
Grambergia liardensis n. sp.
Azarianites bufonis (McLearn)
Ussurites muskwa McLearn

GSC locs. 101887–101894. Spathian, Pilaticus Zone. Blind Fiord Formation, concretions individually numbered from about the same level, approximately the level of GSC locality 64719, coastal section, Axel Heiberg Island, locality 155 (GSC Map 1305A), NTS Cape Stallworthy 560 D; E.T. Tozer and W.W. Nassichuk, 1986.

Arctomeekoceras obtusum n. sp.
Neomeekoceras scalariforme n. sp.
Olenikites subtilis n. sp.
Pseudosageceras sp. indet.

GSC loc. C-90882. Upper Anisian, Deleeni Zone. Toad Formation, talus below 15 m cliff, south bank of Toad River 4.5 km from mouth, 59°21′10″N, 125°49′20″W, NTS Toad River 94 N/7; J.T. Fyles, 1982.
Amphipopanoceras tetsa McLearn
Eogymnotoceras deleeni McLearn
Japonites readi n. sp.
Ptychites trochleaeformis (Lindstroem)

GSC loc. C-134797. Spathian, Pilaticus Zone. Blind Fiord Formation, as for GSC localities 101887–101894; A.F. Embry.
Arctomeekoceas obtusum n. sp.
Olenikites subtilis n. sp.

GSC loc. C-156962. Upper Norian, Crickmayi Zone. Sandlilands Formation, bed BC 18, about 75 m above base (i.e., about 75 m above highest *Monotis* bed), Kennecott Point, Graham Island, NTS Frederick Island 103 F/14; H.W. Tipper party, 1988.
Choristoceras nobile Mojsisovics

GSC loc. C-156963. Upper Norian, Crickmayi Zone. Sandilands Formation, loose block from bed about 80 m above base of formation, Kennecott Point, NTS Frederick Island 103 F/14; H.W. Tipper, 1988.
Choristoceras rhaeticum Guembel

GSC loc. C-157006. Upper Carnian, Dilleri Zone. Sadler Limestone, 22 m above base, west side of Huston Inlet, Moresby Island, UTM 342920E 5796610N, NTS Jedway 103 B/6; M.J. Orchard party, 1987.
Sandlingites oribasus (Dittmar)
Pleurotropites sp. indet.

GSC loc. C-157061. Upper Carnian, Welleri Subzone 1. Peril Formation, Bluejay Cove section, Burnaby Island, NTS Jedway 103 B/6; M.J. Orchard party, 1987.
Discotropites smithi Kutassy

GSC loc. C-157063. Upper Carnian, Welleri Subzone 2. Peril Formation, 3.5 m above C 157061, Bluejay Cove section; M.J. Orchard party, 1987.
Discotropites theron (Dittmar)

GSC loc. C-157119. Upper Carnian, Macrolobatus Zone. Peril Formation, west coast of Huxley Island, UTM 339801E 5814320N, NTS Jedway 103 B/6; M.J. Orchard party, 1987.
Anatropites sp. indet.
Tropiceltites pacificus n. sp.
Thisbites huxleyi n. sp.
Tropithisbites densicostatus (Silberling)

GSC loc. C-157123. Upper Carnian, Macrolobatus Zone. Peril Formation, probably the same bed as for GSC locality C-157119, west coast of Huxley Island, UTM 339801E 5814320N, NTS Jedway 103 B/6; M.J. Orchard party, 1987.
Styrites dawsoni n. sp.

GSC loc. C-157295. Upper Carnian, Welleri Subzone 2. Peril Formation, near base, north coast of Burnaby Island, about 1 km southwest of Alder Island, UTM 341540E 5811390N, NTS Jedway 103 B/6; M.J. Orchard party, 1987.
Pamphagosirenites pacificus n. sp.
Discotropites theron (Dittmar)
Hoplotropites circumspinatus (Mojsisovics)

GSC loc. C-157373. Upper Carnian, Welleri Subzone 2. Peril Formation, 34 m above base, section on west coast of Kunghit Island facing Houston Stewart Channel, south of Hornby Point, UTM 355025E 5779550N, NTS Kunghit Island 103 B/3; M.J. Orchard party, 1987.
Pamphagosirenites pacificus n. sp.
Discotropites theron (Dittmar)
Neotenoceras simplex n. sp.

GSC loc. C-157382. Upper Carnian, Macrolobatus Zone. Peril Formation, 67 m above base, section as for GSC locality C-157373, UTM 355000E 5779390N, NTS Kunghit Island 103 B/3; M.J. Orchard party, 1987. This is the locality where G.M. Dawson collected the type specimens of *Acrochordiceras carlottense* in 1878 (Dawson, 1880, p. 49B; Whiteaves, 1889, p. 141).
Tropithisbites densicostatus (Silberling)
Margarijuvavites carlottensis (Whiteaves)

GSC loc. C-157651. Upper Norian, Crickmayi Zone. Sandilands Formation, bed BC 18, about 75 m above base (i.e., above uppermost *Monotis* bed), Kennecott Point, Graham Island, NTS Frederick Island 103 F/14; H.W. Tipper, 1987.
Choristoceras nobile Mojsisovics

GSC loc. C-157686. Upper Norian, Crickmayi Zone. Sandilands Formation, bed BC 19, about 80 m above base, section as for GSC locality C-157651, Kennecott Point; H.W. Tipper, 1988.
Choristoceras rhaeticum Guembel

PLATES 1–148

(including Figures 4–120)

All figures are natural size, unless otherwise indicated. x indicates the position of the last septum. All specimens are stored in the National Type Collection of Plant and Invertebrate Fossils, Geological Survey of Canada, 601 Booth Street, Ottawa, Canada

A page number in parenthesis after a fossil name indicates the page on which the fossil is described.

PLATE 1

LOWER TRIASSIC
Griesbachian

Figures 1a, b. *Otoceras boreale* Spath (Boreale Zone) (Page 55)
GSC 28236, phragmocone with about one quarter whorl of body chamber. Blind Fiord Formation, Griesbach Creek, Axel Heiberg Island (GSC loc. 64783).

Figures 2a, b. *Otoceras gracile* n. sp. (Concavum Zone) (Page 54)
Holotype GSC 28235. Blind Fiord Formation, Griesbach Creek, Axel Heiberg Island (GSC loc. 64775).

Figures 3a, b. *Otoceras concavum* Tozer (Concavum Zone) (Page 54)
Paratype GSC 18883. Blind Fiord Formation, Griesbach Creek, Axel Heiberg Island (GSC loc. 47539).

Figures 4a, b. *Hypophiceras gracile* (Spath) (Boreale Zone) (Page 49)
Hypotype GSC 28036, last quarter whorl is body chamber. Blind Fiord Formation, Bjarnason Island (GSC loc. 47578).

Figures 5, 6. *Vishnuites kummeli* n. sp. (Boreale Zone) (Page 55)
5a, b. Paratype GSC 33143, septate to break, body chamber beyond.
6a, b. Holotype GSC 33142.
Both from Blind Fiord Formation, Raanes Peninsula, Ellesmere Island (GSC loc. 47548).

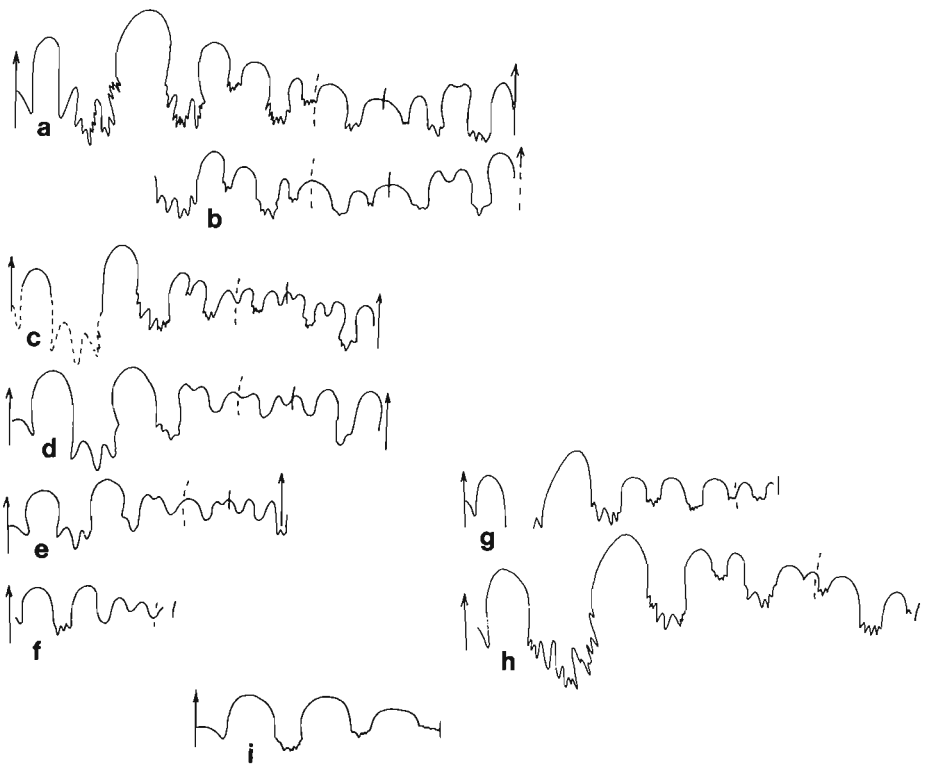


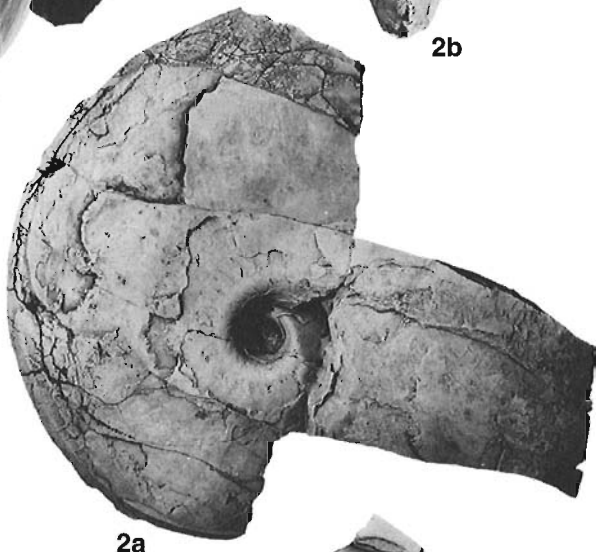
Figure 4. *Sutures. a–f.* ***Otoceras boreale*** *Spath. a, GSC 18895 (Tozer, 1967, Pl. 2, fig. 2) x0.5; b, GSC 28238* x0.5; c–f, GSC 28239. c x1.5; d x6; e x6, f x6; g,* ***Otoceras gracile*** *n. sp., GSC 28235 (Pl. 1, fig. 2) x1; h,* ***Otoceras concavum*** *Tozer, GSC 18883 (Pl. 1, fig. 3) x1; i,* ***Vishnuites kummeli*** *n. sp., GSC 34142 (Pl. 1, fig. 6) x4.*

1a

1b

2b

4a



2a

4b

3b

6a

6b

3a

5a

5b

PLATE 2

LOWER TRIASSIC
Griesbachian

Figures 1, 8. *Otoceras boreale* Spath (Boreale Zone) (Page 55)
1a, b. Hypotype GSC 28237, compressed variant, phragmocone. Blind Fiord Formation, Raanes Peninsula, Ellesmere Island (GSC loc. 51588).
8. Hypotype GSC 14019, thick variant. Blind Fiord Formation, Svartefjeld Peninsula, Ellesmere Island (GSC loc. 28440).

Figures 2–7, 10. *Hypophiceras gracile* (Spath) (Boreale Zone) (Page 49)
2a, b. Hypotype GSC 28029.
3a, b. Hypotype GSC 28030.
4. Hypotype GSC 28031.
5. Hypotype GSC 28032.
6. Hypotype GSC 28033, rubber mould.
7. Hypotype GSC 28034, rubber mould
10. Hypotype GSC 28035.
All from Blind Fiord Formation, Raanes Peninsula, Ellesmere Island (GSC loc. 51588).

Figures 9a, b. *Discophiceras wordiei* (Spath) (Commune Zone) (Page 57)
Hypotype GSC 28070, specimen with approximated septa. Blind Fiord Formation, Griesbach Creek, Axel Heiberg Island (GSC loc. 64750).

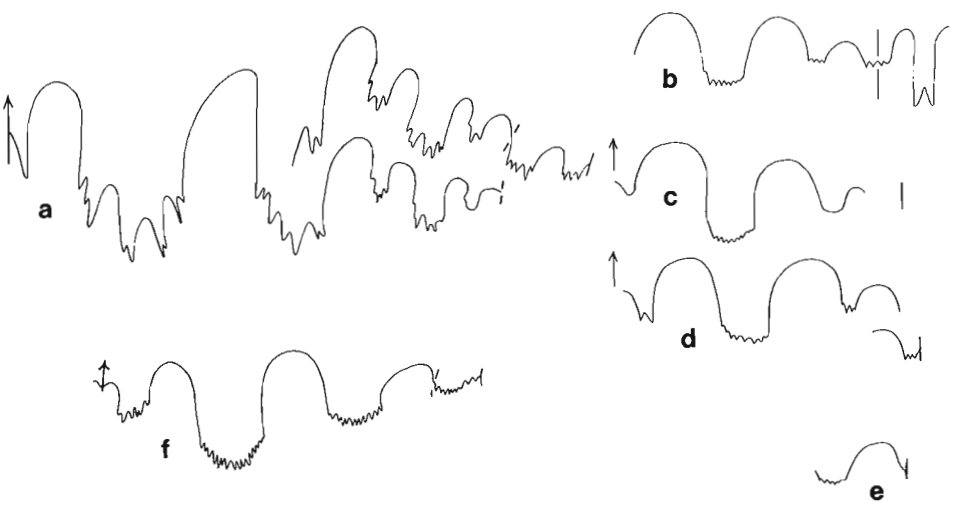


Figure 5. *Sutures. a,* ***Otoceras boreale*** *Spath, GSC 28237 (Pl. 2, fig. 1) x2; b–e.* ***Hypophiceras gracile*** *(Spath). b, GSC 28031 (Pl. 2, fig. 4) x4; c, GSC 28030 (Pl. 2, fig. 5) x4; d, GSC 28032 (Pl. 2, fig. 5) x4; e, GSC 28035 (Pl. 2, fig. 10) x4. f,* ***Discophiceras wordiei*** *(Spath), GSC 28069* x2.*

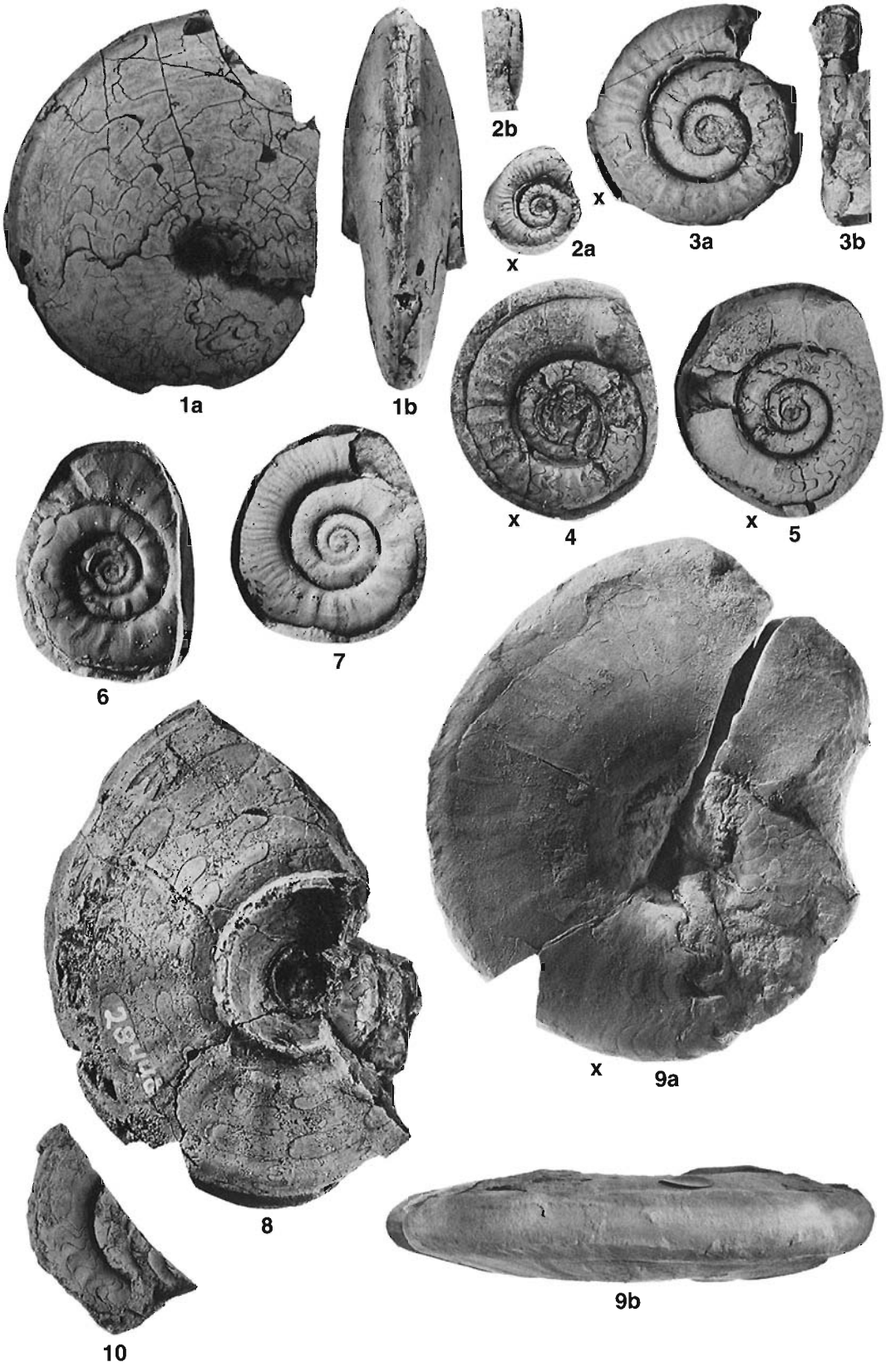

1a
1b
2b
x
2a
x
3a
3b
x
4
x
5
6
7
8
9a
x
9b
10

PLATE 3

LOWER TRIASSIC
Griesbachian–Commune Zone

Figures 1–6. *Tompophiceras extremum* (Spath) (Page 49)

1. Hypotype GSC 28037. Blind Fiord Formation, Ellesmere Island (GSC loc. 51591).
2. Hypotype GSC 28038. Blind Fiord Formation, Ellesmere Island (GSC loc. 51591).

3a–c. Hypotype GSC 28041. Blind Fiord Formation, Bjarnason Island (GSC loc. 47571).

4a–c. Hypotype GSC 28040. Blind Fiord Formation, Raanes Peninsula, Ellesmere Island (GSC loc. 55470).

5. Hypotype GSC 28039. Blind Fiord Formation, Raanes Peninsula, Ellesmere Island (GSC loc. 51591).

6a–c. Hypotype GSC 22738. Blind Fiord Formation, Raanes Peninsula, Ellesmere Island (GSC loc. 51605).

Figure 6. *Suture.* ***Tompophiceras extremum*** *(Spath), GSC 22738 (Pl. 3, fig. 6) x4.*

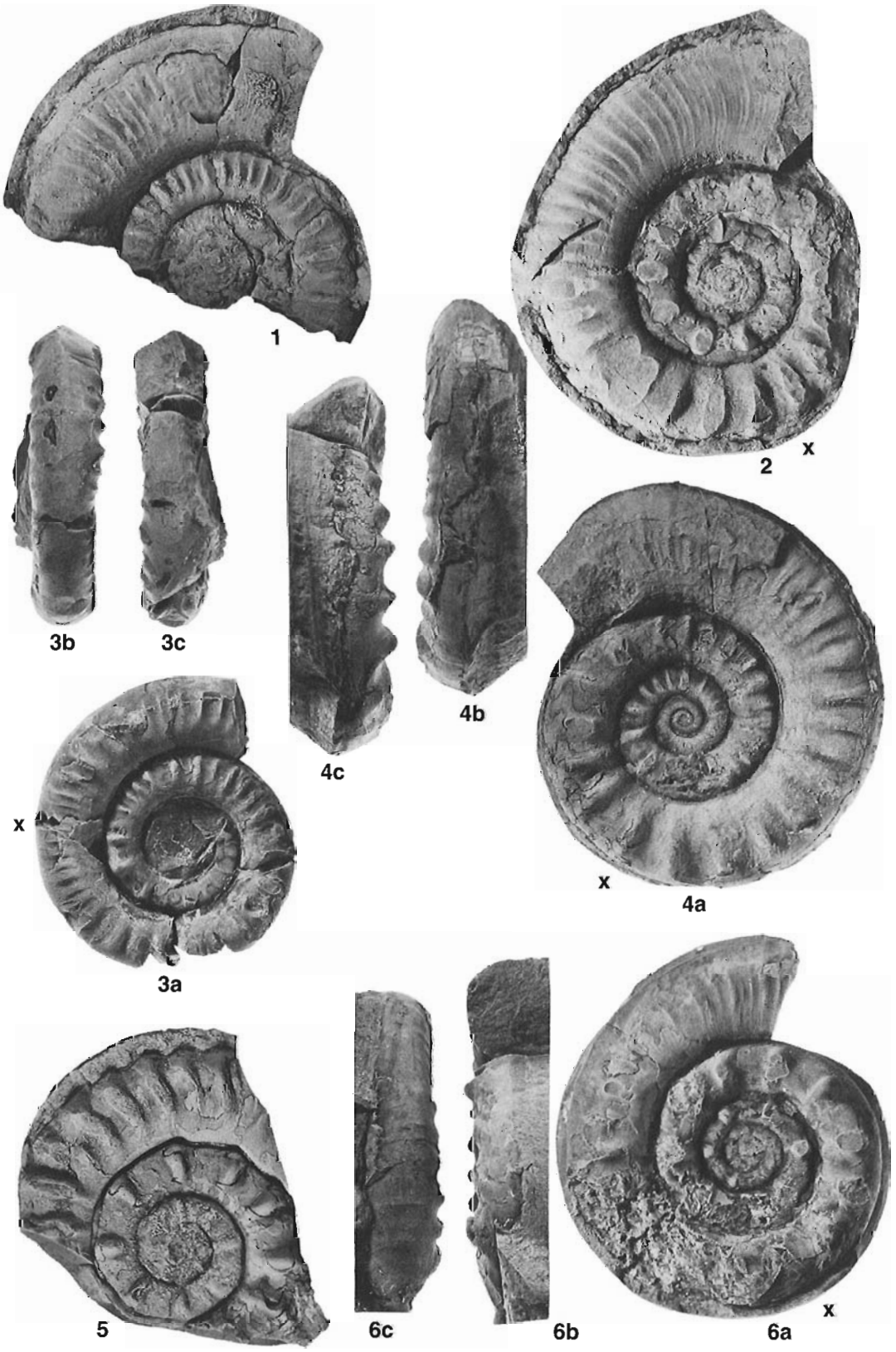

1
2
x
3b
3c
4c
4b
x
3a
x
4a
5
6c
6b
x
6a

PLATE 4

LOWER TRIASSIC
Griesbachian–Commune Zone

Figures 1a–c. *Ophiceras commune* Spath (Page 56)
Hypotype GSC 28056, phragmocone with about one quarter whorl of body chamber. Blind Fiord Formation, Griesbach Creek, Axel Heiberg Island (GSC loc. 64745).

Figures 2a, b. *Ophiceras subsakuntala* Spath (Page 57)
Hypotype GSC 28057. Blind Fiord Formation, Griesbach Creek, Axel Heiberg Island (GSC loc. 64747).

Figures 3a, b. *Ophiceras greenlandicum* Spath (Page 56)
Hypotype GSC 28055. Blind Fiord Formation, Griesbach Creek, Axel Heiberg Island (GSC loc. 64744).

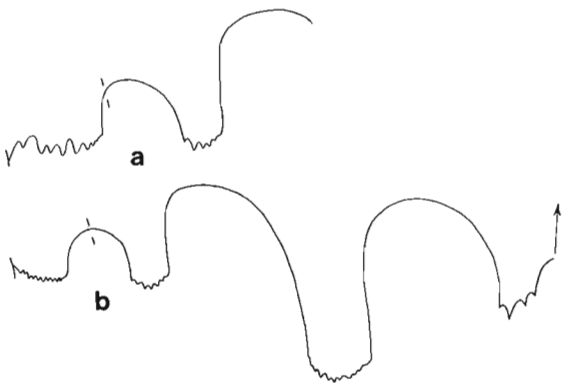


Figure 7. *Sutures.* ***Ophiceras greenlandicum*** *Spath. a, GSC 28055 (Pl. 4, fig. 3) x2; b, GSC I8897 (Tozer, 1967, Pl. 3, fig. 1) x2.*

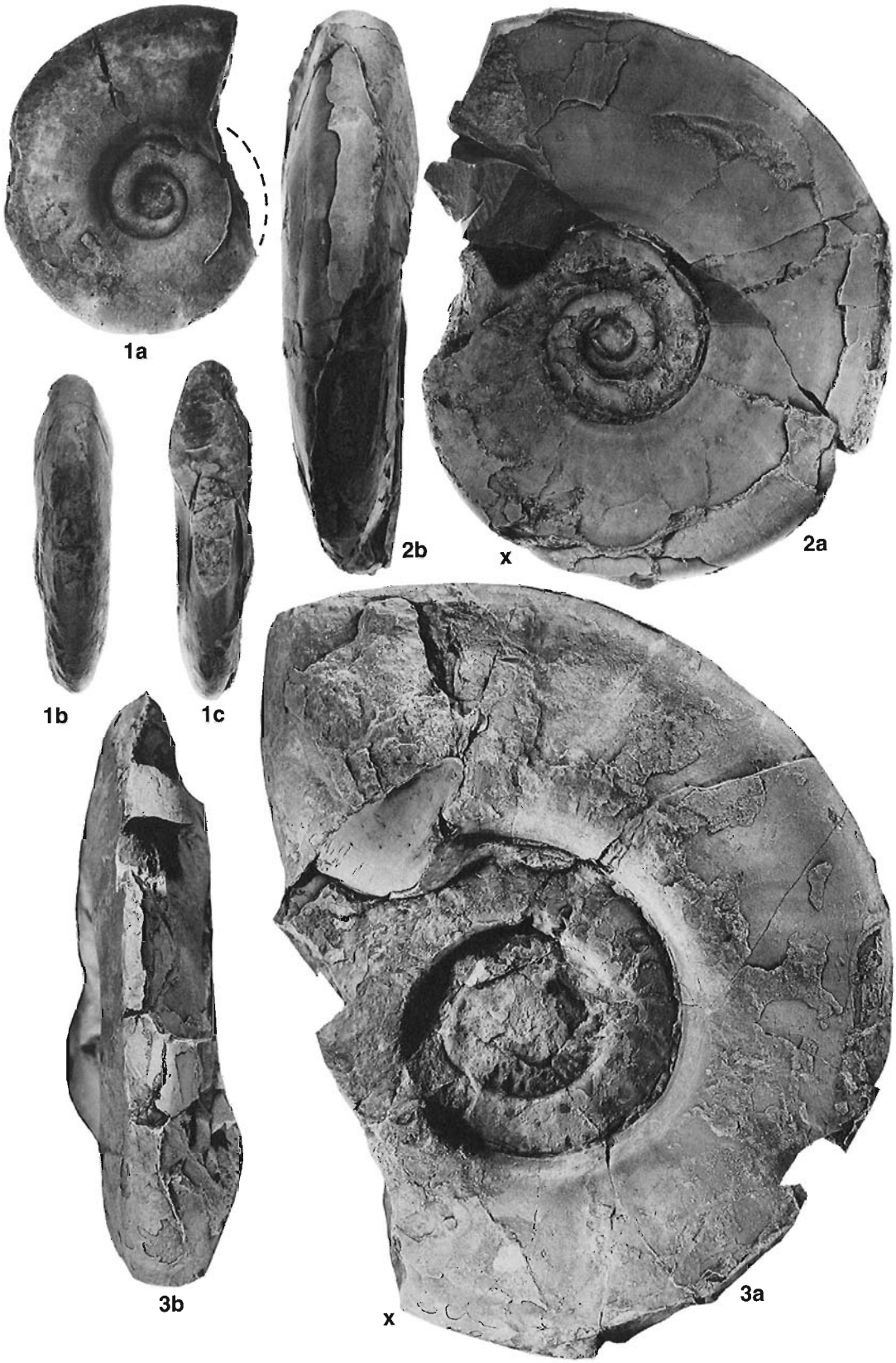

1a
1b
1c
2b
x
2a
3b
x
3a

PLATE 5

LOWER TRIASSIC
Griesbachian–Commune Zone

Figures 1–3. *Wordieoceras wordiei* (Spath) (Page 58)

1a, b. Hypotype GSC 28058, last two septa are approximated. Blind Fiord Formation, Griesbach Creek, Axel Heiberg Island (GSC loc. 64762).

2a, b. Hypotype GSC 28059.

3a, b. Hypotype GSC 28060.

Figures 2, 3 from Blind Fiord Formation, Bjarnason Island (GSC loc. 47527).

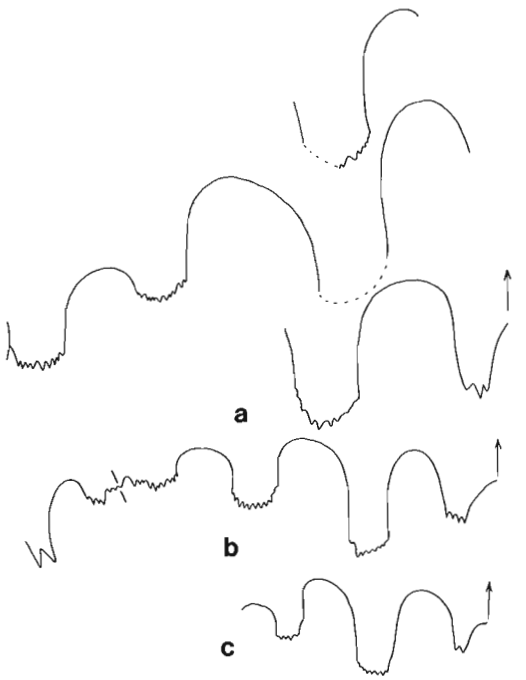


Figure 8. *Sutures.* ***Wordieoceras wordiei*** *(Spath). a, GSC 28060 (Pl. 5, fig. 3) x2; b, GSC 28064* x2; c, GSC 28059 (Pl. 5, fig. 2) x2.*

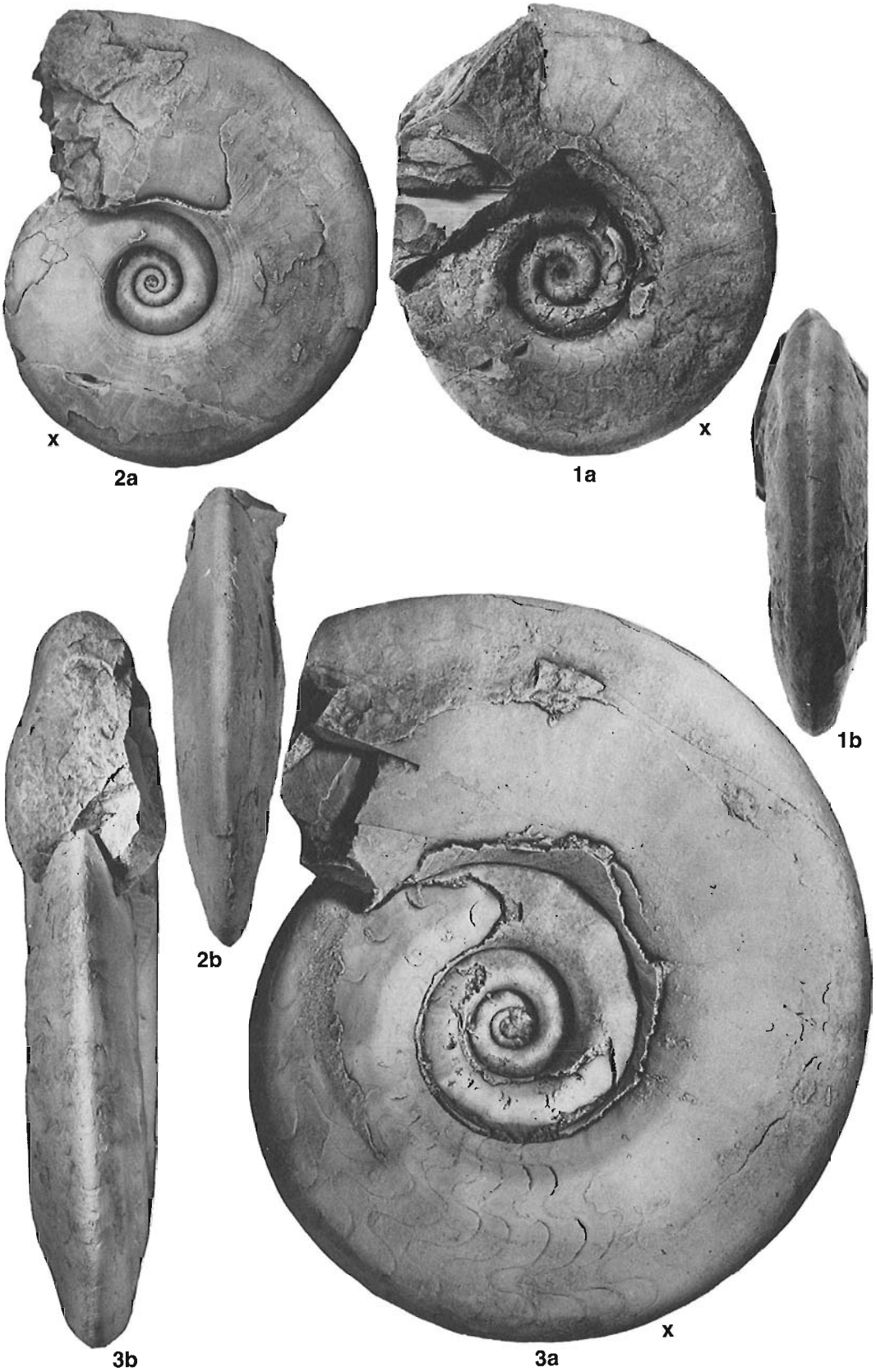

x
2a
x
1a
1b
2b
3b
x
3a

PLATE 6

LOWER TRIASSIC
Griesbachian

Figures 1, 2. *Wordieoceras wordiei* (Spath) (Commune Zone or Strigatus Zone) (Page 58)
1a, b. Hypotype GSC 28062.
2a, b. Hypotype GSC 28063.
Both from Blind Fiord Formation, Bjarnason Island (GSC loc. 47525).

Figures 3a, b. *Wordieoceras wordiei* (Spath) (Commune Zone) (Page 58)
Hypotype GSC 28061. Blind Fiord Formation, Bjarnason Island (GSC loc. 47527).

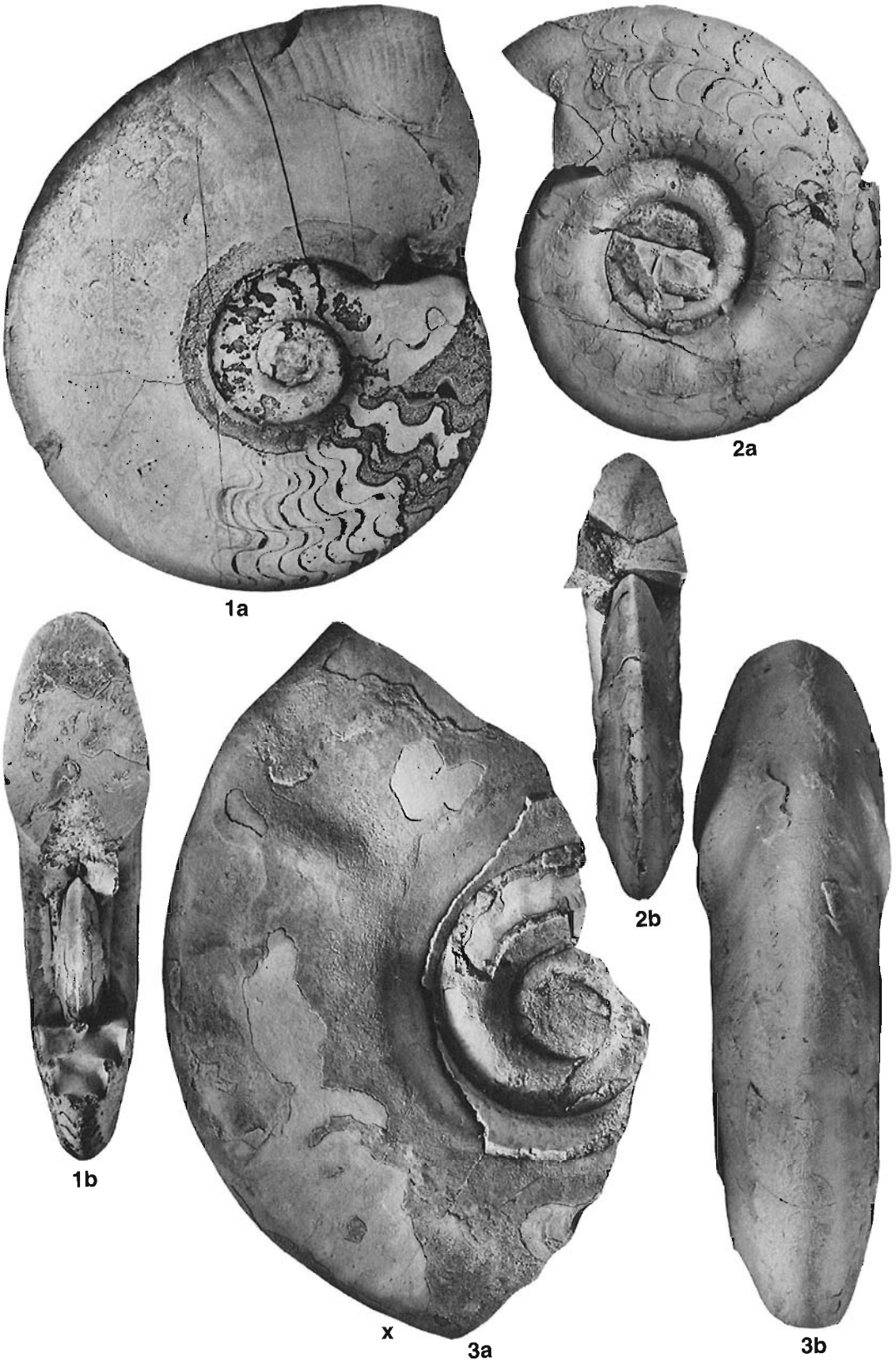

1a
2a
2b
1b
x
3a
3b

PLATE 7

LOWER TRIASSIC
Griesbachian–Strigatus Zone

Figures 1–4. *Wordieoceras wordiei* (Spath) (Page 58)
1a, b. Hypotype GSC 28067.
2a, b. Hypotype GSC 28068, last quarter whorl is body chamber.
Figures 1, 2 from Blind Fiord Formation, Diener Creek, Ellesmere Island (GSC loc. 51689).
3a, b. Hypotype GSC 28065. Blind Fiord Formation, south of Bunde Fiord, Axel Heiberg Island (GSC loc. 64769).
4a, b. GSC 28066. Blind Fiord Formation, Bjarnason Island (GSC loc. 47610).

Figures 5a, b. *Bukkenites nitidus* n. sp. (Page 60)
Hypotype GSC 28077, small specimen with about one quarter whorl of body chamber. Blind Fiord Formation, Diener Creek, Ellesmere Island (GSC loc. 51689).

Figures 6a, b. *Bukkenites strigatus* (Tozer) (Page 60)
Hypotype GSC 28078, one half natural size. Blind Fiord Formation, Bjarnason Island (GSC loc. 47611).

Figures 7a, b. *Bukkenites macilentus* n. sp. (Page 61)
Holotype GSC 28080, phragmocone. Blind Fiord Formation, south of Bunde Fiord, Axel Heiberg Island (GSC loc. 64771).

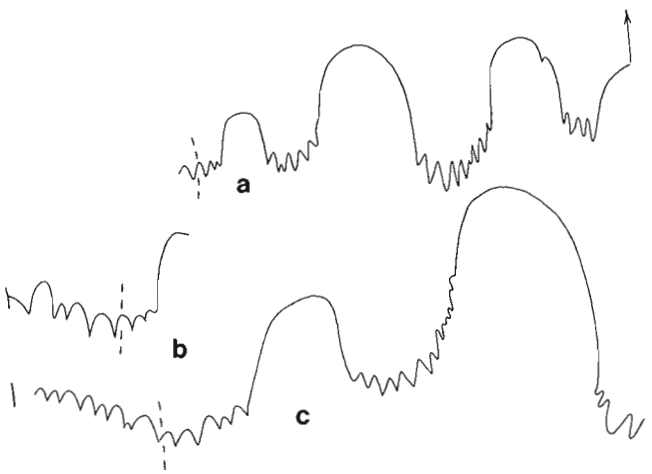


Figure 9. *Sutures. a,* ***Bukkenites macilentus*** *n. sp., GSC 28080 (Pl. 7, fig. 7) x2; b,* ***Bukkenites strigatus*** *(Tozer), GSC 28078 (Pl. 7, fig. 6) x2; c,* ***Bukkenites nitidus*** *n. sp., GSC 14039* x2.*

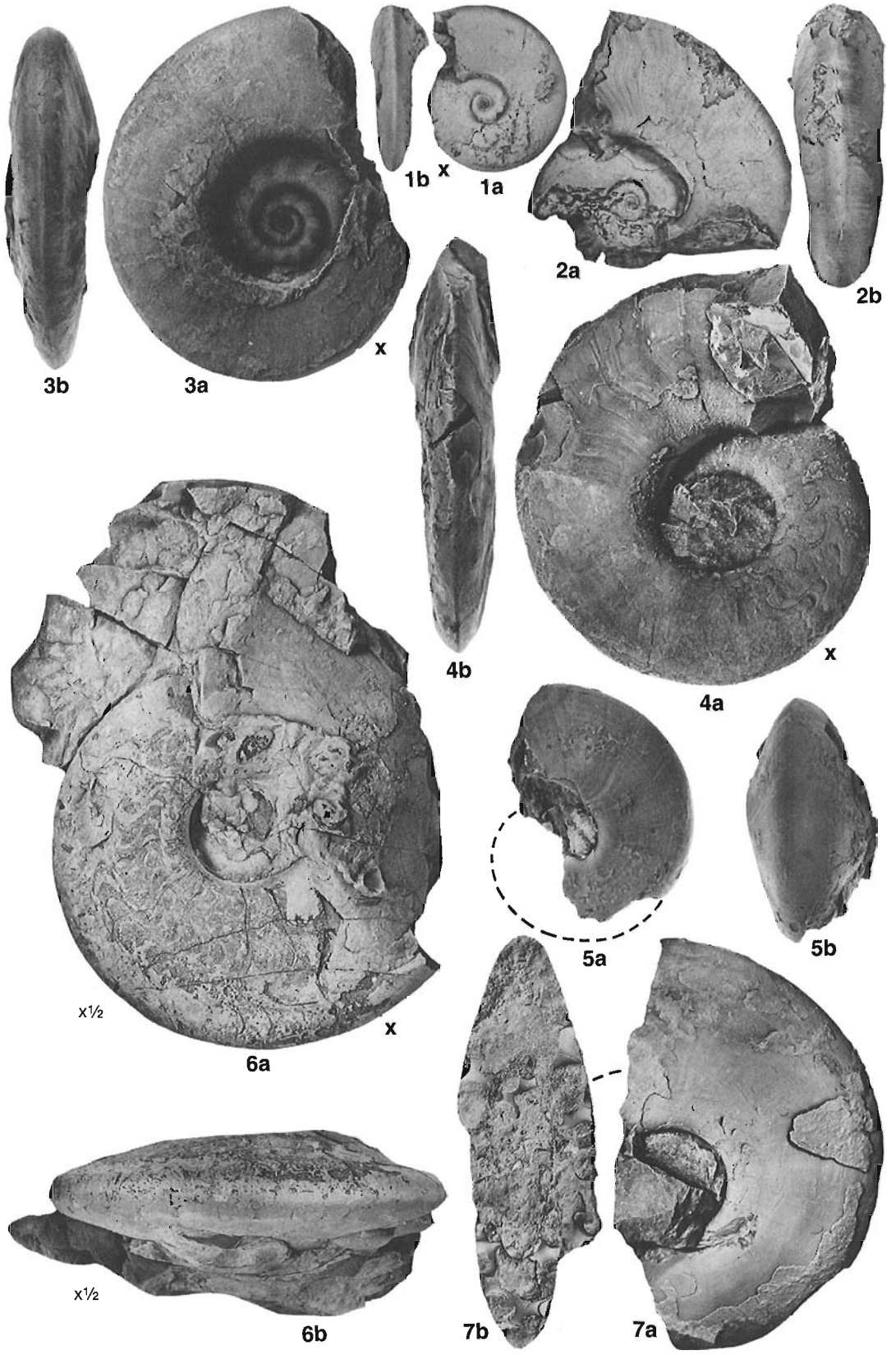

1b
x
1a
2a
2b
3b
3a
x
4b
4a
x
x½
x
6a
5a
5b
6b
x½
7b
7a

PLATE 8

LOWER TRIASSIC
Griesbachian–Strigatus Zone

Figures 1a, b. *Bukkenites nanus* n. sp. (Page 61)
Holotype GSC 28075. Blind Fiord Formation, Bjarnason Island (GSC loc. 47525).

Figures 2, 3. *Bukkenites strigatus* (Tozer) (Page 60)
2a, b. Hypotype GSC 28079 (GSC loc. 47530).
3a, b. Hypotype GSC 28076, 3a, one half natural size (GSC loc. 47525).
Both from Blind Fiord Formation, Bjarnason Island.

Figures 4a, b. *Bukkenites nitidus* n. sp. (Page 60)
Holotype GSC 18896. Blind Fiord Formation, south of Bunde Fiord, Axel Heiberg Island (GSC loc. 64765).

Figure 10. *Suture.* ***Bukkenites nanus*** *n. sp., GSC 28075 (Pl. 8, fig. 1) x2.*

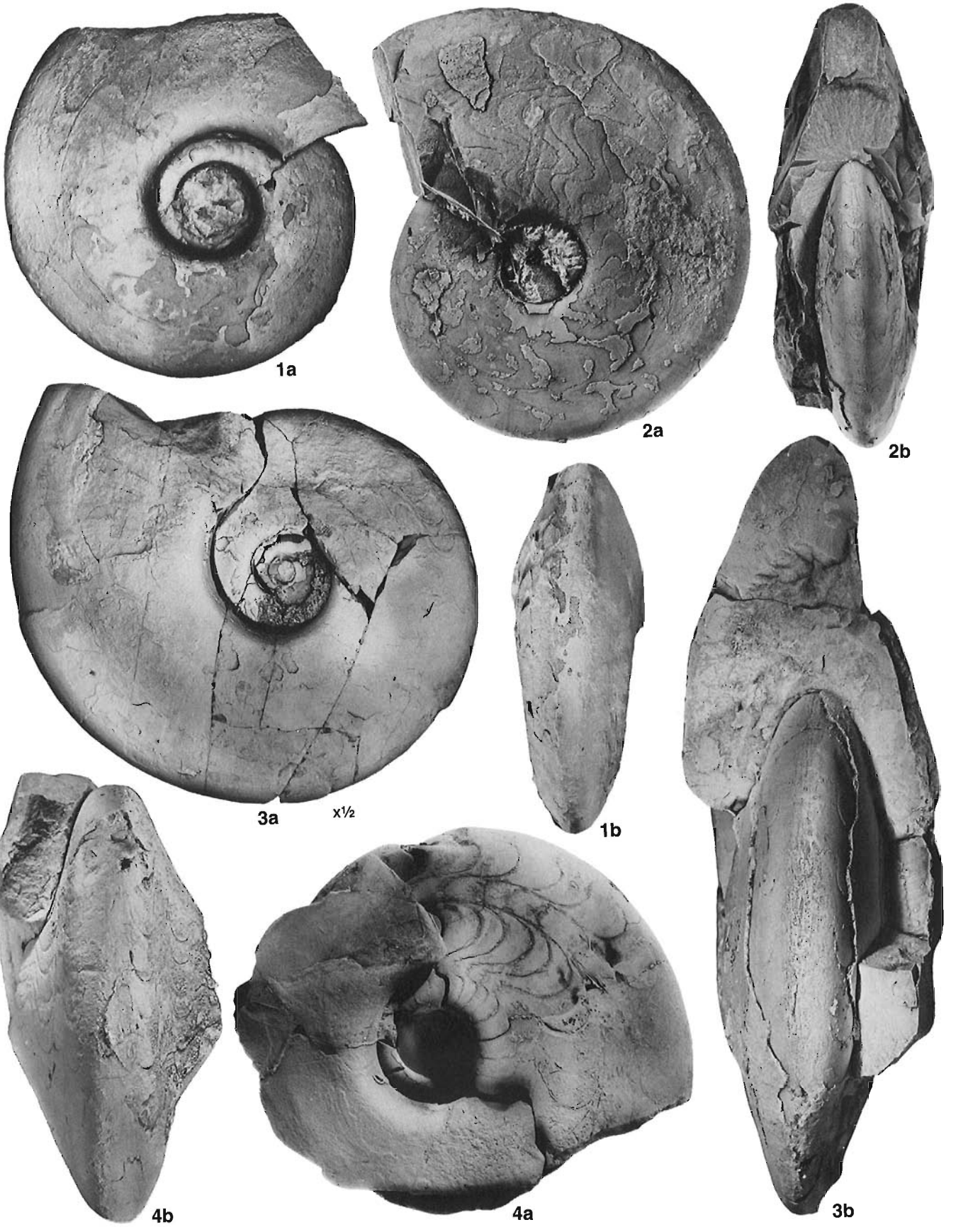

1a
2a
2b
3a
x½
1b
3b
4b
4a

PLATE 9

LOWER TRIASSIC
Griesbachian–Strigatus Zone

Figures 1, 2. *Bukkenites incisus* n. sp. (Page 59)

1a, b. Holotype GSC 28081, one half natural size. Blind Fiord Formation, Raanes Peninsula, Ellesmere Island (GSC loc. 51593).

2a, b. Paratype GSC 28082. Blind Fiord Formation, south of Bunde Fiord, Axel Heiberg Island (GSC loc. 64765).

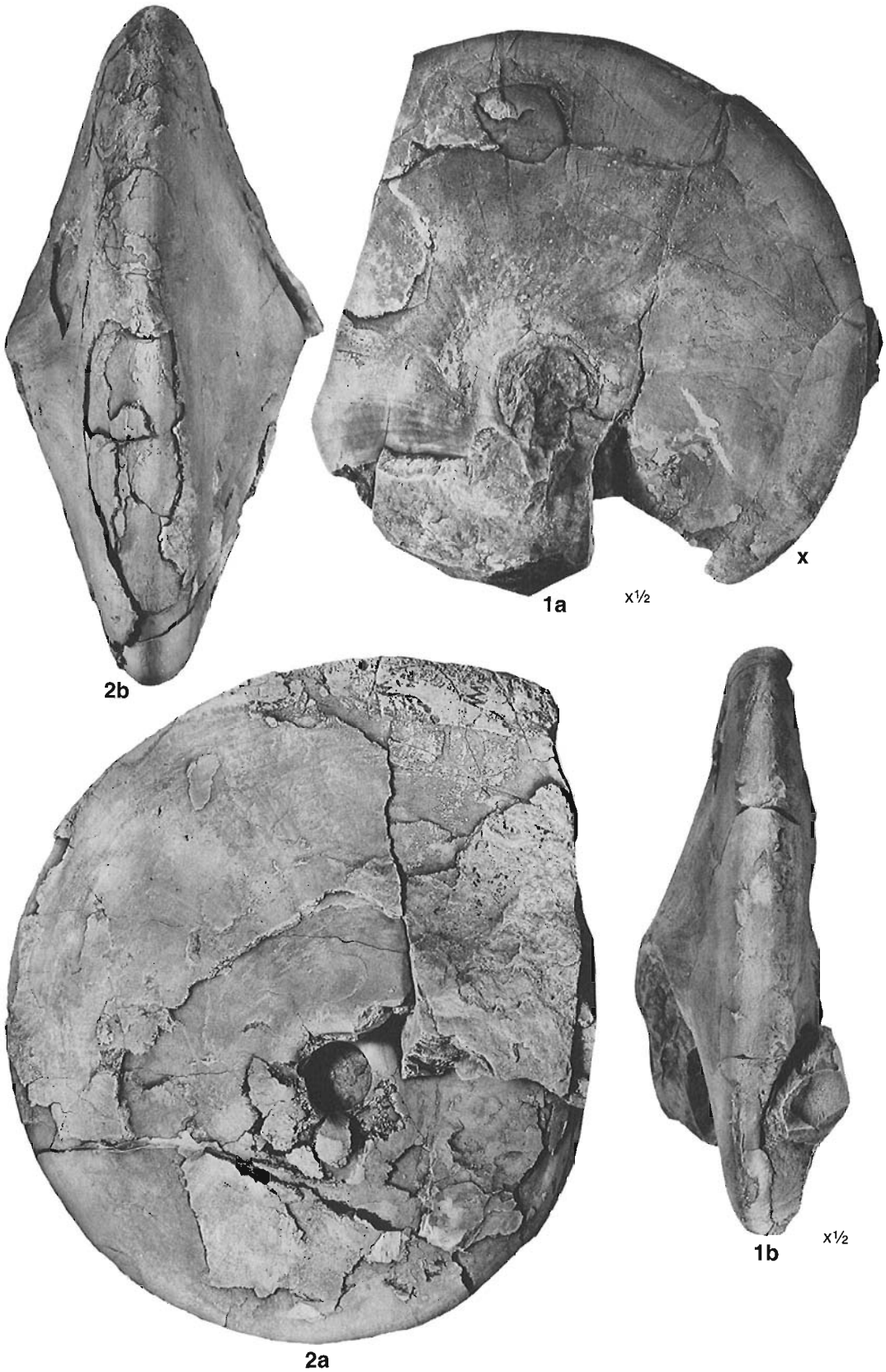

x
1a
x½
2b
1b
x½
2a

PLATE 10

LOWER TRIASSIC
Dienerian–Candidus Zone

All specimens from Grayling Formation, Dunedin River, British Columbia (GSC loc. 42372)

Figures 1a, b. *Meekophiceras columbianum* (Tozer) (Page 66)
Holotype GSC 14266.

Figures 2a, b. *Dunedinites pinguis* Tozer (Page 62)
Holotype GSC 14287, body chamber one half whorl, peristome preserved.

Figures 3a, b. *Proptychites newelli* Tozer (Page 62)
Holotype GSC 14270; 3b, periphery of inner whorl.

Figures 4a, b. *Proptychites kummeli* Tozer (Page 62)
Holotype GSC 14272.

Figures 5a, b. *Pleurogyronites kraffti* n. sp. (Page 66)
Holotype GSC 14269.

Figure 6. *Proptychites mulleri* Tozer (Page 62)
Holotype GSC 14268.

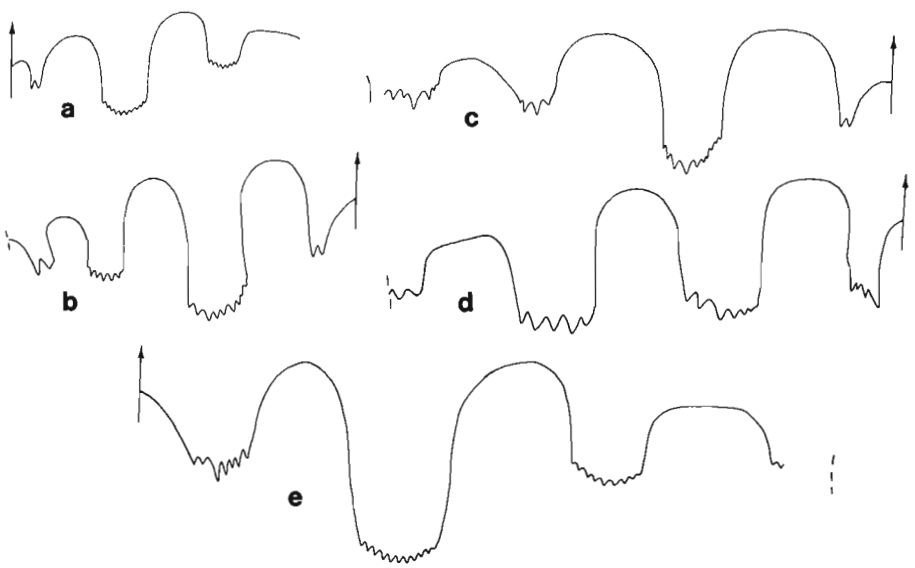


Figure 11. *Sutures. a,* ***Pleurogyronites kraffti*** *n. sp., GSC 14269 (Pl. 10, fig. 5) x4; b,* ***Proptychites newelli*** *Tozer, GSC 14270 (Pl. 10, fig. 3) x4; c,* ***Proptychites kummeli*** *Tozer, GSC 14272 (Pl. 10, fig. 4) x4; d,* ***Dunedinites pinguis*** *Tozer, GSC 14287 (Pl. 10, fig. 2) x4; e,* ***Meekophiceras columbianum*** *(Tozer), GSC 14266 (Pl. 10, fig. 1) x4.*

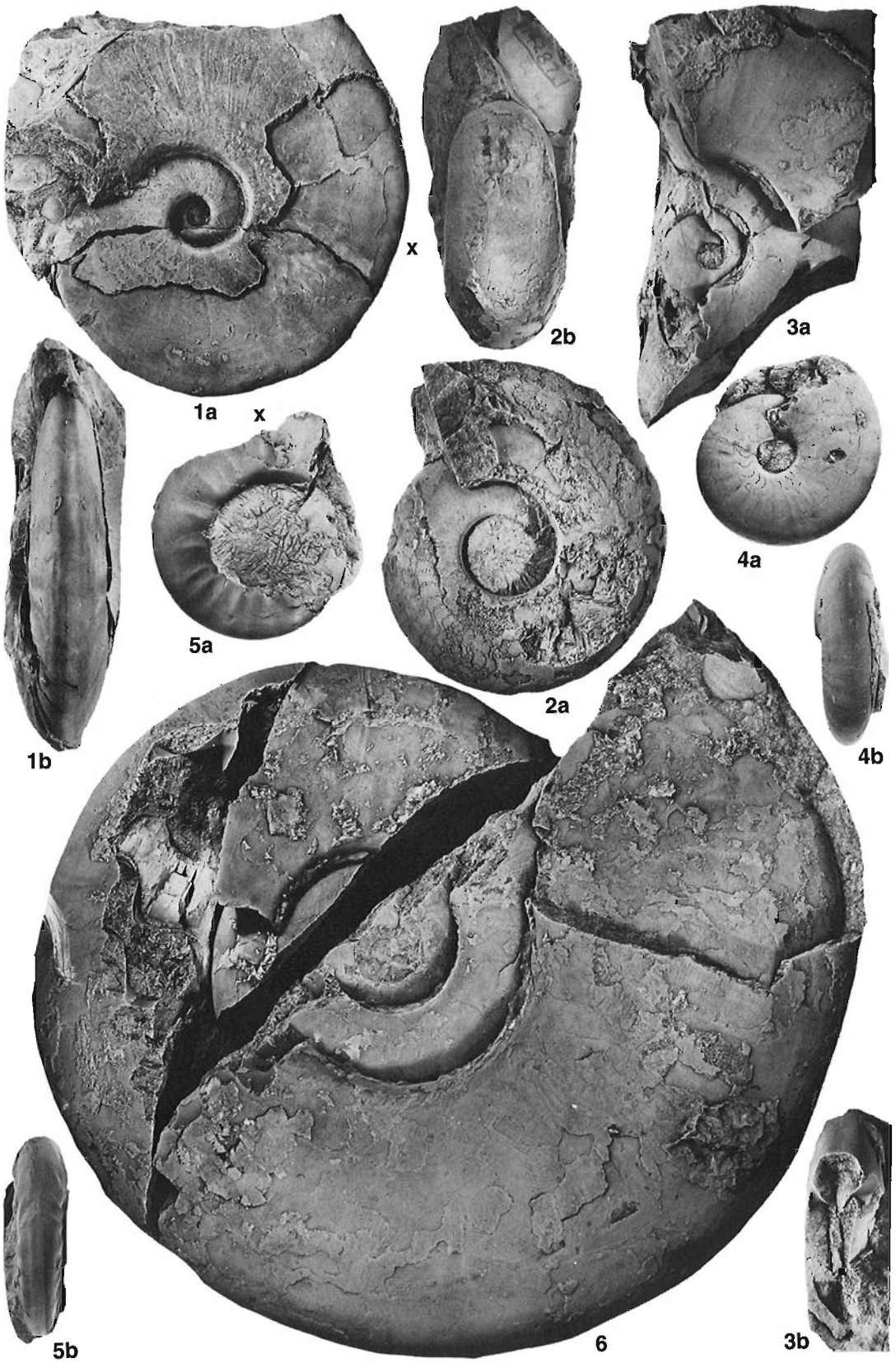

1a
x
2b
3a
1b
x
5a
2a
4a
4b
1b
5b
6
3b

PLATE 11

LOWER TRIASSIC
Dienerian–Candidus Zone

Figures 1–3. *Meekophiceras franklini* n. sp. (Page 66)
1a, b. Holotype GSC 28071 (GSC loc. 47551).
2a, b. Paratype GSC 28074 (GSC loc. 64729).
3. Paratype GSC 28073 (GSC loc. 64729).
All from Blind Fiord Formation, south of Bunde Fiord, Axel Heiberg Island.

Figures 4, 5. *Proptychites candidus* Tozer (Page 61)
4a, b. Hypotype GSC 28084 (GSC loc. 51693).
5. Hypotype GSC 28085 (GSC loc. 51691).
Both from Blind Fiord Formation, Diener Creek, Ellesmere Island.

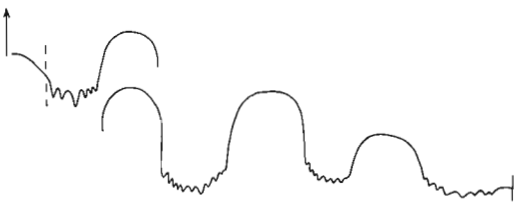


Figure 12. *Sutures.* ***Meekophiceras franklini*** *n. sp., GSC 28071 (Pl. 11, fig. 1) x4.*

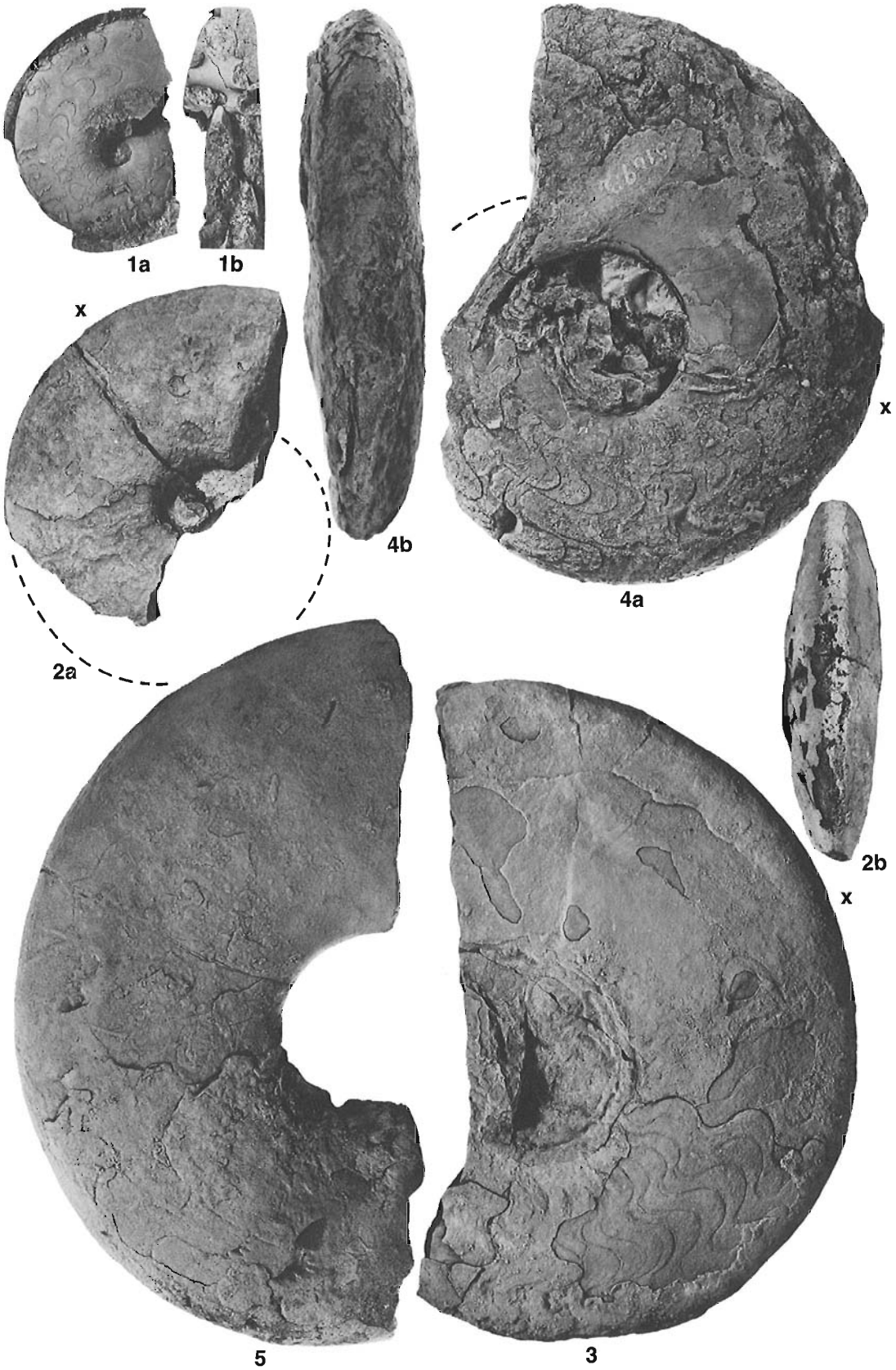

1a
1b
x
2a
4b
4a
x
2b
x
5
3

PLATE 12

LOWER TRIASSIC
Dienerian–Candidus Zone

Figures 1, 2. *Prionolobus welteri* n. sp. (Page 69)
1a–c. Holotype GSC 28111 (GSC loc. 56182).
2a, b. Paratype GSC 28110 (GSC loc. 56183).
Both from Toad Formation, southwest of Mount Laurier, northeastern British Columbia.

Figures 3–5. *Proptychites candidus* Tozer (Page 61)
3a, b. Hypotype GSC 28091, side and sectional view of phragmocone.
4. Hypotype GSC 28090, body chamber, one half natural size, maximum width 75 mm.
Figures 3, 4 from Grayling Formation, near Tuchodi River, northeastern British Columbia (GSC loc. 68274).
5a, b. GSC 28092, one half natural size, last half whorl appears to be body chamber but septa are not visible on phragmocone. Toad Formation, near Calnan Creek, northeastern British Columbia (GSC loc. 56220).

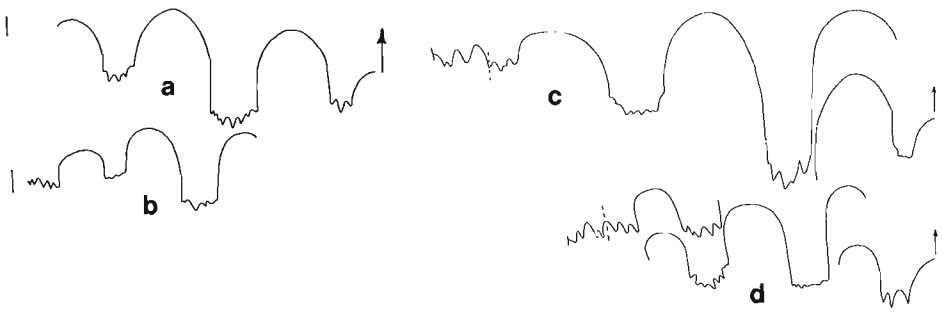


Figure 13. *Sutures. a, b.* ***Prionolobus welteri*** *n. sp. a, GSC 28110 (Pl. 12, fig. 2) x2; b, GSC 28111 (Pl. 12, fig. 1) x2; c, d.* ***Proptychites candidus*** *Tozer; c, GSC 14046* x1; d, GSC 28091 (Pl. 12, fig. 3) x1.*

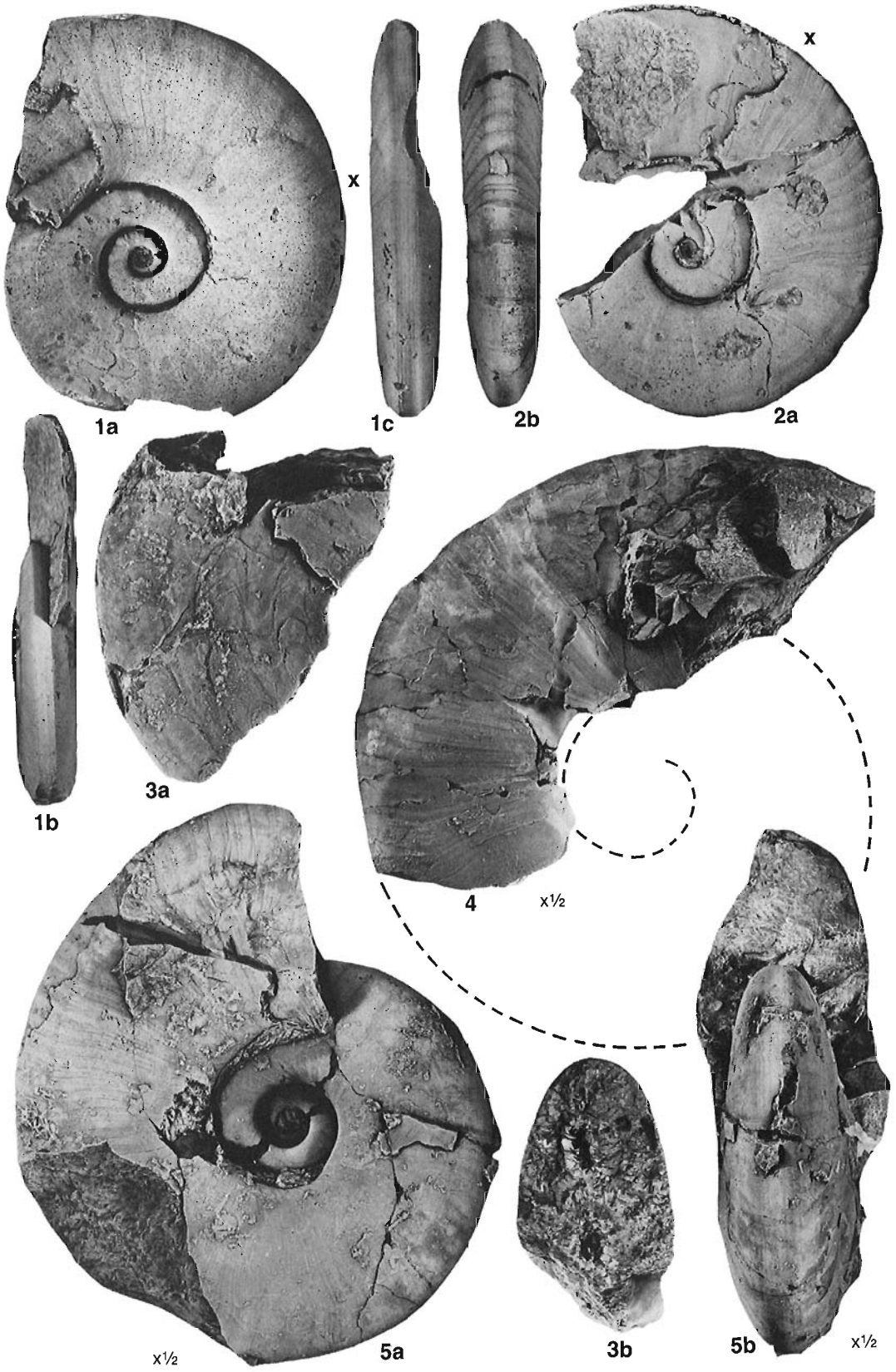

x
1a
1c
2b
x
2a
1b
3a
4
x½
x½
5a
3b
5b
x½

PLATE 13

LOWER TRIASSIC
Dienerian–Candidus Zone

Figures 1–3, 6. *Pleurambites frechi* n. sp. (Page 68)

1a, b. Paratype GSC 28112, outer whorl is partly body chamber. Grayling Formation, near Tuchodi River, British Columbia (GSC loc. 68275).

2a–c. Paratype 28116, septa not preserved. Toad Formation, near Calnan Creek, British Columbia (GSC loc. 56218).

3a, b. Holotype GSC 28114, septa not preserved. Grayling Formation, near Tuchodi River, British Columbia (GSC loc. 88732).

6a, b. Paratype GSC 28113, septa not visible. Toad Formation, Grayling Formation, near Tuchodi River, British Columbia (GSC loc. 68275).

Figures 4, 5, 7. *Ambites fuliginatus* n. sp. (Page 67)

4a, b. Paratype GSC 28121. Grayling Formation, near Tuchodi River, British Columbia (GSC loc. 88733).

5a, b. Paratype GSC 28125. Toad Formation, near Calnan Creek, British Columbia (GSC loc. 56202).

7a, b. Paratype GSC 28124, body chamber is preserved but exact limit of phragmocone uncertain. Grayling Formation, near Tuchodi River, British Columbia (GSC loc. 68273).

Figures 8a–c. *Ambites wissneri* n. sp. (Page 68)

Holotype GSC 28122. Grayling Formation, near Tuchodi River, northeastern British Columbia (GSC loc. 88732).

Figure 14. *Suture.* ***Pleurambites frechi*** *n. sp., GSC 28112 (Pl. 13, fig. 1) x8.*

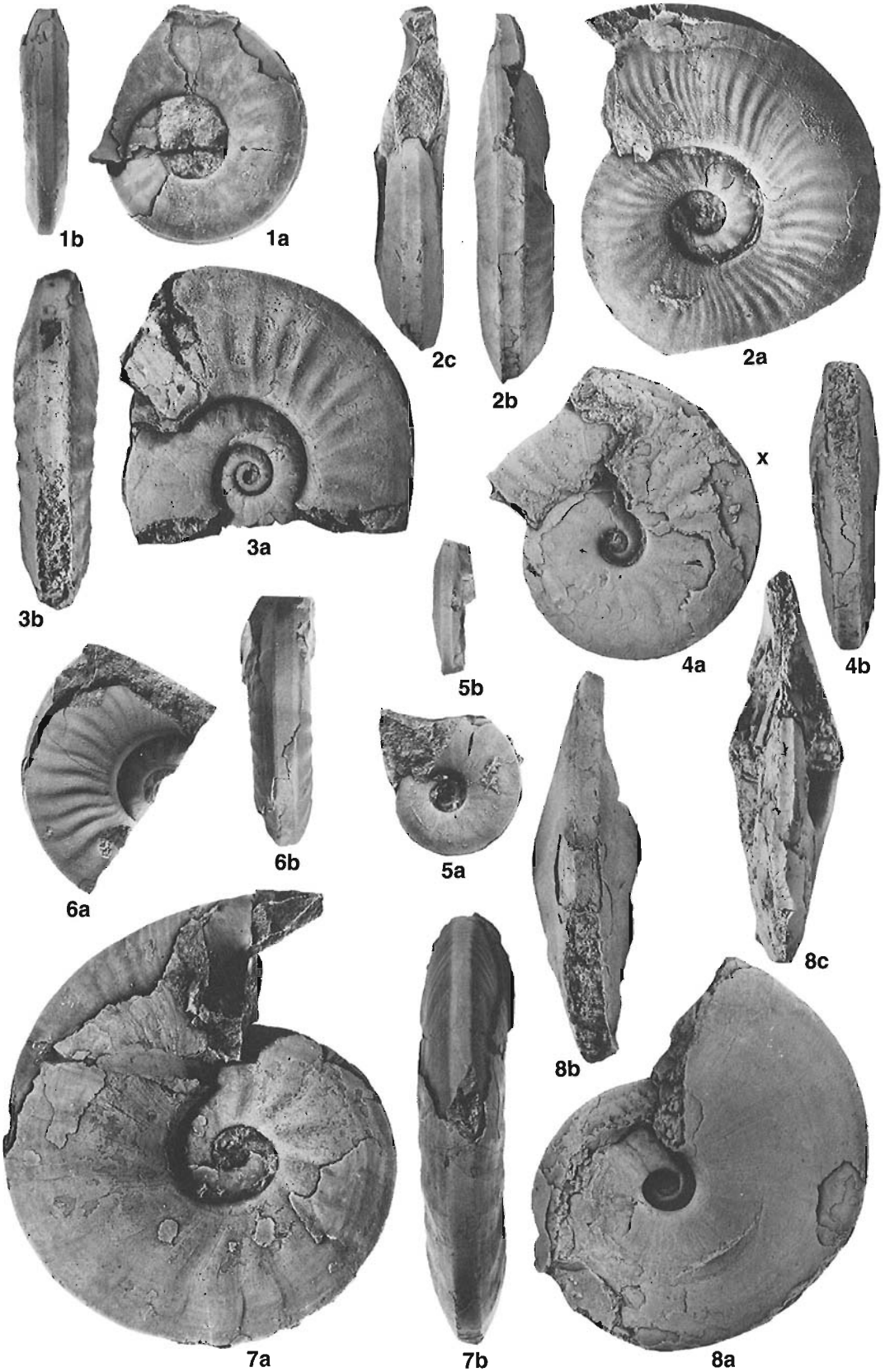

1b
1a
2c
2b
2a
3b
3a
x
4a
4b
5b
6b
5a
6a
8c
8b
7a
7b
8a

PLATE 14

LOWER TRIASSIC
Dienerian–Candidus Zone

Figures 1–7. *Ambites ferruginus* n. sp. (Page 67)
1a, b. Paratype GSC 28128 (GSC loc. 51694).
2a, b. Paratype GSC 28129 (GSC loc. 51694).
3. Paratype GSC 28130, sectional view (GSC loc. 51694).
4. Paratype GSC 28131, body chamber (GSC loc. 51665).
5. Paratype GSC 28132, phragmocone (GSC loc. 51665).
6a, b. Paratype GSC 28133 (GSC loc. 51665).
7a,. b. Holotype GSC 28134 (GSC loc. 51665).
All from Blind Fiord Formation, near Diener Creek, Ellesmere Island.

Figures 8a, b. *Ambites fuliginatus* n. sp. (Page 67)
Holotype GSC 28123. Grayling Formation, near Tuchodi River, British Columbia (GSC loc. 88732).

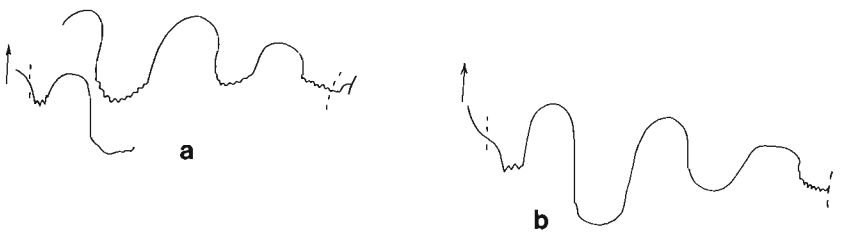


Figure 15. *Sutures. a,* ***Ambites fuliginatus*** *n. sp., GSC 28123 (Pl. 14, fig. 8) x2; b,* ***Ambites ferruginus*** *n. sp., GSC 28133 (Pl. 14, fig. 6) x2; the lobes are weathered.*

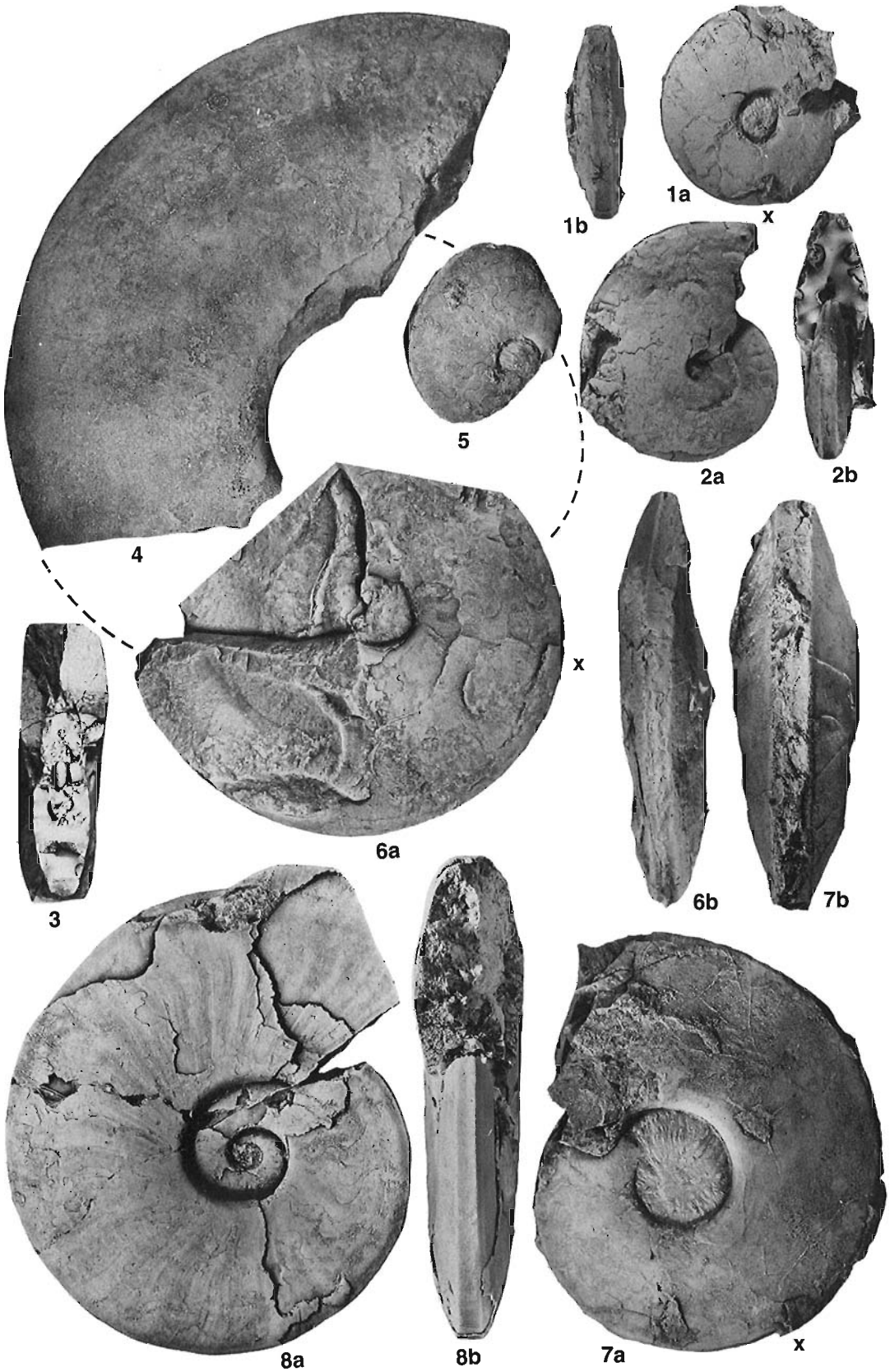

1b
1a
x
5
2a
2b
4
6a
x
3
6b
7b
8a
8b
7a
x

PLATE 15

LOWER TRIASSIC
Dienerian–Sverdrupi Subzone 2

All specimens from Blind Fiord Formation, Lindstrøem Creek, Ellesmere Island

Figures 1–3. *Vavilovites sverdrupi* (Tozer) (Page 63)

1a, b. Paratype GSC 14275, side and sectional views (GSC loc. 47543).

2. Holotype GSC 14277 (GSC loc. 47543), complete phragmocone removed from poorly preserved body chamber, which attained a diameter of about 160 mm with an umbilical width of 47 mm. For illustration of inner whorl, venter, and suture line see Tozer, 1963a, Pl. 4, figs. 2a–d.

3a, b. GSC. 28098 (GSC loc. 47621), nucleus removed from specimen about 100 mm in diameter.

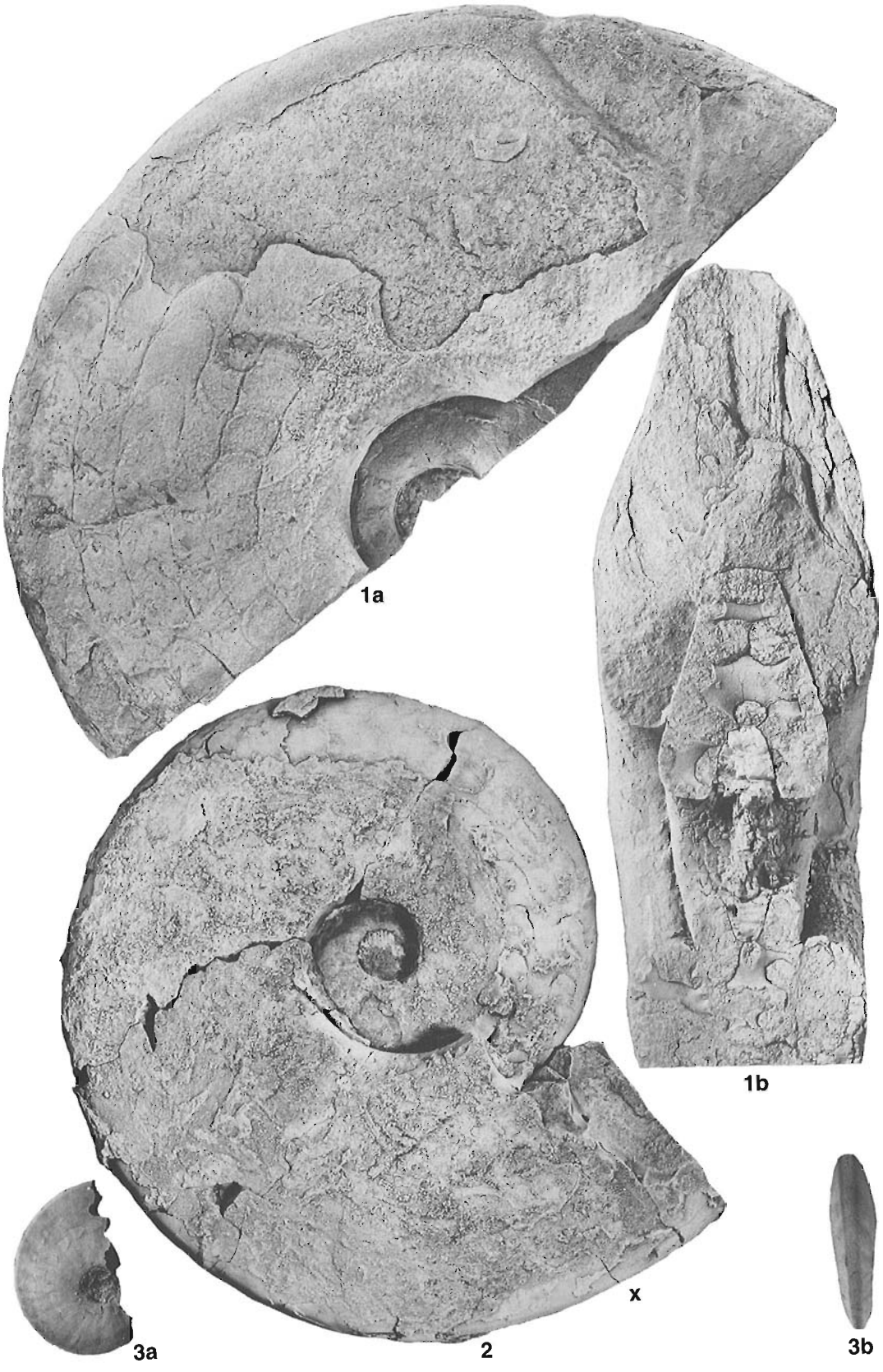

1a
1b
2
x
3a
3b

PLATE 16

LOWER TRIASSIC
Dienerian–Sverdrupi Subzone 2

All specimens from Blind Fiord Formation, Diener Creek, Ellesmere Island (GSC loc. 51695)

Figures 1–5. *Vavilovites obtusus* n. sp. (Page 63)
1a, b. Paratype GSC 28095.
2a, b. Paratype GSC 28094.
3a, b. Paratype GSC 28093.
4a–c. Paratype GSC 28096, complete phragmocone.
5a, b. Holotype GSC 28097, complete individual.

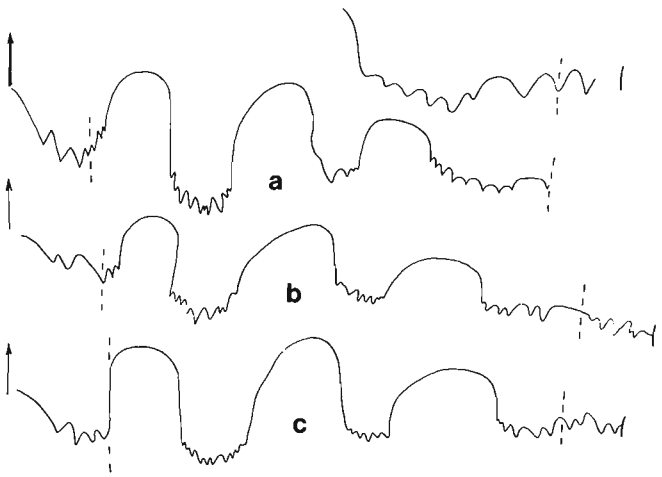


Figure 16. *Sutures. a,* ***Vavilovites sverdrupi*** *(Tozer), GSC 18898 (Tozer, 1967, Pl. 4, fig. 2), two sutures x2; b, c.* ***Vavilovites obtusus*** *n. sp. b, GSC 28096 (Pl. 16, fig. 4) x2; c, GSC 28097 (Pl. 16, fig. 5) x2.*

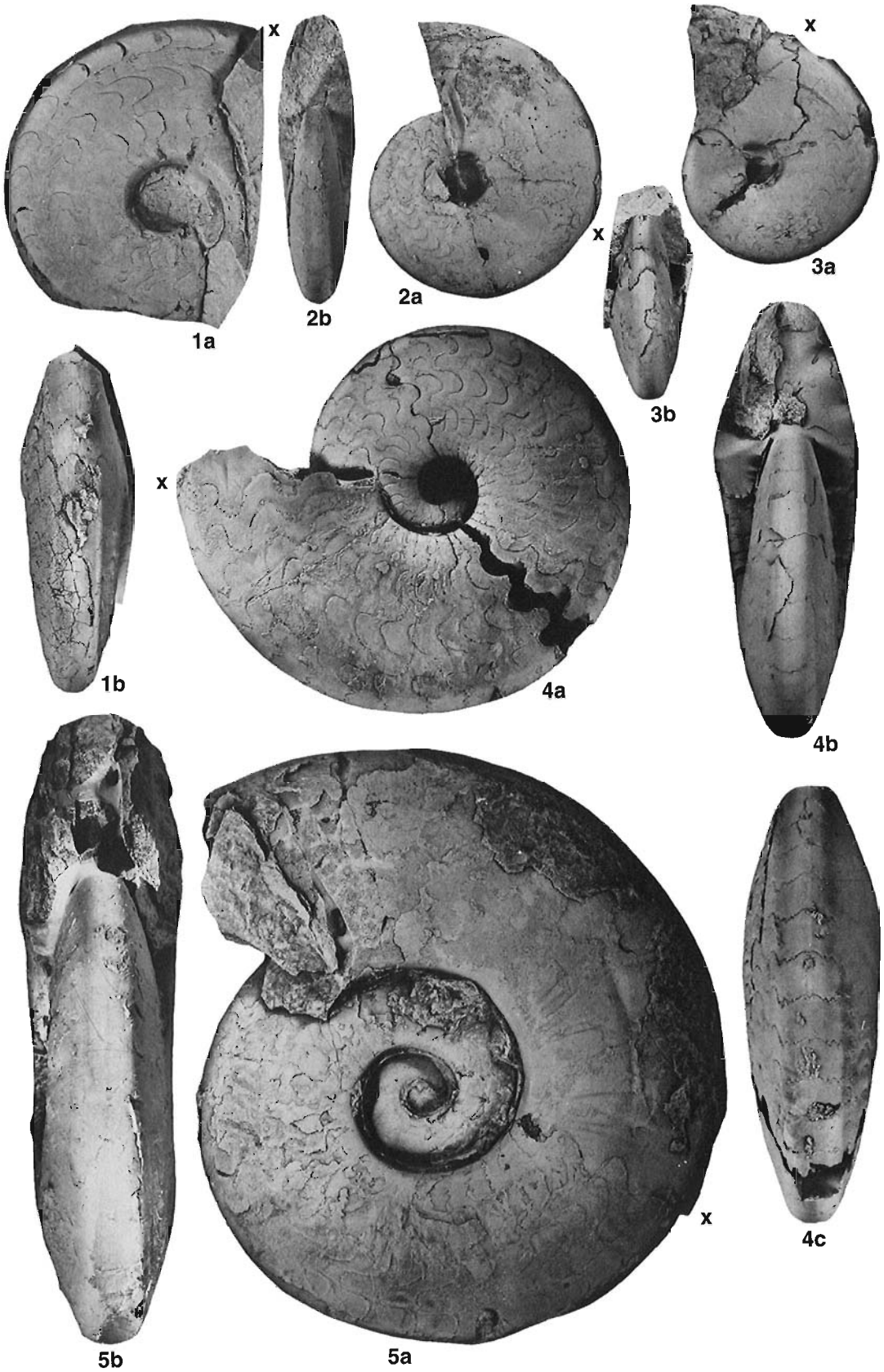

x
1a
2b
2a
x
3b
x
3a
1b
x
4a
4b
5b
5a
x
4c

PLATE 17

LOWER TRIASSIC
Dienerian–Sverdrupi Zone

Figures 1a, b. *Heibergites heibergensis* (Tozer) (Subzone 3) (Page 65)
Hypotype GSC 28106. Blind Fiord Formation, southeast of Cape Stallworthy, Axel Heiberg Island (GSC loc. 64716).

Figures 2a, b. *Kingites thulensis* n. sp. (Page 64)
Holotype GSC 28104. Blind Fiord Formation, southeast of Cape Stallworthy, Axel Heiberg Island (GSC loc. 64717).

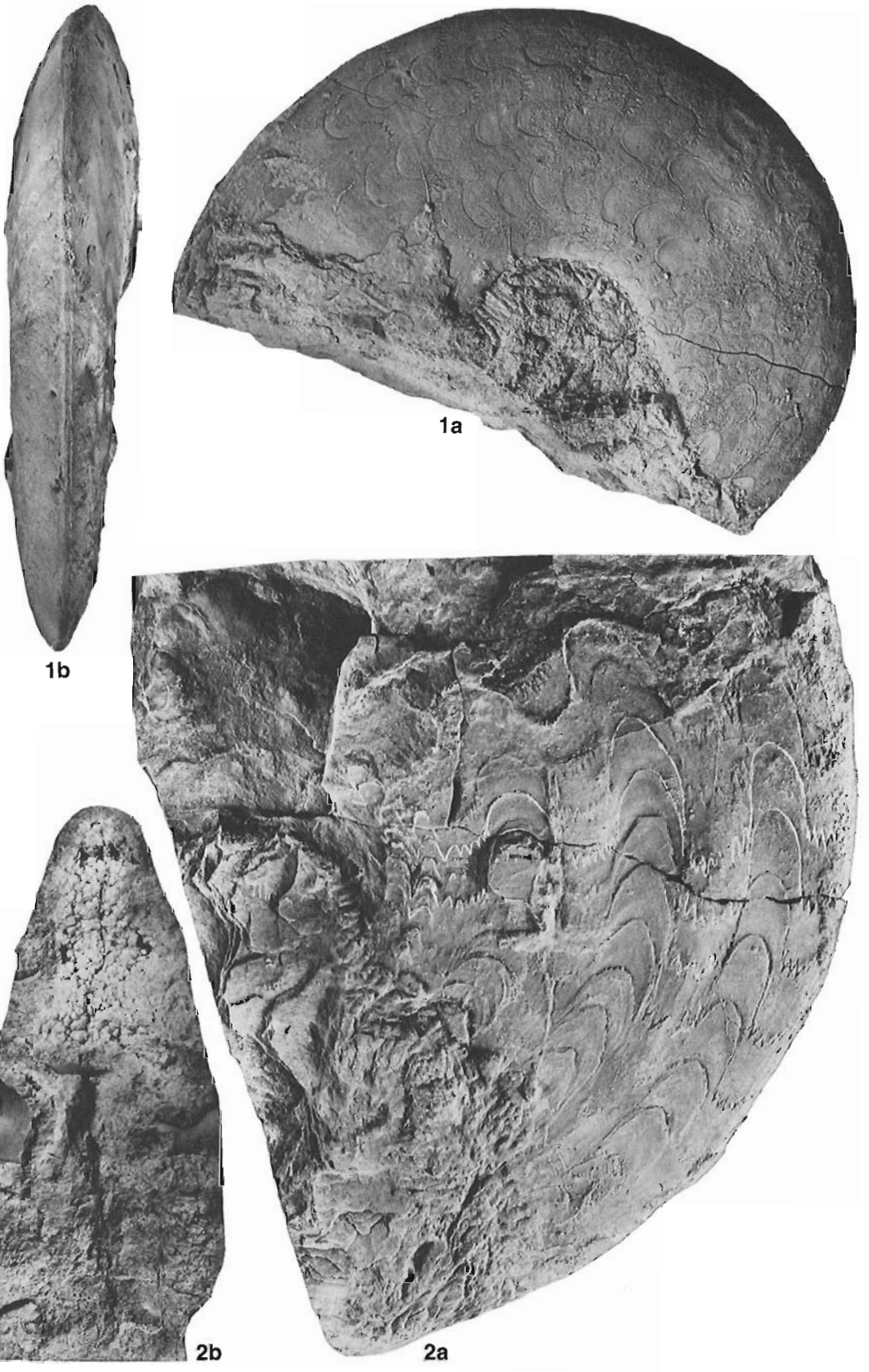

1a
1b
2a
2b

PLATE 18

LOWER TRIASSIC
Dienerian–Sverdrupi Zone

Specimens from Blind Fiord Formation, south of Bunde Fiord, Axel Heiberg Island (GSC loc. 64731).

Figures 1a, b. *Pseudosageceras multilobatum* Noetling (Page 83)
Hypotype GSC 28240, phragmocone.

Figures 2a, b. *Heibergites heibergensis* (Tozer) (Page 65)
Topotype GSC 28105, phragmocone.

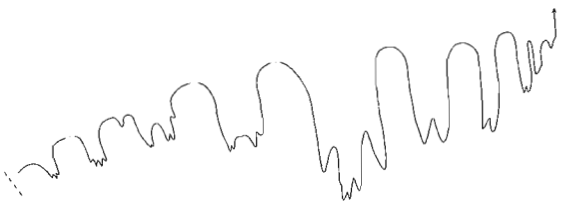


Figure 17. *Suture.* ***Pseudosageceras multilobatum*** *Noetling, GSC 28240 (Pl. 18, fig. 1) x1.*

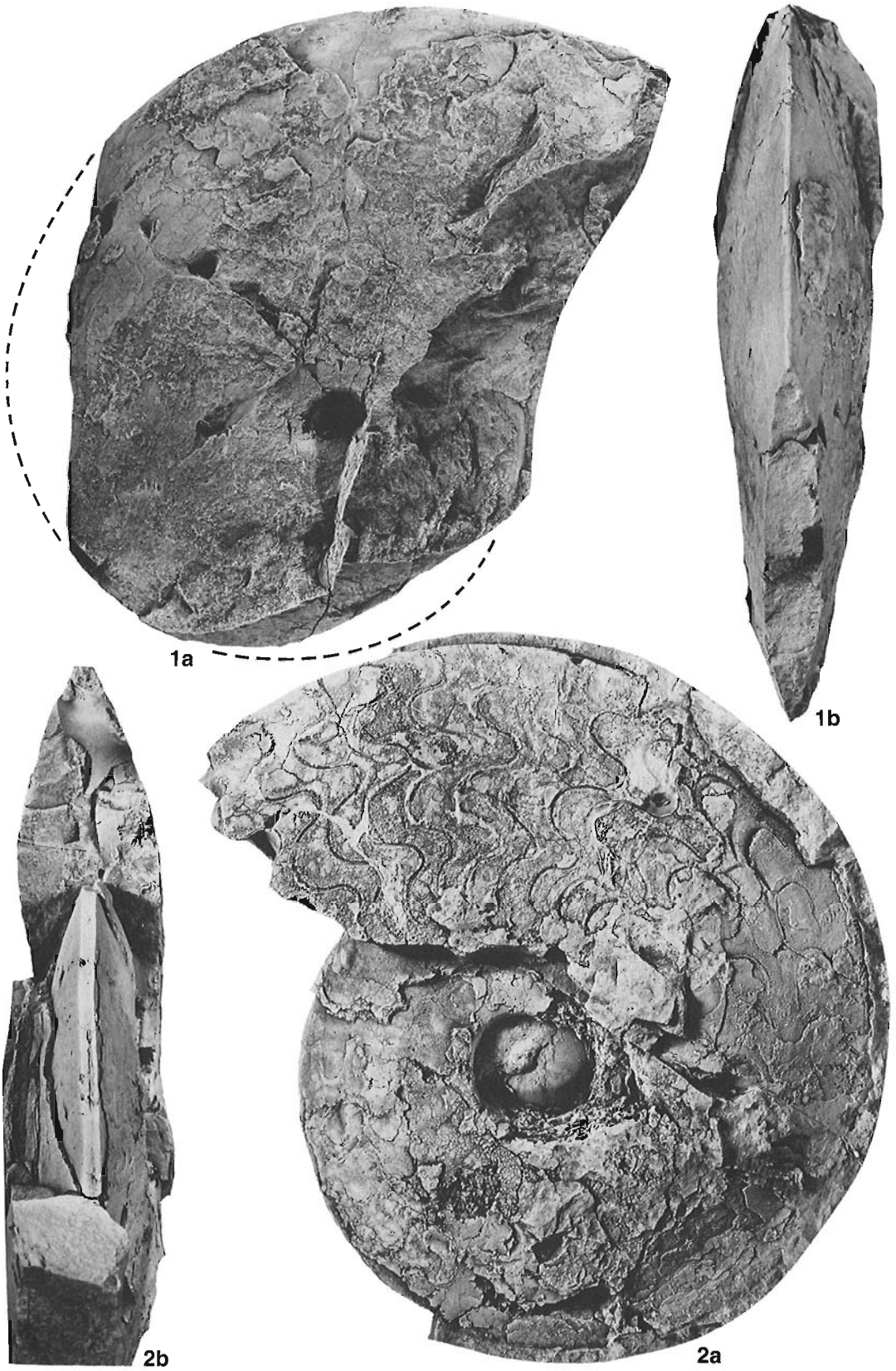

1a
1b
2a
2b

PLATE 19

LOWER TRIASSIC
Dienerian–Sverdrupi Subzone 3

Figures 1–3. *Kingites discoidalis* n. sp. (Page 64)
1a, b. Holotype GSC 28102.
2a, b. Paratype GSC 28103.
Figures 1, 2 from Blind Fiord Formation, southeast of Cape Stallworthy, Axel Heiberg Island (GSC loc. 64716).
3a, b. Paratype GSC 28101. Blind Fiord Formation, Griesbach Creek, Axel Heiberg Island (GSC loc. 47584).

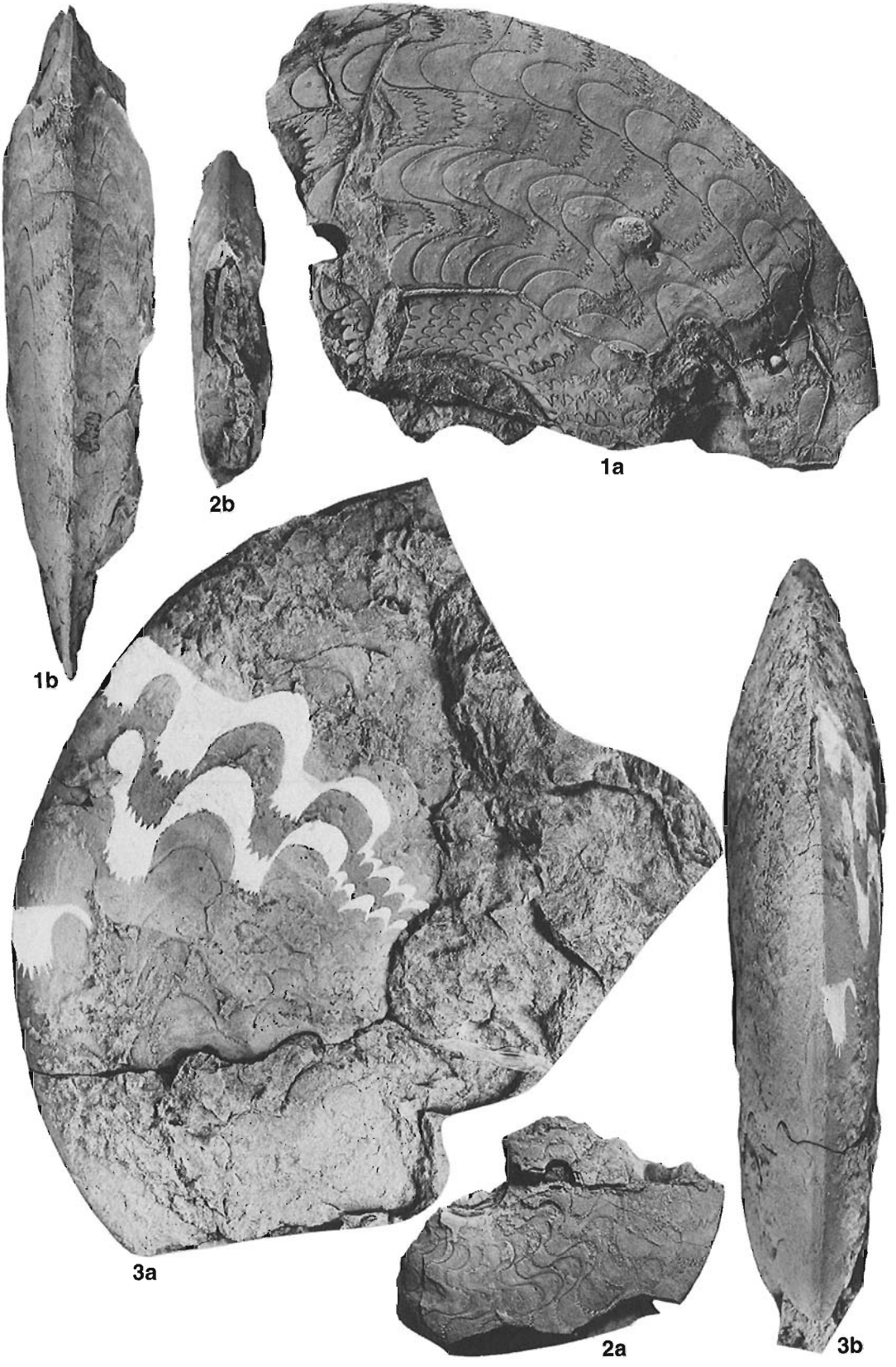

1a
2b
1b
3a
2a
3b

PLATE 20

LOWER TRIASSIC
Dienerian–Sverdrupi Zone

All specimens from Toad Formation, near Calnan Creek, northeastern British Columbia

Figures 1a, b. *Xenodiscoides calnani* n. sp. (Page 50)
Holotype GSC 28049, last half whorl is probably body chamber (GSC loc. 56223).

Figures 2a, b. *Vavilovites sverdrupi* (Tozer) (Subzone 2) (Page 63)
Hypotype GSC 28100, septa not visible (GSC loc. 56222).

Figures 3, 4. *Koninckites dimidiatus* n. sp. (Subzone 1) (Page 62)
3a, b. Paratype GSC 28108 (GSC loc. 56225), more than last quarter whorl is body chamber.
4. Holotype GSC 28107 (GSC loc. 56225).

Figures 5–7. *Flemingites reticulatus* n. sp. (Page 71)
5a, b. Paratype GSC 28138 (GSC loc. 56223), septa not visible.
6a, b. Paratype GSC 28136 (GSC loc. 56206).
7. Holotype GSC 28137 (GSC loc. 56224), body chamber length about one half whorl.

Figures 8, 9. *Wyomingites scapulatus* n. sp. (Subzone 2) (Page 70)
8a, b. Holotype GSC 28144 (GSC loc. 56228).
9. Paratype GSC 28145 (GSC loc. 56233).

Figures 10a, b. *Tellerites* sp. indet. (Page 84)
GSC 28241, phragmocone (GSC loc. 56209).

Figure 11. Genus indet.
GSC 28242 (GSC loc. 56209).

Figures 12, 13. *Prionolobus koninckl* n. sp. (Page 69)
12a, b. Paratype GSC 28117 (GSC loc. 56226).
13. Holotype GSC 28118 (GSC loc. 56226).

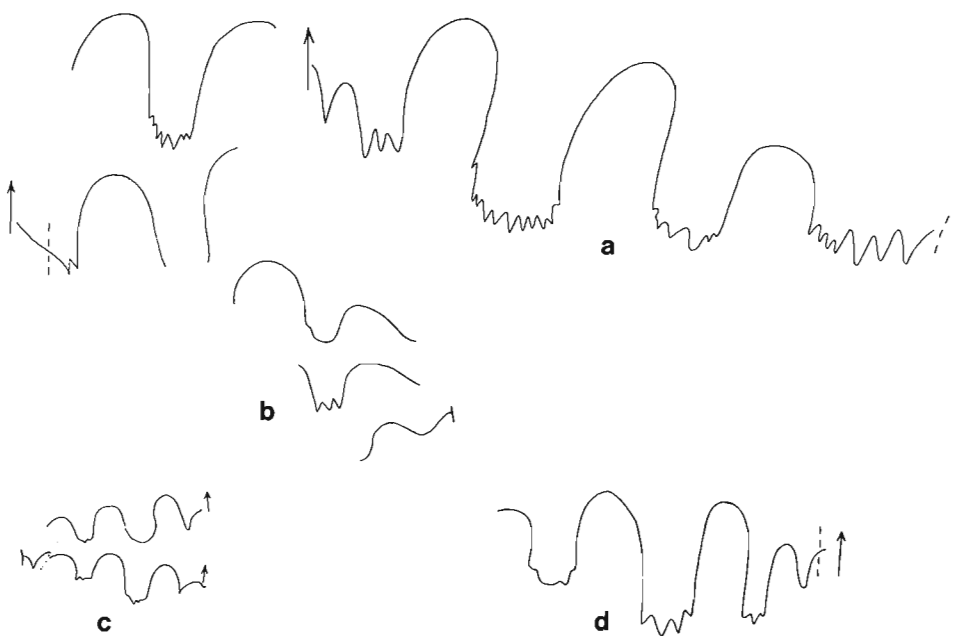


Figure 18. *Sutures. a,* ***Koninckites dimidiatus*** *n. sp., GSC 28107 (Pl. 20, fig. 4) x4; b,* ***Prionolobus koninckl*** *n. sp., GSC 28118 (Pl. 20, fig. 13) x4; c,* ***Xenodiscoides calnani*** *n. sp., GSC 28049 (Pl. 20, fig. 1) x4; d,* ***Tellerites*** *sp. indet., GSC 28241 (Pl. 20, fig. 10) x4.*

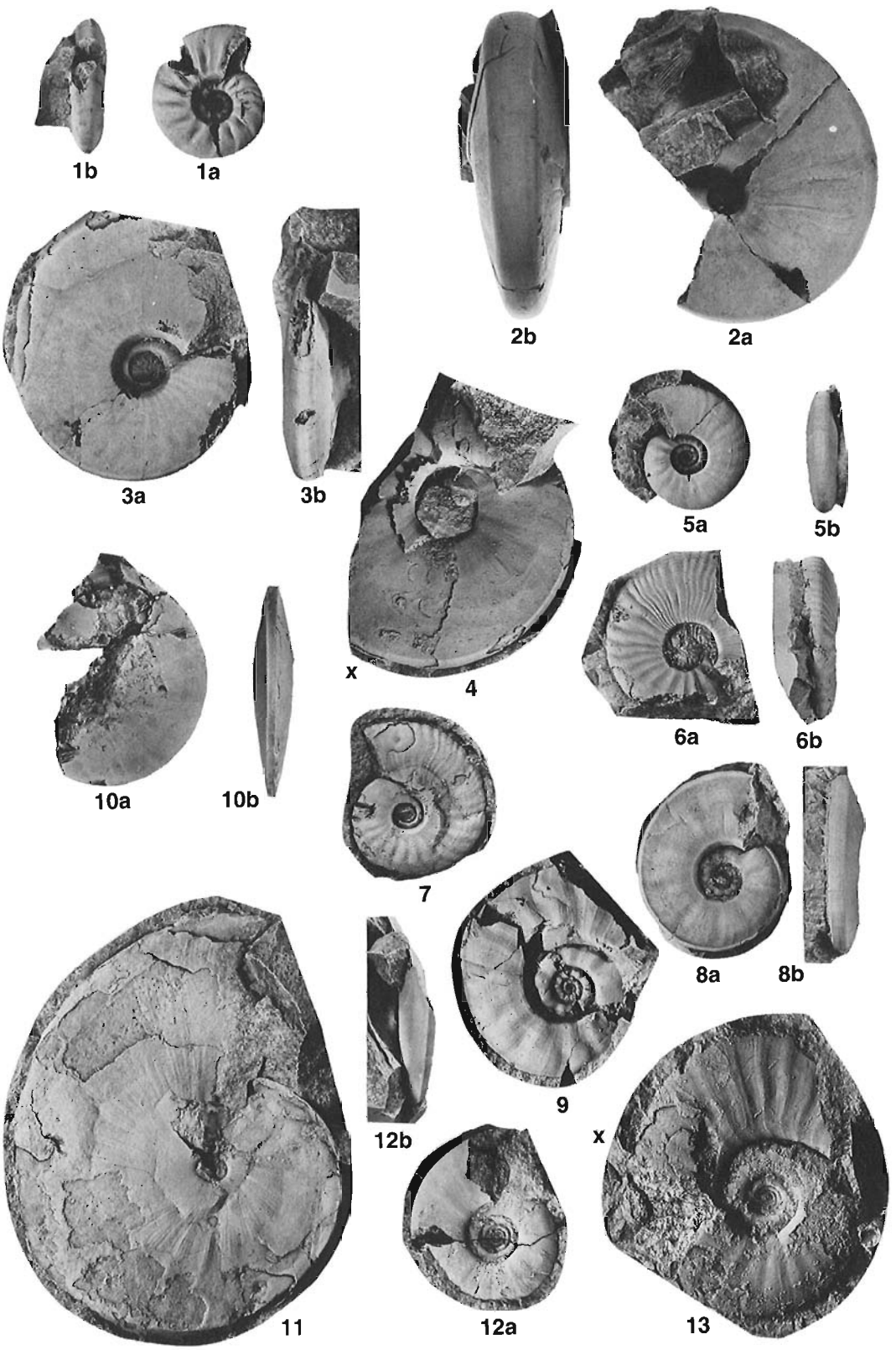

1b
1a
2b
2a
3a
3b
5a
5b
x
4
6a
6b
10a
10b
7
8a
8b
9
12b
x
11
12a
13

PLATE 21

LOWER TRIASSIC
Smithian–Romunderi Zone

Figures 1a, b. *Thermalites canadensis* (Tozer) (Page 53)
Holotype GSC 14079. Blind Fiord Formation, near Smith Creek, Ellesmere Island (GSC loc. 28681).

Figures 2a, b. *Meekoceras gracilitatis* White (Page 70)
Hypotype GSC 14053. Blind Fiord Formation, near Smith Creek, Ellesmere Island (GSC loc. 32371).

Figures 3a, b. *Kashmirites borealis* (Tozer) (Page 50)
Paratype GSC 14076. Blind Fiord Formation, near Smith Creek, Ellesmere Island (GSC loc. 28681).

Figure 4. *Euflemingites romunderi* Tozer (Page 72)
Hypotype GSC 28150, whorl fragment. Blind Fiord Formation, Lindstroem Creek, Ellesmere Island (GSC loc. 47801).

Figures 5a, b. *Pseudosageceras longilobatum* Kiparisova (Page 83)
Hypotype GSC 14175, phragmocone. Blind Fiord Formation, near Smith Creek, Ellesmere Island (GSC loc. 28681).

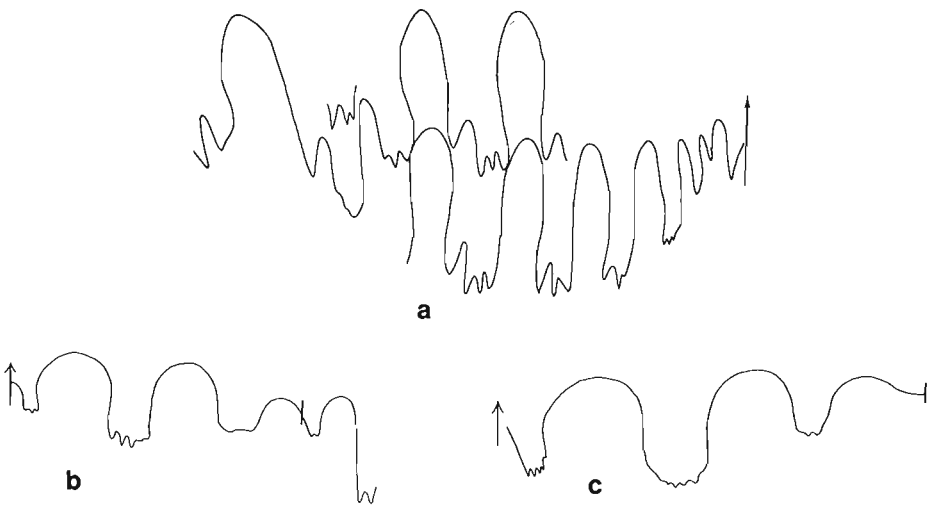


Figure 19. *Sutures. a,* ***Pseudosageceras longilobatum*** *Kiparisova, GSC 14175 (Pl. 21, fig. 5) x2. b, c.* ***Kashmirites borealis*** *(Tozer). b, GSC 28042* x4; c, GSC 14077 (Tozer, 1961, Pl. 14, fig. 6) x4.*

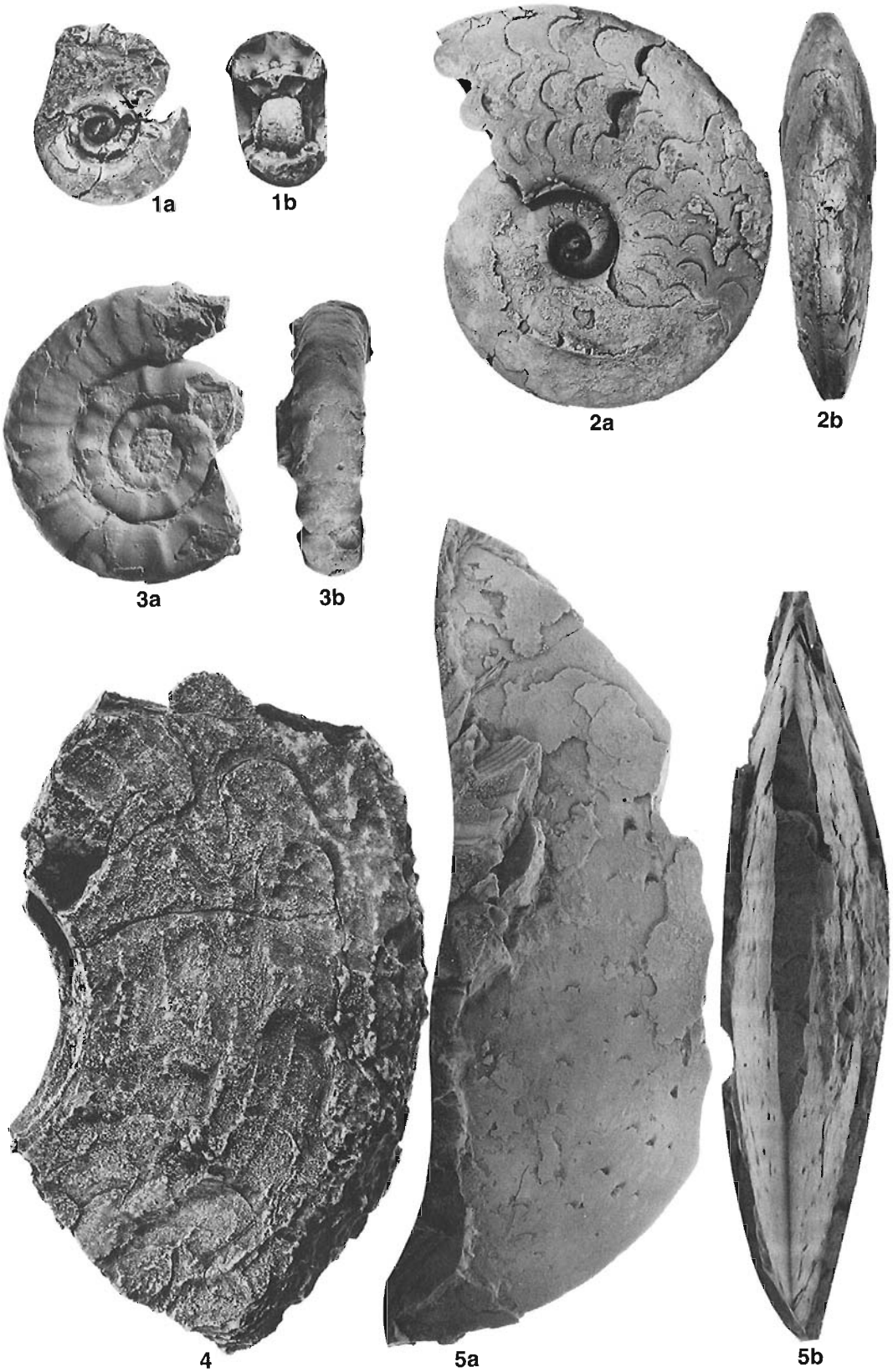

1a
1b
2a
2b
3a
3b
4
5a
5b

PLATE 22

LOWER TRIASSIC
Smithian–Romunderi Zone

All specimens from Toad Formation, Needham Creek, northeastern British Columbia

Figures 1, 2. *Kashmirites columbianus* n. sp. (Page 51)
1a, b. Paratype GSC 28043, about half a whorl is body chamber (GSC loc. 56173).
2a, b. Holotype GSC 28044, septa not visible (GSC loc. 56174).

Figures 3a, b. *Gyronites recentis* n. sp. (Page 68)
Holotype GSC 28119, last half whorl apparently body chamber (GSC loc. 56279).

Figures 4a, b. *Prionolobus lucinus* n. sp. (Page 69)
Holotype GSC 28120, last quarter whorl is body chamber (GSC loc. 56170).

Figures 5, 6. *Thermalites needhami* (Tozer) (Page 54)
5a–c. Topotype GSC 28163, septa not visible (GSC loc. 56166).
6a, b. Topotype GSC 28164 (GSC loc. 56171).

Figures 7, 8. *Paranannites aspenensis* Hyatt and Smith (Page 76)
7a, b. Hypotype GSC 28166 (GSC loc. 56171).
8a, b. Hypotype GSC 28165 (GSC loc. 56174).

Figures 9, 10. *Juvenites laevis* n. sp. (Page 53)
9a, b. Holotype GSC 28168 (GSC loc. 56166).
10a, b. Paratype GSC 28167 (GSC loc. 56166).

Figures 11a, b. *Melagathiceras depressum* (Smith) (Page 52)
Hypotype GSC 28162 (GSC loc. 56172).

Figures 12a, b. *Meekoceras haydeni* (Smith) (Page 71)
Hypotype GSC 28135 (GSC loc. 56166), septa not visible.

Figures 13a, b. *Euflemingites cirratus* (White) (Page 72)
Hypotype GSC 28149 (GSC loc. 56172), side and sectional views of small phragmocone.

Figure 14. *Anaxenaspis* sp. indet. (Page 74)
GSC 28143 (GSC loc. 56279), one half natural size, ribbed portion is natural external impression, smooth portion is internal mould.

Figures 15, 16. *Oxyussuria canadensis* n. sp. (Page 76)
15. Holotype GSC 28233, phragmocone with umbilical seam of body chamber(?) (GSC loc. 56279).
16a, b. Paratype GSC 28234, phragmocone (GSC loc. 56172).

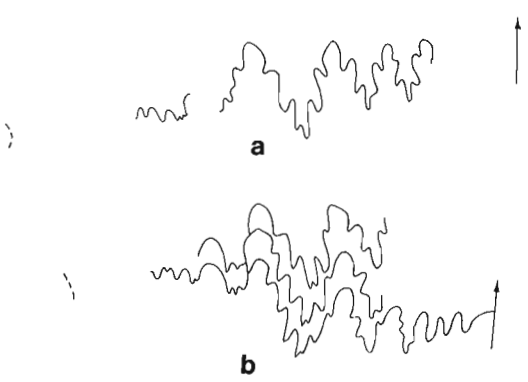


Figure 20. *Sutures.* ***Oxyussuria canadensis*** *n. sp. a, GSC 28234 (Pl. 22, fig. 16) x4; b, GSC 28233 (Pl. 22, fig. 15) x4.*

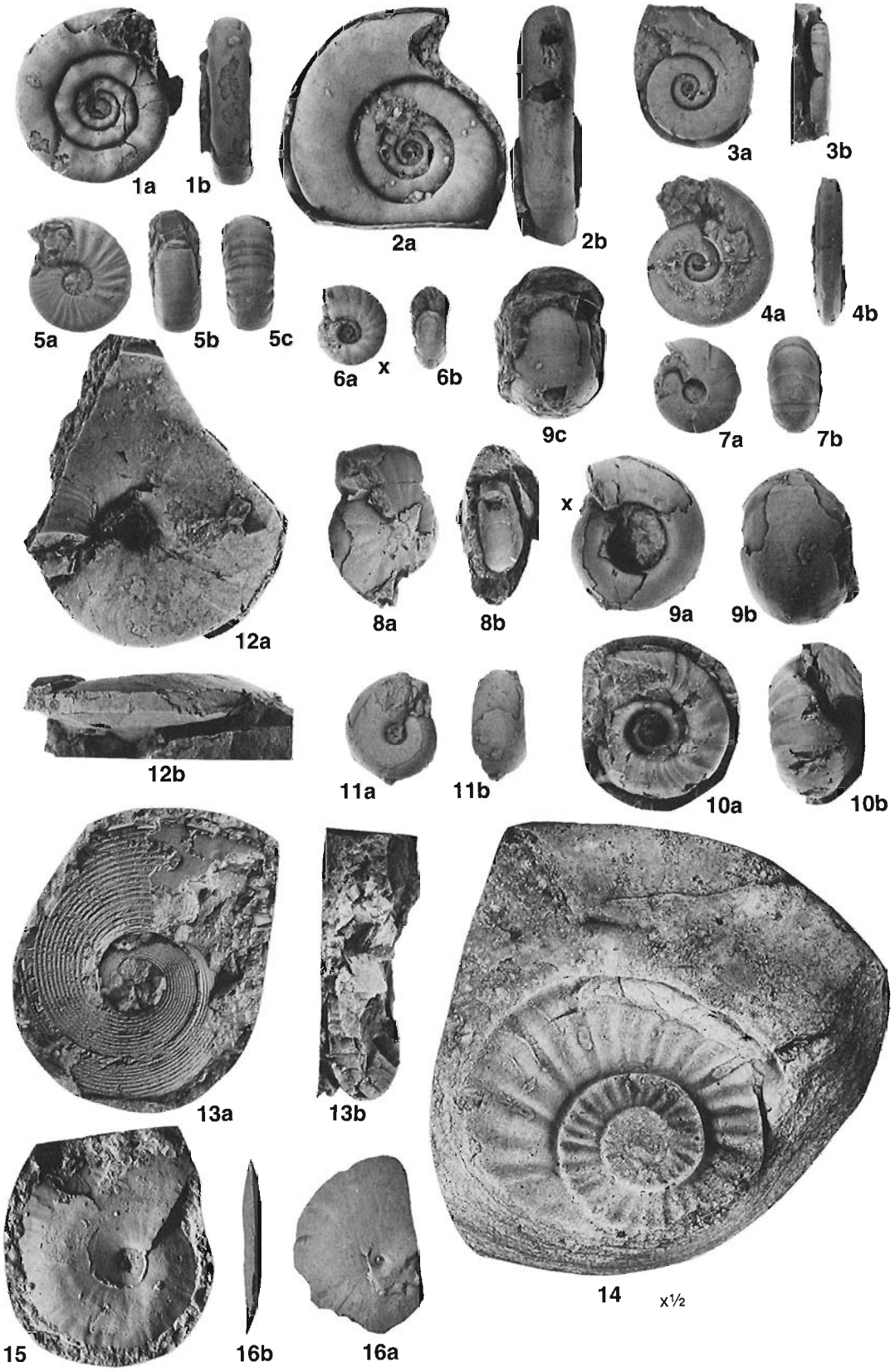

1a
1b
2a
2b
3a
3b
4a
4b
5a
5b
5c
6a
x
6b
9c
7a
7b
12a
8a
8b
x
9a
9b
12b
11a
11b
10a
10b
13a
13b
14
x½
15
16b
16a

PLATE 23

LOWER TRIASSIC
Smithian–Romunderi Zone

Figures 1a, b. *Melagathiceras crassum* (Tozer) (Page 53)
Hypotype GSC 28161. Blind Fiord Formation, Lindstroem Creek, Ellesmere Island (GSC loc. 47801).

Figures 2, 3. *Anaxenaspis kraffti* n. sp. (Page 74)
2a, b. Paratype GSC 14177, phragmocone (GSC loc. 28680).
3a, b. Holotype GSC 28139 (GSC loc. 28681).
Both from Blind Fiord Formation, near Smith Creek, Ellesmere Island.

Figures 4, 5. *Euflemingites cirratus* (White) (Page 72)
4. Hypotype GSC 28148. Toad Formation, Rapids of the Drowned, Liard River, northeastern British Columbia (GSC loc. 68183).
5a, b. GSC 28146, specimen originally about 300 mm in diameter, with approximated septa. Blind Fiord Formation, Bjarnason Island (GSC loc. 47526).
Both illustrated one half natural size.

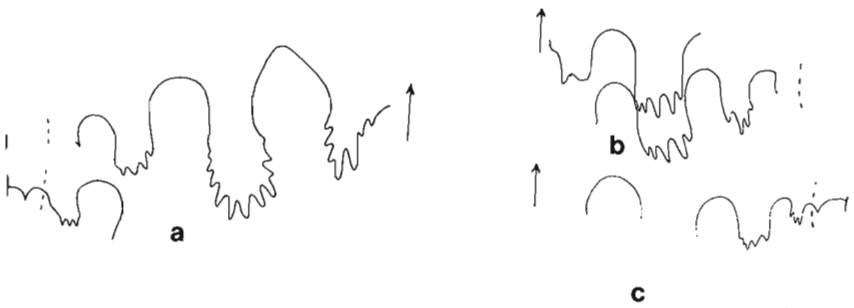


Figure 21. *Sutures. a,* ***Anaxenaspis kraffti*** *n. sp., GSC 28139 (Pl. 23, fig. 3) x2; b, c.* ***Euflemingites cirratus*** *(White). b, GSC 28147* x0.5; c, GSC 28146 (Pl. 23, fig. 5) x0.5.*

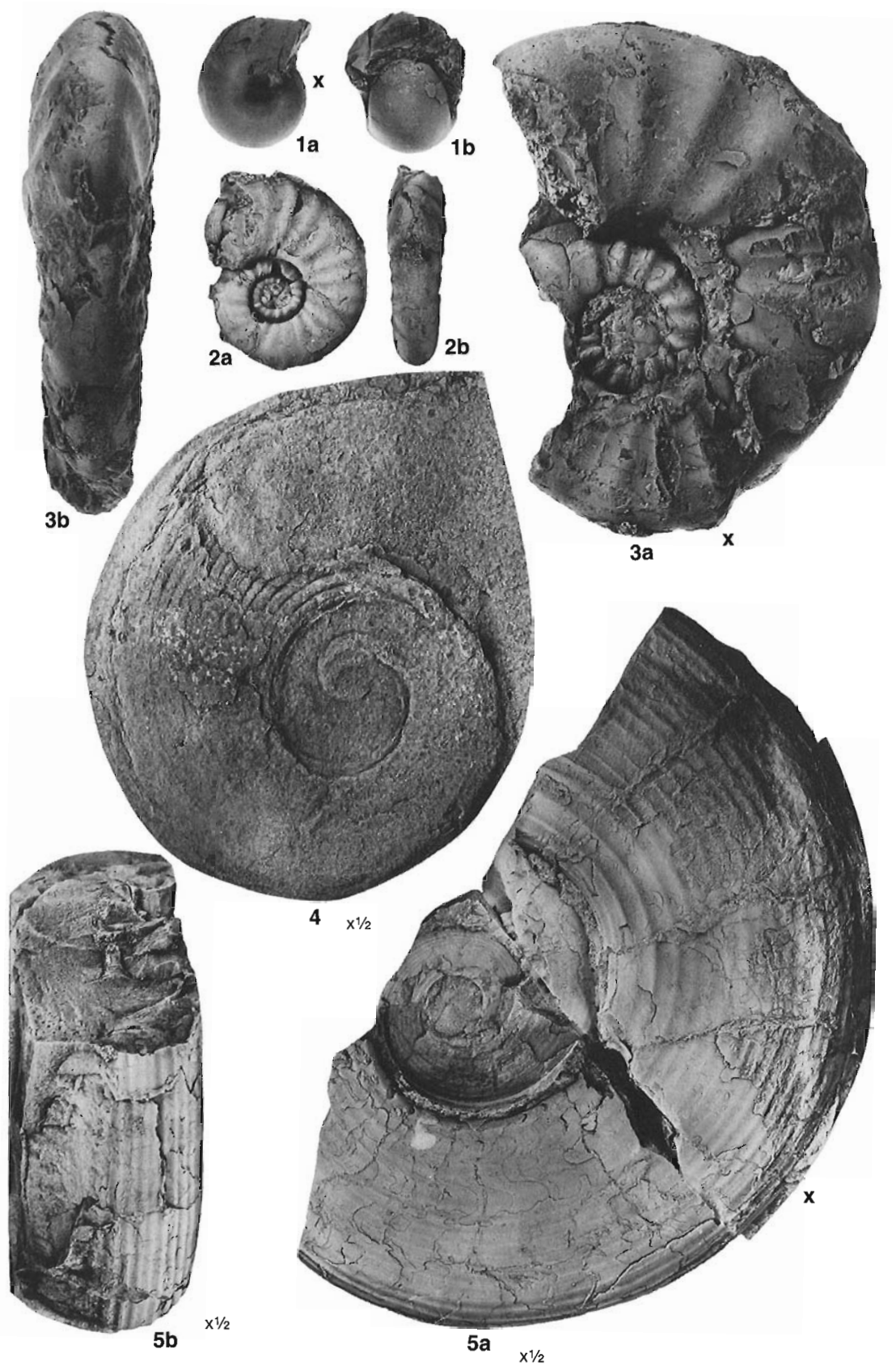

x
1a
1b
2a
2b
3b
3a
x
4
x½
5b
x½
5a
x½
x

PLATE 24

LOWER TRIASSIC
Smithian–Romunderi Zone

All figures one half natural size

Figure 1. *Anaxenaspis welteri* n. sp. (Page 73)
Holotype GSC 28142. Blind Fiord Formation, Griesbach Creek, Axel Heiberg Island (GSC loc. 47558).

Figures 2, 3. *Anaxenaspis dieneri* n. sp. (Page 73)
2. Paratype GSC 28141.
3. Holotype GSC 28140.
Both from Blind Fiord Formation, Bjarnason Island (GSC loc. 47526).

Figure 22. *Suture.* ***Anaxenaspis dieneri*** *n. sp., GSC 28140 (Pl. 24, fig. 3) x0.5.*


1
2
3
x

PLATE 25

LOWER TRIASSIC
Smithian

Figures 1a–c. *Meekoceras haydeni* (Smith) (Romunderi Zone) (Page 71)
Hypotype GSC 70987. Sulphur Mountain Formation, Ganoid Range, Wapiti Lake, northeastern British Columbia (GSC loc. 98863).

Figures 2a–c. *Paranannites aspenensis* Hyatt and Smith (Romunderi Zone) (Page 76)
Hypotype GSC 70988. Sulphur Mountain Formation, Ganoid Range, Wapiti Lake, northeastern British Columbia (GSC loc. 98863).

Figure 3. *Hedenstroemia hedenstroemi* (Keyserling) (Hedenstroemi Zone) (Page 84)
Hypotype GSC 70989. Blind Fiord Formation, Griesbach Creek, Axel Heiberg Island (GSC loc. 89675).

Figures 4, 5. *Euflemingites romunderi* Tozer (Romunderi Zone) (Page 72)
4a, b. Paratype GSC 14191 (GSC loc. 28681).
5a, b. Holotype GSC 14051 (GSC loc. 28680), one half natural size.
Both from Blind Fiord Formation, near Smith Creek, Ellesmere Island.

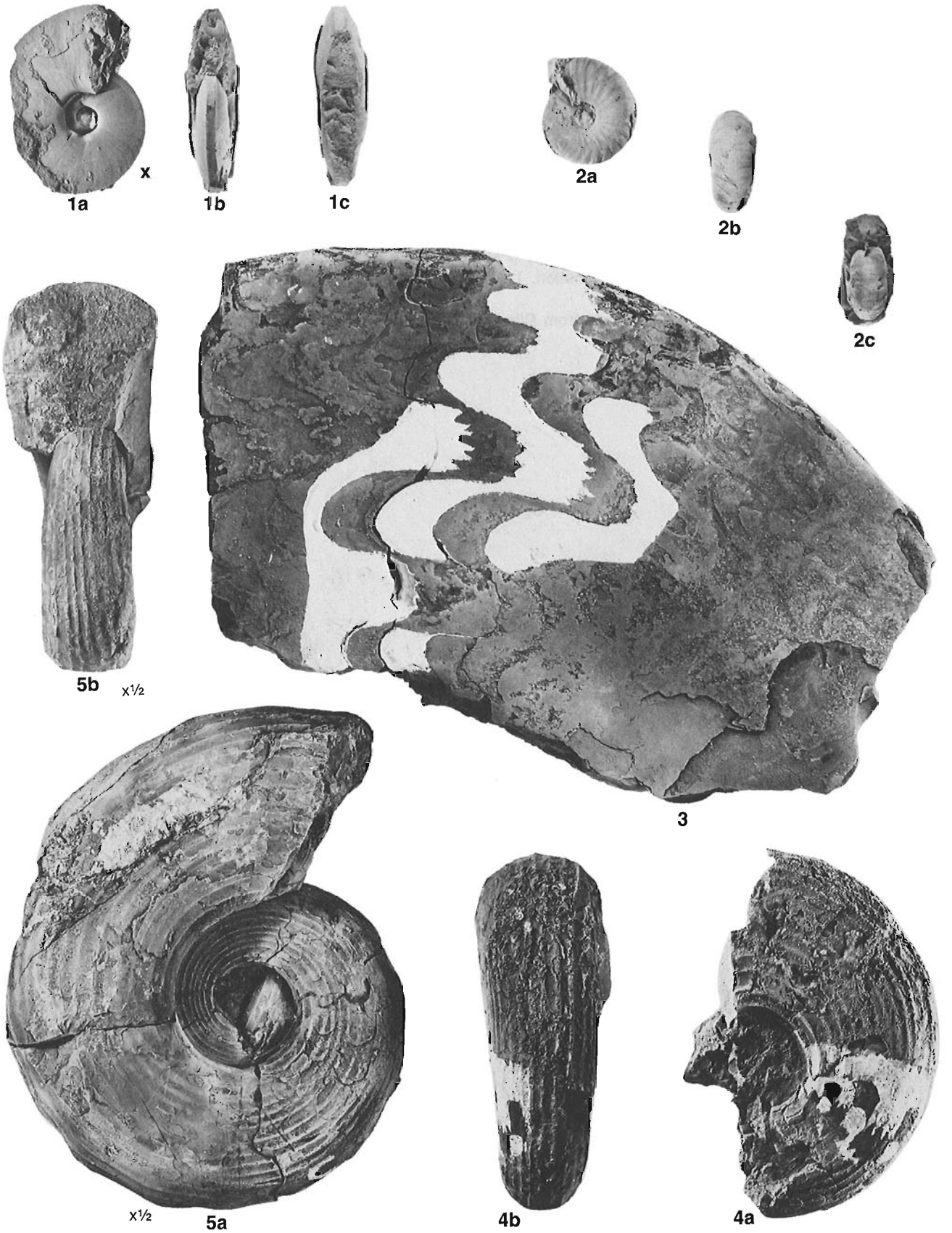

x
1a
1b
1c
2a
2b
2c
5b x½
3
x½
5a
4b
4a

PLATE 26

LOWER TRIASSIC
Smithian–Romunderi and Tardus(?) zones

All figures one half natural size

Figures 1–3. *Arctoceras blomstrandi* (Lindstroem) (Romunderi Zone) (Page 74)

1. Hypotype GSC 28151. Blind Fiord Formation, Bjarnason Island (GSC loc. 47526).
2. Hypotype GSC 28152. Blind Fiord Formation, Lindstroem Creek, Ellesmere Island (GSC loc. 47623).
3. Hypotype GSC 28155, body chamber. Toad Formation, Needham Creek, northeastern British Columbia (GSC loc. 56169).

Figures 4–6. *Arctoceras gigas* n. sp. (Tardus Zone?) (Page 75)

4. Holotype GSC 28156. Blind Fiord Formation, Lindstroem Creek, Ellesmere Island (GSC loc. 47534).
5. Paratype GSC 28157.
6. Paratype GSC 28158. Figures 5, 6 are from Blind Fiord Formation, southeast of Cape Stallworthy, Axel Heiberg Island (GSC loc. 64718).

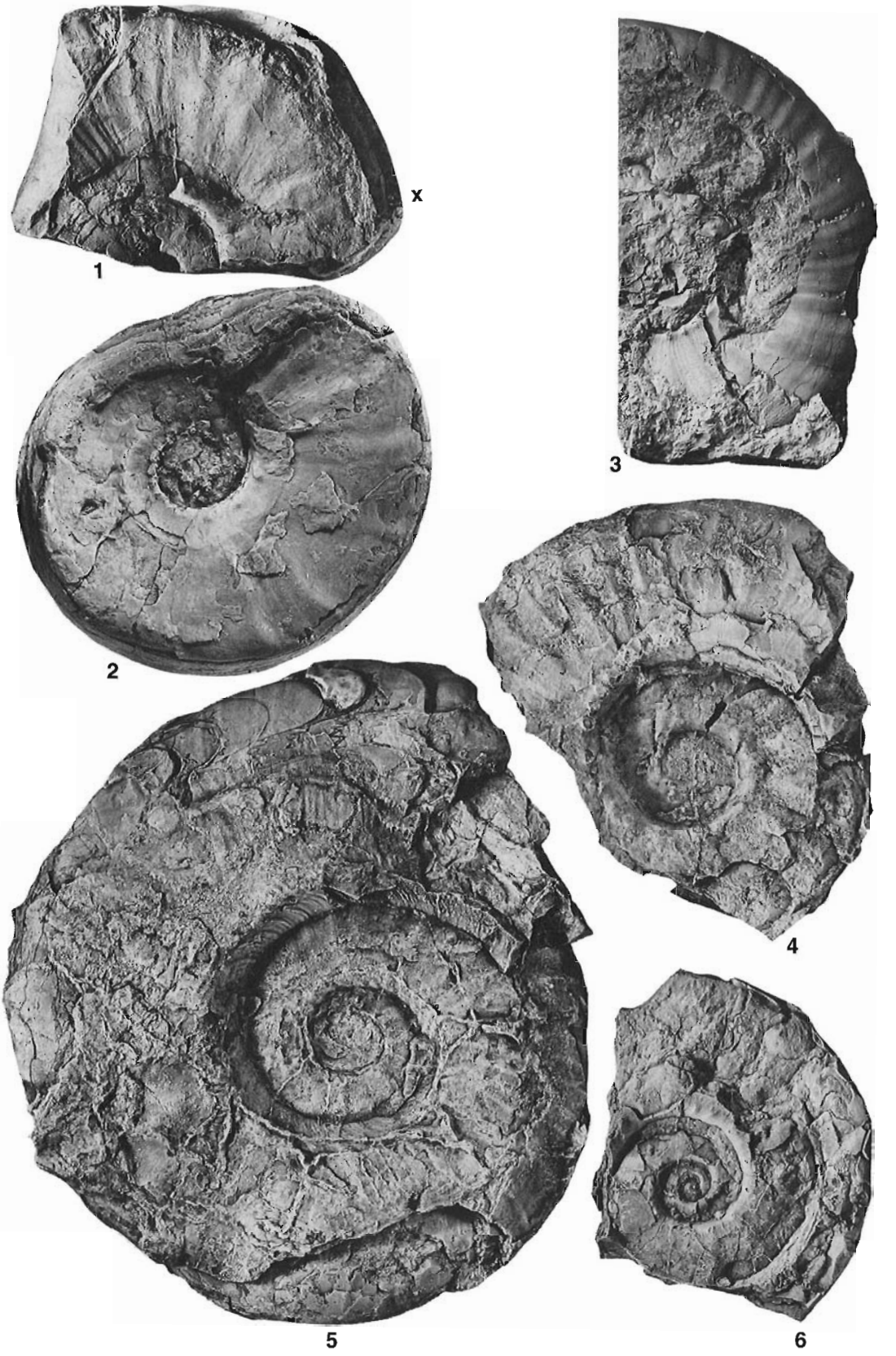

x
1
2
3
4
5
6

PLATE 27

LOWER TRIASSIC
Smithian

Figure 1. *Arctoceras blomstrandi* (Lindstroem) (Tardus Zone?) (Page 74)
Hypotype GSC 28154. Blind Fiord Formation, Svartefjeld Peninsula, Ellesmere Island (GSC loc. 51672).

Figures 2a, b. *Hedenstroemia hedenstroemi* (Keyserling) (Hedenstroemi Zone) (Page 84)
Hypotype GSC 28244. Bjorne Formation, Bjorne Peninsula, Ellesmere Island (GSC loc. 55448).

Figures 3, 4. *Prionites hollandi* McLearn (Tardus Zone) (Page 79)
3a, b. Topotype GSC 28174. Toad Formation, Liard River, northeastern British Columbia (GSC loc. 42360).
4. Hypotype GSC 28177, ribbed part is external impression, smooth part is steinkern. Blind Fiord Formation, Svartefjeld Peninsula, Ellesmere Island (GSC loc. 51672).

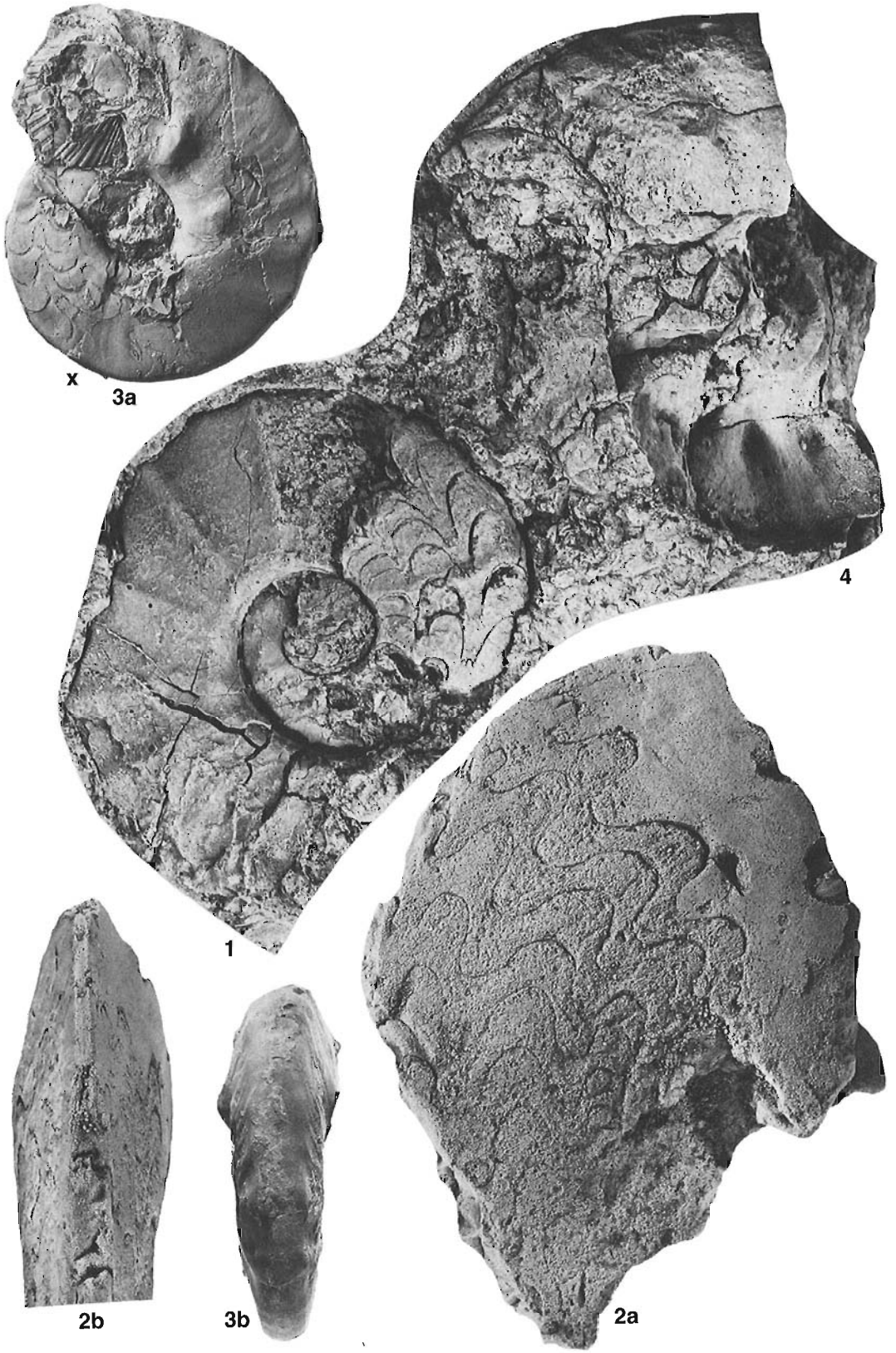

x
3a
4
1
2b
3b
2a

PLATE 28

LOWER TRIASSIC
Smithian–Tardus Zone

All specimens from Toad Formation, northeastern British Columbia

Figures 1a, b. *Anasibirites crickmayi* Mathews (Page 78)
Hypotype GSC 28172. Liard River (GSC loc. 42340).

Figures 2a, b. *Anasibirites robustus* Welter (Page 78)
Hypotype GSC 28226. Rapids of the Drowned, Liard River (GSC loc. 68184).

Figures 3, 6, 7, 10. *Wasatchites deleeni* McLearn (Page 80)
3a–c. Topotype GSC 28186. Liard River (GSC loc. 42360).
6a–c. Topotype GSC 28188. Liard River (GSC loc. 10657).
7a, b. Topotype GSC 28187. Liard River (GSC loc. 42340).
10a–c. Holotype GSC 9474. Liard River (GSC loc. 10657).

Figures 4, 5, 8, 9. *Wasatchites tridentinus* Spath (Page 80)
4a, b. Hypotype GSC 28184. Liard River (GSC loc. 10657).
5a, b. Hypotype, paratype of *Wasatchites canadensis* McLearn, GSC 9473. Liard River (GSC loc. 10657).
8a–c. Hypotype, holotype of *Wasatchites canadensis* McLearn, GSC 9472. Liard River (GSC loc. 10657).
9a–c. Hypotype GSC 28185. Liard River (GSC loc. 42360).

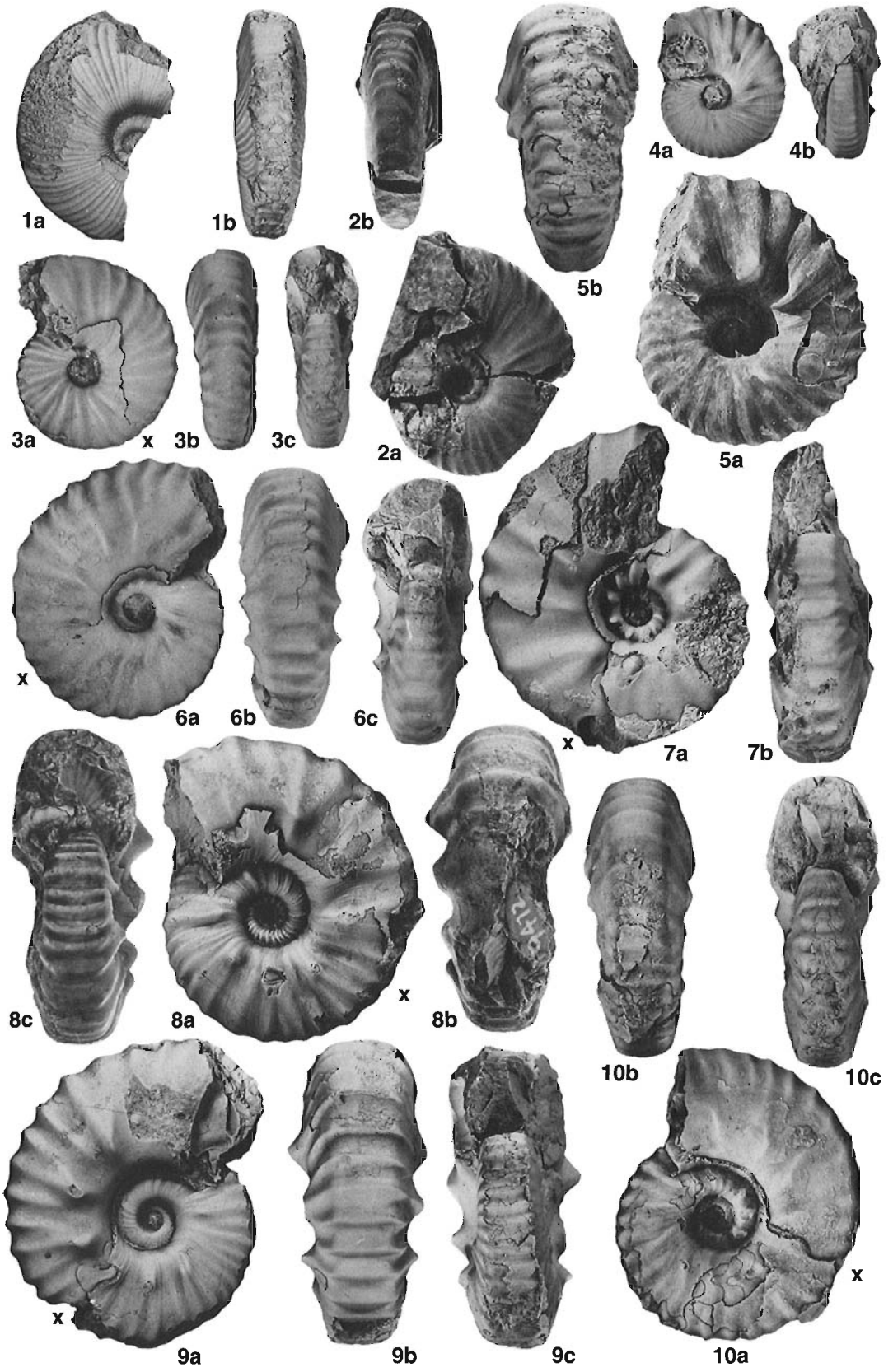

1a
1b
2b
5b
4a
4b
3a
x
3b
3c
2a
5a
x
6a
6b
6c
x
7a
7b
8c
8a
x
8b
10b
10c
x
9a
9b
9c
x
10a

PLATE 29

TRIASSIC
Smithian–Tardus Zone

All specimens from Toad Formation, northeastern British Columbia

Figures 1–3. *Wasatchites procurvus* McLearn (Page 80)
1a, b. Topotype GSC 28190, phragmocone. Liard River (GSC loc. 42360).
2a–c. Topotype GSC 28191. Toad River (GSC loc. 42364).
3a–c. Holotype GSC 9475. Liard River (GSC loc. 10657).

Figures 4a, b. *Anasibirites kummeli* n. sp. (Page 78)
Holotype GSC 28195. Liard River (GSC loc. 42360).

Figures 5a–c. *Wasatchites perrini* Mathews (Page 79)
Hypotype GSC 28183, complete phragmocone. Toad River (GSC loc. 42364).

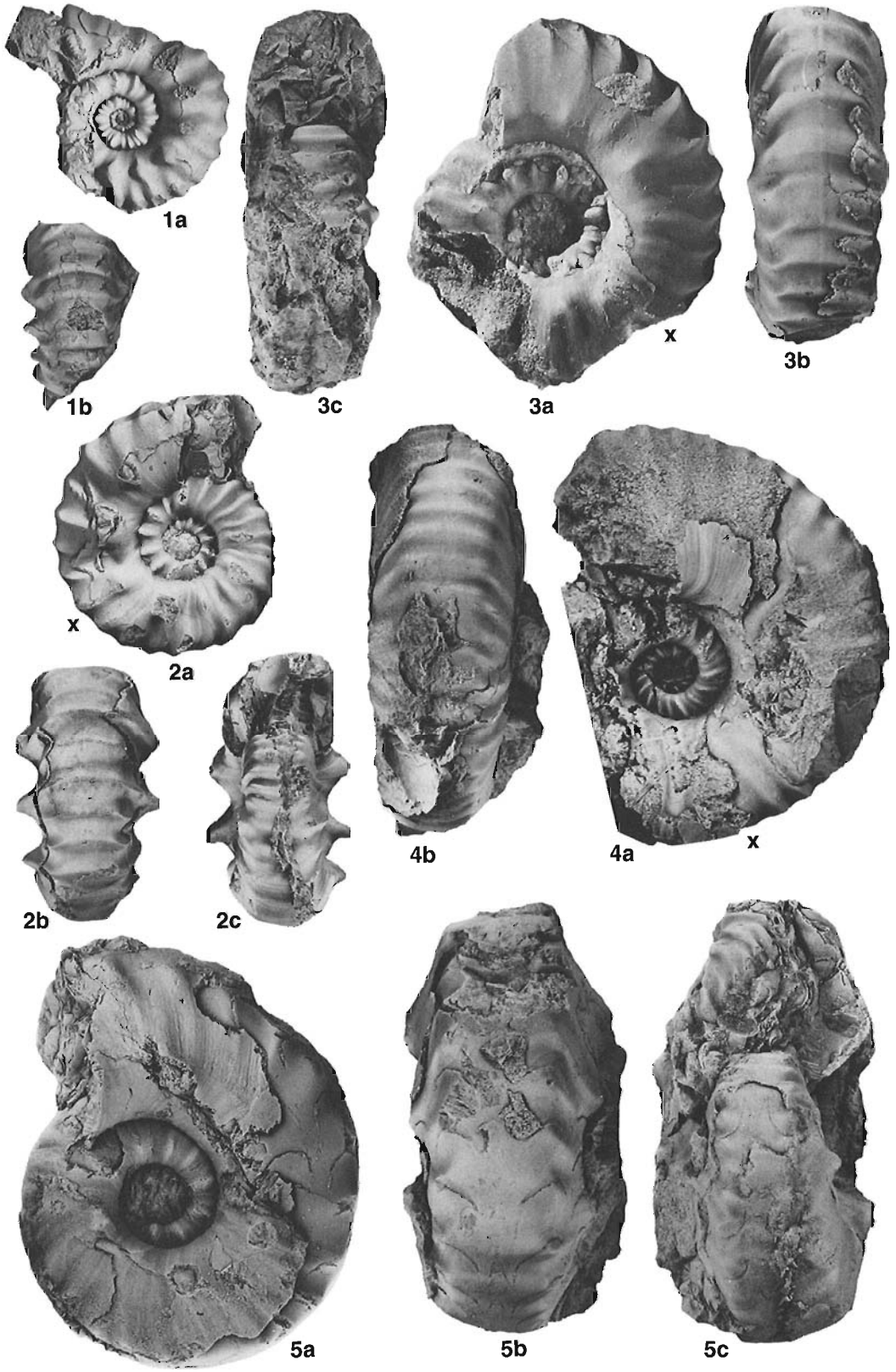

1a
1b
3c
3a
x
3b
x
2a
4b
4a
x
2b
2c
5a
5b
5c

PLATE 30

LOWER TRIASSIC
Smithian–Tardus Zone

All specimens from Toad Formation, northeastern British Columbia

Figures 1a–c. *Anawasatchites merrilli* McLearn (Page 81)
Holotype GSC 9471. Liard River (GSC loc. 10657).

Figures 2, 3. *Anawasatchites tardus* McLearn (Page 81)
2a, b. Topotype GSC 28203. Liard River (GSC loc. 42369).
3a–c. Topotype GSC 28200. Toad River (GSC loc. 42364).

Figures 4a, b. *Anawasatchites kindlei* n. sp. (Page 82)
Holotype GSC 28198. Liard River (GSC loc. 42360).

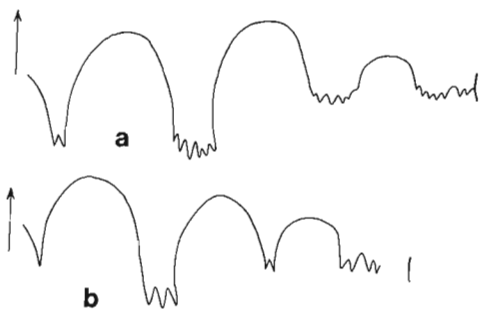


Figure 23. *Sutures. a,* ***Anawasatchites merrilli*** *McLearn, GSC 9471 (Pl. 30, fig. 1) x2; b,* ***Anawasatchites tardus*** *McLearn, GSC 9470 (Tozer, 1967, Pl. 5, fig. 3) x2.*

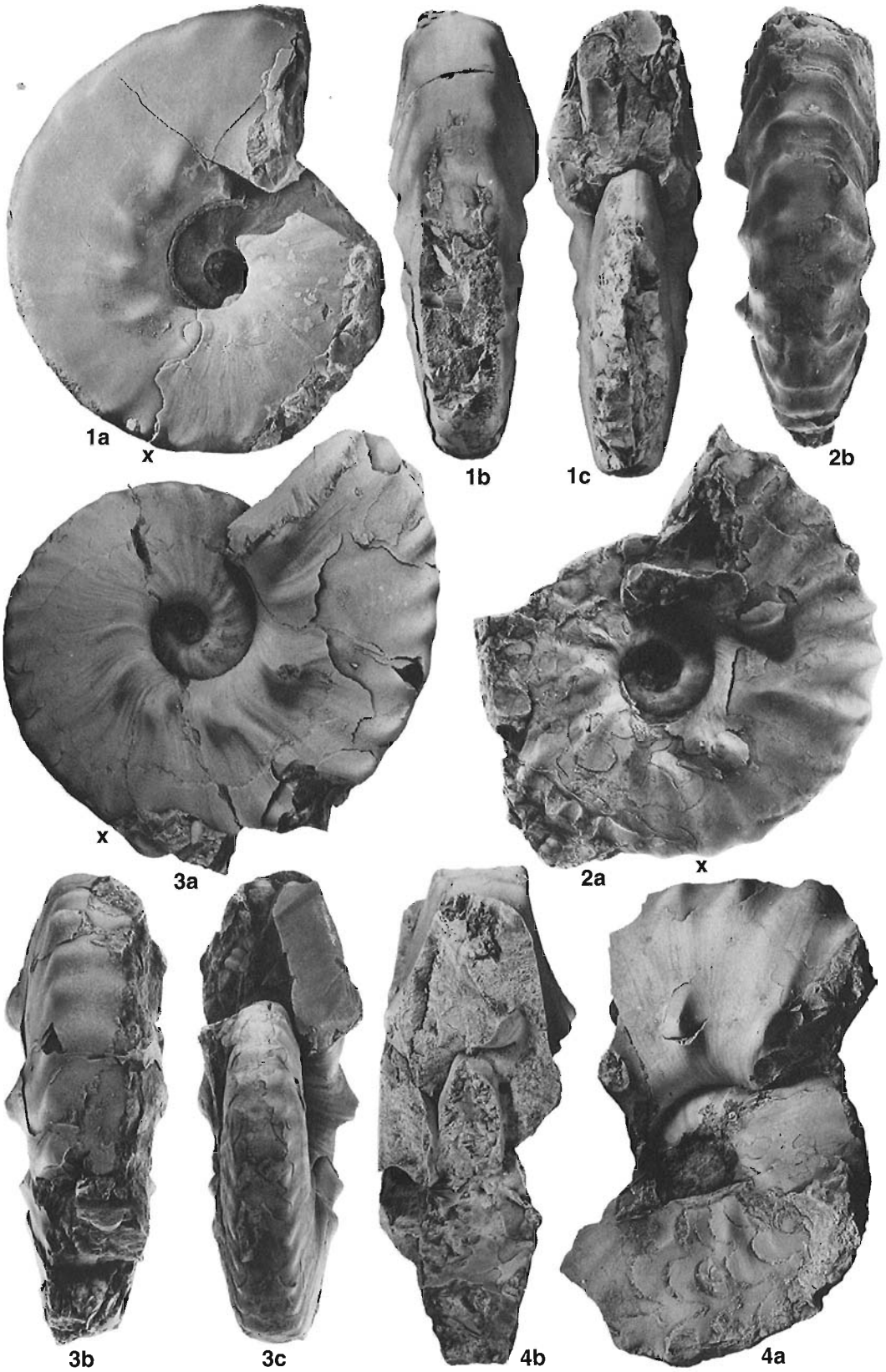

1a
x
1b
1c
2b
x
3a
2a
x
3b
3c
4b
4a

PLATE 31

LOWER TRIASSIC
Smithian–Tardus Zone

All specimens from Toad Formation, northeastern British Columbia

Figures 1a–c. *Anawasatchites dawsoni* n. sp. (Page 82)
Holotype GSC 28208. Liard River (GSC loc. 42340).

Figures 2a–c. *Anawasatchites spathi* n. sp. (Page 82)
Holotype GSC 28205. Liard River (GSC loc. 42360).

Figures 3a–c. *Anawasatchites tardus* McLearn (Page 81)
Topotype GSC 28196. Liard River (GSC loc. 42360).

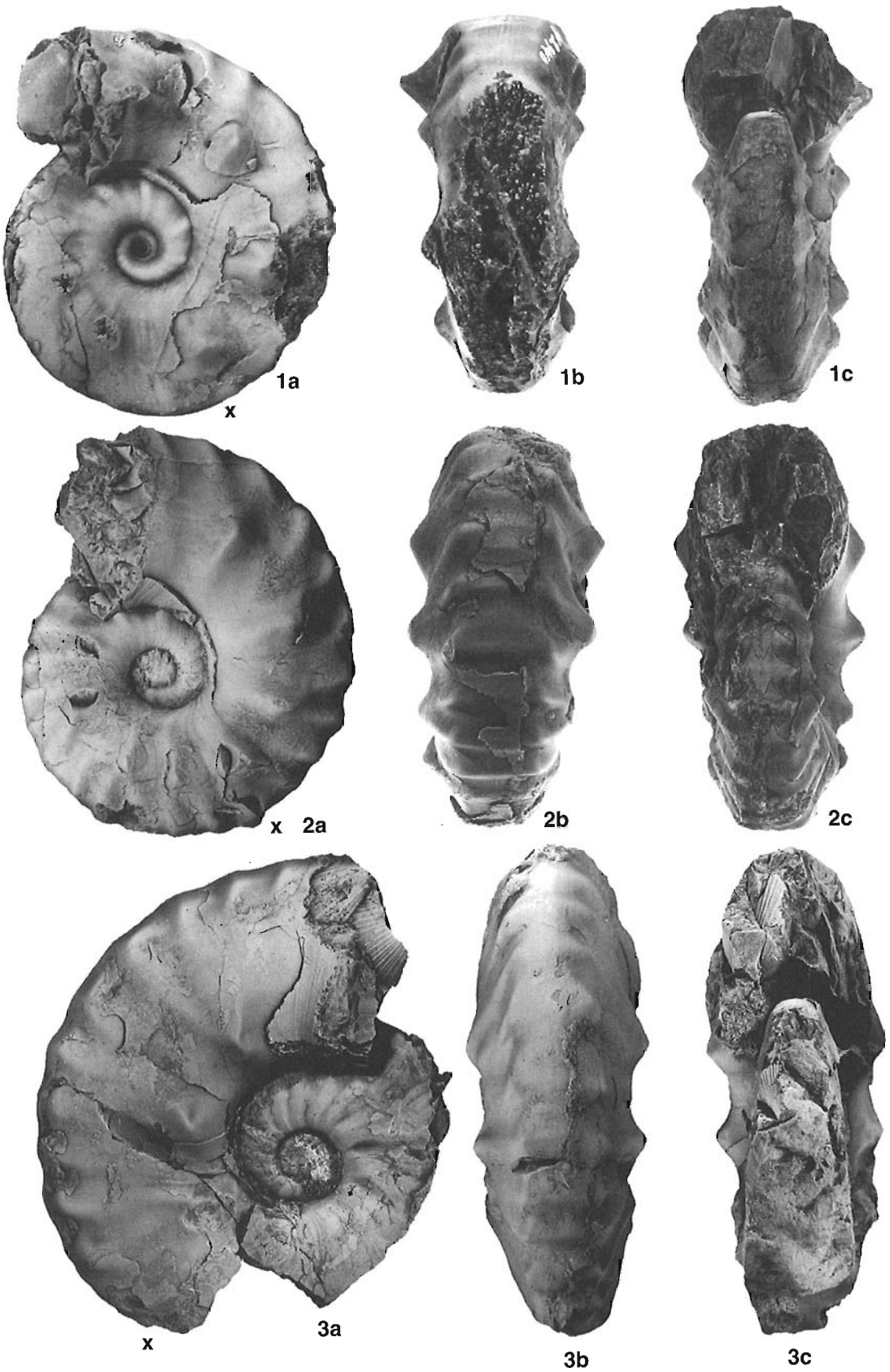

1a
x
1b
1c
x 2a
2b
2c
x
3a
3b
3c

PLATE 32

LOWER TRIASSIC
Smithian–Tardus Zone

All specimens, except Figures 5a, b, from Toad Formation, northeastern British Columbia

Figures 1a–c. *Anawasatchites merrilli* McLearn (Page 81)
Topotype GSC 28199. Toad River (GSC loc. 42364).

Figures 2a–c. *Anawasatchites spathi* n. sp. (Page 82)
Paratype GSC 28207. Liard River (GSC loc. 42360).

Figures 3, 6. *Anawasatchites dawsoni* n. sp. (Page 82)
3a–c. Paratype GSC 28201. Toad River (GSC loc. 42364).
6a, b. Paratype GSC 28206. Liard River (GSC loc. 42360).

Figures 4a–c. *Wasatchites deleeni* McLearn (Page 80)
Topotype GSC 28189. Toad River (GSC loc. 42364).

Figures 5a, b. *Anawasatchites tardus* McLearn (Page 81)
Hypotype GSC 28204, phragmocone. The other side shows part of body chamber and indicates that the umbilicus attained a width of 28 mm. Blind Fiord Formation, near Smith Creek, Ellesmere Island (GSC loc. 47531).

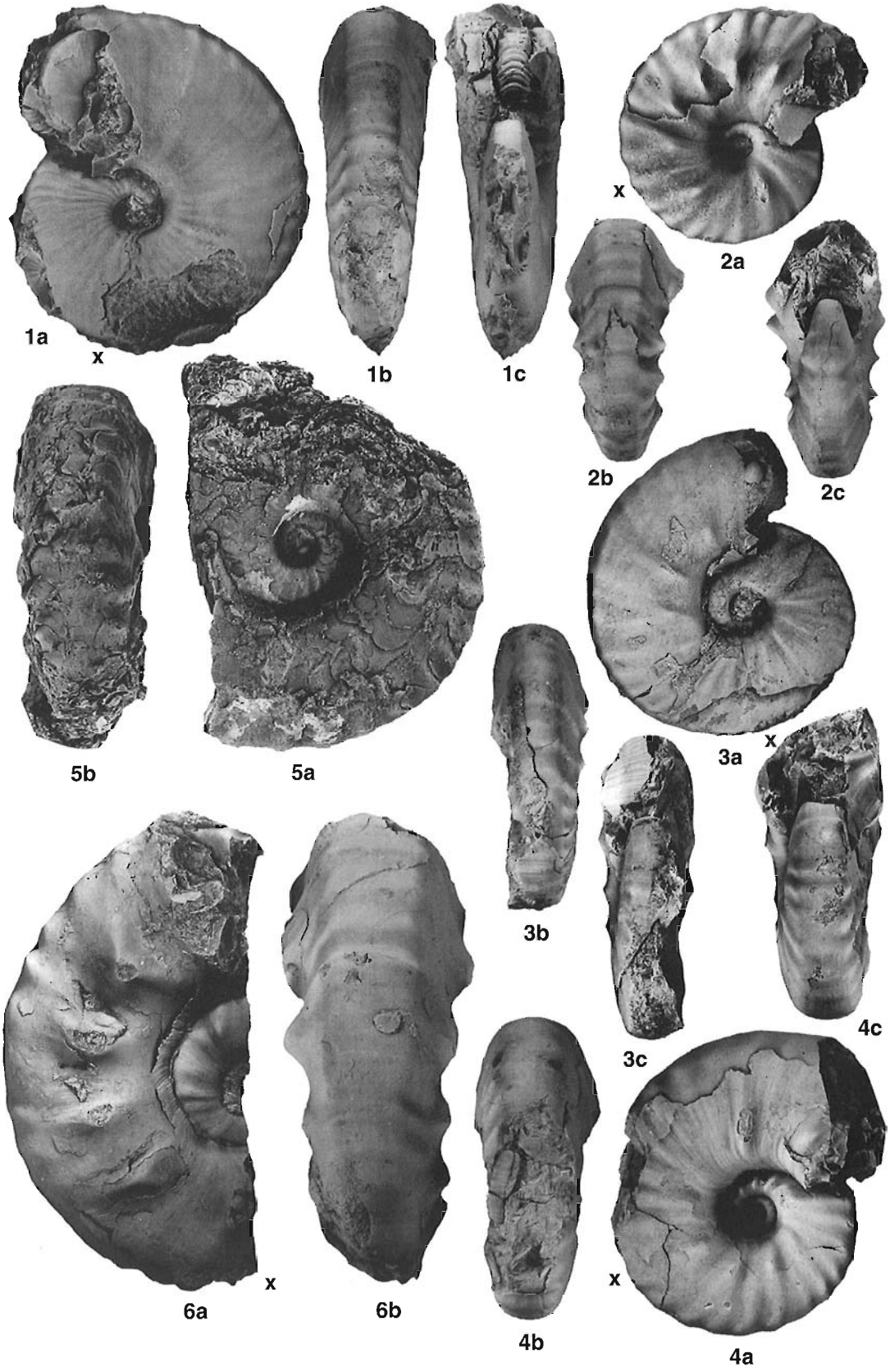

1a
x
1b
1c
x
2a
2b
2c
5b
5a
3a
x
3b
3c
4c
6a
x
6b
4b
x
4a

PLATE 33

LOWER TRIASSIC
Smithian–Tardus Zone

All specimens from Toad Formation, northeastern British Columbia

Figures 1–4. *Prionites hollandi* McLearn (Page 79)
1a–c. Holotype GSC 9469. Liard River (GSC loc. 10657).
2a–c. Topotype GSC 28176. Toad River (GSC loc. 42364).
3a, b. Topotype GSC 28175, side and sectional views, last portion is body chamber, preceding portion, up to break, is septate. Liard River (GSC loc. 42360).
4a–c. Topotype GSC 28193. Liard River (GSC loc. 42360).

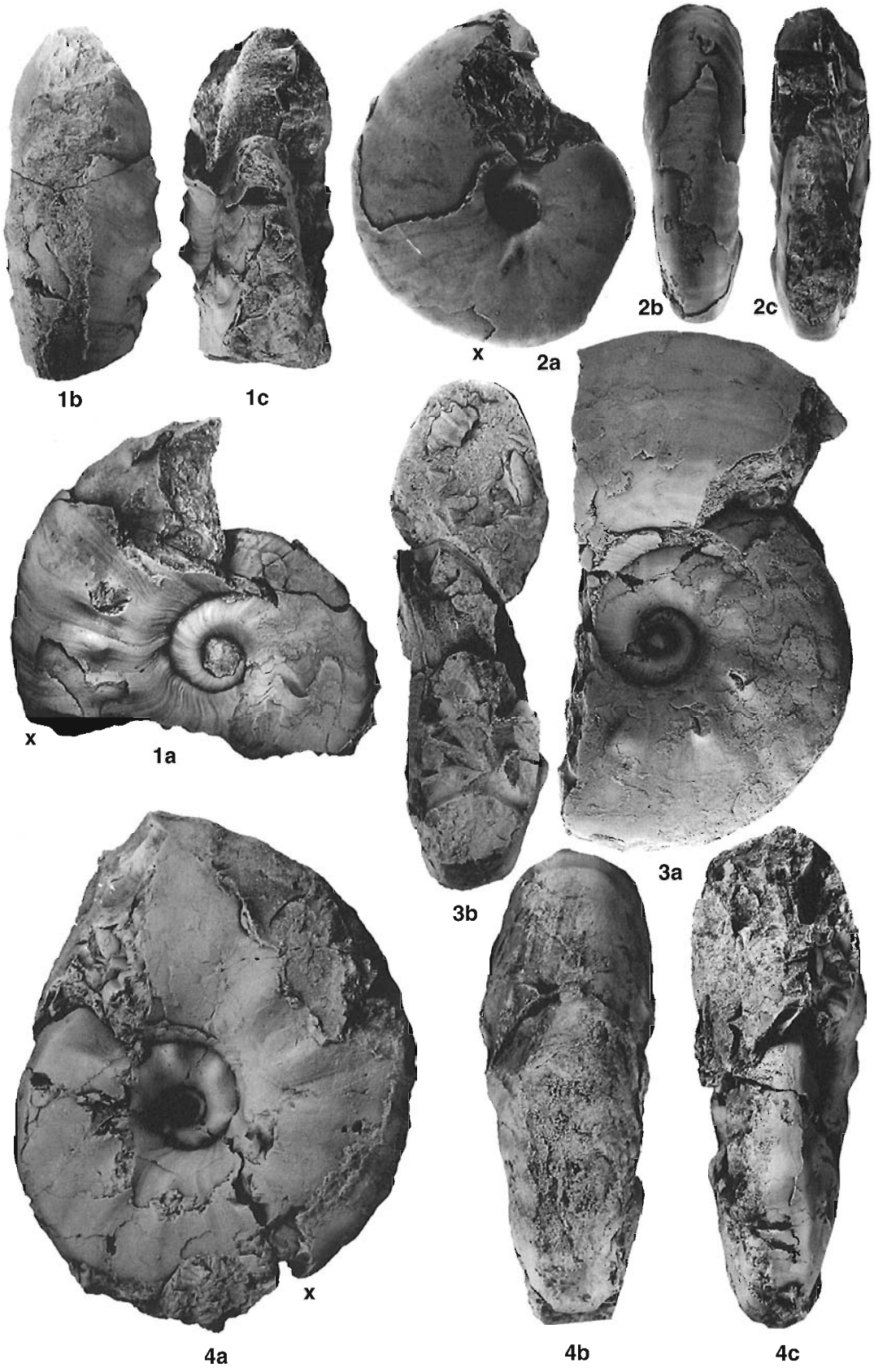

1b
1c
x
2a
2b
2c
x
1a
3b
3a
x
4a
4b
4c

PLATE 34

LOWER TRIASSIC
Smithian–Tardus Zone

All specimens, except Figures 5, 6, from Toad Formation, northeastern British Columbia

Figures 1–4. *Arctoprionites williamsi* n. sp. (Page 83)
1a–c. Paratype GSC 28202. Toad River (GSC loc. 42364).
2a–c. Holotype GSC 28179. Liard River (GSC loc. 42340).
3a, b. Paratype GSC 28180. Toad River (GSC loc. 42364).
4a–c. Paratype GSC 28178. Toad River (GSC loc. 42364).

Figures 5, 6. *Arctoprionites nodosus* (Frebold) (Page 83)
5a, b. Hypotype GSC 28181.
6a, b. Hypotype GSC 28182.
Both from Blind Fiord Formation, Smith Creek, Ellesmere Island (GSC loc. 47547).

Figures 7, 8. *Wasatchites macconnelli* n. sp. (Page 81)
7a, b. Paratype GSC 28197. Liard River (GSC loc. 42340).
8a–c. Holotype GSC 28194. Toad River (GSC loc. 42364).

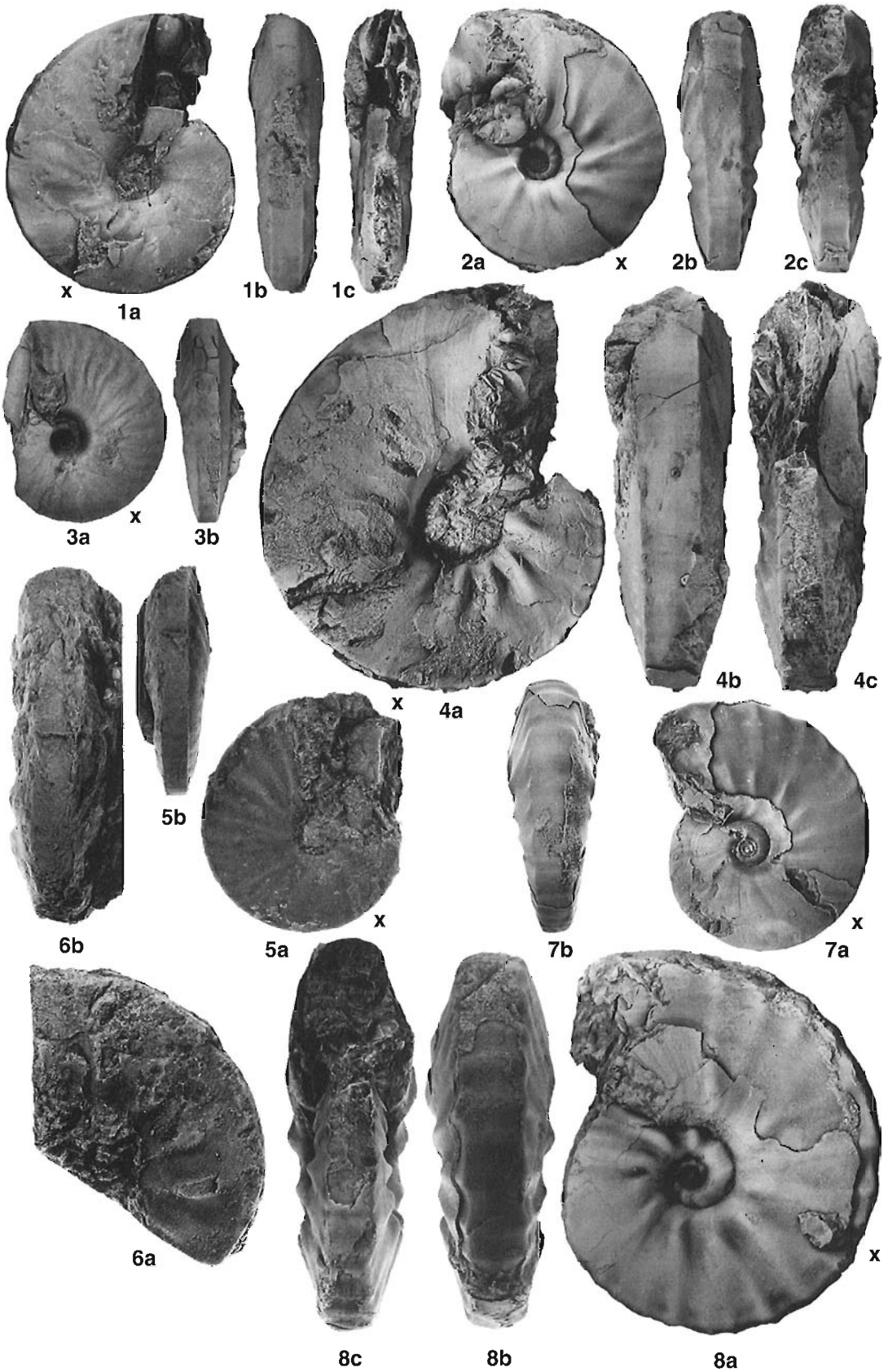

x
1a
1b
1c
2a
x
2b
2c
3a
x
3b
x
4a
4b
4c
6b
5b
x
5a
7b
x
7a
6a
8c
8b
x
8a

PLATE 35

LOWER TRIASSIC
Smithian–Tardus Zone

All specimens from Toad Formation, northeastern British Columbia

Figures 1a, b. *Anawasatchites tardus* McLearn (Page 81)
Topotype GSC 28224. Liard River (GSC loc. 42360).

Figures 2–4. *Wasatchites perrini* Mathews (Page 79)
2a, b. Hypotype GSC 28228. Liard River (GSC loc. 42340).
3a–c. Hypotype GSC 28225. Liard River (GSC loc. 42342).
4a, b. Hypotype GSC 28227. Liard River (GSC loc. 42360).

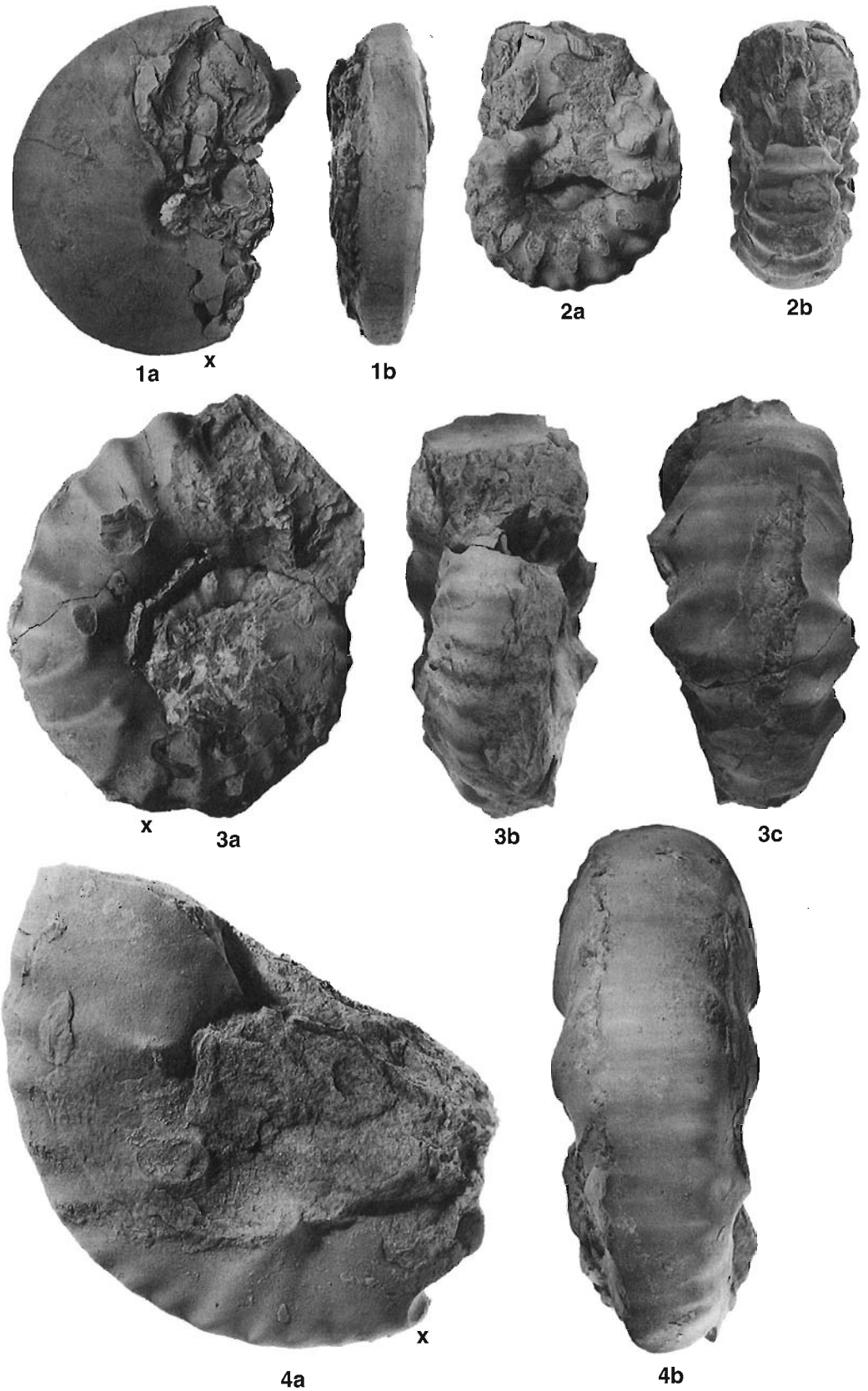

1a
x
1b
2a
2b
x
3a
3b
3c
x
4a
4b

PLATE 36

LOWER TRIASSIC
Smithian–Tardus and ?Romunderi zones

All specimens except Figures 1, 2, from Toad Formation, northeastern British Columbia

Figures 1, 2. *Paranannites spathi* (Frebold) (Tardus Zone or Romunderi Zone) (Page 77)
1a–c. Hypotype GSC 28169.
2a, b. Hypotype GSC 28170, most or all of outer whorl is body chamber.
Both from Blind Fiord Formation, Svartefjeld Peninsula, Ellesmere Island (GSC loc. 51672).

Figures 3–8. *Xenoceltites subevolutus* Spath (Tardus Zone) (Page 52)
3a, b. Hypotype GSC 28050.
4a, b. Hypotype GSC 28051.
5a, b. Hypotype GSC 14303.
6a, b. Hypotype GSC 28052.
Figures 3–6 from near Graham River, British Columbia (GSC loc. 42538).
7a, b. Hypotype GSC 28053.
8a, b. GSC 28054 (x3).
Figures 7, 8 from Toad River (GSC loc. 42363).

Figures 9a, b. *Pseudosageceras plicatum* n. sp. (Tardus Zone) (Page 84)
Holotype GSC 28243. Liard River (GSC loc. 42369).

Figures 10–14. *Kashmirites warreni* (McLearn) (Tardus Zone) (Page 51)
10a, b. Topotype GSC 9600. Liard River (GSC loc. 10657).
11a, b. Holotype GSC 9477. Liard River (GSC loc. 10657).
12a, b. Topotype GSC 9476, holotype of *Xenoceltites robertsoni* McLearn. Liard River (GSC loc. 10657).
13a–c. Topotype GSC 28046. Toad River (GSC loc. 42364).
14a, b. Topotype GSC 28045. Toad River (GSC loc. 42364).

Figure 24. *Sutures. a–c.* ***Kashmirites warreni*** *(McLearn). a, GSC 28047* x4; b, GSC 9476 (Pl. 36, fig. 12) x4; c, GSC 28048* x4; d, e.* ***Xenoceltites subevolutus*** *Spath; d, GSC 14183 (Tozer, 1961, Pl. 16, fig. 1) x4; e, GSC 28054 (Pl. 36, fig. 8) x4; f, g.* ***Pseudosageceras plicatum*** *n. sp., two sutures of GSC 28243 (Pl. 36, fig. 9) x4.*

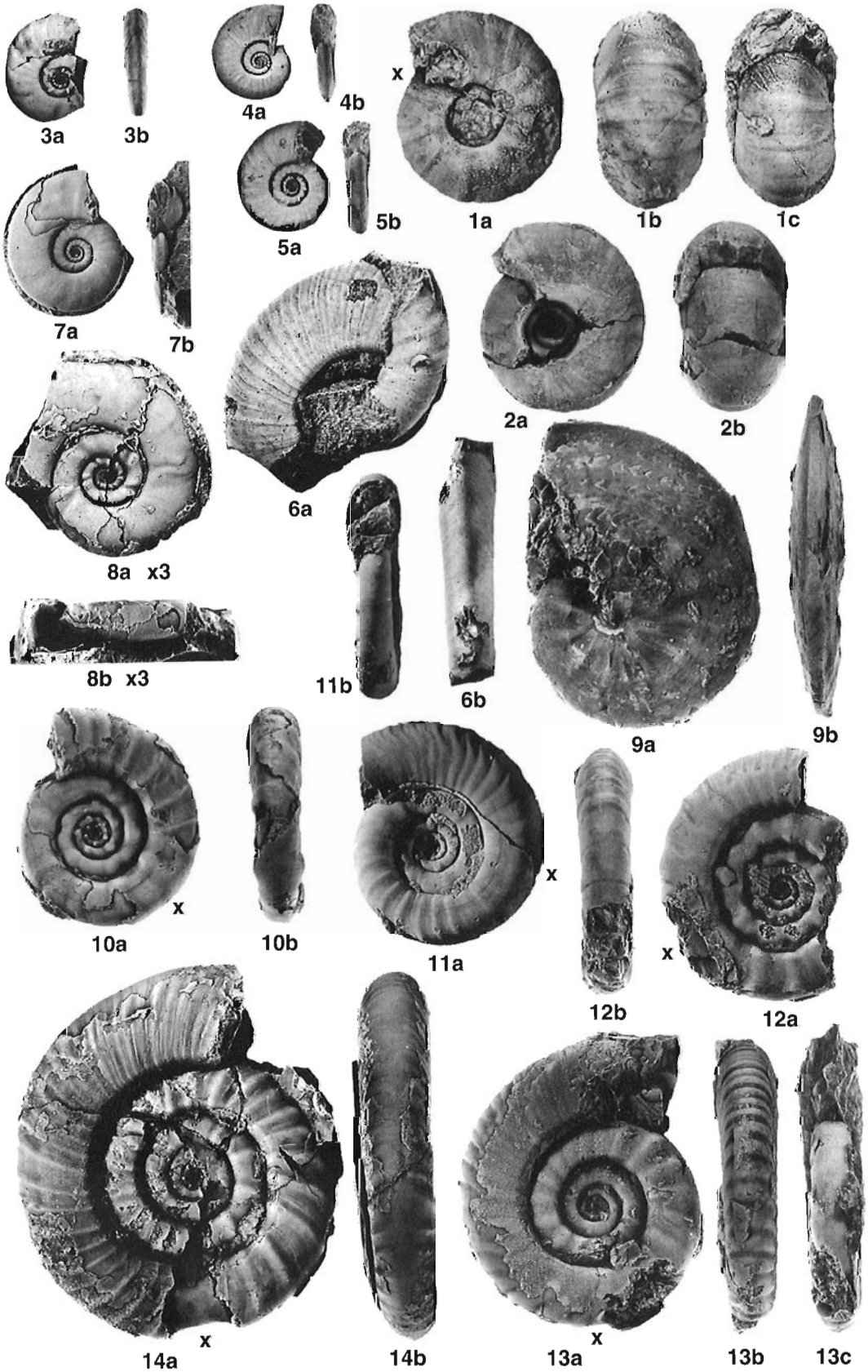

3a
3b
4a
4b
x
1a
1b
1c
5a
5b
7a
7b
2a
2b
6a
8a x3
8b x3
11b
6b
9a
9b
10a
x
10b
11a
x
12b
x
12a
14a
x
14b
13a
x
13b
13c

PLATE 37

Spathian, Pilaticus and Subrobustus zones

Figures 1a, b. *Olenikites triton* n. sp. (Subrobustus Zone) (Page 93)
Holotype GSC 18853. Blind Fiord Formation, Spath Creek, Ellesmere Island (GSC loc. 47544).

Figures 2a, b. *Olenikites bombus* n. sp. (Subrobustus Zone) (Page 93)
Holotype GSC 18852. Blind Fiord Formation, Spath Creek, Ellesmere Island (GSC loc. 47544).

Figures 3a–c. *Monacanthites monoceros* Tozer (Subrobustus Zone) (Page 94)
Holotype GSC 18838, outer whorl is probably body chamber. Toad Formation, Chowade River, British Columbia (GSC loc. 56194).

Figures 4a, b. *Popovites borealis* Tozer (Subrobustus Zone) (Page 78)
Holotype GSC 18833, body chamber is about one whorl. Blind Fiord Formation, Spath Creek, Ellesmere Island (GSC loc. 47544).

Figures 5a, b. *Popovites occidentalis* Tozer (Subrobustus Zone) (Page 78)
Paratype GSC 18827. Toad Formation, Chowade River, British Columbia (GSC loc. 56198).

Figures 6a, b. *Prosphingites czekanowskii* Mojsisovics (Subrobustus Zone) (Page 86)
Hypotype GSC 18816, last preserved whorl is body chamber. Toad Formation, near Calnan Creek, British Columbia (GSC loc. 56241).

Figures 7a, b. *Zenoites arcticus* Tozer (Subrobustus Zone) (Page 77)
Holotype GSC 18834. Blind Fiord Formation, Spath Creek, Ellesmere Island (GSC loc. 47544).

Figures 8a, b. *Cordillerites bicarinatus* (Tozer) (Subrobustus Zone) (Page 85)
Holotype GSC 18814, phragmocone removed from crushed body chamber about 85 mm in diameter. Toad Formation, near Calnan Creek, British Columbia (GSC loc. 56234).

Figures 9a, b. *Isculitoides minor* Tozer (Subrobustus Zone) (Page 77)
Paratype GSC 18818, specimen complete with peristome, body chamber crushed. Toad Formation, near Calnan Creek, British Columbia (GSC loc. 56234).

Figures 10a, b. *Olenikites pilaticus* Tozer (Pilaticus Zone) (Page 92)
Holotype GSC 18893. Blind Fiord Formation, Svartevaeg, Axel Heiberg Island (GSC loc. 64719).

Figure 11. Ammonoid indet. (Pilaticus Zone)
GSC 28246. Blind Fiord Formation. Svartevaeg, Axel Heiberg Island (GSC loc. 64719).

Figures 12–19. *Olenikites subtilis* n. sp. (Pilaticus Zone) (Page 92)
12a, b. Paratype GSC 72356. 13a, b. Paratype GSC 72359. 14a, b. Paratype GSC 72360.
15a, b. Paratype GSC 72357. 16a, b. Paratype GSC 72355. 17a, b. Holotype GSC 72354.
18. Paratype GSC 72361. 19a, b. Paratype GSC 72362.
All from Blind Fiord Formation, Svartevaeg, Axel Heiberg Island (GSC locs. C-134797, 101891).

Figures 20, 21. *Arctomeekoceras obtusum* n. sp. (Pilaticus Zone) (Page 65)
20a, b. Holotype GSC 85767 (GSC loc. 101889). 21a, b. Paratype GSC 85768 (GSC loc. C-134797).
Both from Blind Fiord Formation, Svartevaeg, Axel Heiberg Island.

Figures 22–26. *Neomeekoceras scalariforme* n. sp. (Pilaticus Zone) (Page 71)
22a, b. Paratype GSC 85766. 23a, b. Holotype GSC 85762. 24. Paratype GSC 85764.
25. Paratype GSC 85763. 26. Paratype GSC 85765.
All from Blind Fiord Formation, Svartevaeg, Axel Heiberg Island (GSC loc. 101891).

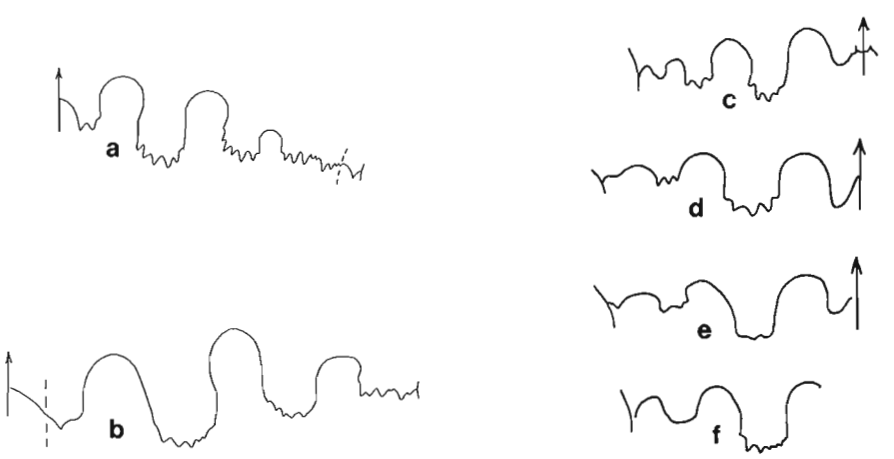
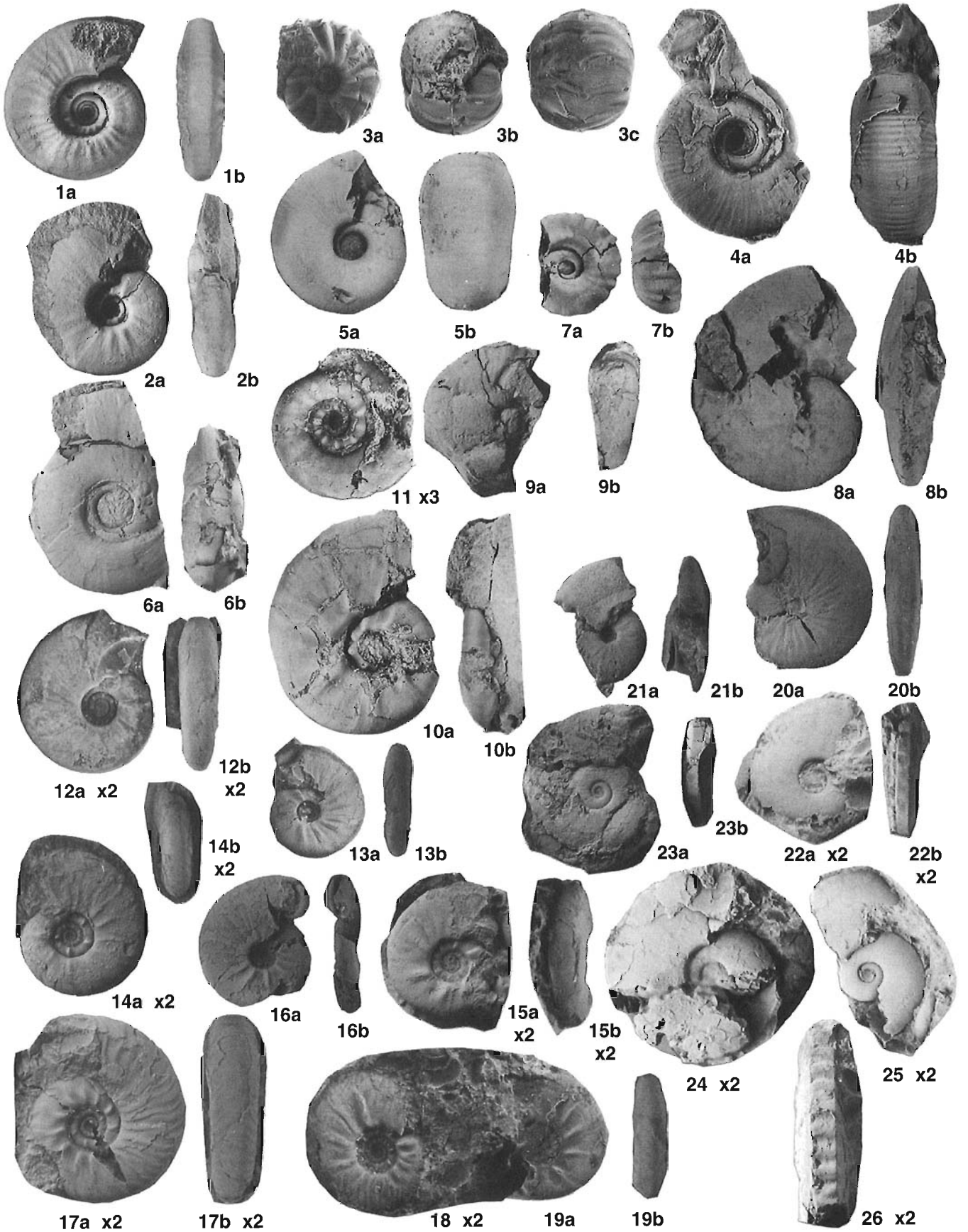


Figure 25. *Sutures. a,* ***Arctomeekoceras obtusum*** *n. sp., GSC 85768 (Pl. 37, fig. 21) x6; b,* ***Neomeekoceras scalariforme*** *n. sp., GSC 85763 (Pl. 37, fig. 25) x6; c–f,* ***Olenikites subtilis*** *n. sp. c, GSC 72362 (Pl. 37, fig. 19) x6; d, GSC 72359 (Pl. 37, fig. 13) x6; e, GSC 72358* x6; f, GSC 72354 (Pl. 37, fig. 17), x6.*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16b
15a x2
15b x2
24 x2
25 x2
17a x2
17b x2
18 x2
19a
19b
26 x2

PLATE 38

LOWER TRIASSIC
Spathian–Subrobustus Zone

Figures 1a, b. *Olenikites canadensis* Tozer (Page 93)
Holotype GSC 14094 (x2). Blind Fiord Formation, Spath Creek, Ellesmere Island (GSC loc. 32363).

Figures 2a, b. *Svalbardiceras freboldi* Tozer (Page 93)
Paratype GSC 18858. Blind Fiord Formation, Spath Creek, Ellesmere Island (GSC loc. 47544).

Figures 3a, b. *Svalbardiceras chowadei* Tozer (Page 94)
Holotype GSC 18861, at least one quarter whorl is body chamber. Toad Formation, headwaters of Chowade River, British Columbia (GSC loc. 56263).

Figures 4a, b. *Sulioticeras intermedium* (Tozer) (Page 52)
Holotype GSC 18815. Toad Formation, near Calnan Creek, British Columbia (GSC loc. 56240).

Figure 5. *Leiophyllites* sp. indet. (Page 268)
GSC 18871, rubber mould from natural cast. Toad Formation, near Calnan Creek, British Columbia (GSC loc. 56234).

Figures 6a, b. *Procarnites modestus* Tozer (Page 85)
Holotype GSC 18867, phragmocone and crushed body chamber. Toad Formation, headwaters of Chowade River (GSC loc. 56198)

Figures 7a, b. *Metadagnoceras pulchrum* Tozer (Page 85)
Holotype GSC 18848. Toad Formation, headwaters of Chowade River, northeastern British Columbia (GSC loc. 56196).

Figures 8, 9. *Keyserlingites subrobustus* (Mojsisovics) (Page 94)
8. Hypotype GSC 18843, oblique view showing parabolic node on venter. Blind Fiord Formation, Spath Creek, Ellesmere Island (GSC loc. 47545).
9a, b. Plaster cast of topotype, Olenek River, Siberia, figured in Mojsisovics (1886, Pl. VI, figs. 1a–c).

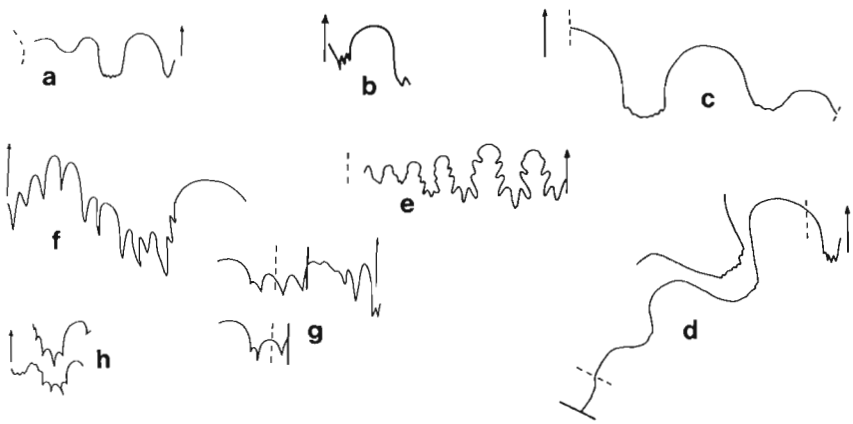

Figure 26. *Sutures. a,* ***Olenikites canadensis*** *Tozer, GSC 14094 (Pl. 38, fig. 1) x4; b,* ***Sulioticeras intermedium*** *(Tozer), GSC 18815 (Pl. 38, fig. 4) x2.5; c, d,* ***Svalbardiceras freboldi*** *Tozer. c, GSC 18857 (Tozer, 1965a, Pl. 1, fig. 2) x4; d, GSC 18858 (Pl. 38, fig. 2) x4; e,* ***Procarnites modestus*** *Tozer, GSC 18869 (Tozer, 1965a, Pl. 1, fig. 2) x4; f–h.* ***Metadagnoceras pulchrum*** *Tozer, 5 sutures of GSC 18848 (Pl. 38, fig. 7) x1.5.*

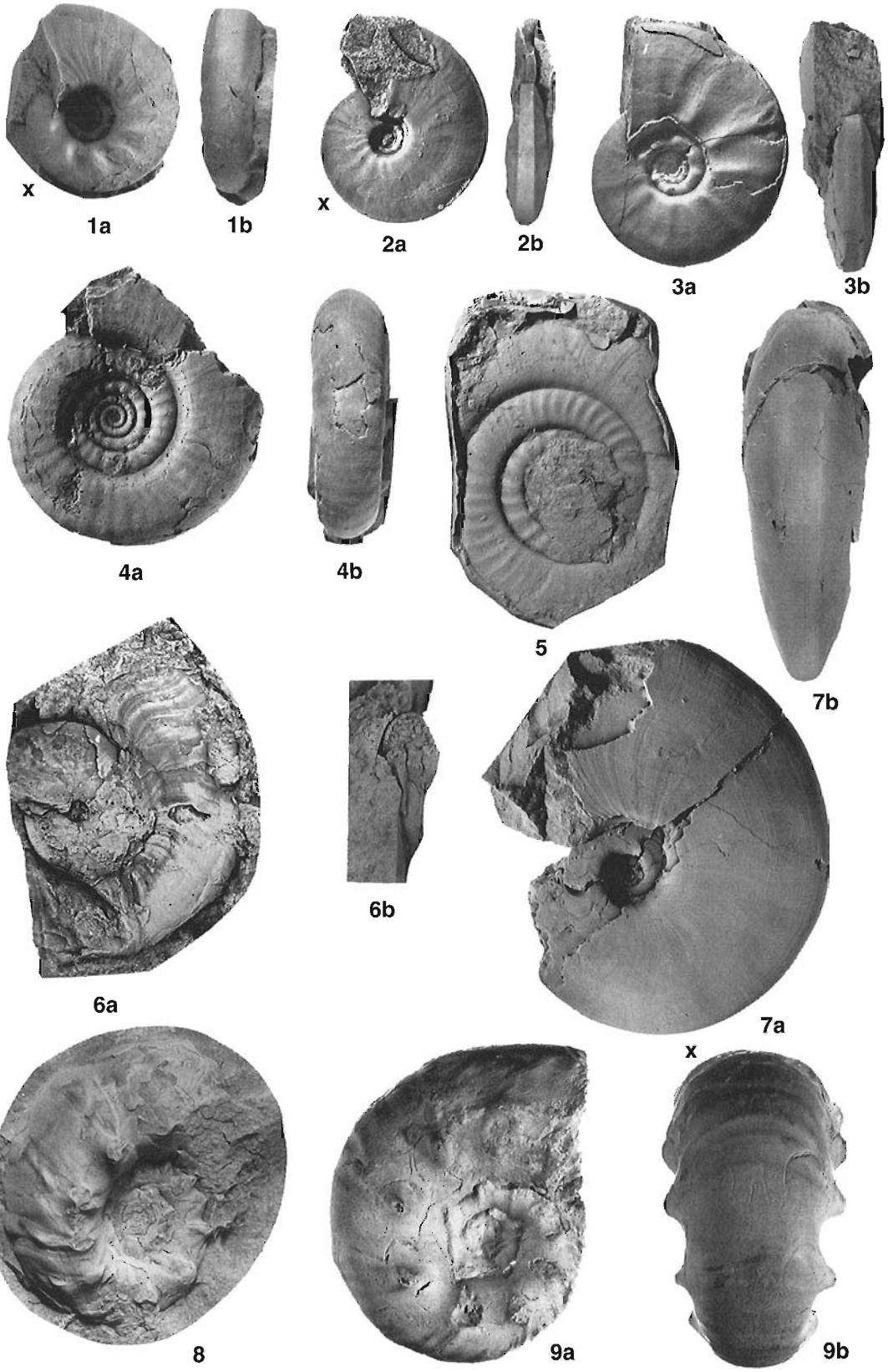
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PLATE 39

MIDDLE TRIASSIC
Lower Anisian–Mulleri Zone

All specimens from Toad Formation, Alaska Highway, northeastern British Columbia (GSC loc. 68226)

Figures 1–12. *Groenlandites silberlingi* n. sp. (Page 95)
- 1a–c. Paratype GSC 28440.
- 2a–c. Paratype GSC 28436.
- 3a–c. Paratype GSC 28437, small mature example, no septa visible.
- 4a–c. Paratype GSC 28438.
- 5. Paratype GSC 28439.
- 6a–c. Holotype GSC 28435.
- 7a, b. Paratype GSC 28441.
- 8a–c. Paratype GSC 28442.
- 9a–c. Paratype GSC 28443.
- 10a–c. Paratype GSC 28444.
- 11a, b. Paratype GSC 28445, large mature example.
- 12a, b. Paratype GSC 28446.

Figures 13–15. *Stenopopanoceras falcatum* n. sp. (Page 86)
- 13. Paratype GSC 28247, phragmocone.
- 14a–c. Holotype GSC 28249.
- 15a–c. Paratype GSC 28248. GSC 28248 and GSC 28249 are complete specimens with the peristome preserved.

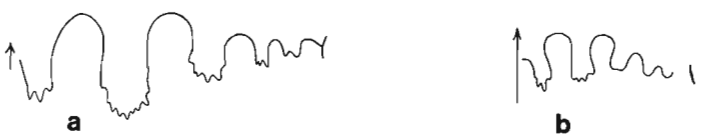

Figure 27. *Sutures. a,* ***Groenlandites silberlingi*** *n. sp., GSC 28435 (Pl. 39, fig. 6), x4; b,* ***Stenopopanoceras falcatum*** *n. sp., GSC 28247 (Pl. 39, fig. 13), x4.*

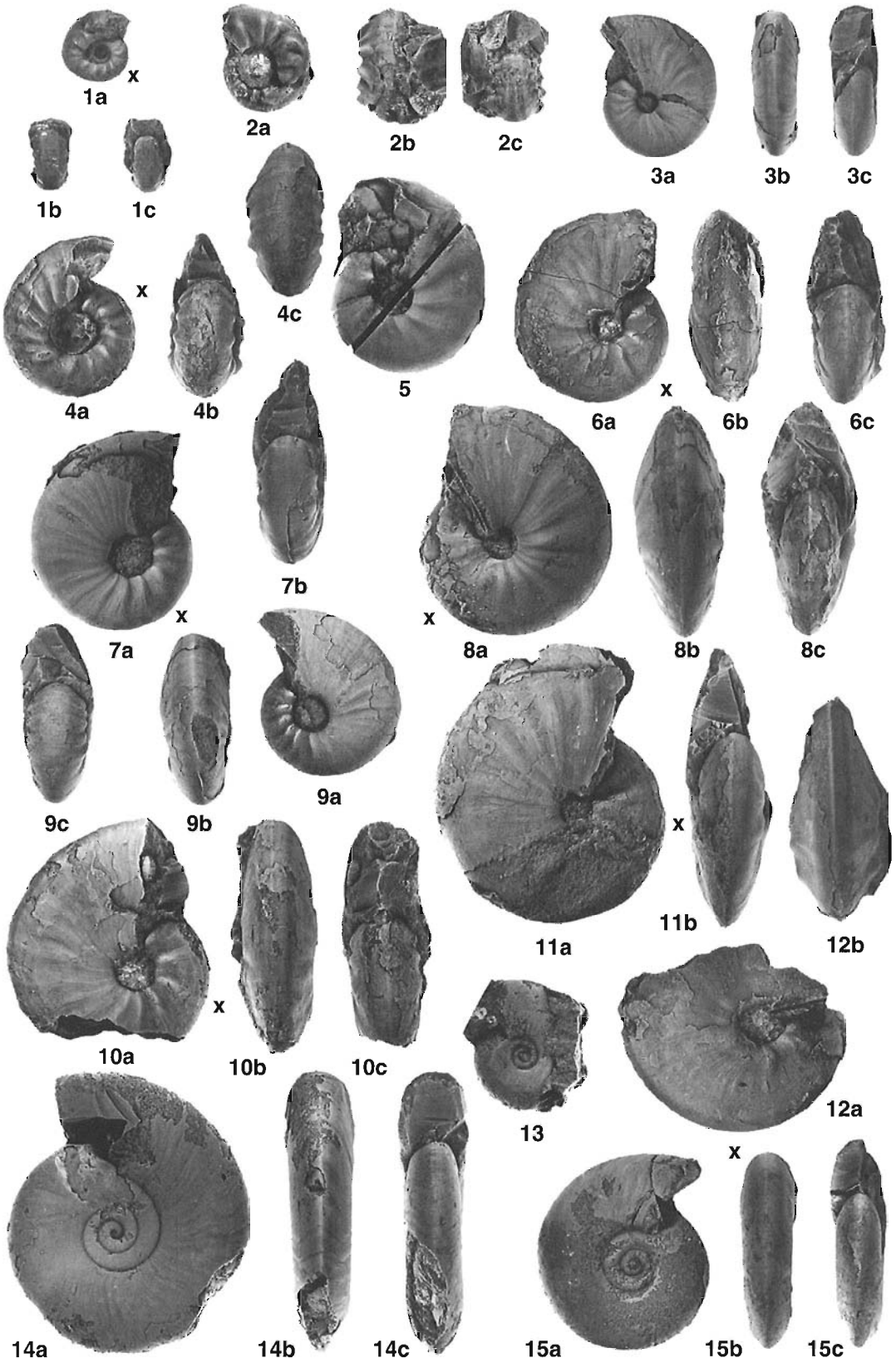
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PLATE 40

MIDDLE TRIASSIC
Lower Anisian–Caurus Zone

Figures 1–5. *Groenlandites kummeli* n. sp. (Page 96)
1a, b. Paratype GSC 28449.
2a–c. Paratype GSC 28450.
3a–c. Paratype GSC 28451.
4a–c. Holotype GSC 28452.
5a–c. Paratype GSC 28453.
All from Toad Formation, Alaska Highway, northeastern British Columbia (GSC loc. 68203).

Figures 6–12. *Groenlandites canadensis* n. sp. (Page 95)
6a–c. Paratype GSC 28454.
7a–c. Paratype GSC 28456.
8a–c. Paratype GSC 28455.
Figures 6–8 from Toad Formation, Chischa River, northeastern British Columbia (GSC loc. 74719).
9a, b. Paratype GSC 28460.
10a–c. Paratype GSC 28458.
11a–c. Paratype GSC 28459.
12a–c. Holotype GSC 28457.
Figures 9–12 from Toad Formation, Chischa River, northeastern British Columbia (GSC loc. 74732).

Figures 13a–d. *Groenlandites amplus* n. sp. (Page 96)
Holotype GSC 28461, phragmocone. Toad Formation, Chischa River, northeastern British Columbia (GSC loc. 74741).

Figures 14a–c. *Azarianites bufonis* (McLearn) (Page 103)
Topotype GSC 28424. Toad Formation, Liard River, northeastern British Columbia (GSC loc. 42339).

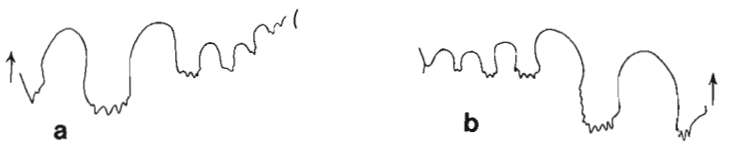

Figure 28. *Sutures. a,* ***Groenlandites canadensis*** *n. sp., GSC 28457 (Pl. 40, fig. 12), x4; b,* ***Groenlandites amplus*** *n. sp., GSC 28461 (Pl. 40, fig. 13), x2.*

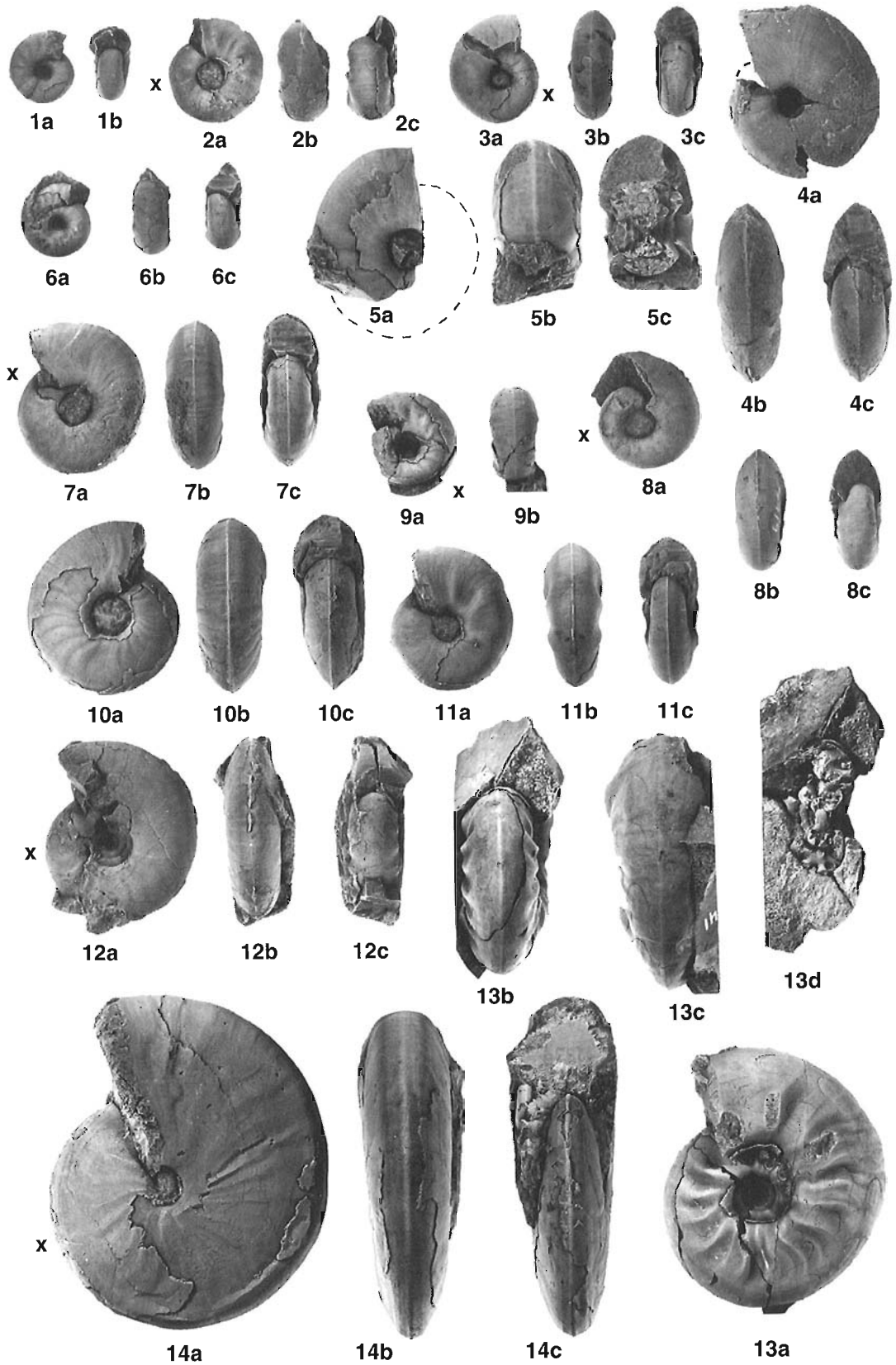
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PLATE 41

MIDDLE TRIASSIC
Lower Anisian–Caurus Zone

Figures 1–12, 16. *Lenotropites caurus* (McLearn) (Page 97)
1a–c. Hypotype GSC 28467.
2a–c. Hypotype GSC 28468.
3a–c. Hypotype GSC 28469.
4a–c. Hypotype GSC 28470.
5a, b. Hypotype GSC 28471.

Figures 1–5 from Toad Formation, Alaska Highway, northeastern British Columbia (GSC loc. 68203).
6a–c. Hypotype GSC 28476.
7a–c. Hypotype GSC 28477.
8a–c. Hypotype GSC 28478.

Figures 6–8 from Toad Formation, Chischa River, northeastern British Columbia (GSC loc. 74735).
9a–c. Hypotype GSC 28474.
10a–c. Hypotype GSC 28472.
11a–c. Hypotype GSC 28473.
12a–c. Hypotype GSC 28475.

Figures 9–12 from Toad Formation, Liard River, northeastern British Columbia (GSC loc. 42349).
16a, b. Hypotype GSC 28466. Toad Formation, Chischa River (GSC loc. 74720).

Figures 13–15. *Lenotropites tardus* McLearn (Page 99)
13a–d. Hypotype GSC 28484.
14a–c. Hypotype GSC 28485.
15a–c. Hypotype GSC 28486.
All from Toad Formation, Chischa River, northeastern British Columbia (GSC loc. 74719).

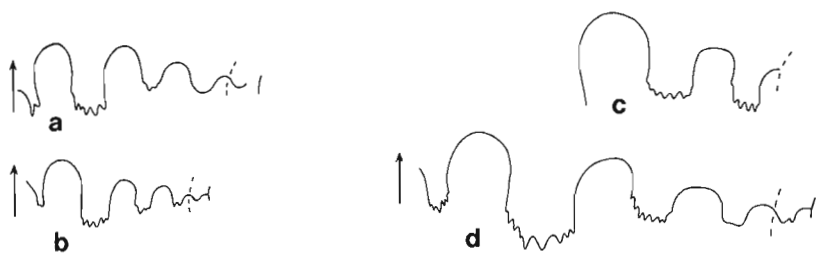

Figure 29. *Sutures. a–c.* ***Lenotropites caurus*** *(McLearn). a, GSC 28469 (Pl. 41, fig. 3); b, GSC 28468 (Pl. 41, fig. 2); c, GSC 28476 (Pl. 41, fig. 6); d,* ***Lenotropites tardus*** *McLearn, GSC 28485 (Pl. 41, fig. 14). All x4.*

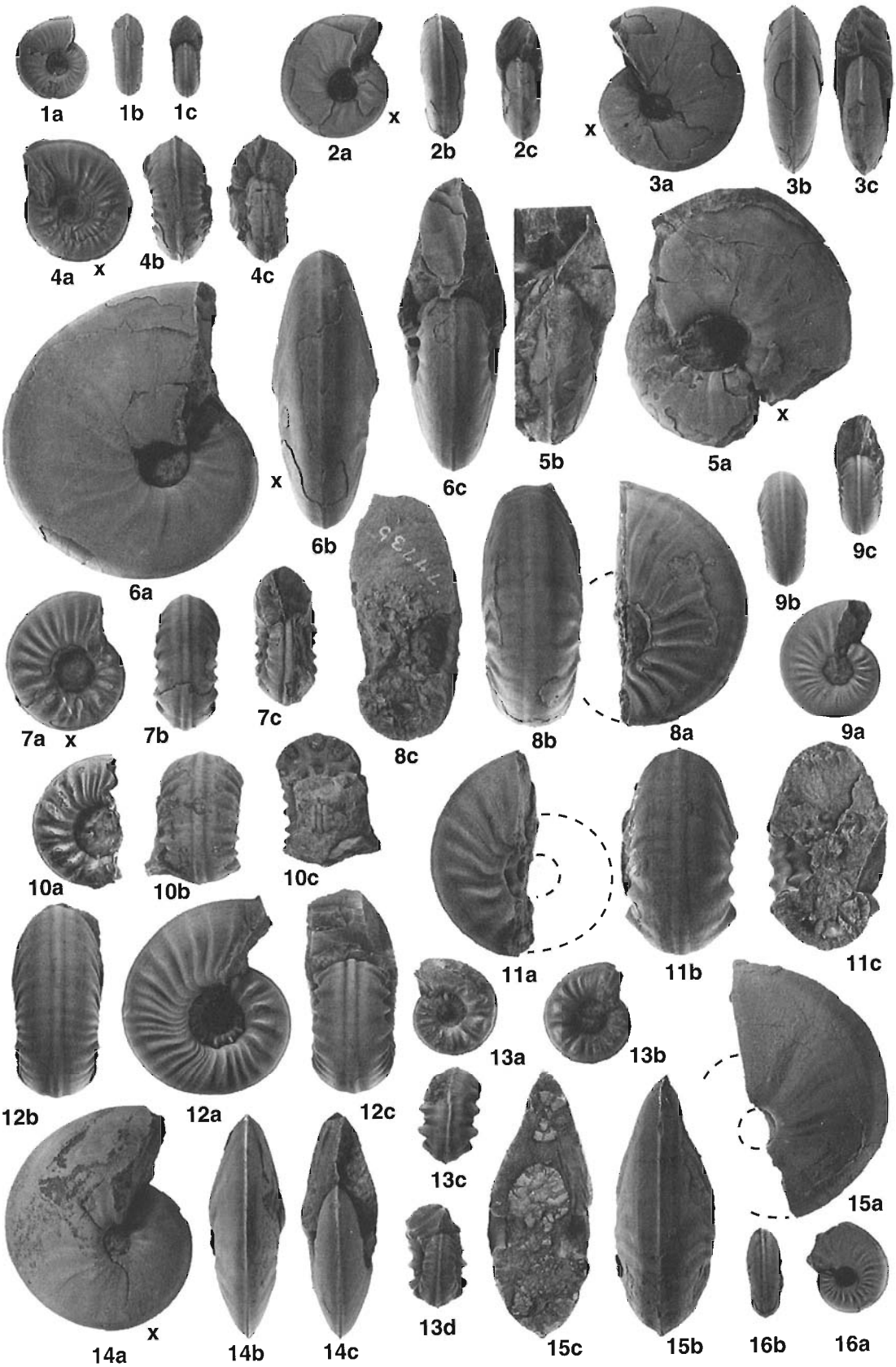
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PLATE 42

MIDDLE TRIASSIC
Lower Anisian–Caurus Zone

Figures 1–3. *Paracrochordiceras americanum* McLearn (Page 111)
1a, b. Holotype GSC 6475.
2a, b. Topotype GSC 21696.
3a–c. Topotype GSC 28279.
All from Toad Formation, Alaska Highway, northeastern British Columbia (GSC loc. 10732).

Figures 4–9. *Lenotropites tardus* McLearn (Page 99)
4a–c. Hypotype GSC 28487. Toad Formation, Chischa River, northeastern British Columbia (GSC loc. 74742).
5a, b. Hypotype GSC 28489.
6a, b. Hypotype GSC 28490.
7a, b. Hypotype GSC 28491.
8a, b. Hypotype GSC 28492.
9a–c. Hypotype GSC 28493.
Figures 5–9 from Toad Formation, Chischa River, northeastern British Columbia (GSC loc. 74732).

Figures 10a–c. *Lenotropites caurus* (McLearn) (Page 97)
Hypotype GSC 72206. Toad Formation, Alaska Highway, northeastern British Columbia (GSC loc. 98907).

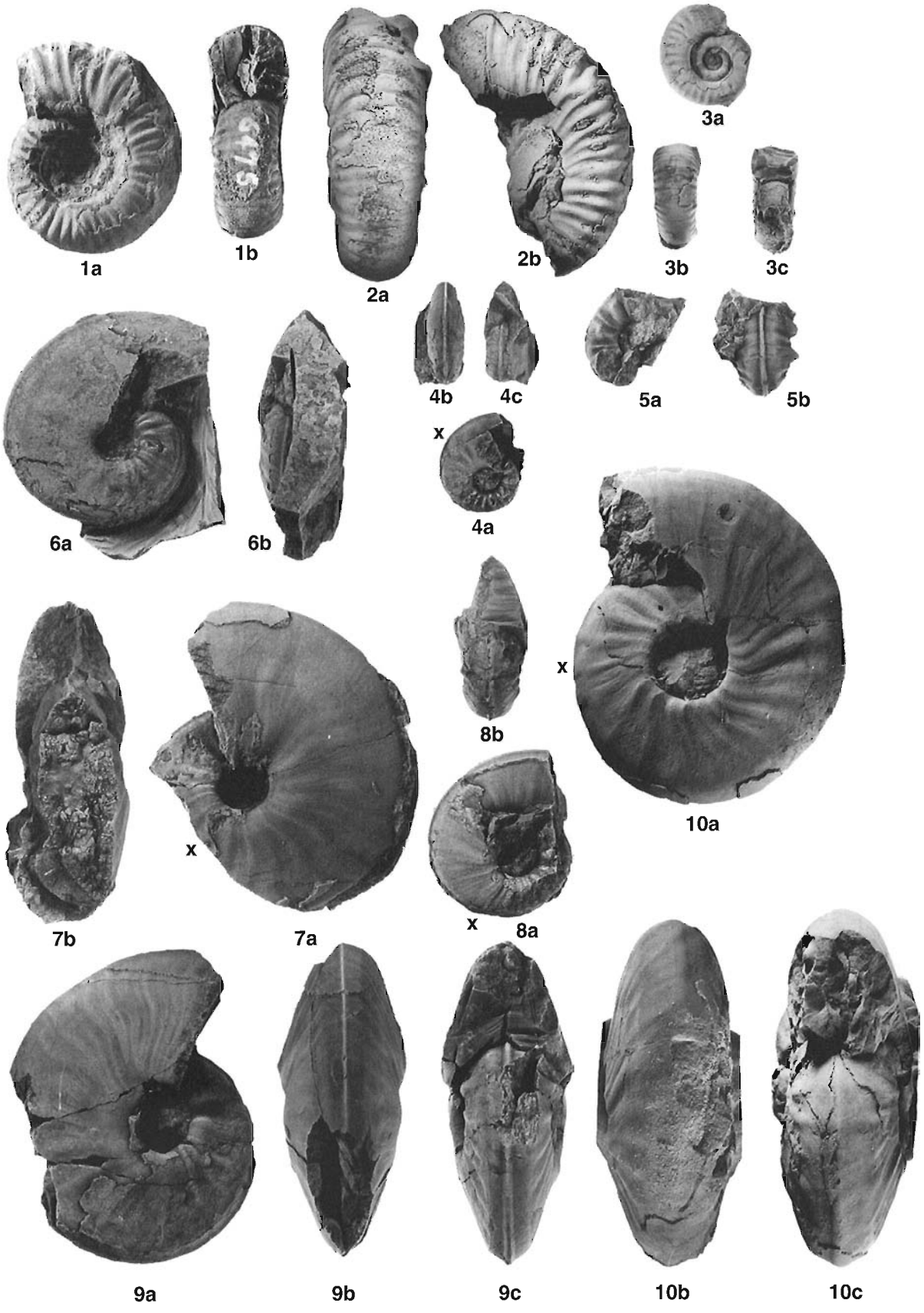
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PLATE 43

MIDDLE TRIASSIC
Lower Anisian–Mulleri and Caurus zones

Figures 1a, b. *Lenotropites ellesmerensis* n. sp. (Caurus Zone) (Page 100)
Holotype GSC 28483. Blaa Mountain Formation, Spath Creek, Ellesmere Island (GSC loc. 47550).

Figures 2a, b, 7. *Grambergia mackenzii* (McLearn) (Caurus Zone) (Page 102)
2a, b. Topotype GSC 28506.
7. Topotype GSC 28496.
Both from Toad Formation, Chischa River, northeastern British Columbia (GSC loc. 74741).

Figures 3, 4. *Grambergia tetsaensis* McLearn (Mulleri Zone) (Page 101)
3a, b. Hypotype GSC 28499.
4a, b. Hypotype GSC 28500.
Both from Toad Formation, Alaska Highway, northeastern British Columbia (GSC loc. 68226).

Figures 5, 6. *Pearylandites troelseni* Kummel (Caurus Zone)
5a, b. Hypotype GSC 28463 (x2).
6a, b. Hypotype GSC 28464.
Both from Schei Point Formation, Exmouth Island (GSC loc. 30339).

Figures 8, 9. *Lenotropites tardus* McLearn (Caurus Zone) (Page 99)
8a, b. Holotype GSC 21723. Toad Formation, Tetsa River valley, northeastern British Columbia (GSC loc. 36446).
9a, b. Hypotype GSC 28482, phragmocone. Toad Formation, Liard River, northeastern British Columbia (GSC loc. 42338).

Figures 10, 11. *Grambergia nahwisi* (McLearn) (Caurus Zone, Subzone 2) (Page 103)
10a, b. Topotype GSC 28508 (GSC loc. 42343).
11a, b. Topotype GSC 28509 (GSC loc. 42338).
Both from Toad Formation, Liard River, northeastern British Columbia.

Figure 12. *Discogymnites hollandi* (McLearn) (Caurus Zone, Subzone 2) (x0.5) (Page 129)
Holotype GSC 6448. Toad Formation, Liard River, northeastern British Columbia (GSC loc. 10660).

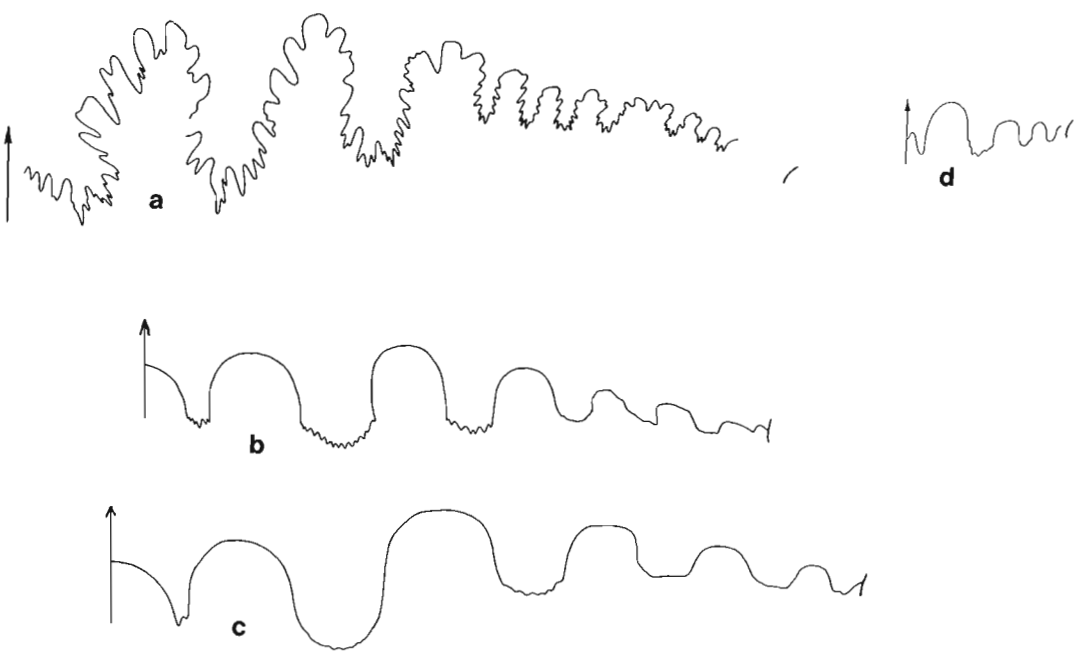

Figure 30. *Sutures. a,* ***Discogymnites hollandi*** *(McLearn), GSC 6448 (Pl. 43, fig. 12), x1; b, c.* ***Grambergia nahwisi*** *(McLearn). b, GSC 28508 (Pl. 43, fig. 10), x2; c, GSC 28509 (Pl. 43, fig. 11), x2; d,* ***Pearylandites troelseni*** *Kummel, GSC 28463 (Pl. 43, fig. 6) x4.*

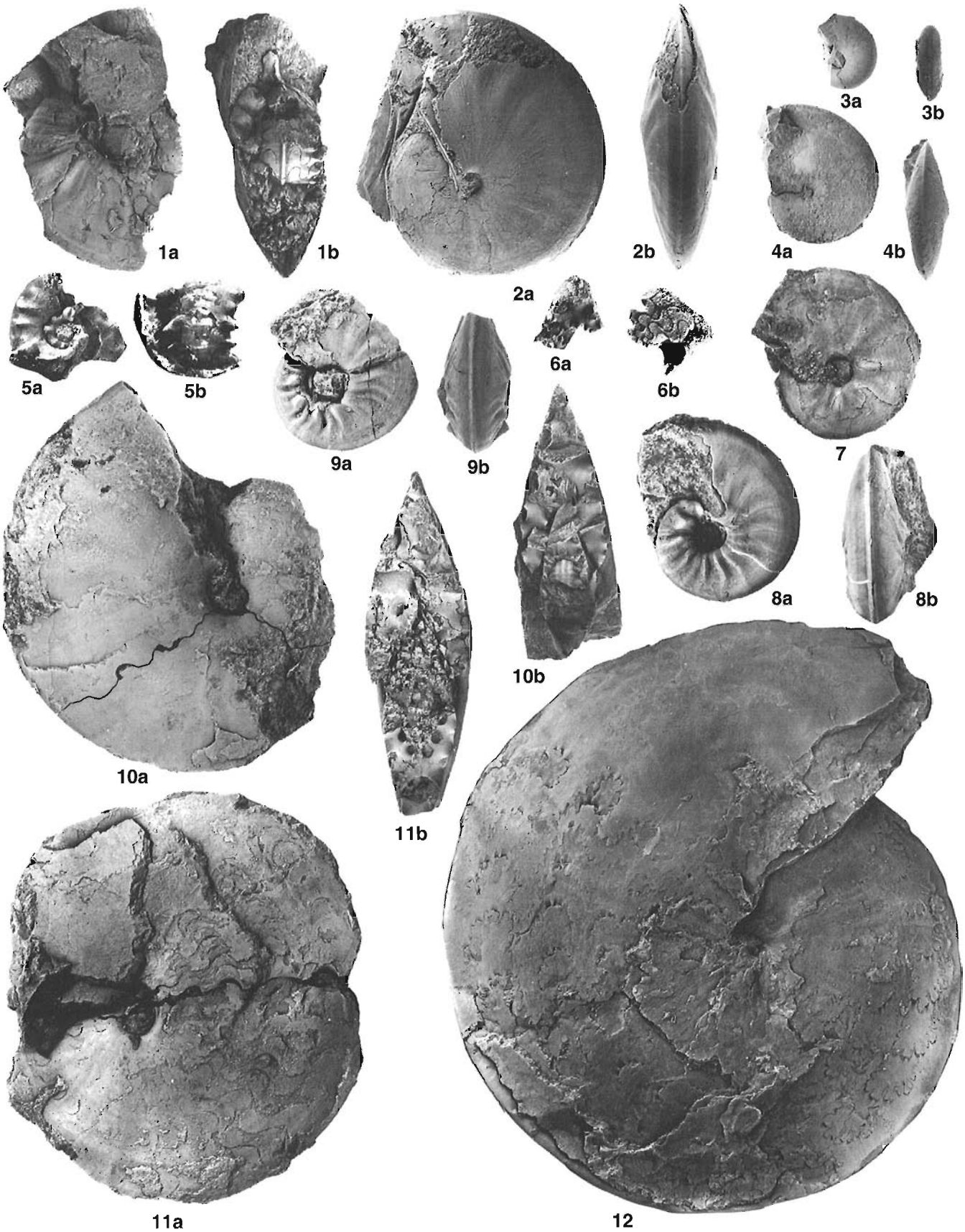
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PLATE 44

MIDDLE TRIASSIC
Lower Anisian–Mulleri and Caurus zones

Figures 1, 2, 13. *Lenotropites undulatus* (Spath) (Caurus Zone) (Page 99)
1a–c. Hypotype GSC 28479, phragmocone.
2a, b. GSC 28480.
Figures 1, 2 from Blaa Mountain Formation, Spath Creek, Ellesmere Island (GSC loc. 47580).
13a, b. Hypotype GSC 28481. Schei Point Formation, Exmouth Island (GSC loc. 30339).

Figures 3, 4, 10. *Grambergia tetsaensis* McLearn (Caurus Zone) (Page 101)
3a–c. Hypotype GSC 28501.
4a, b. Hypotype GSC 28502, complete phragmocone with occluded umbilicus.
Figures 3, 4 from Toad Formation, Chischa River, northeastern British Columbia (GSC loc. 74719).
10a–c. Hypotype GSC 28498. Toad Formation, Alaska Highway, northeastern British Columbia (GSC loc. 68203).

Figures 5–9. *Grambergia mackenzii* (McLearn) (Caurus Zone) (Page 102)
5a–c. Hypotype GSC 28514, complete phragmocone. Toad Formation, Chischa River, northeastern British Columbia (GSC loc. 74719).
6a, b. Topotype GSC 28504, phragmocone.
7a–c. Topotype GSC 28503, phragmocone.
8a, b. Topotype GSC 28505, phragmocone.
9a, b. Topotype GSC 28507.
Figures 6–9 from Toad Formation, Chischa River, northeastern British Columbia (GSC loc. 74741).

Figures 11, 12. *Caucasites mulleri* n. sp. (Mulleri Zone) (Page 125)
11a, b. Paratype GSC 28372.
12a, b. Holotype GSC 28371.
Both from Toad Formation, Alaska Highway, northeastern British Columbia (GSC loc. 68226).

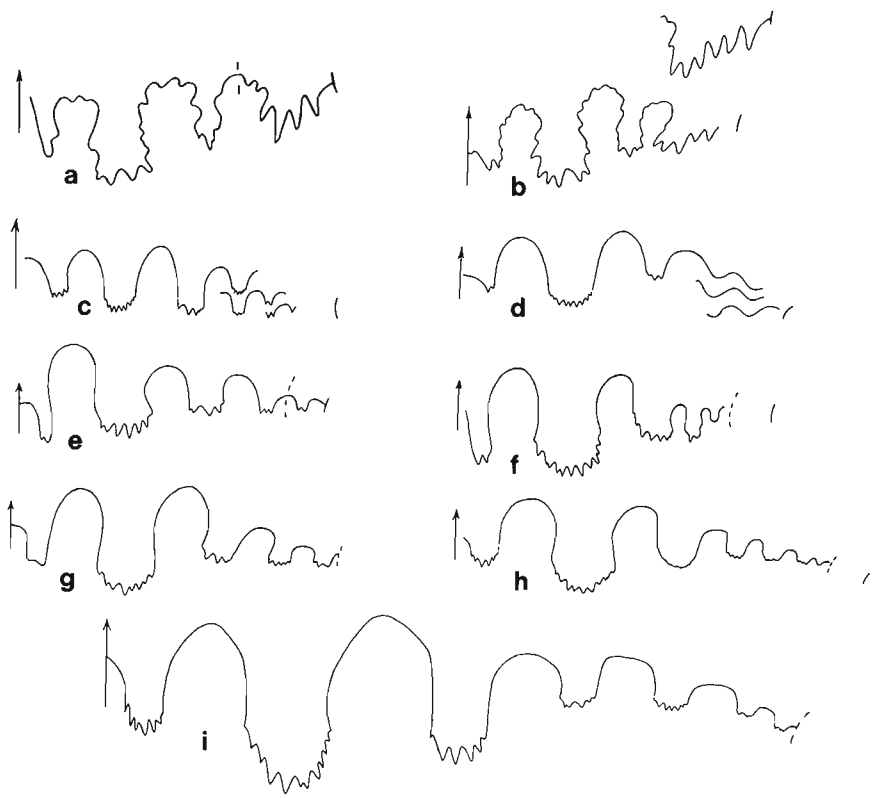

Figure 31. *Sutures. a, b.* ***Caucasites mulleri*** *n. sp. a, GSC 28732 (Pl. 44, fig. 11); b, two sutures of GSC 28371 (Pl. 44, fig. 12), both x8. c, d.* ***Grambergia tetsaensis*** *McLearn. c, GSC 28502 (Pl. 44, fig. 4), x2; d, GSC 28498 (Pl. 44, fig. 10), x4. e,* ***Lenotropites undulatus*** *(Spath), GSC 28479 (Pl. 44, fig. 1), x4. f–i.* ***Grambergia mackenzii*** *(McLearn). f, GSC 9584 (McLearn, 1969, Pl. 7, fig. 6), x4; g, GSC 28503 (Pl. 44, fig. 7), x4; h, GSC 28504 (Pl. 44, fig. 6), x4; i, GSC 28507 (Pl. 44, fig. 9), x2.*

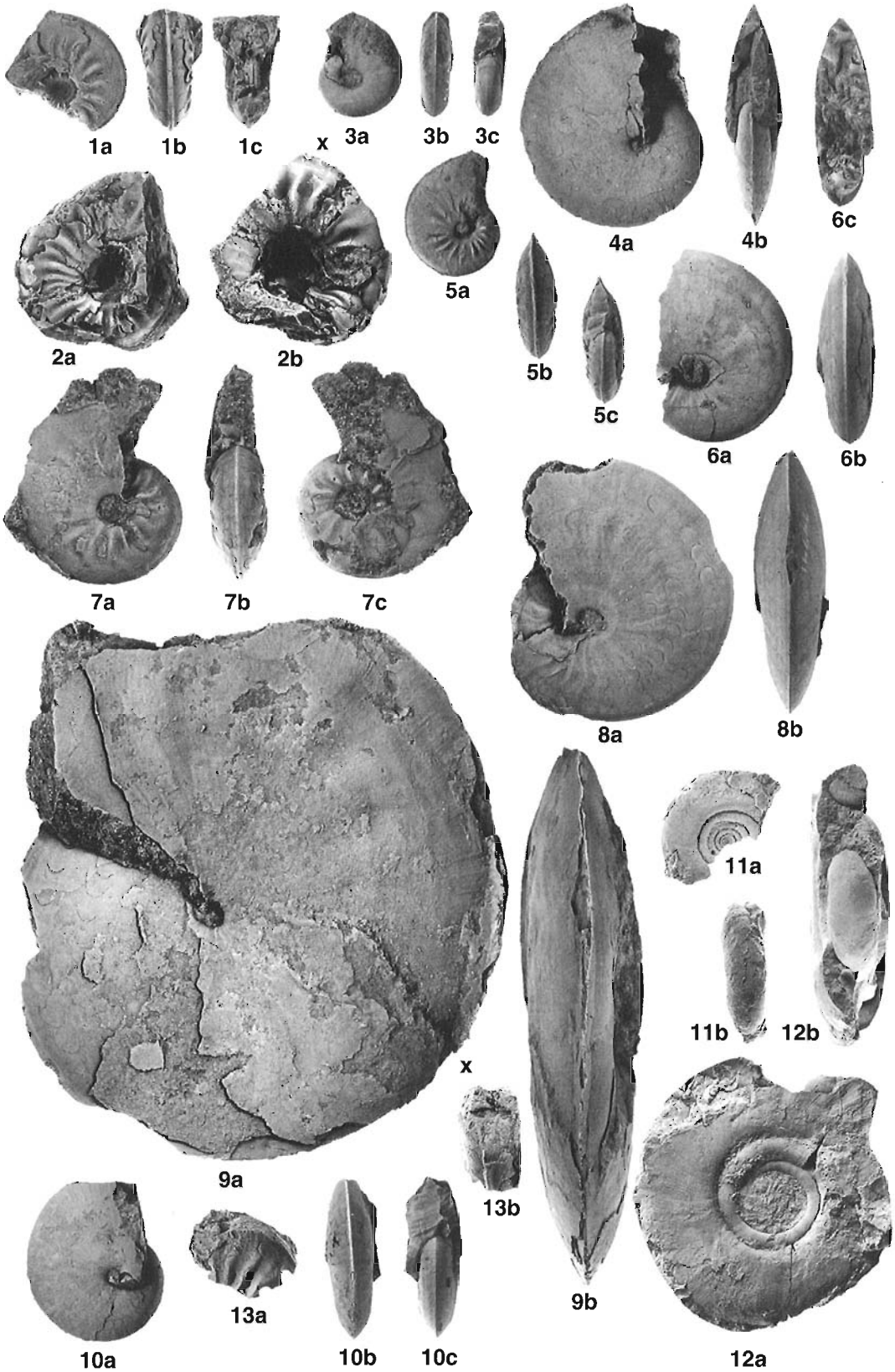
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PLATE 45

MIDDLE TRIASSIC
Lower Anisian–Mulleri and Caurus zones

Figures 1a, b. *Groenlandites silberlingi* n. sp. (Mulleri Zone) (Page 95)
Paratype GSC 28447. Toad Formation, Alaska Highway, northeastern British Columbia (GSC loc. 68226).

Figures 2, 3. *Paracrochordiceras benderi* n. sp. (Mulleri Zone) (Page 110)
2a–c. Holotype GSC 28280.
3a–c. Paratype GSC 28281.
Both from Toad Formation, Alaska Highway, northeastern British Columbia (GSC loc. 68226).

Figures 4, 12. *Paradanubites shevyrevi* n. sp. (Mulleri Zone) (Page 109)
4a, b. Holotype GSC 28423, much of the outer whorl is apparently body chamber.
12a, b. Paratype GSC 35320.
Both from Toad Formation, Alaska Highway, northeastern British Columbia (GSC loc. 68226).

Figures 5–8. *Grambergia liardensis* n. sp. (Caurus Subzone 1) (Page 101)
5a–c. Paratype GSC 28511.
6a, b. Holotype GSC 28510.
7a, b. Paratype GSC 28512.
8a, b. Paratype GSC 28513.
All from Toad Formation, Liard River, northeastern British Columbia (GSC loc. 42339).

Figures 9a, b. *Lenotropites*(?) *tricarinatus* n. sp. (Caurus Subzone 1) (Page 100)
Holotype GSC 28497. Toad Formation, Alaska Highway, northeastern British Columbia (GSC loc. 68203).

Figures 10a, b. *Lenotropites caurus* (McLearn) (Caurus Subzone 1) (Page 97)
Topotype GSC 28465. Toad Formation, Liard River, northeastern British Columbia (GSC loc. 42339).

Figures 11a, b. *Columbisculites maclearni* n. sp. (Caurus Zone) (Page 133)
Holotype GSC 33283, complete with peristome, body chamber one and three-eights whorls. Toad Formation, Alaska Highway, northeastern British Columbia (GSC loc. 10732)

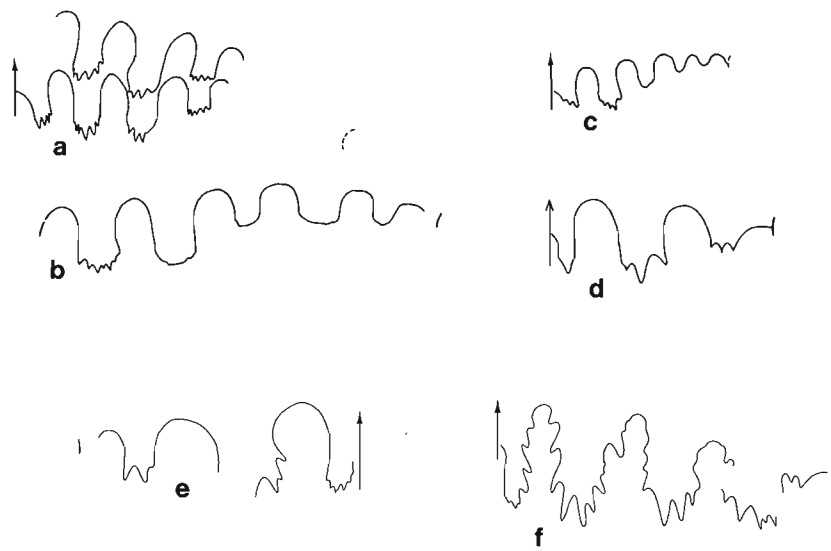

Figure 32. *Sutures. a–c.* ***Grambergia liardensis*** *n. sp. a, GSC 28510 (Pl. 45, fig. 6), x2; b, GSC 28513 (Pl. 45, fig. 8), x2; c, GSC 28511 (Pl. 45, fig. 5), x4; d,* ***Paracrochordiceras benderi*** *n. sp., GSC 28281 (Pl. 45, fig. 3), x4; e,* ***Paradanubites shevyrevi*** *n. sp., GSC 28423 (Pl. 45, fig. 4), x2; f,* ***Columbisculites maclearni*** *n. sp., GSC 33283 (Pl. 45, fig. 11), x4.*

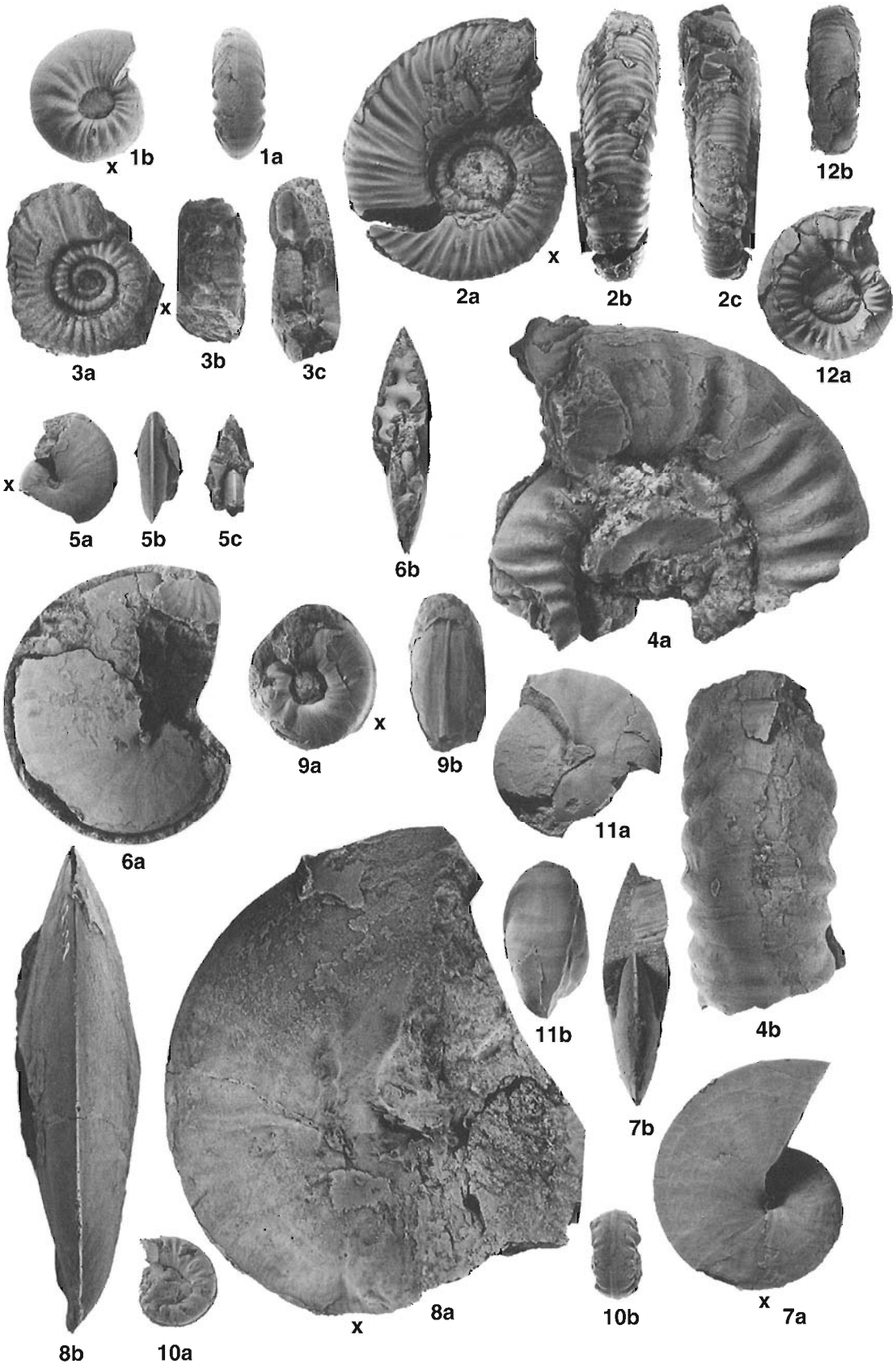
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PLATE 46

MIDDLE TRIASSIC
Lower Anisian–Mulleri and Caurus zones

Figures 1–3. *Ussurites muskwa* McLearn (Caurus Zone) (Page 269)
1a, b. Hypotype GSC 32336, no septa visible. Toad Formation, Alaska Highway, northeastern British Columbia (GSC loc. 74715).
2a, b. Hypotype GSC 32335, phragmocone. Toad Formation, Liard River, northeastern British Columbia (GSC loc. 42404).
3a, b. Topotype GSC 32334. Toad Formation, Alaska Highway, northeastern British Columbia (GSC loc. 10732).

Figures 4–6. *Stenophyllites kindlei* (McLearn) (Caurus Zone) (Page 269)
4a, b. Hypotype GSC 32331. Toad Formation, Chischa River, northeastern British Columbia (GSC loc. 74719).
5a, b. Hypotype GSC 32333. Toad Formation, Liard River, northeastern British Columbia (GSC loc. 42403).
6a, b. Hypotype GSC 32332. Toad Formation, Liard River, northeastern British Columbia (GSC loc. 42404).

Figures 7, 8. *Gymnites procerus* n. sp. (Mulleri Zone) (Page 127)
7a, b. Holotype GSC 28376, phragmocone.
8. Paratype GSC 28377.
Both from Toad Formation, Alaska Highway, northeastern British Columbia (GSC loc. 68226).

Figures 9, 10. *Discogymnites hollandi* (McLearn) (Caurus Subzone 2) (x0.5) (Page 109)
9a, b. Topotype GSC 28382. Toad Formation, Liard River, northeastern British Columbia (GSC loc. 42338).
10a, b. GSC 28383. Toad Formation, Chischa River, northeastern British Columbia (GSC loc. 74733).

Figures 11a, b. *Sturia sansovinii* (Mojsisovics) (Caurus Subzone 2) (x0.5) (Page 132)
Hypotype GSC 28398, phragmocone. Toad Formation, Liard River, northeastern British Columbia (GSC loc. 10660).

Figures 12a, b. *Stenopopanoceras normale* (McLearn) (Caurus Zone) (Page 86)
Holotype GSC 9574. Toad Formation, Alaska Highway, northeastern British Columbia (GSC loc. 10732).

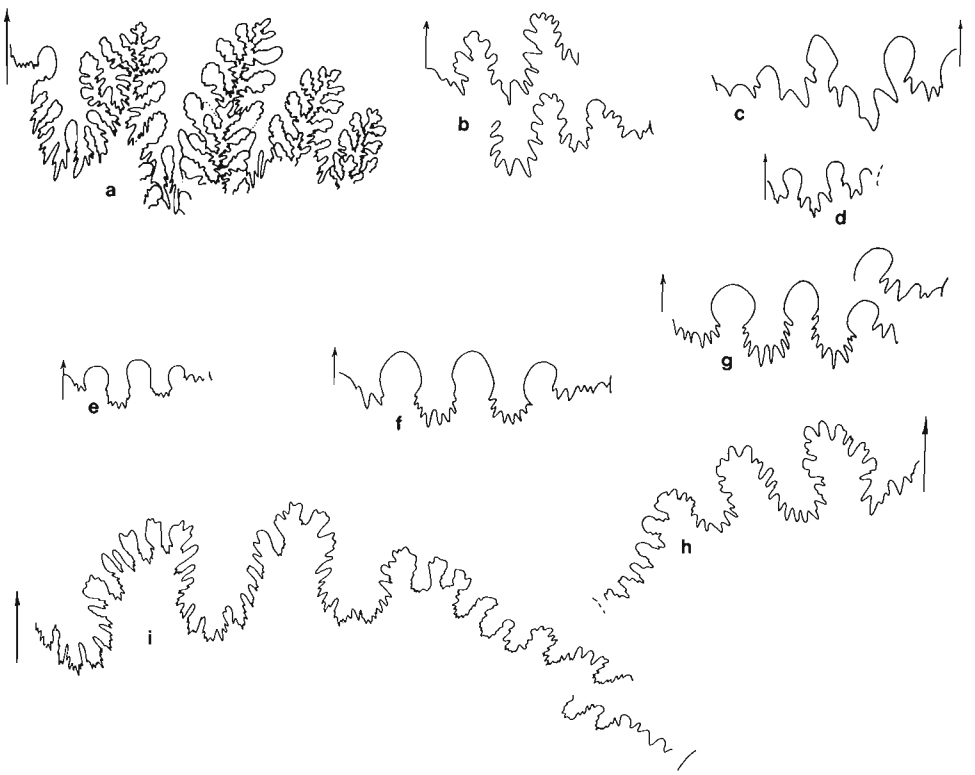

Figure 33. *Sutures. a,* ***Sturia sansovinii*** *(Mojsisovics), GSC 28398 (Pl. 46, fig. 11), x0.75; b,* ***Gymnites procerus*** *n. sp., GSC 28376 (Pl. 46, fig. 7), x3. c,d.* ***Ussurites muskwa*** *McLearn. c, GSC 6444 (McLearn, 1969, Pl. 13, fig. 3); d, GSC 32334 (Pl. 46, fig. 3). e–g.* ***Stenophyllites kindlei*** *(McLearn). e, GSC 32331 (Pl. 46, fig. 4), x3; f, GSC 32332 (Pl. 46, fig. 6), x3; g, GSC 32333 (Pl. 46, fig. 5), x1.5; h, i.* ***Discogymnites hollandi*** *(McLearn). h, GSC 28383 (Pl. 46, fig. 10), x0.75; i, GSC 28382 (Pl. 46, fig. 9),* x0.75.

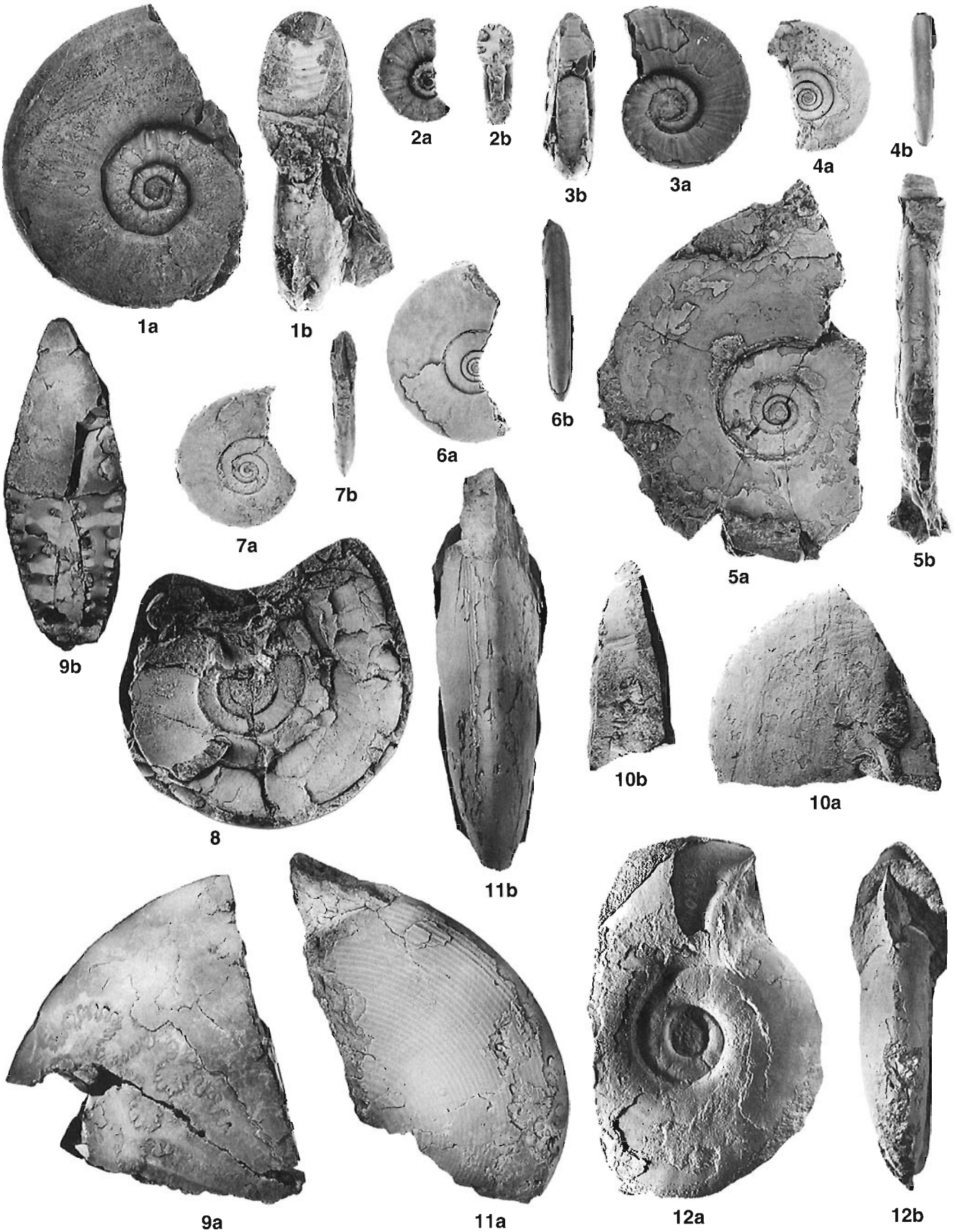
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PLATE 47

MIDDLE TRIASSIC
Lower and Middle Anisian

All specimens from a bed 1 m thick, evidently containing faunas of Caurus and Hagei zones, Chischa River, northeastern British Columbia (GSC loc. 74740)

Figures 1, 2. *Intornites mactaggarti* (McLearn) (Hagei Zone) (Page 104)
1a, b. Hypotype GSC 28495.
2a–c. Hypotype GSC 28494.

Figure 3. *Discogymnites hollandi* (McLearn) (Caurus Zone) (Page 129)
Hypotype GSC 70990.

Figures 4a–c. *Pearylandites peregrinus* n. sp. (Caurus Zone) (Page 97)
Holotype GSC 28462.

Figures 5, 6. *Grambergia mackenzii* (McLearn) (Caurus Zone) (Page 102)
5. Hypotype GSC 70991.
6. Hypotype GSC 70992.

Figures 7a, b. *Japonites wrighti* n. sp. (Caurus Zone) (Page 126)
Holotype GSC 28370.

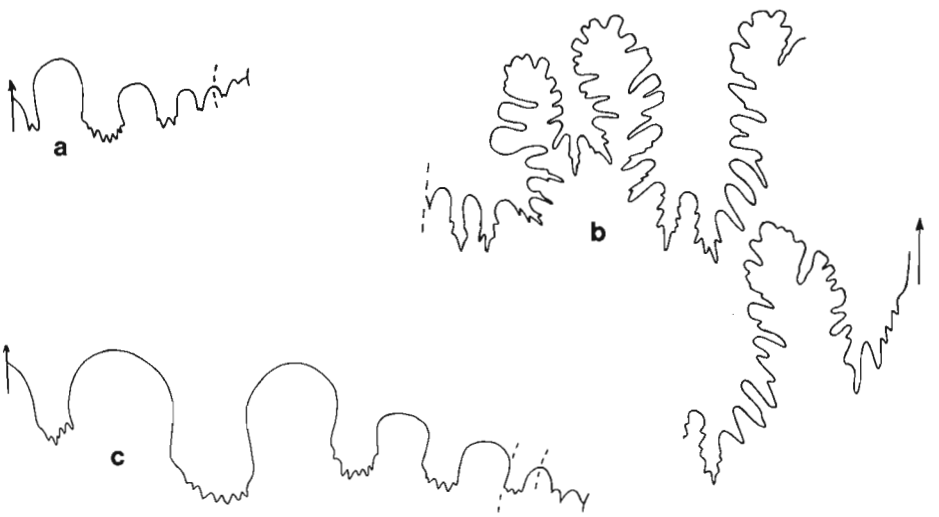
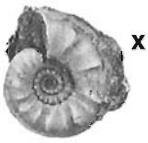


Figure 34. *Sutures. a,* ***Intornites mactaggarti*** *(McLearn), GSC 28494 (Pl. 47, fig. 2), x4; b,* ***Japonites wrighti*** *n. sp., two sutures, GSC 28370 (Pl. 47, fig. 7), x2; c,* ***Pearylandites peregrinus*** *n. sp., GSC 28462 (Pl. 47, fig. 4), x2.*



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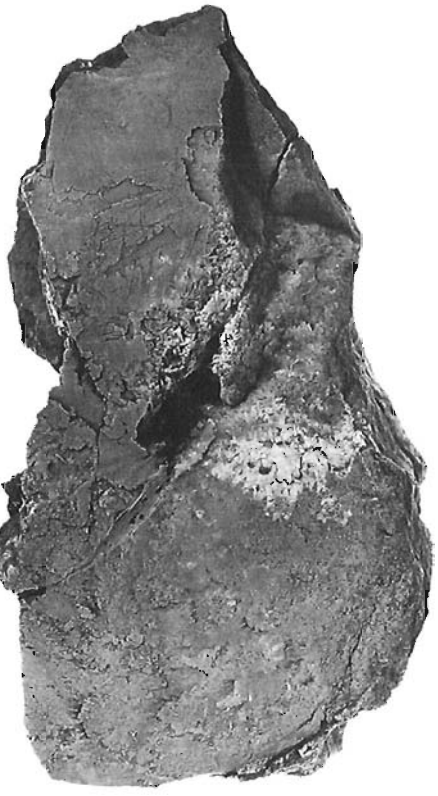

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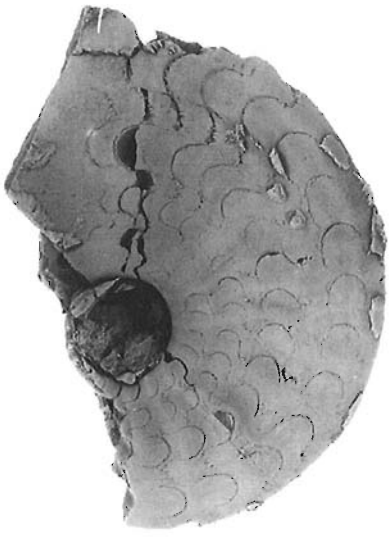

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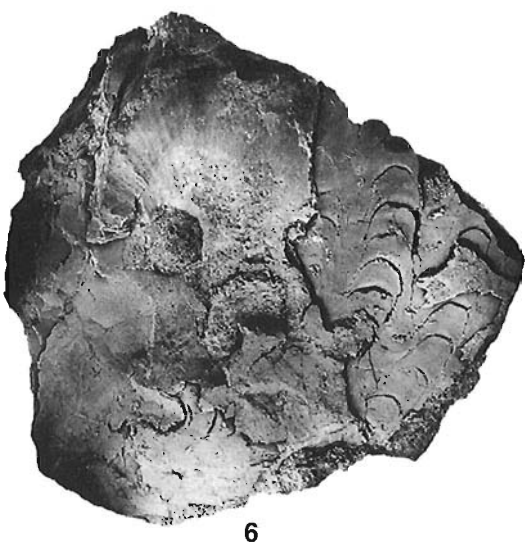

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PLATE 48

MIDDLE TRIASSIC
Middle Anisian

Figures 1, 2. *Ptychites guloensis* n. sp. (Minor Zone) (Page 133)
1a, b. Holotype GSC 70993. Sulphur Mountain Formation, near Hook Lake, northeastern British Columbia (GSC loc. 83873).
2a, b. Paratype GSC 35315, outer whorl mostly or wholly body chamber. Toad Formation, Alaska Highway, northeastern British Columbia (GSC loc. 68295).

Figures 3, 4. *Ptychites wrighti* McLearn (Page 134)
3a, b. Topotype GSC 35318.
4a, b. Holotype, GSC 6442.
Both from Toad Formation, Mount Wooliever, northeastern British Columbia (GSC loc. 10731).

Figures 5a–c. *Arctohungarites liardensis* n. sp. (Hayesi Zone) (Page 109)
Paratype GSC 70994. Toad Formation, Liard River, northeastern British Columbia (GSC loc. 42410).

Figures 6–7. *Buddhaites hagei* (McLearn) (Hagei Zone) (Page 129)
6. Hypotype GSC 28384. Toad Formation, Chlotapecta Creek, northeastern British Columbia (GSC loc. 40109).
7a, b. Hypotype GSC 28389. Toad Formation, Chischa River, northeastern British Columbia (GSC loc. 74736).

Figures 8a, b. *Gymnites*(?) *perplanus* (Meek) (Hayesi Zone) (Page 128)
Hypotype GSC 32369. Toad Formation, Toad River, northeastern British Columbia (GSC loc. 89548).

Figures 9a, b. *Intornites mactaggarti* (McLearn) (Hayesi Zone?) (Page 104)
Hypotype, holotype of *Longobardites larvalis* McLearn, GSC 9583. Toad Formation, Alaska Highway, northeastern British Columbia (GSC loc. 10696).

Figures 10a, b. *Ussurites yabei* Diener (Hagei Zone) (Page 269)
Hypotype GSC 32337. Blaa Mountain Formation, Smith Creek, Ellesmere Island (GSC loc. 51676).

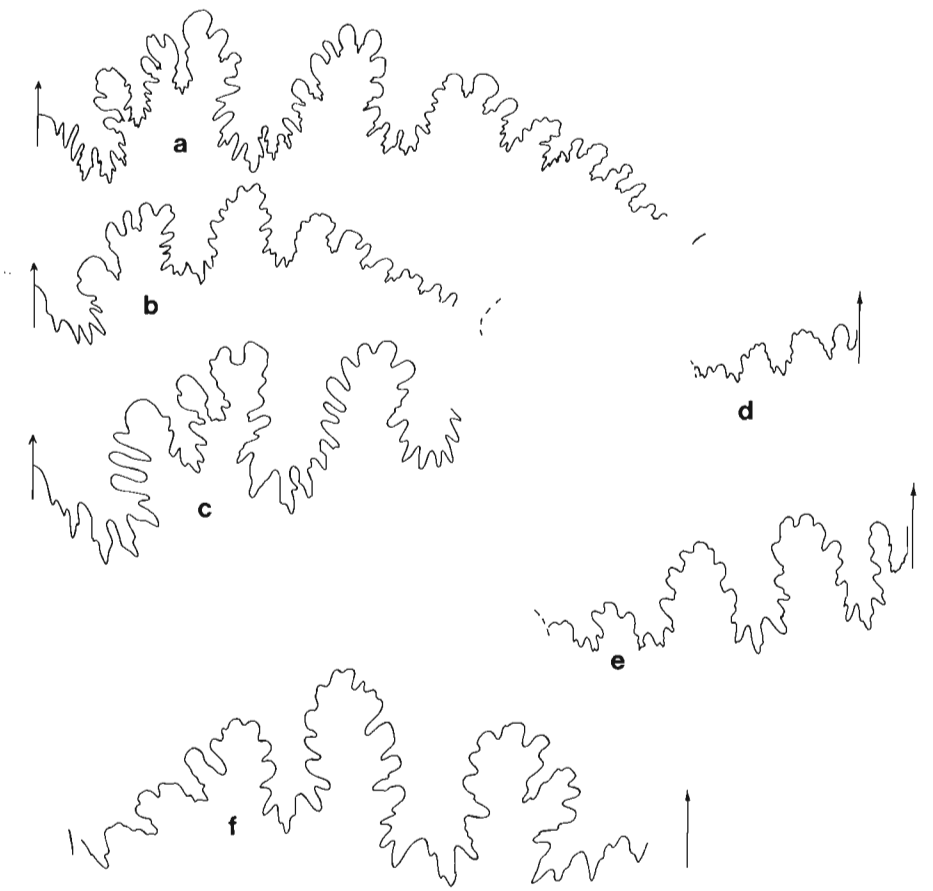

Figure 35. *Sutures. a–c.* ***Buddhaites hagei*** *(McLearn). a, GSC 28390*, x2; b, GSC 28389 (Pl. 48, fig. 7), x2; c, GSC 6447 (McLearn, 1969, Pl. 10, fig. 5), x4. d, e.* ***Ptychites guloensis*** *n. sp. d, GSC 35316*, x4; e, GSC 70993 (Pl. 48, fig. 1), x1.5. f,* ***Gymnites(?) perplanus*** *(Meek), GSC 32369 (Pl. 48, fig. 8), x4.*

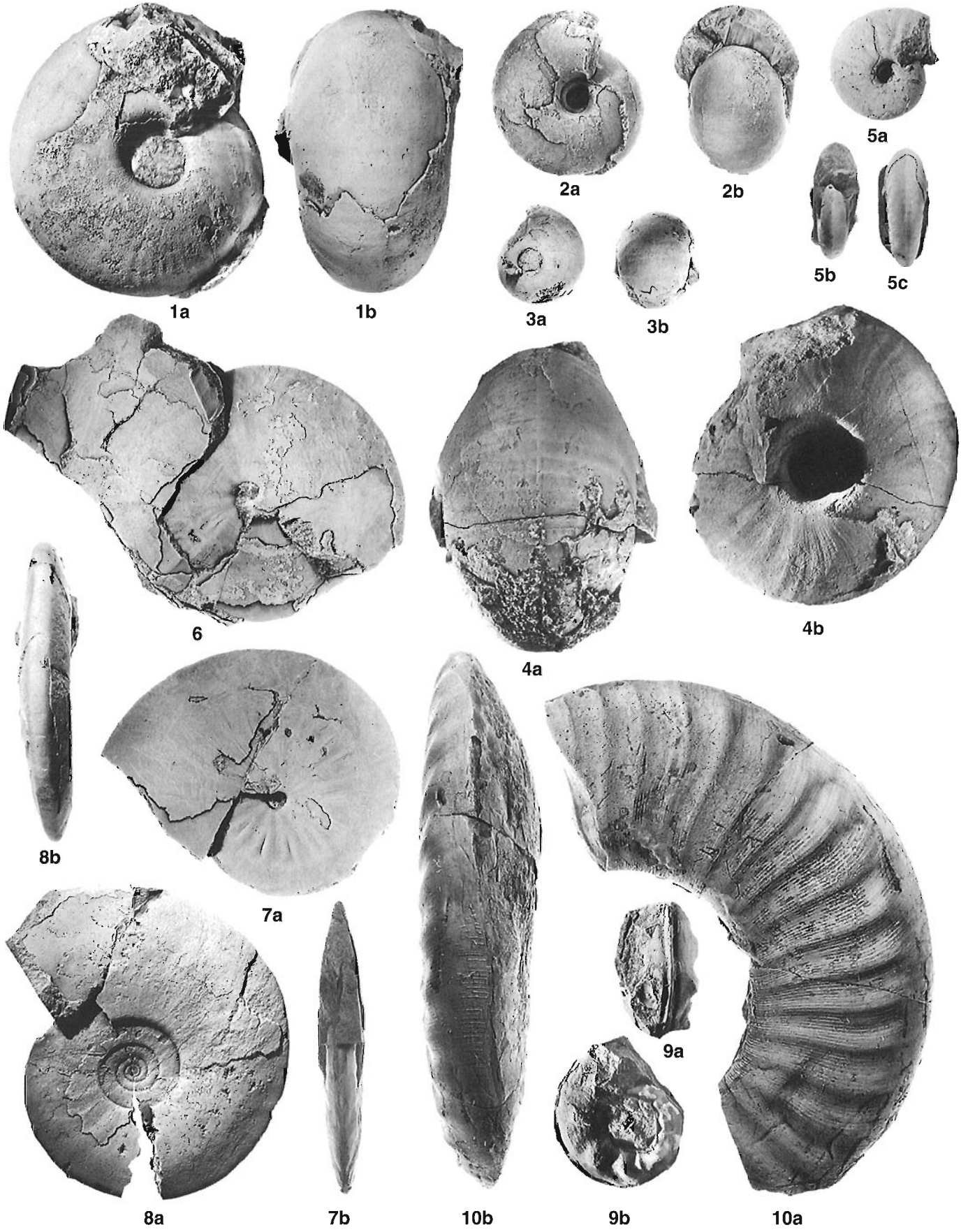
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PLATE 49

MIDDLE TRIASSIC
Middle Anisian

Figures 1, 2, 4. *Intornites mactaggarti* (McLearn) (Hagei Zone) (Page 104)
1a–c. Hypotype GSC 28521 (GSC loc. 42406).
2a–d. Hypotype GSC 28520 (GSC loc. 42402).
4a–d. Hypotype GSC 28518 (GSC loc. 42400), 4d broken to show inner whorls.
All from Toad Formation, Liard River, northeastern British Columbia.

Figures 3a, b. *Intornites intornatus* (McLearn) (Hagei Zone) (Page 106)
Hypotype GSC 28515, 3b broken to show inner whorls. Toad Formation, Liard River, northeastern British Columbia (GSC loc. 42337).

Figures 5–7. *Buddhaites hagei* (McLearn) (Hagei Zone) (Page 129)
5. Hypotype GSC 28386 (GSC loc. 74739), sectional view.
6. Hypotype GSC 28388 (large specimen).
Hypotype GSC 28387 (small specimen) (GSC loc. 74736).
Figures 5, 6 from Toad Formation, Chischa River, northeastern British Columbia.
7a, b. Hypotype GSC 28385, phragmocone. Toad Formation, Liard River, northeastern British Columbia (GSC loc. 42337).

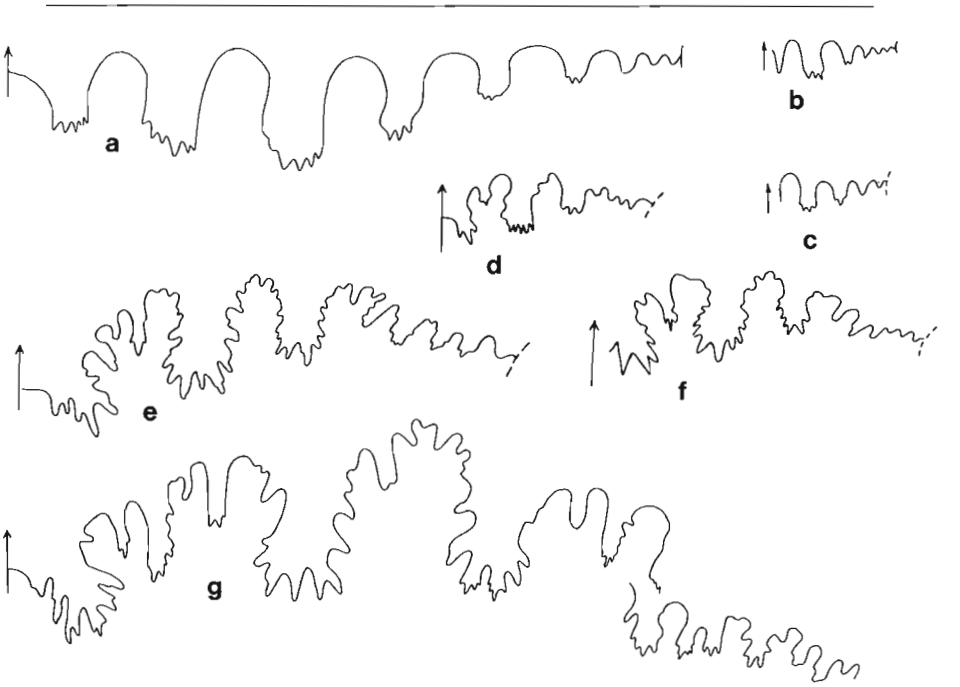

Figure 36. *Sutures. a,* ***Intornites intornatus*** *(McLearn), GSC 28515 (Pl. 49, fig. 3), x2. b, c.* ***Intornites mactaggarti*** *(McLearn). b, GSC 28520 (Pl. 49, fig. 2); c, GSC 28521 (Pl. 49, fig. 1). d–g.* ***Buddhaites hagei*** *(McLearn). d, GSC 28387 (Pl. 49, fig. 6), x4; e, GSC 28386 (Pl. 49, fig. 5), x4; f, GSC 28385 (Pl. 49, fig. 7), x4; g, GSC 28388 (Pl. 49, fig. 6) x2.*

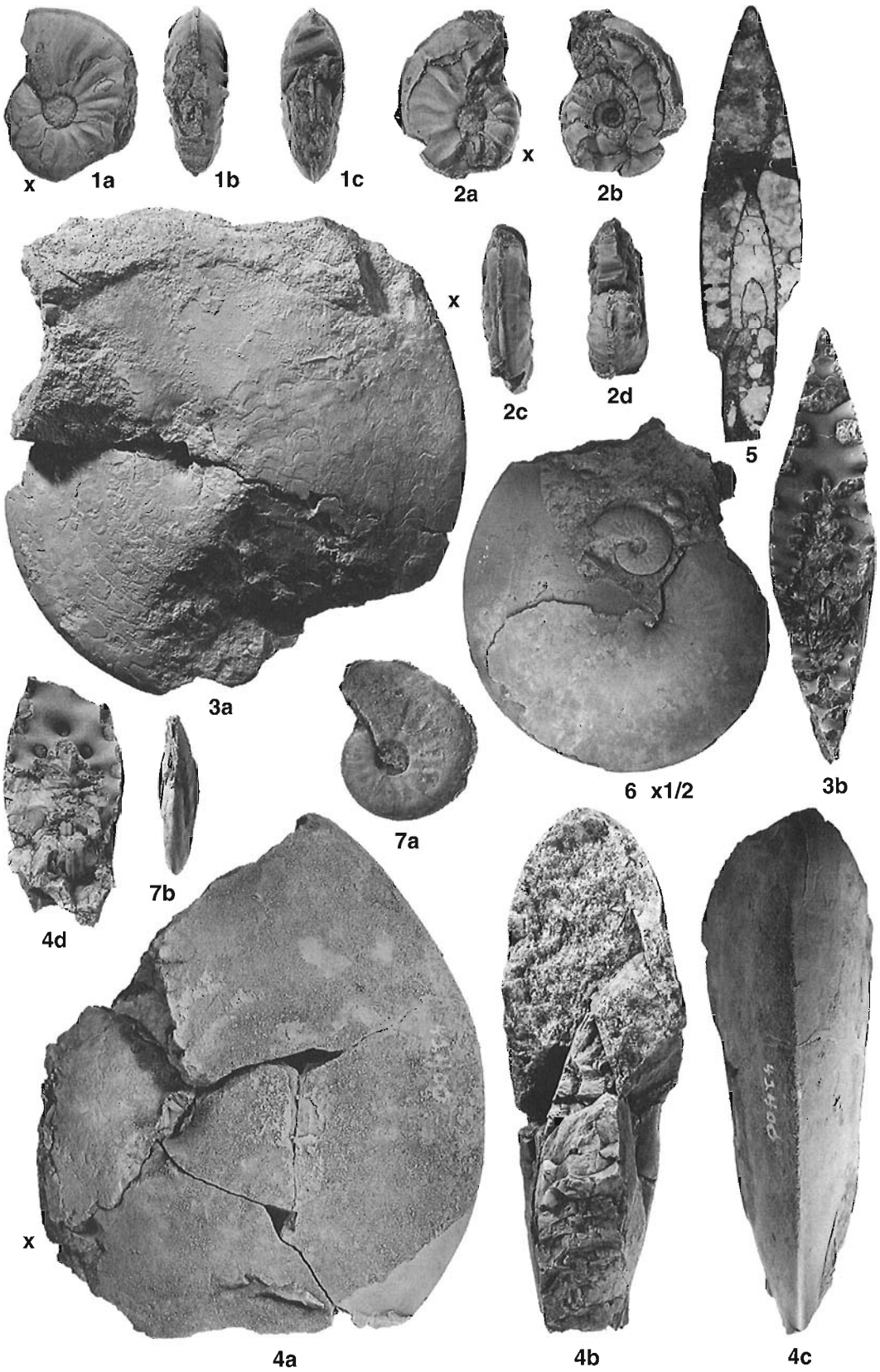
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PLATE 50

MIDDLE TRIASSIC
Middle Anisian

Figures 1–6. *Intornites mactaggarti* (McLearn) (Hagei Zone) (Page 104)
1a–c. Hypotype GSC 28516, phragmocone (sculptured) and body chamber (smooth) (GSC loc. 42400).
2a–c. Hypotype GSC 28524 (GSC loc. 42409), about ½ whorl is body chamber.
3a–c. GSC 28522 (GSC loc. 42406).
4a–c. Hypotype GSC 28517 (GSC loc. 42400), body chamber about ½ whorl.
5a, b. Hypotype GSC 28523 (GSC loc. 42406), phragmocone with umbilical callus indicating extent of body chamber.
6a–c. Hypotype GSC 28519 (GSC loc. 42402).
All are from Toad Formation, Liard River, northeastern British Columbia and are probably topotypes.

Figures 7–12. *Intornites intornatus* (McLearn) (Figs. 9–12 from Hagei Zone; Figs. 7, 8 from Hayesi Zone) (Page 106)
7a, b. Hypotype GSC 28529, last half whorl is apparently body chamber.
8. Hypotype GSC 28530.
Figures 7, 8 from Toad Formation, Alaska Highway, British Columbia (GSC loc. 68294).
9a–c. Hypotype GSC 28525, phragmocone.
10a–c. Hypotype GSC 28527.
11a–c. Hypotype GSC 28526, septa not visible but umbilical callus indicates extent of body chamber.
12a, b. Hypotype GSC 28528, carinate inner whorls visible in section.
Figures 9–12 from Toad Formation, Chlotapecta Creek, northeastern British Columbia (GSC loc. 40109).

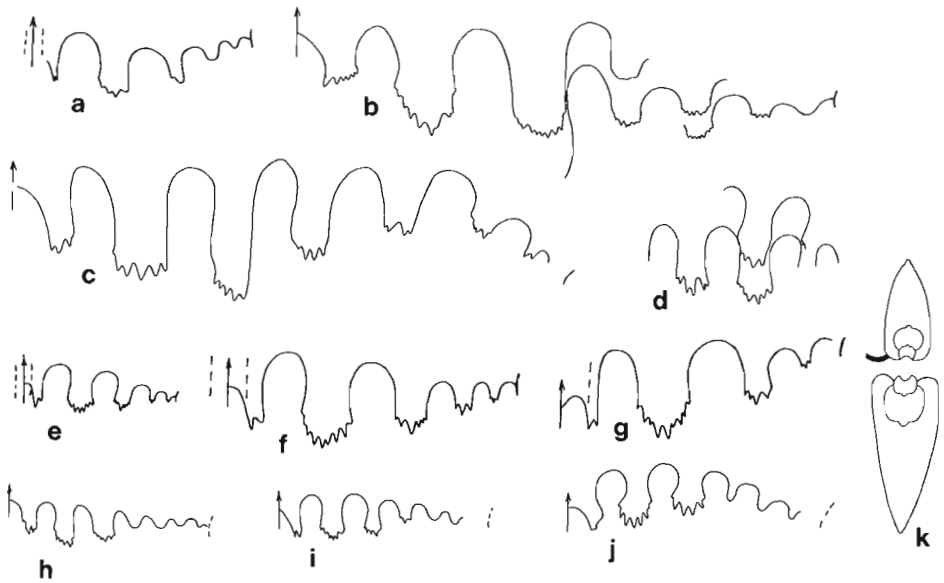

Figure 37. *Sutures and section. a–g.* ***Intornites mactaggarti*** *(McLearn). a, b, GSC 6474 (McLearn, 1969, Pl. 8, fig. 8), a x4, b x2; c, GSC 28523 (Pl. 50, fig. 5) x2; d, GSC 28519 (Pl. 50, fig. 6) x2; e, f, GSC 28522 (Pl. 50, fig. 3), e x2, f x4; g, GSC 28516 (Pl. 50, fig. 1) x4. h–k.* ***Intornites intornatus*** *(McLearn). h, GSC 28530 (Pl. 50, fig. 8) x2; i, GSC 28527 (Pl. 50, fig. 10) x2; j, GSC 28525 (Pl. 50, fig. 9) x2; k, GSC 28528 (Pl. 50, fig. 12) x1.*

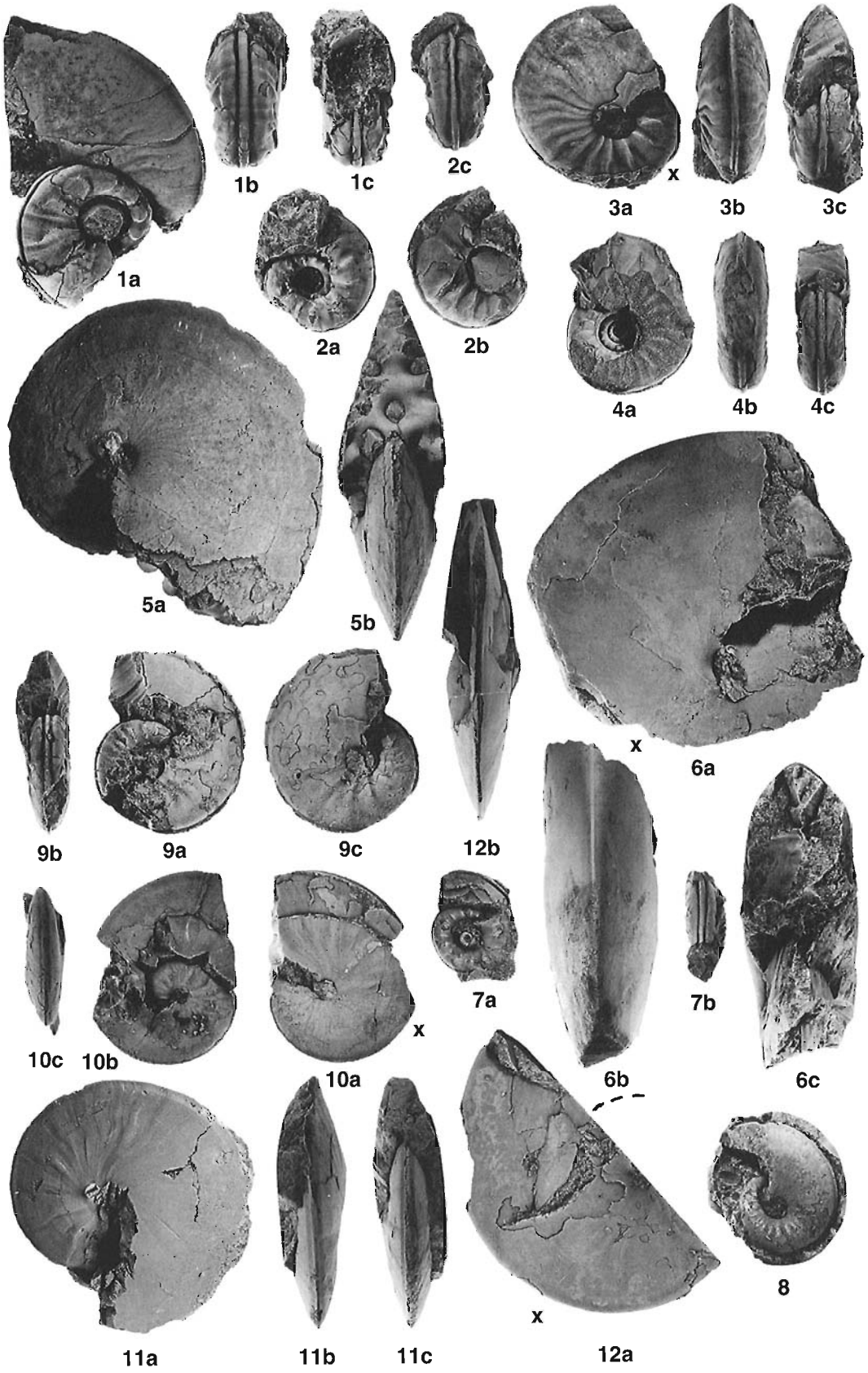
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PLATE 51

MIDDLE TRIASSIC
Middle Anisian

Figures 1–3. *Gymnites compressus* n. sp. (Fig. 3 from Hagei Zone; Figs. 1, 2 from Hayesi Zone) (Page 127)
1a, b. Paratype GSC 28380, outer whorl is body chamber.
2a, b. Paratype GSC 28379, mostly or wholly phragmocone.
Figures 1, 2 from Toad Formation, north of Alaska Highway, northeastern British Columbia (GSC loc. 46512).
3a, b. Holotype GSC 28378, phragmocone. Toad Formation, Liard River, northeastern British Columbia (GSC loc. 42400).

Figures 4a, b. *Tropigastrites*(?) *costatus* n. sp. (Hayesi Zone?) (Page 137)
Holotype GSC 28373, phragmocone. Toad Formation, Alaska Highway, northeastern British Columbia (GSC loc. 10706).

Figures 5a, b. *Alanites laevis* n. sp. (Hagei Zone) (Page 85)
Holotype GSC 28245. Toad Formation, Chlotapecta Creek, northeastern British Columbia (GSC loc. 40109).

Figures 6–11. *Intornites intornatus* (McLearn) (Fig. 6, from Hagei Zone or Hayesi Zone; Figs. 7, 8 from Hagei Zone; Figs. 9–11 from Hayesi Zone) (Page 104)
6a, b. Hypotype GSC 28536, phragmocone. Sulphur Mountain Formation, Whistler Member, Monaghan Creek, Alberta (GSC loc. 58385).
7a–c. Hypotype GSC 28531, phragmocone.
8a, b. Hypotype GSC 28532, phragmocone.
Figures 7, 8 from Toad Formation, Chischa River, northeastern British Columbia (GSC loc. 74736).
9a, b. Hypotype GSC 28535, phragmocone. Toad Formation, Liard River, northeastern British Columbia (GSC loc. 42408).
10a, b. Hypotype GSC 28534, phragmocone.
11. GSC 28533, phragmocone.
Figures 10, 11 from Toad Formation, Chischa River, northeastern British Columbia (GSC loc. 74737).

Figures 12, 13. *Intornites williamsi* n. sp. (Minor Zone) (Page 105)
12a–c. Holotype GSC 28537, phragmocone.
13a, b. Paratype GSC 28538, complete phragmocone with approximated septa, umbilical callus indicates extent of body chamber.
Both from Toad Formation, Alaska Highway, northeastern British Columbia (GSC loc. 68295).

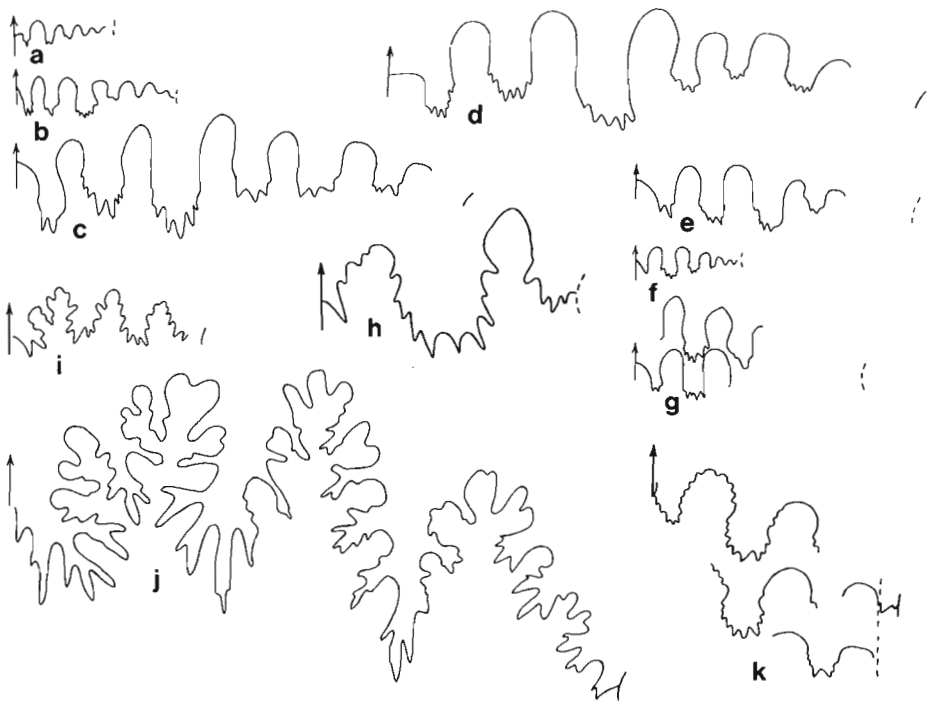

Figure 38. *Sutures. a–c.* ***Intornites williamsi*** *n. sp. a, b, GSC 28537 (Pl. 51, fig. 12); c, GSC 28538 (Pl. 51, fig. 13), all x2. d–g.* ***Intornites intornatus*** *(McLearn). d, GSC 28532 (Pl. 51, fig. 8); e, GSC 28535 (Pl. 51, fig. 9); f, g, GSC 28533 (Pl. 51, fig. 11), all x2. h,* ***Alanites laevis*** *n. sp., GSC 28245 (Pl. 51, fig. 5), x4. i, j.* ***Gymnites compressus*** *n. sp. i, GSC 28379 (Pl. 51, fig. 2); j. GSC 28378 (Pl. 51, fig. 3) both x4. k,* ***Tropigastrites****(?)* ***costatus*** *n. sp., GSC 28373 (Pl. 5l, fig. 4), x4.*

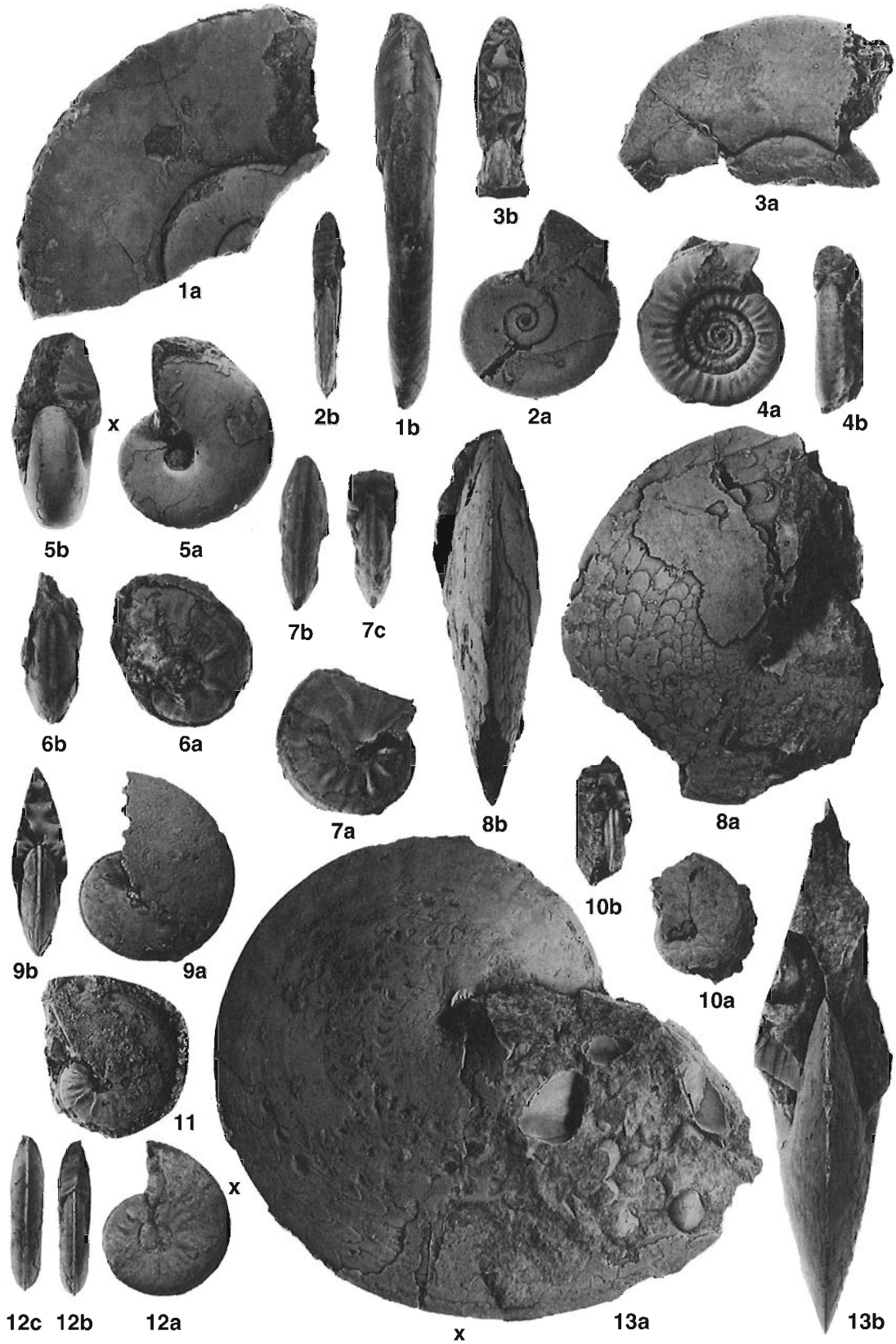
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PLATE 52

MIDDLE TRIASSIC
Middle Anisian

Figures 1a, b. *Czekanowskites acuteplicatus* n. sp. (Hayesi Zone) (Page 108)
Holotype GSC 28428. Toad Formation, Liard River, northeastern British Columbia (GSC loc. 42410).

Figures 2, 4. *Czekanowskites pinguis* (McLearn) (Hayesi Zone) (Page 107)
2a–c. Hypotype GSC 28426. Toad Formation, Liard River, northeastern British Columbia (GSC loc. 42408).
4a, b. GSC 28432. Toad Formation, Alaska Highway, northeastern British Columbia (GSC loc. 42413).

Figures 3, 5–7. *Tetsaoceras hayesi* (McLearn) (Hayesi Zone) (Page 108)
3a–c. Hypotype GSC 14232. Toad Formation, Liard River, northeastern British Columbia (GSC loc. 42410).
5a, b. Hypotype GSC 28429.
6a, b. Hypotype GSC 28430.
Figures 5, 6 from Toad Formation, Chischa River, northeastern British Columbia (GSC loc. 74737).
7a, b. Hypotype GSC 28431. Sulphur Mountain Formation, Whistler Member, Monaghan Creek, Alberta (GSC loc. 58385).

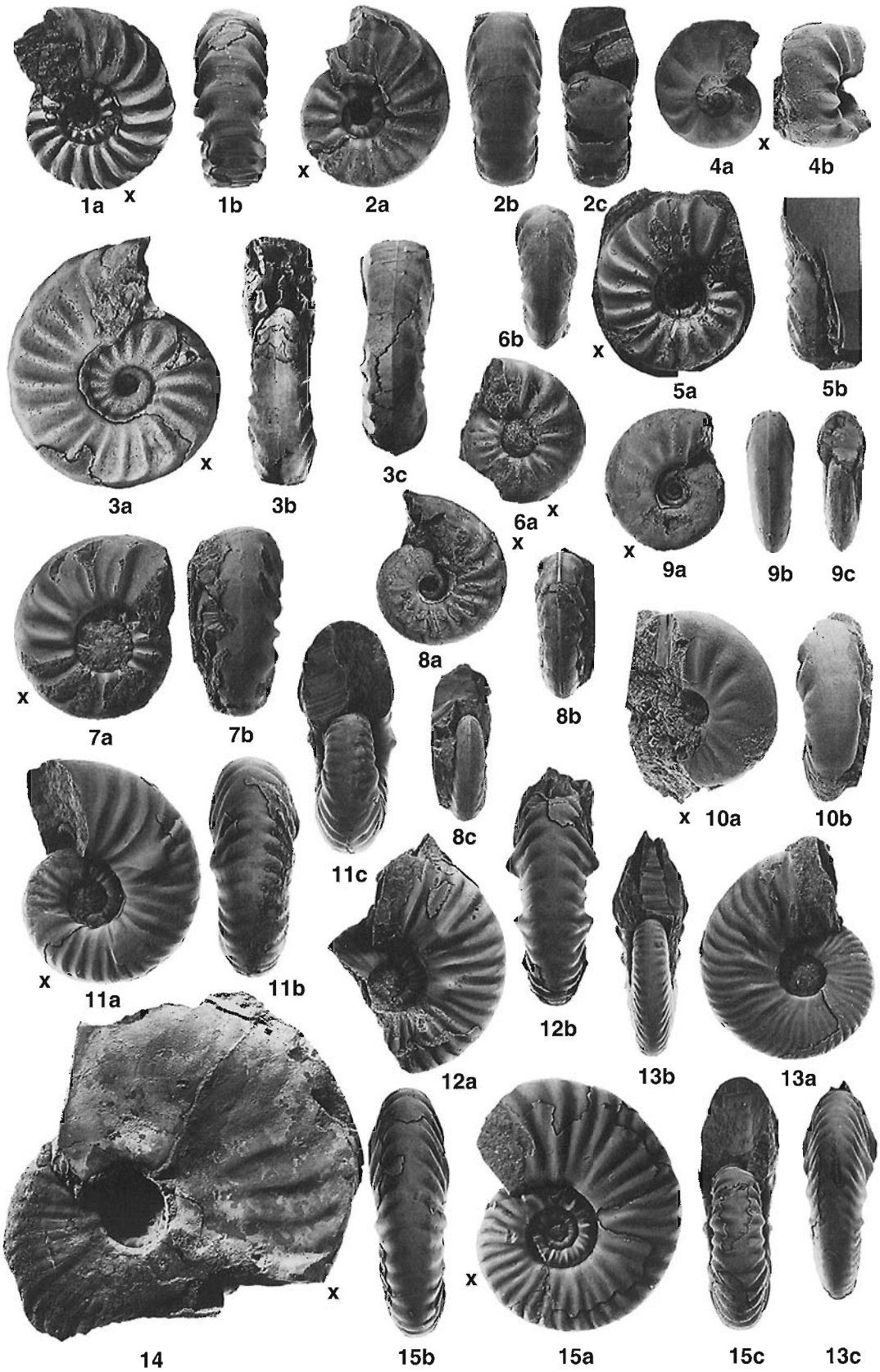
Figures 8a–c. *Tetsaoceras angulatum* (McLearn) (Hayesi Zone) (Page 109)
8a–c. Hypotype GSC 28427. Toad Formation, Liard River, northeastern British Columbia (GSC loc. 42408).

Figures 9, 10. *Arctohungarites liardensis* n. sp. (Hayesi Zone) (Page 109)
9a–c. Holotype GSC 28434. Toad Formation, Liard River, northeastern British Columbia (GSC loc. 42407).
10a, b. Paratype GSC 28433. Toad Formation, Alaska Highway, northeastern British Columbia (GSC loc. 42413).

Figures 11–13, 15. *Hollandites pelletieri* McLearn (Hagei Zone) (Page 112)
11a–c. Topotype GSC 28285.
12a, b. Topotype GSC 28286.
13a–c. Topotype GSC 28287, body chamber about half a whorl.
15a–c. Topotype GSC 28288.
All from Toad Formation, Chlotapecta Creek, northeastern British Columbia (GSC loc. 40109).

Figure 14. *Nicomedites moderatus* (McLearn) (Hayesi Zone) (Page 115)
14. Topotype GSC 28306. Toad Formation, Alaska Highway, northeastern British Columbia (GSC loc. 68294).

Figure 39. *Sutures. a,* ***Arctohungarites liardensis*** *n. sp., GSC 28434 (Pl. 52, fig. 9), x4; b,* ***Tetsaoceras angulatum*** *(McLearn), GSC 28427 (Pl. 52, fig. 8), x4; c, d,* ***Tetsaoceras hayesi*** *(McLearn), GSC 14232 (Pl. 52, fig. 3), x4.*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8c
11c
x 10a
10b
x
11a
11b
12b
13b
13a
12a
x
14
15b
x
15a
15c
13c

PLATE 53

MIDDLE TRIASSIC
Middle Anisian

Figures 1, 2. *Anagymnotoceras varium* (McLearn) (Hayesi Zone) (Page 114)

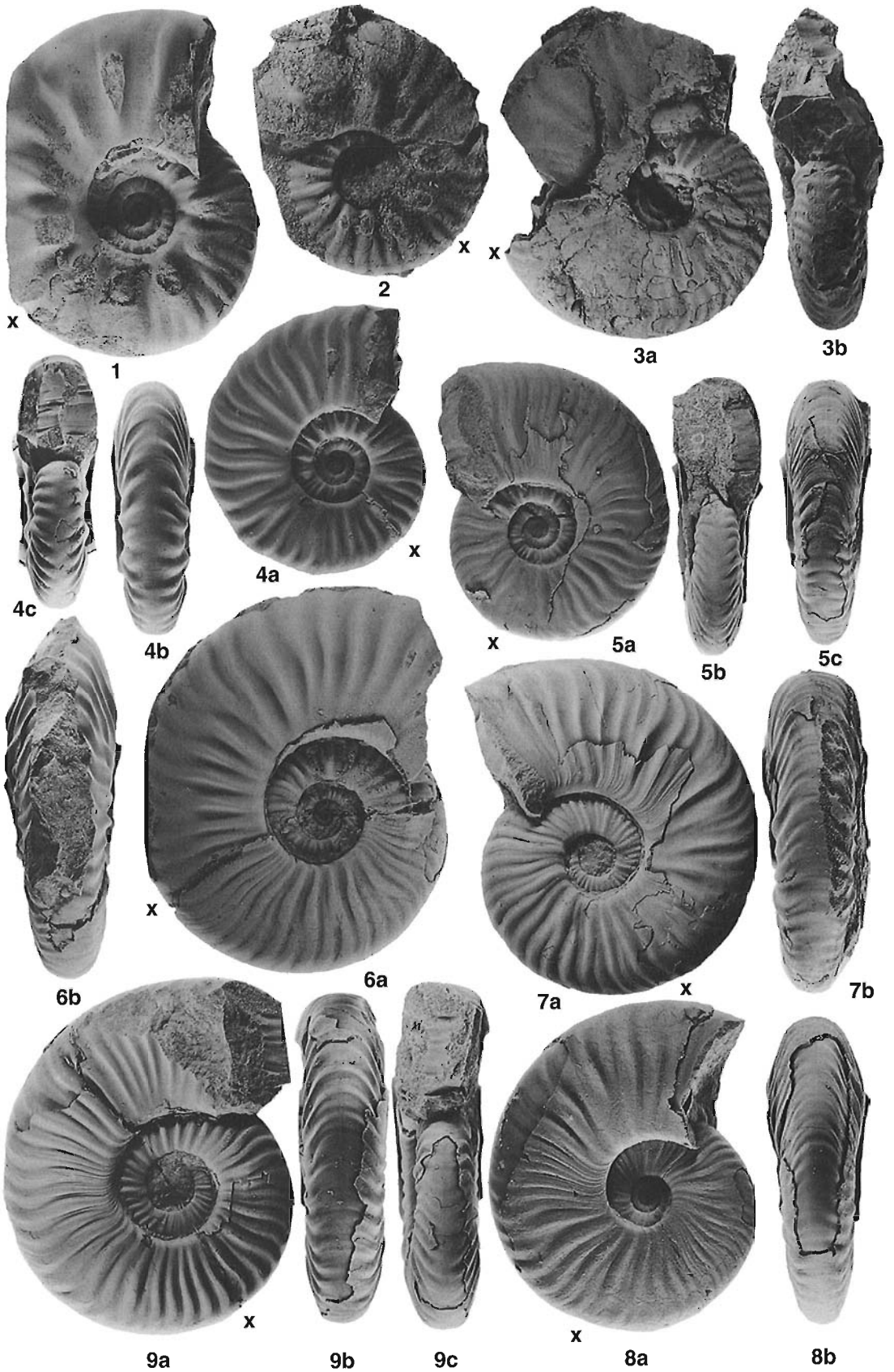
1. Topotype GSC 18899, for apertural and peripheral views see Tozer (1967, Pl. 7, figs. 2b, c). Toad Formation, Alaska Highway, northeastern British Columbia (GSC loc. 68294).
2. Hypotype GSC 28298. Toad Formation, Chischa River, northeastern British Columbia (GSC loc. 74737).

Figures 3a, b. *Nicomedites moderatus* (McLearn) (Hayesi Zone) (Page 115)

Hypotype GSC 28307. Toad Formation, Chischa River, northeastern British Columbia (GSC loc. 74738).

Figures 4–9. *Hollandites pelletieri* McLearn (Hagei Zone) (Page 112)

4a–c. Topotype GSC 28289.
5a–c. Topotype GSC 28290.
6a, b. Topotype GSC 28291.
7a, b. Topotype GSC 28292.
8a, b. Topotype GSC 28293.
9a–c. Topotype GSC 28294.
All from Toad Formation, Chlotapecta Creek, northeastern British Columbia (GSC loc. 40109).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7a
x
7b
x
9a
9b
9c
x
8a
8b

PLATE 54

MIDDLE TRIASSIC
Middle Anisian

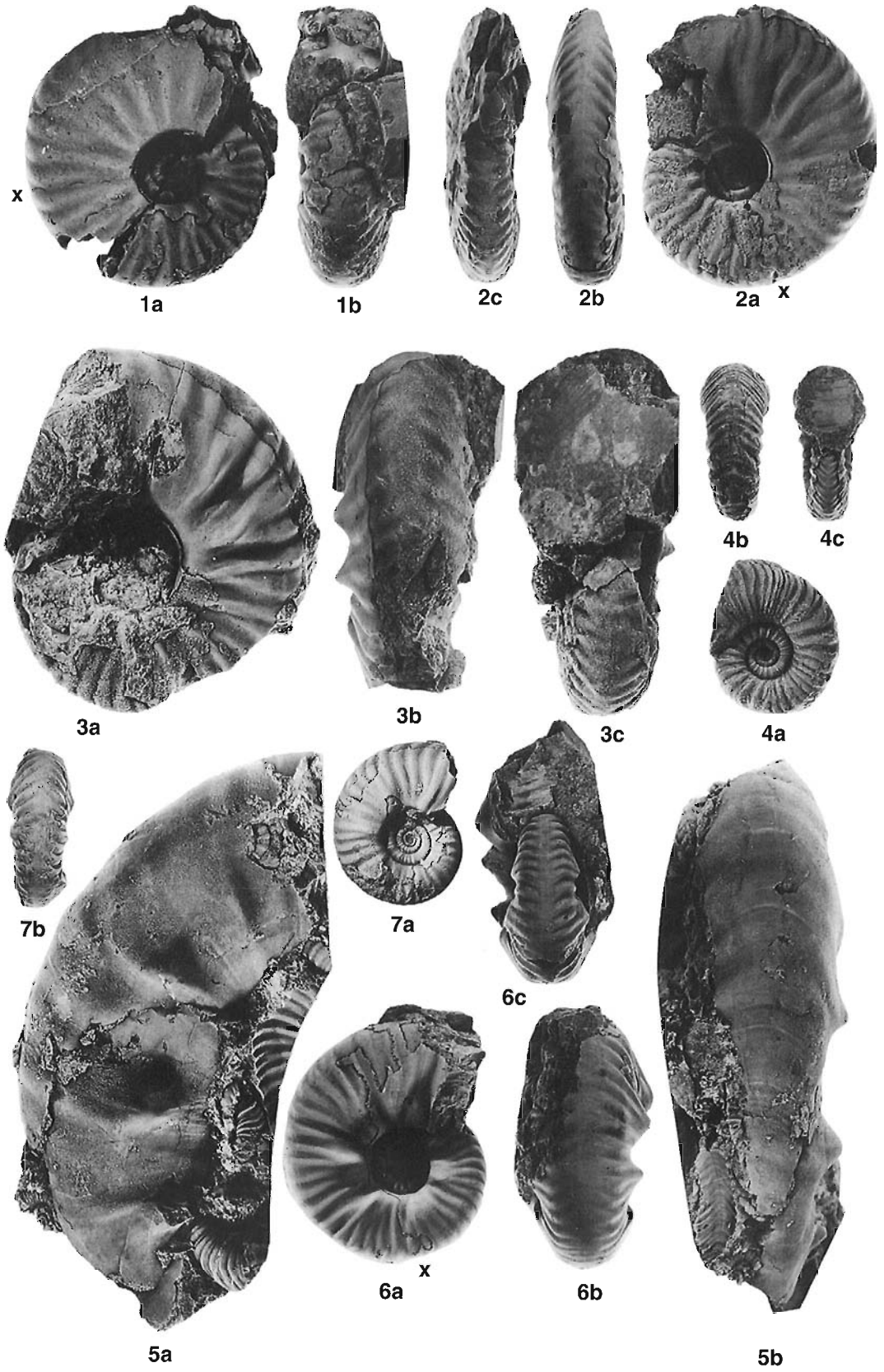
Figures 1a, b. *Anagymnotoceras tozeri* McLearn (Hagei Zone) (Page 113)
Hypotype GSC 28304. Toad Formation, Liard River, northeastern British Columbia (GSC loc. 42400).

Figures 2a–c. *Hollandites macconnelli* McLearn (Hayesi Zone) (Page 112)
Topotype(?) GSC 28299. Toad Formation, Alaska Highway, northeastern British Columbia (GSC loc. 68294).

Figures 3–5. *Anagymnotoceras wrighti* (McLearn) (Page 115)
3a–c. Hypotype GSC 28300, body chamber about half a whorl.
4a–c. Hypotype GSC 28301, phragmocone.
5a, b. Hypotype GSC 28302, body chamber.
All from Sulphur Mountain Formation, Whistler Member, Monaghan Creek, Alberta (GSC loc. 58385).

Figures 6a–c. *Anagymnotoceras columbianum* (McLearn) (Hayesi Zone) (Page 114)
Hypotype GSC 28303. Toad Formation, north of Alaska Highway, northeastern British Columbia (GSC loc. 46512).

Figures 7a, b. *Anagymnotoceras varium* (McLearn) (Hayesi Zone) (Page 114)
Topotype GSC 14233. Toad Formation, Alaska Highway, northeastern British Columbia (GSC loc. 10696).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5a
x
6a
6b
5b

PLATE 55

MIDDLE TRIASSIC
Middle Anisian

Figures 1–3. *Hollandites minor* n. sp. (Minor Zone) (Page 112)
1a, b. Paratype GSC 28295, phragmocone.
2a, b. Holotype GSC 28296.
3a, b. Paratype GSC 28297, body chamber.
All from Toad Formation, Alaska Highway, northeastern British Columbia (GSC loc. 68295).

Figures 4a–c. *Hollandites liardensis* n. sp. (Hagei Zone) (Page 111)
Holotype GSC 28284. Toad Formation, Liard River, northeastern British Columbia (GSC loc. 42402).

Figures 5, 6. *Hollandites dieneri* n. sp. (Hagei Zone) (Page 111)
5a, b. Hypotype GSC 28283 (GSC loc. 74736), phragmocone questionably assigned to this species.
6a, b. Holotype GSC 28282 (GSC loc. 74739).
Both from Toad Formation, Chischa River, northeastern British Columbia.

Figures 7a, b. *Hollandites spivaki* McLearn (Minor Zone) (Page 113)
Hypotype GSC 32367, phragmocone. Toad Formation, Alaska Highway, northeastern British Columbia (GSC loc. 68295).

Figures 8a, b. *Anagymnotoceras wrighti* (McLearn) (Minor Zone) (Page 115)
Hypotype GSC 32366, phragmocone. Toad Formation, Alaska Highway, northeastern British Columbia (GSC loc. 68295).

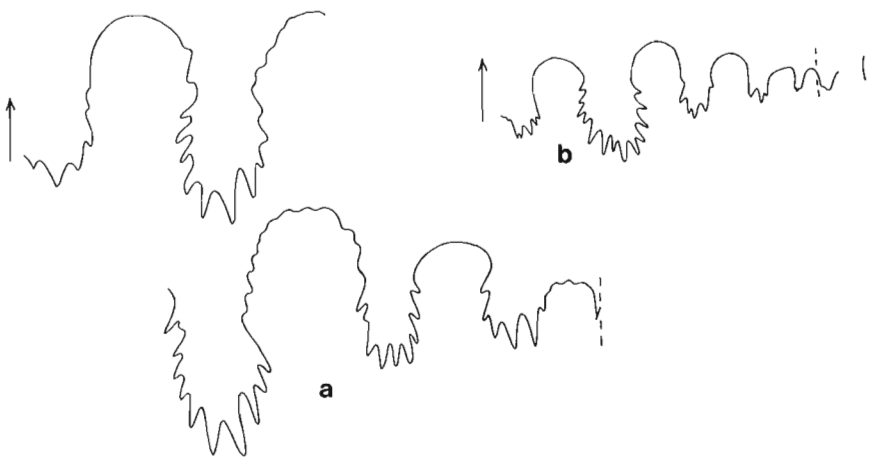
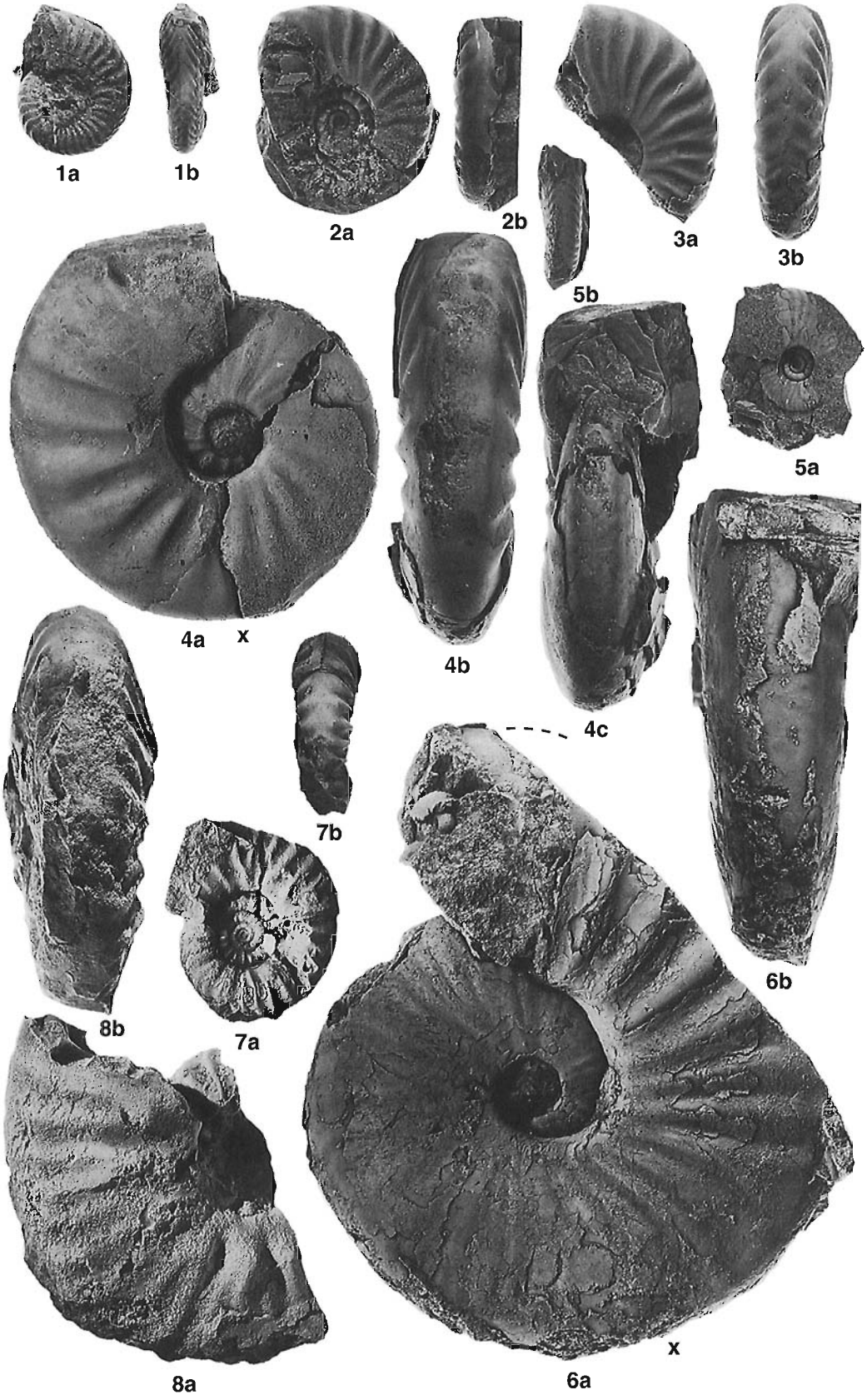


Figure 40. *Sutures. a,* ***Hollandites dieneri*** *n. sp., two sutures of GSC 28282 (Pl. 55, fig. 6) x2; b,* ***Hollandites liardensis*** *n. sp., GSC 28284 (Pl. 55, fig. 4) x2.*


1a
1b
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2b
3a
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5b
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4a
x
4b
4c
7b
6b
8b
7a
8a
6a
x

PLATE 56

MIDDLE TRIASSIC
Middle Anisian

Figures 1, 2, 4. *Nicomedites arthaberi* n. sp. (Minor Zone) (Page 116)
1a, b. Paratype GSC 28311.
2a–c. Holotype GSC 28310, 2b, one side showing the sculptured inner whorls, 2a, the other side, shows the smooth body chamber with part of the peristome preserved near the umbilicus.
Figures 1, 2 from Toad Formation, Alaska Highway, northeastern British Columbia (GSC loc. 68295).
4a, b. Paratype GSC 28309. Talus from Toad Formation, Alaska Highway, northeastern British Columbia (GSC loc. 10692).

Figures 3a, b. *Nicomedites moderatus* (McLearn) (Hayesi Zone) (Page 115)
Topotype(?) GSC 28308. Toad Formation, Alaska Highway, northeastern British Columbia (GSC loc. 68294)

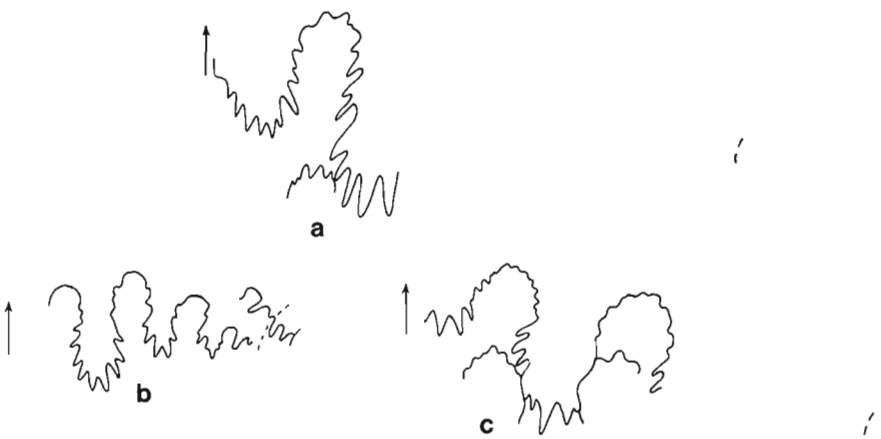
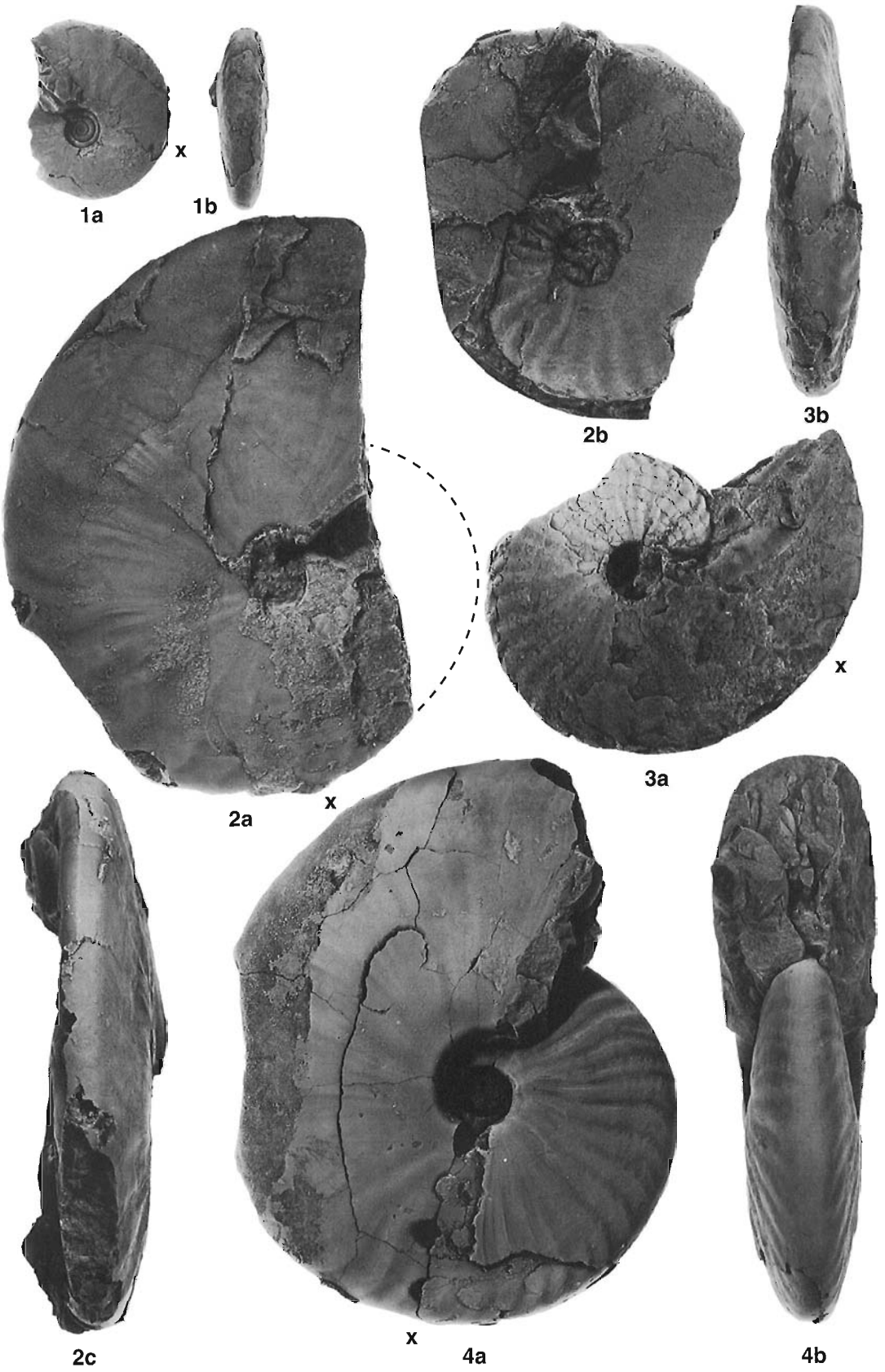


Figure 41. *Sutures. a,* ***Nicomedites arthaberi*** *n. sp., GSC 28310 (Pl. 56, fig. 2) x2. b, c,* ***Nicomedites moderatus*** *(McLearn), two sutures of GSC 28308 (Pl. 56, fig. 3) x2.*


x
1a
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3b
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x
x
3a
2c
x
4a
4b

PLATE 57

MIDDLE TRIASSIC
Middle Anisian

Figures 1–3. *Stenopopanoceras angulatum* n. sp. (Hagei Zone) (Page 87)
1a, b. Paratype GSC 28251.
2a, b. Holotype GSC 28250, complete with peristome, most or all of outer whorl is body chamber.
Figures 1, 2 from Toad Formation, Chischa River, northeastern British Columbia (GSC loc. 74736).
3a, b. Paratype GSC 28252, most or all of outer whorl is body chamber. Toad Formation, Liard River, northeastern British Columbia (GSC loc. 42406).

Figures 4, 5. *Stenopopanoceras obesum* (McLearn) (Hagei Zone) (Page 87)
4a–c. Topotype GSC 22734 (GSC loc. 42406).
5a–c. Topotype GSC 28253 (GSC loc. 42402), an additional half whorl of body chamber is also preserved, to a diameter of about 60 mm.
Both from Toad Formation, Liard River, northeastern British Columbia.

Figures 6–8. *Amphipopanoceras medium* (McLearn) (Hayesi Zone) (Page 88)
6a, b. Topotype GSC 22735 (GSC loc. 10712).
7a, b. Hypotype GSC 28254 (GSC loc. 46499).
8a–c. GSC 28255 (GSC loc. 46499), complete specimen with peristome and one whorl of body chamber.
All from Toad Formation, Alaska Highway, northeastern British Columbia.

Figures 9a, b. *Amphipopanoceras selwyni* (McLearn) (Hayesi Zone) (Page 88)
Hypotype GSC 28257, complete specimen with peristome. Toad Formation, Chischa River, northeastern British Columbia (GSC loc. 74737).

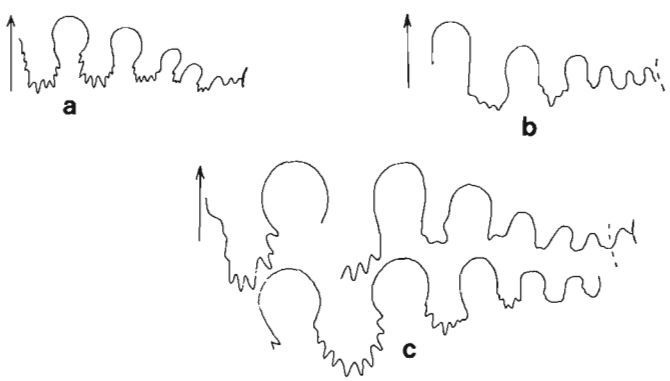
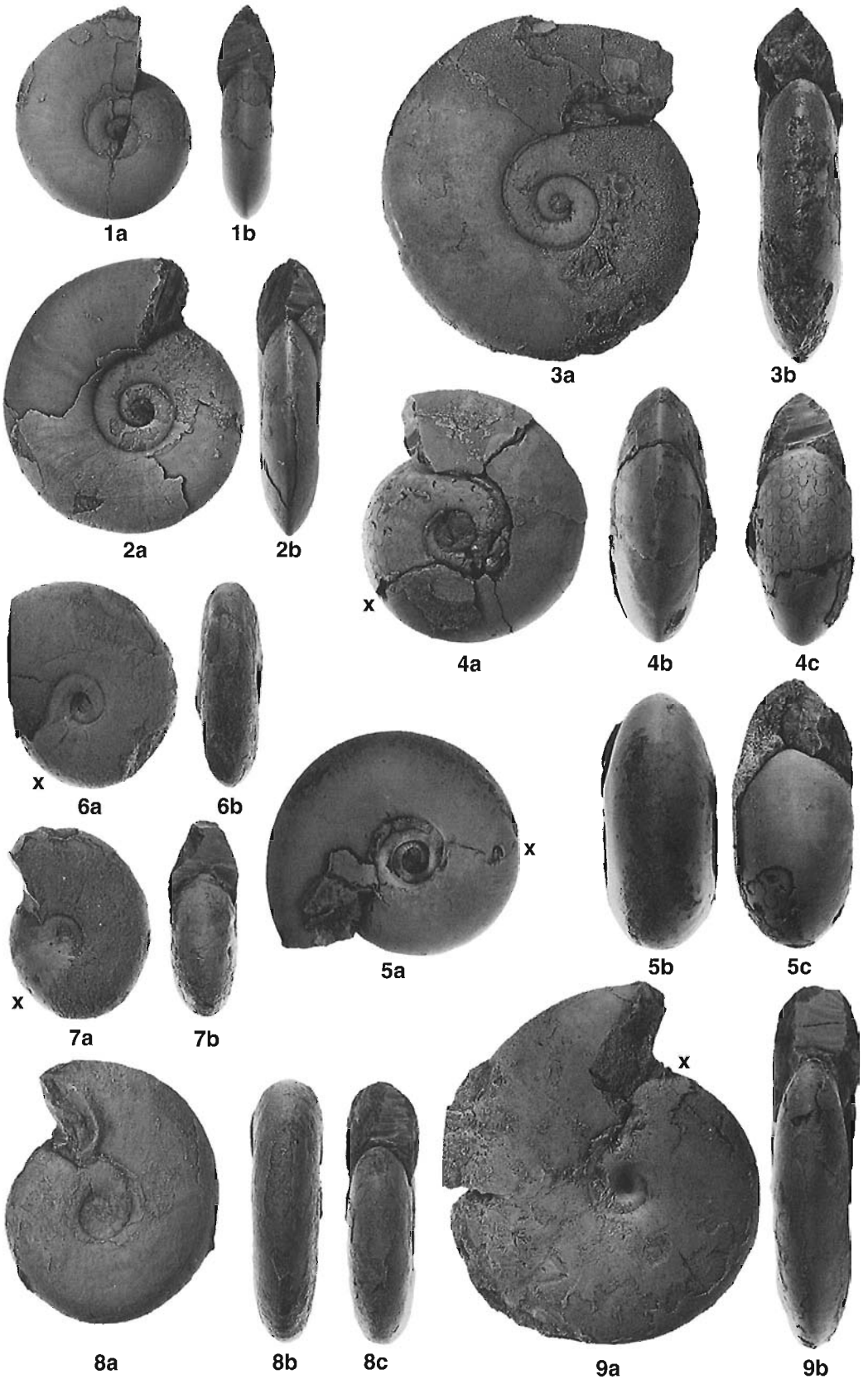


Figure 42. *Sutures. a,* ***Stenopopanoceras angulatum*** *n. sp., GSC 28251 (Pl. 57, fig. 1) x3; b,* ***Amphipopanoceras medium*** *(McLearn), GSC 28254 (Pl. 57, fig. 7) x3; c,* ***Stenopopanoceras obesum*** *(McLearn), GSC 28253 (Pl. 57, fig. 5) x3.*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7b
8a
8b
8c
x
9a
9b

PLATE 58

MIDDLE TRIASSIC
Middle Anisian

Figures 1a, b. *Amphipopanoceras inconstans* (Dagys and Ermakova) (Minor Zone) (Page 89)
Hypotype GSC 28260. Toad Formation, Alaska Highway, northeastern British Columbia (GSC loc. 68295).

Figures 2, 4, 5, 6. *Amphipopanoceras selwyni* (McLearn) (Figs. 2, 4 from Minor Zone; Figs. 5, 6 from Hayesi Zone) (Page 88)
2a–c. Hypotype GSC 28259, complete with peristome.
4a–c. Hypotype GSC 28261, complete with peristome.
Figures 2, 4 from Toad Formation, Alaska Highway, northeastern British Columbia (GSC loc. 68295).
5a, b. Hypotype GSC 28262.
6a, b. Hypotype GSC 28263.
Figures 5, 6 from Toad Formation, Alaska Highway, northeastern British Columbia (GSC loc. 68294).

Figures 3a–c. *Stenopopanoceras celere* n. sp. (Minor Zone) (Page 87)
Holotype GSC 28256, preserves peristome. Toad Formation, Alaska Highway, northeastern British Columbia (GSC loc. 68295).

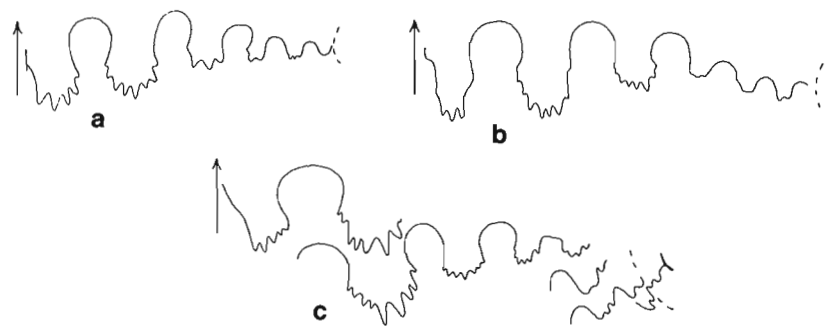

Figure 43. *Sutures. a–c.* ***Amphipopanoceras selwyni*** *(McLearn). a, GSC 28262 (Pl. 58, fig. 5); b, GSC 28258*; c, GSC 28263 (Pl. 58, fig. 6), all x3.*

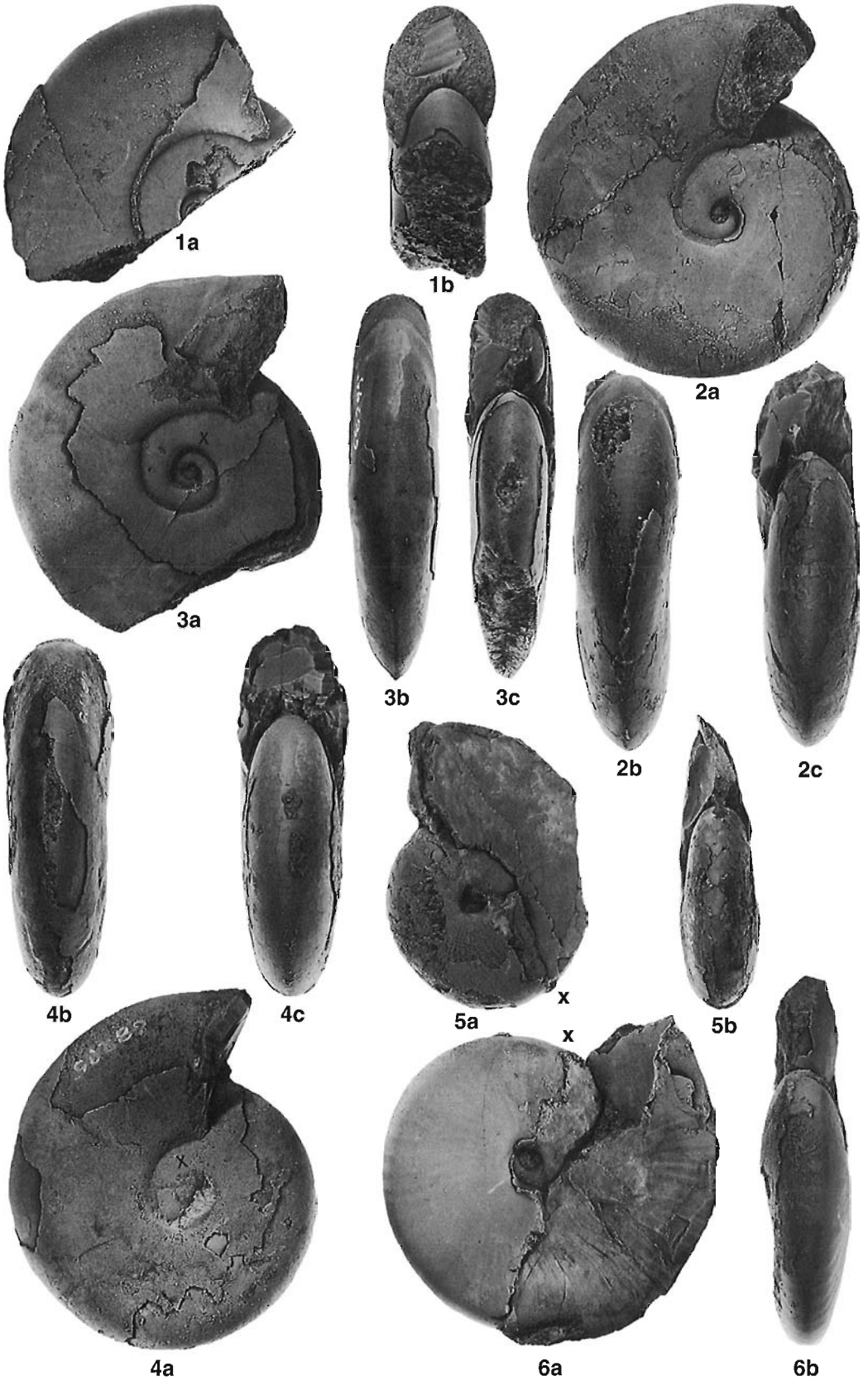
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PLATE 59

MIDDLE TRIASSIC
Upper Anisian–Deleeni Zone

Figures 1–9. *Intornites canadensis* (McLearn) (Page 106)
1a, b. Hypotype GSC 28540, phragmocone.
2a–c. Hypotype GSC 28541, phragmocone.
3a–c. Hypotype GSC 28542, phragmocone.
4a–c. Hypotype GSC 28543, phragmocone.
9a, b. GSC 28544, complete phragmocone.
Figures 1–4, 9 from Toad Formation, Alaska Highway, northeastern British Columbia (GSC loc. 68297).
5a, b. Hypotype GSC 28547, phragmocone. Toad Formation, Chischa River, northeastern British Columbia (GSC loc. 74724).
6a–c. Hypotype GSC 28545, phragmocone.
7a, b. Hypotype GSC 28546, complete phragmocone.
Figures 6, 7 from Toad Formation, Alaska Highway, northeastern British Columbia (GSC loc. 68228).
8a, b. Hypotype GSC 28549. Toad Formation, Chischa River, northeastern British Columbia (GSC loc. 74731).

Figures 10, 11. *Eogymnotoceras deleeni* (McLearn) (Page 117)
10a–c. Hypotype GSC 28317, phragmocone.
11a, b. Hypotype GSC 28318.
Both from Toad Formation, Alaska Highway, northeastern British Columbia (GSC loc. 68297).

Figures 12, 13. *Gymnotoceras smithi* n. sp. (Page 118)
12a–c. Paratype GSC 28327.
13a–c. Holotype GSC 28326.
Both from Toad Formation, Chischa River, northeastern British Columbia (GSC loc. 74724).

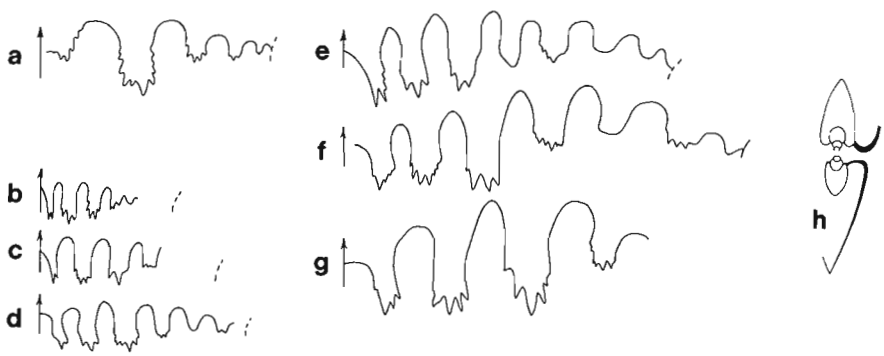
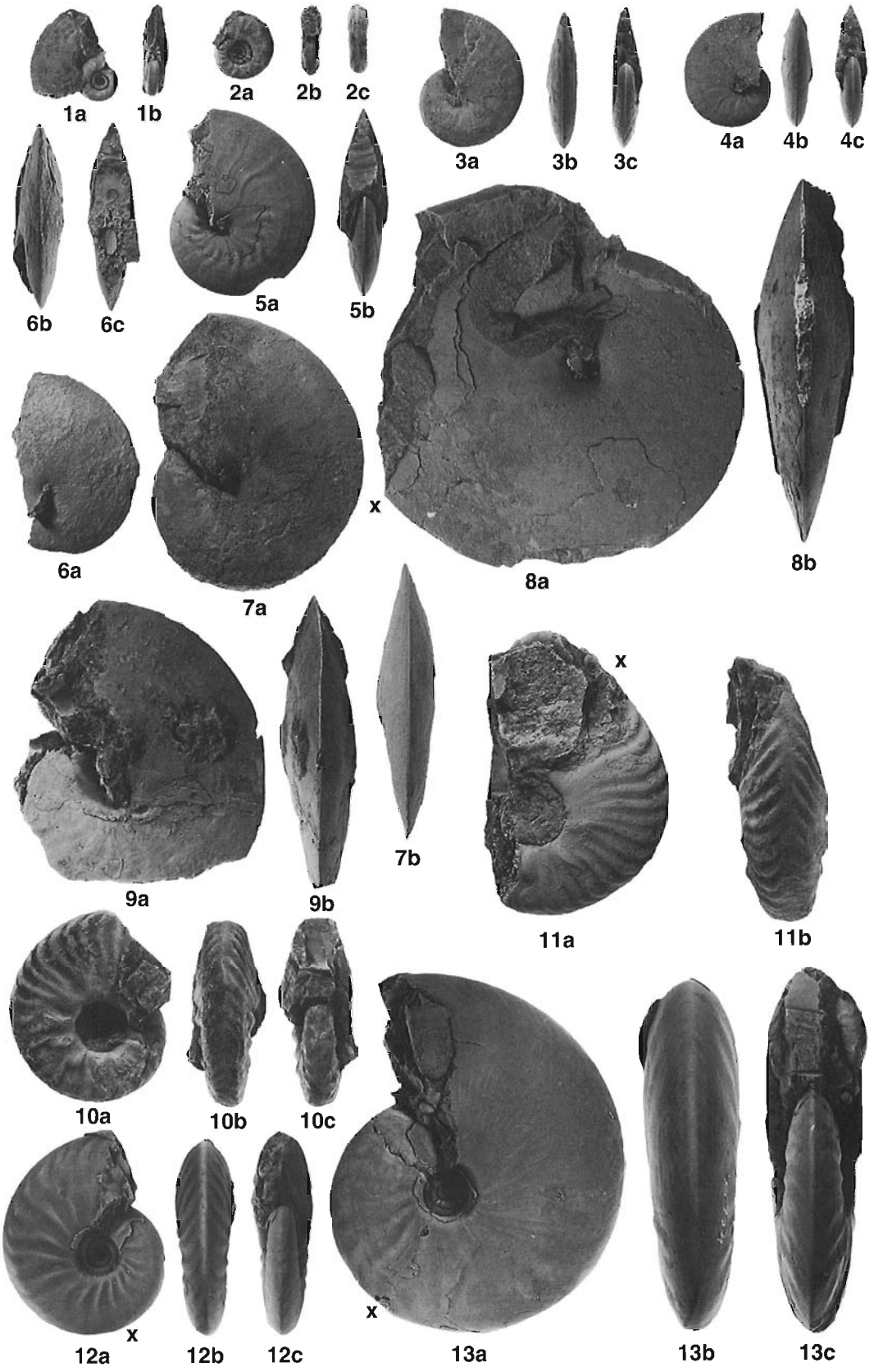


Figure 44. *Sutures and section. a,* ***Gymnotoceras smithi*** *n. sp., GSC 28326 (Pl. 59, fig. 13), x2. b–h.* ***Intornites canadensis*** *(McLearn). b, e, GSC 6449 (McLearn, 1969, Pl. 6, fig. 1) x2; c, GSC 28542 (Pl. 59, fig. 3) x2; d, GSC 28547 (Pl. 59, fig. 5) x2; f, GSC 28549 (Pl. 59, fig. 8) x2; g, GSC 28544 (Pl. 59, fig. 9) x2; h, GSC 28548* x1.*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7a
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7b
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11a
11b
10a
10b
10c
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12a
12b
12c
13a
13b
13c

PLATE 60

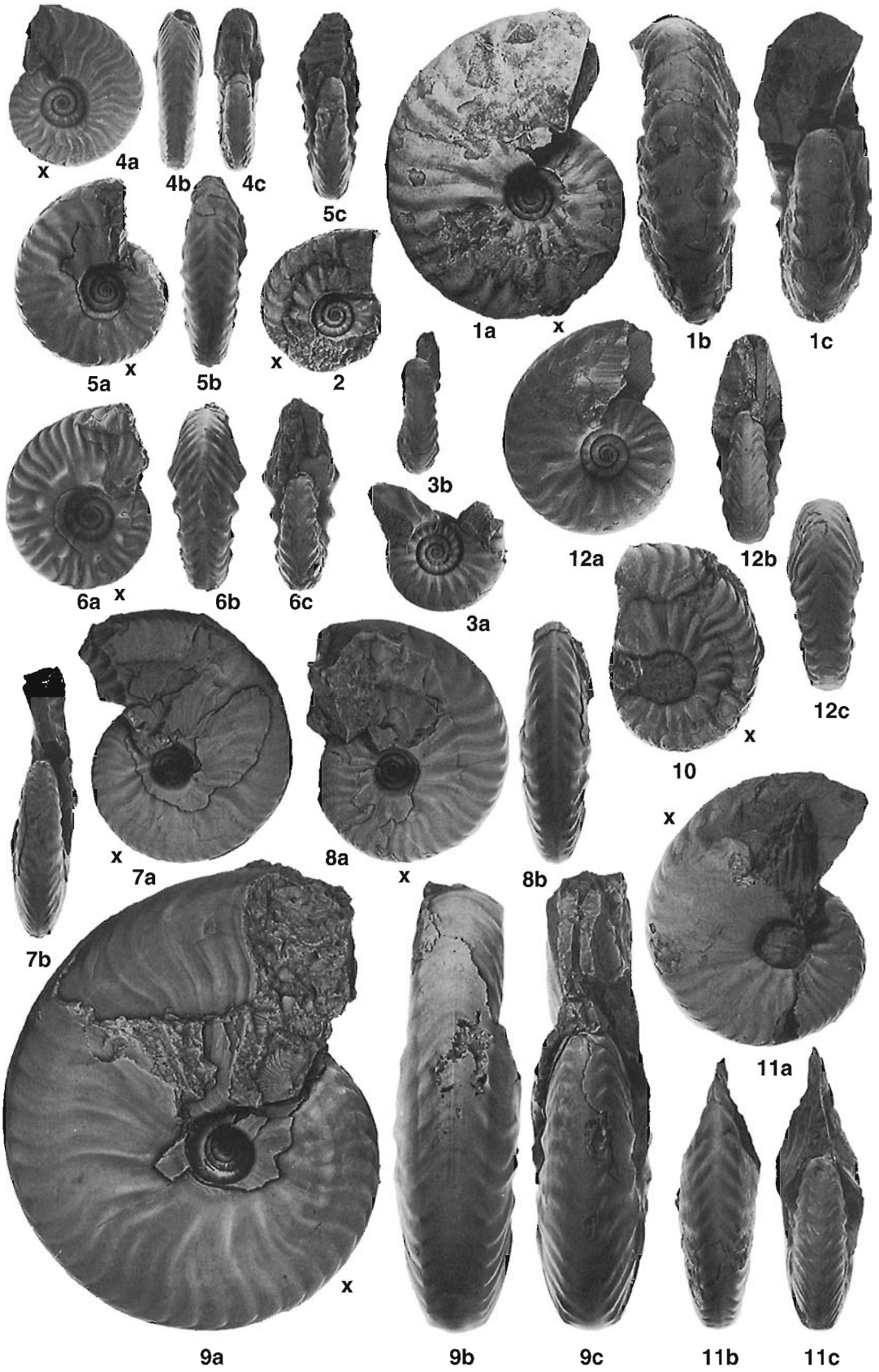
MIDDLE TRIASSIC
Upper Anisian–Deleeni Zone

Figures 1–3. *Eogymnotoceras beachi* (McLearn) (Page 116)
1a–c. Hypotype GSC 28315.
2. Hypotype GSC 28314.
3a, b. Hypotype GSC 28313.
All from Toad Formation, Alaska Highway, northeastern British Columbia (GSC loc. 68228).

Figures 4–9. *Eogymnotoceras liardense* (McLearn) (Page 118)
4a–c. Hypotype GSC 28320.
5a–c. Hypotype GSC 28321.
6a–c. Hypotype GSC 28322.
7a, b. Hypotype GSC 28323.
8a, b. Hypotype GSC 28324.
9a–c. Hypotype GSC 28325.
All from Toad Formation, Chischa River, northeastern British Columbia (GSC loc. 74724).

Figures 10–12. *Eogymnotoceras deleeni* (McLearn) (Page 117)
10. Hypotype GSC 28316. Toad Formation, Alaska Highway, northeastern British Columbia (GSC loc. 68224).
11a–c. Hypotype GSC 28319. Toad Formation, Alaska Highway, northeastern British Columbia (GSC loc. 68297).
12a–c. Topotype GSC 28312. Toad Formation, Alaska Highway, northeastern British Columbia (GSC loc. 10694).

Figure 45. *Suture.* ***Eogymnotoceras liardense*** *(McLearn), GSC 28325 (Pl. 60, fig. 9), x2.*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8b
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11a
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x
9b
9c
11b
11c

PLATE 61

MIDDLE TRIASSIC
Upper Anisian–Deleeni Zone

Figures 1, 2. *Tropigymnites haueri* n. sp. (Page 126)
1a–c. Paratype GSC 28374, no septa visible.
2a–c. Holotype GSC 28375.
Both from Toad Formation, Chischa River, northeastern British Columbia (GSC loc. 74724).

Figures 3, 4. *Amphipopanoceras acutum* Popov (Page 89)
3a–c. Hypotype GSC 28265, complete with peristome.
4a, b. Hypotype GSC 28264, phragmocone.
Both from Toad Formation, Alaska Highway, northeastern British Columbia (GSC loc. 68228).

Figures 5–8. *Amphipopanoceras tetsa* (McLearn) (Page 89)
5a, b. Hypotype GSC 28266, complete with peristome.
6a, b. Hypotype GSC 28268, phragmocone.
7a, b. Hypotype GSC 28267, phragmocone.
Figures 5–7 from Toad Formation, Alaska Highway, northeastern British Columbia (GSC loc. 68224).
8a–c. Hypotype GSC 28270, complete with peristome. Toad Formation, Chischa River, northeastern British Columbia (GSC loc. 74724).

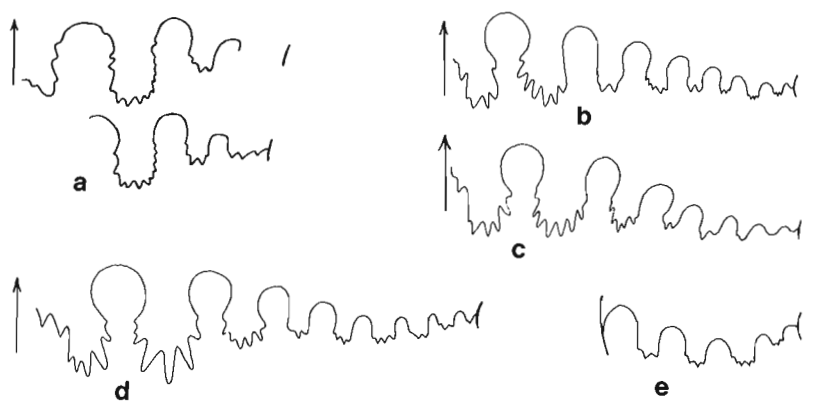
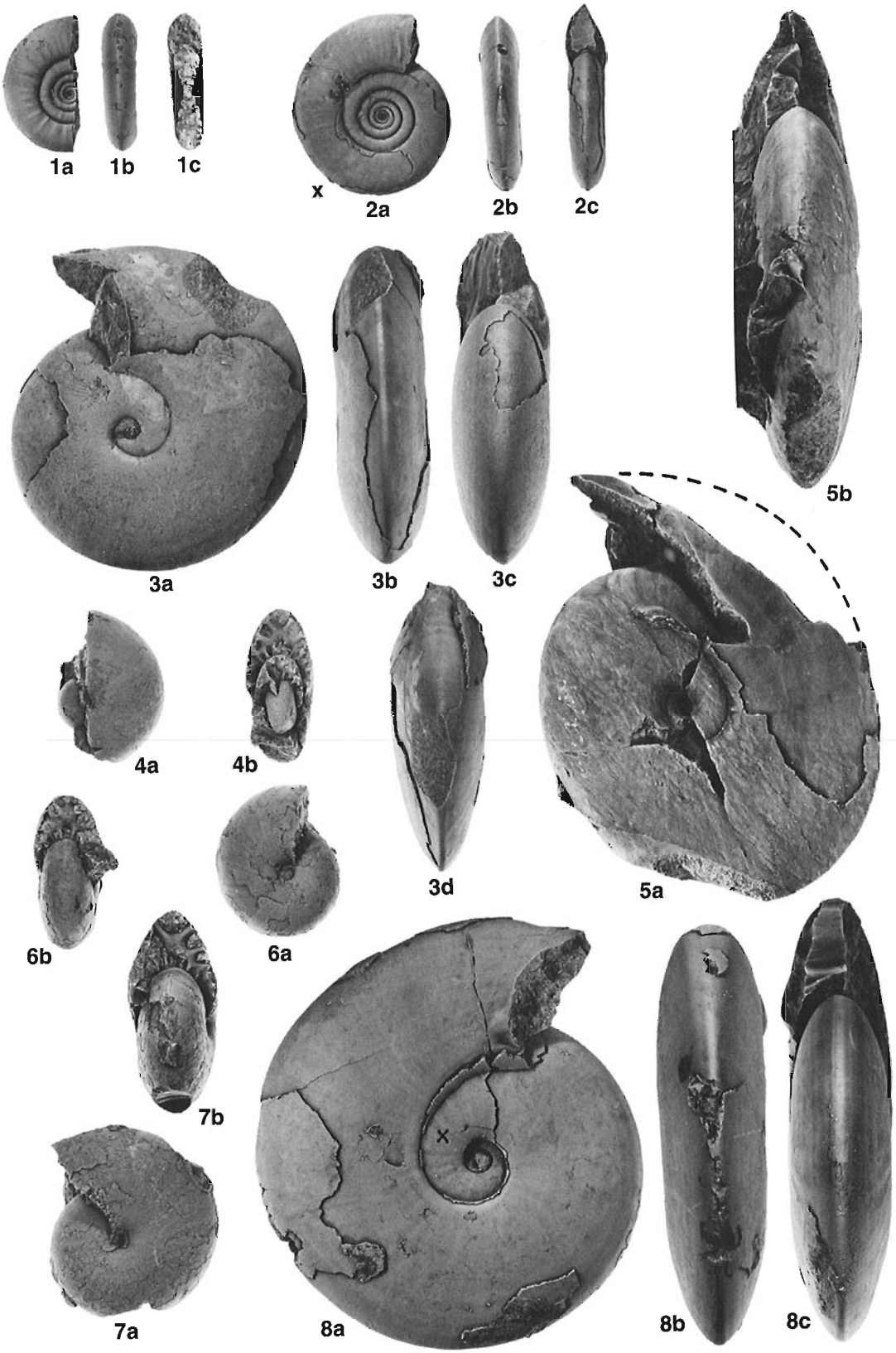


Figure 46. *Sutures. a,* ***Tropigymnites haueri*** *n. sp., GSC 28375 (Pl. 61, fig. 2) x4; b,* ***Amphipopanoceras acutum*** *Popov, GSC 28264 (Pl. 61, fig. 4) x3. c–e.* ***Amphipopanoceras tetsa*** *(McLearn). c, GSC 28268 (Pl. 61, fig. 6) x3; d, GSC 28267 (Pl. 61, fig. 7) x3; e, GSC 28270 (Pl. 61, fig. 8) x3.*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6b
6a
7b
8a
8b
8c
7a

PLATE 62

MIDDLE TRIASSIC
Upper Anisian–Deleeni Zone

Figures 1a, b. *Ptychites trochleaeformis* (Lindstroem) (Page 134)
Hypotype GSC 28400. Sulphur Mountain Formation, Llama Member, Sulphur River, Alberta (GSC loc. 55007).

Figures 2–4. *Ussurites cameroni* McLearn (Page 270)
2a, b. Hypotype GSC 32342, complete phragmocone. Toad Formation, Alaska Highway, northeastern British Columbia (GSC loc. 68297).
3a, b. Hypotype GSC 32341.
4a–c. Hypotype GSC 32340.
Figures 3, 4 from Toad Formation, Chischa River, northeastern British Columbia (GSC loc. 74724).

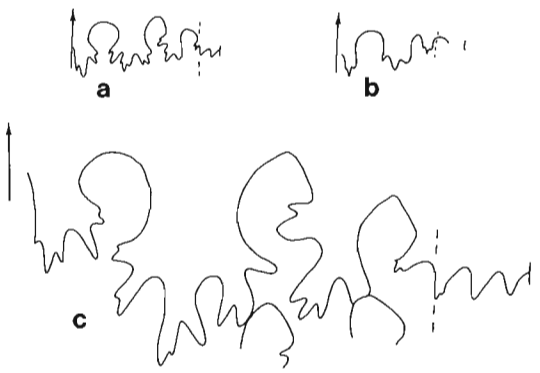

Figure 47. *Sutures.* ***Ussurites cameroni*** *McLearn. a, GSC 32341 (Pl. 62, fig. 3) x2; b, GSC 32340 (Pl. 62, fig. 4) x4; c, GSC 32342 (Pl. 62, fig. 2) x2.*

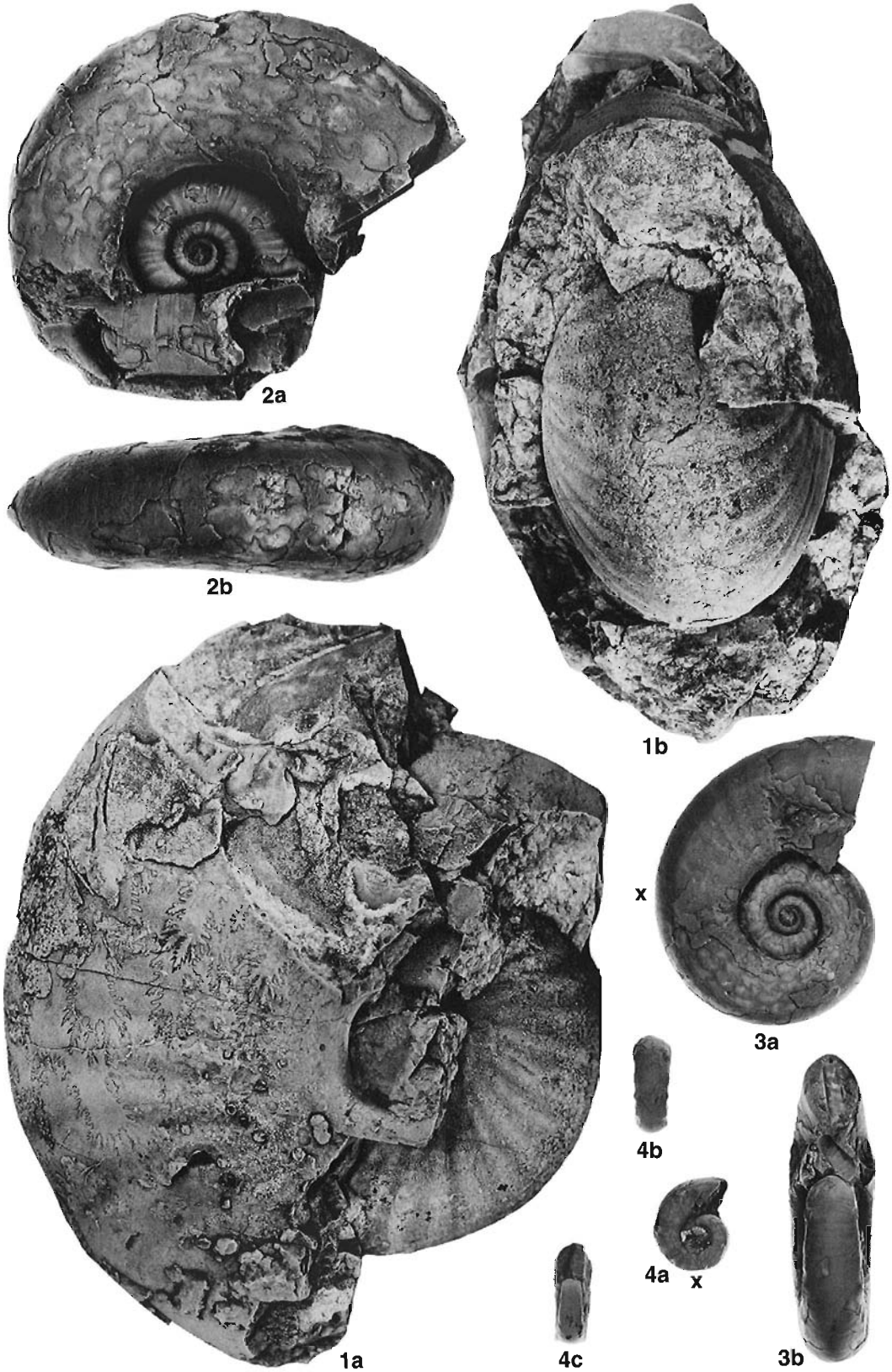
2a
2b
1b
1a
x
3a
4b
4a
x
4c
3b

PLATE 63

MIDDLE TRIASSIC
Upper Anisian–Deleeni Zone

Figures 1a–c. *Japonites readi* n. sp. (Page 126)
Holotype GSC 72299, 1a, b, x0.5. Outer whorl (1a) is body chamber, 1c, inner whorl, x1. Toad Formation, Toad River, northeastern British Columbia (GSC loc. C–90882).

Figures 2, 3. *Anagymnites via alaska* McLearn (Page 129)
2a, b. Hypotype GSC 21730, phragmocone.
3. Holotype GSC 6446, whole of outer whorl is body chamber.
Both from Toad Formation, Alaska Highway, northeastern British Columbia (GSC locs. 10693, 10694).

1a x½

1b x½

1c

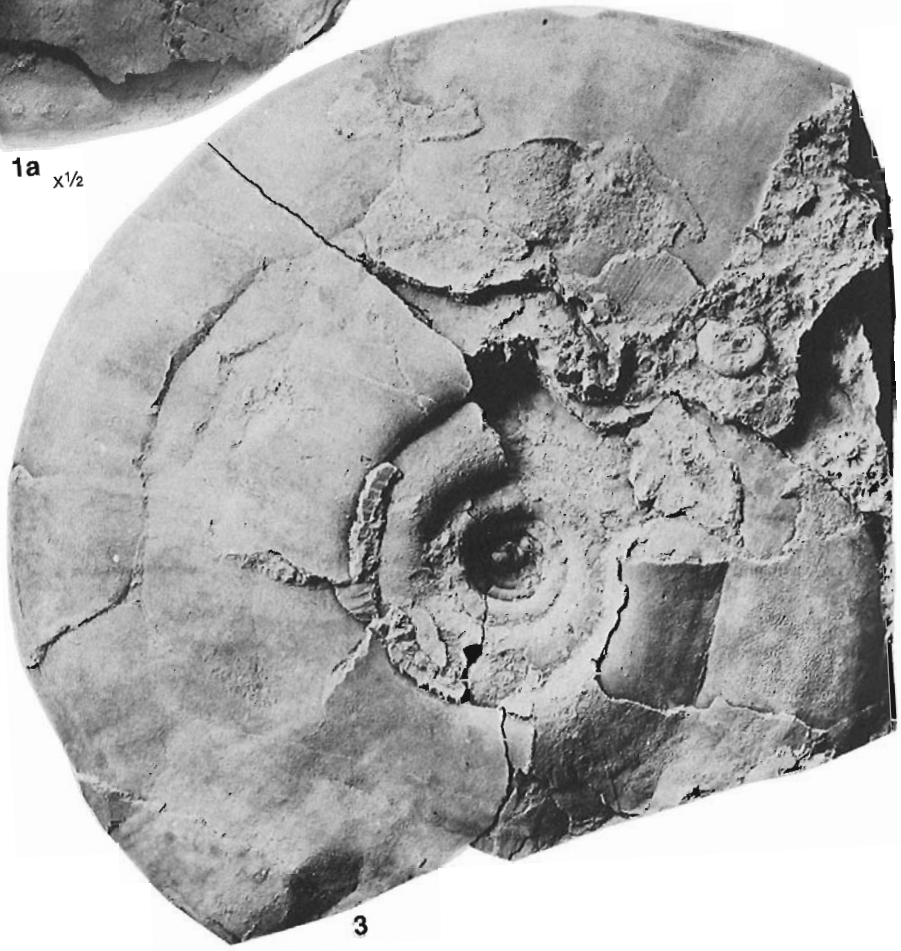

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PLATE 64

MIDDLE TRIASSIC
Upper Anisian–Chischa Zone

All specimens from the Sulphur Mountain Formation, Llama Member

Figures 1–8. *Pleurofrechites lineatus* n. sp. (Page 121)
1a–c. Holotype GSC 28333 (GSC loc. 83889).
2a, b. Paratype GSC 28334 (GSC loc. 83889).
3a–c. Paratype GSC 28335 (GSC loc. 83889).
4a, b. Paratype GSC 28331 (GSC loc. 83883).
5a, b. Paratype GSC 28332 (GSC loc. 83882).
7. Paratype GSC 28336 (GSC loc. 83874).
Figure 1–5, 7 from Hook Lake, northeastern British Columbia.
6a, b. Paratype GSC 28337.
8a, b. Paratype GSC 28338.
Figure 6, 8 from north of Wapiti Lake, northeastern British Columbia (GSC loc. 83867).

Figures 9–11. *Frechites hamatus* n. sp. (Page 120)
9. Paratype GSC 28328 (GSC loc. 83882).
10a, b. Paratype GSC 28329 (GSC loc. 45655).
11a–c. Holotype GSC 28330 (GSC loc. 45655), 11c is view with part of outer whorl removed, no septa are visible.
All from Hook Lake, northeastern British Columbia.

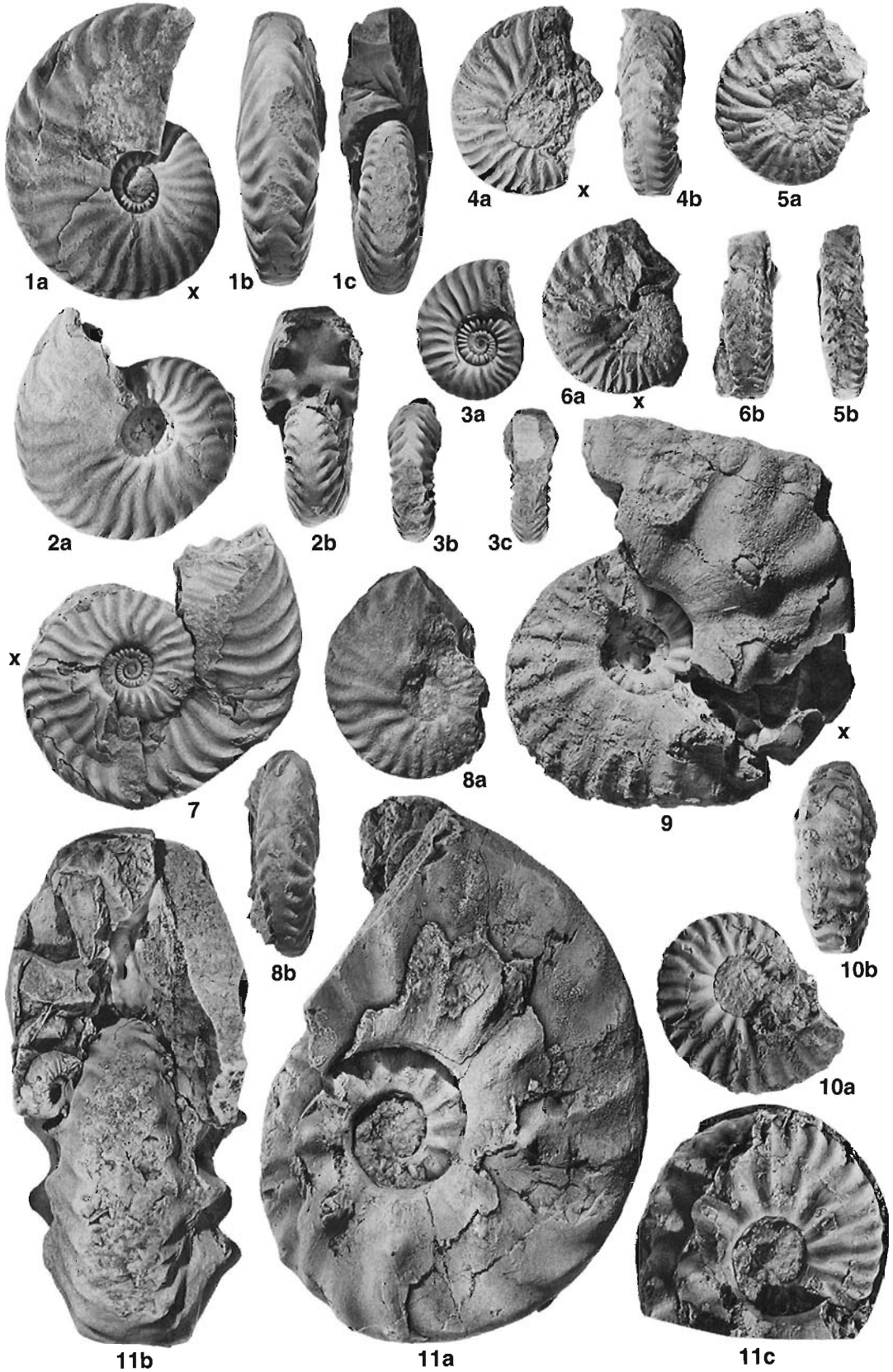
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PLATE 65

MIDDLE TRIASSIC
Upper Anisian–Chischa Zone

All specimens from Sulphur Mountain Formation, Llama Member, Hook Lake, northeastern British Columbia

Figures 1a, b. *Frechites chischa* (Tozer) (Page 119)
Hypotype GSC 28348 (GSC loc. 83875).

Figures 2a–c. *Pleurofrechites subsidens* n. sp. (Page 121)
Paratype GSC 28345 (GSC loc. 83875), outer whorl apparently partly body chamber.

Figures 3a–c. *Paranevadites* sp. indet. (Page 124)
GSC 28359 (GSC loc. 83890), mostly or wholly phragmocone.

Figures 4a, b. *Tozerites polygyratus* (Smith) (Page 137)
Hypotype GSC 28567 (GSC loc. 83875).

Figures 5, 6. *Parapopanoceras malmgreni* (Lindstroem) (Page 90)
5a, b. Hypotype 28271 (GSC loc. 83875), phragmocone and crushed body chamber.
6a, b. Hypotype GSC 28272 (GSC loc. 83890), phragmocone.

Figures 7–12. *Longobardites murrayensis* n. sp. (Page 106)
7a–c. Paratype GSC 28554 (GSC loc. 83875).
8a–c. Paratype GSC 28551 (GSC loc. 83875), phragmocone.
9a–c. Paratype GSC 28552 (GSC loc. 83875), phragmocone.
10a, b. Paratype GSC 28553 (GSC loc. 83875), phragmocone with wrinkle layer (runzelschicht).
11a–c. Holotype GSC 28550 (GSC loc. 83875).
12a, b. Paratype GSC 28555 (GSC loc. 83890).

Figures 13, 14. *Ptychites hamatus* n. sp. (Page 134)
13. Holotype GSC 28401 (GSC loc. 83875).
14a, b. Paratype GSC 28402 (GSC loc. 83875), outer whorl is wholly body chamber.

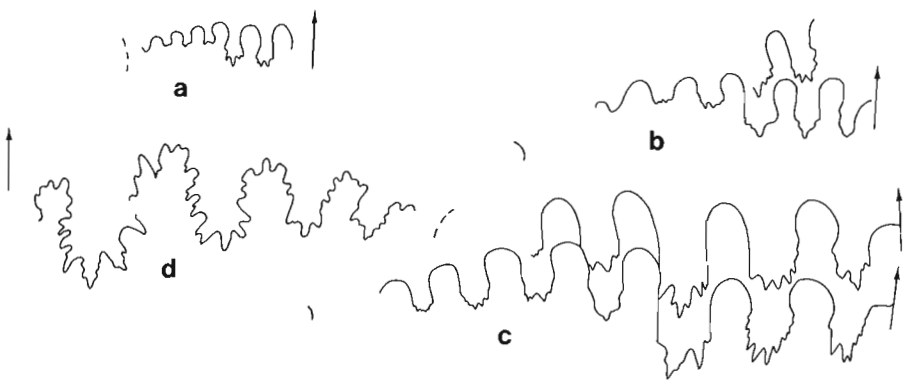

Figure 48. *Sutures. a–c.* ***Longobardites murrayensis*** *n. sp. a, GSC 28553 (Pl. 65, fig. 10) x2; b, GSC 28555 (Pl. 65, fig. 12) x2; c, GSC 28550 (Pl. 65, fig. 11) x2. d,* ***Ptychites hamatus*** *n. sp., GSC 28401 (Pl. 65, fig. 13) x2.*

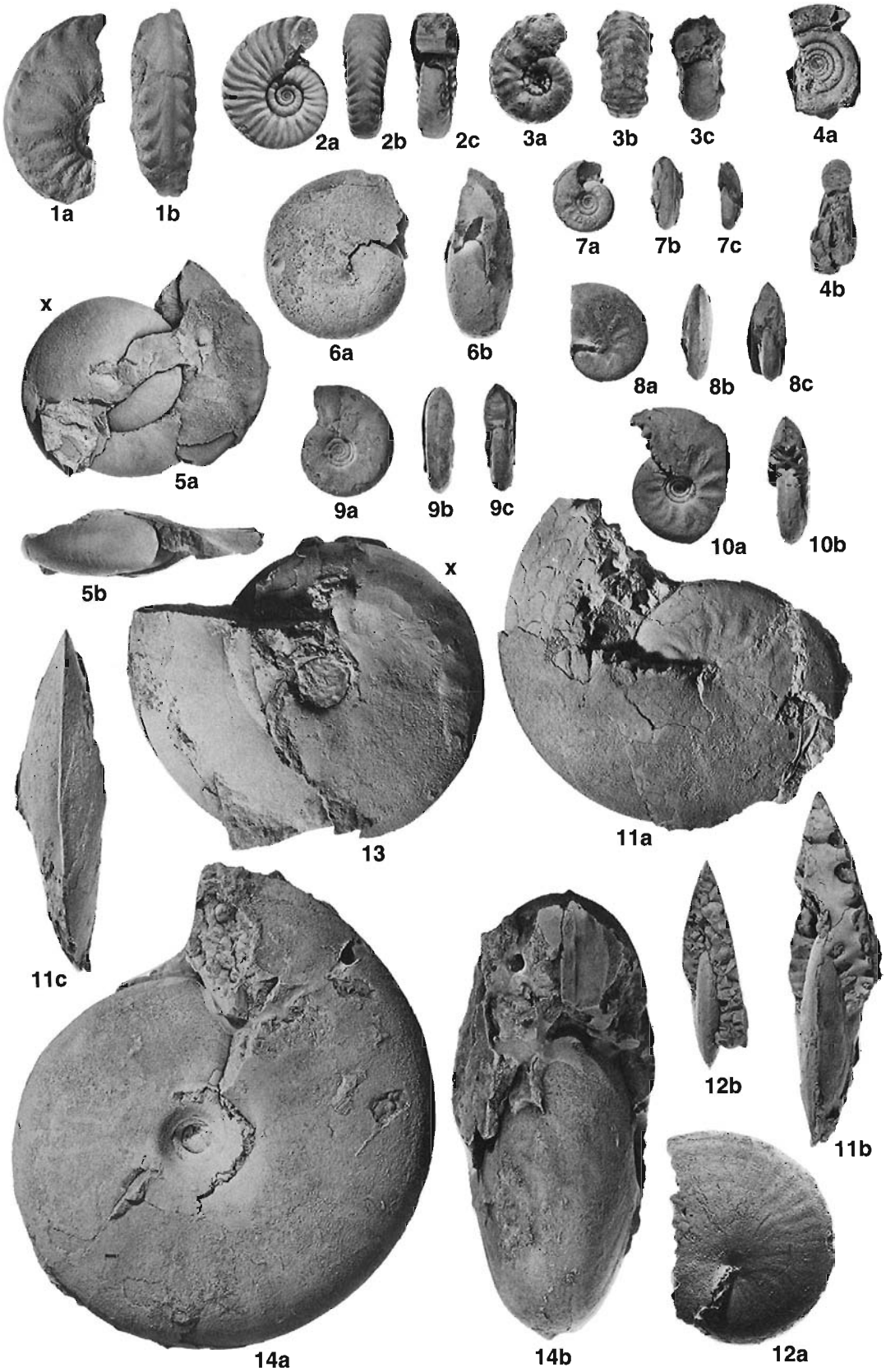
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PLATE 66

MIDDLE TRIASSIC
Upper Anisian–Chischa Zone

Figures 1, 2. *Tozerites polygyratus* (Smith) (Page 137)
1a–c. Hypotype GSC 28564 (GSC loc. 74726), outer whorl mostly or wholly body chamber.
2a, b. Paratype GSC 28565 (GSC loc. 40088).
Both from Toad Formation, Chischa River, northeastern British Columbia.

Figures 3, 4. *Longobardites murrayensis* n. sp. (Page 106)
3a–c. Paratype GSC 28556.
4. Paratype GSC 28557.
Both from Toad Formation, Chischa River, northeastern British Columbia (GSC loc. 74726).

Figures 5–10. *Pleurofrechites subsidens* n. sp. (Page 121)
5a, b. Holotype GSC 28339 (GSC loc. 40088).
6a, b. Paratype GSC 28340 (GSC loc. 40088).
7a–c. Paratype GSC 28344 (GSC loc. 74726).
8a–c. Paratype GSC 28341 (GSC loc. 40088).
9a, b. Paratype GSC 28343 (GSC loc. 40088), piece of body chamber.
10. Paratype GSC 28342 (GSC loc. 40088), latex impression from natural cast.
All from Toad Formation, Chischa River, northeastern British Columbia.

Figures 11a, b. *Parapopanoceras*(?) *torelli* (Mojsisovics) (Page 90)
Hypotype GSC 28274. Toad Formation, Chischa River, northeastern British Columbia (GSC loc. 74726).

Figures 12a, b. *Parapopanoceras malmgreni* (Lindstroem) (Page 90)
Hypotype GSC 28273. Toad Formation, Chischa River, northeastern British Columbia (GSC loc. 40088).

Figures 13–15. *Frechites laqueatus* (Lindstroem) (Page 120)
13. Hypotype GSC 28349, fragment of body chamber.
14a, b. Hypotype GSC 14189, body chamber.
15a, b. Hypotype GSC 28350, body chamber.
All from Schei Point Formation, Exmouth Island (GSC loc. 30341).

Figures 16, 17. *Frechites chischa* (Tozer) (Page 119)
16a, b. Topotype GSC 28347, piece of body chamber.
17a–c. Topotype GSC 28346.
Both from Toad Formation, Chischa River, northeastern British Columbia (GSC loc. 74726).

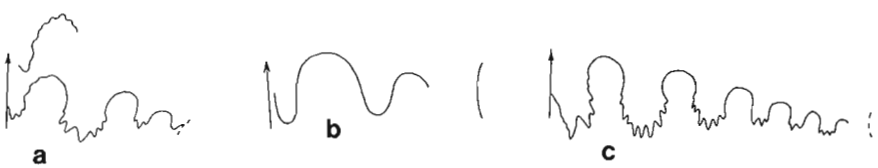

Figure 49. *Sutures. a,* ***Pleurofrechites subsidens*** *n. sp., GSC 28339 (Pl. 66, fig. 5) x4; b,* ***Tozerites polygyratus*** *(Smith), GSC 28565 (Pl. 66, fig. 2) x8; c,* ***Parapopanoceras malmgreni*** *(Lindstroem), GSC 28273 (Pl. 66, fig. 12), x4.*

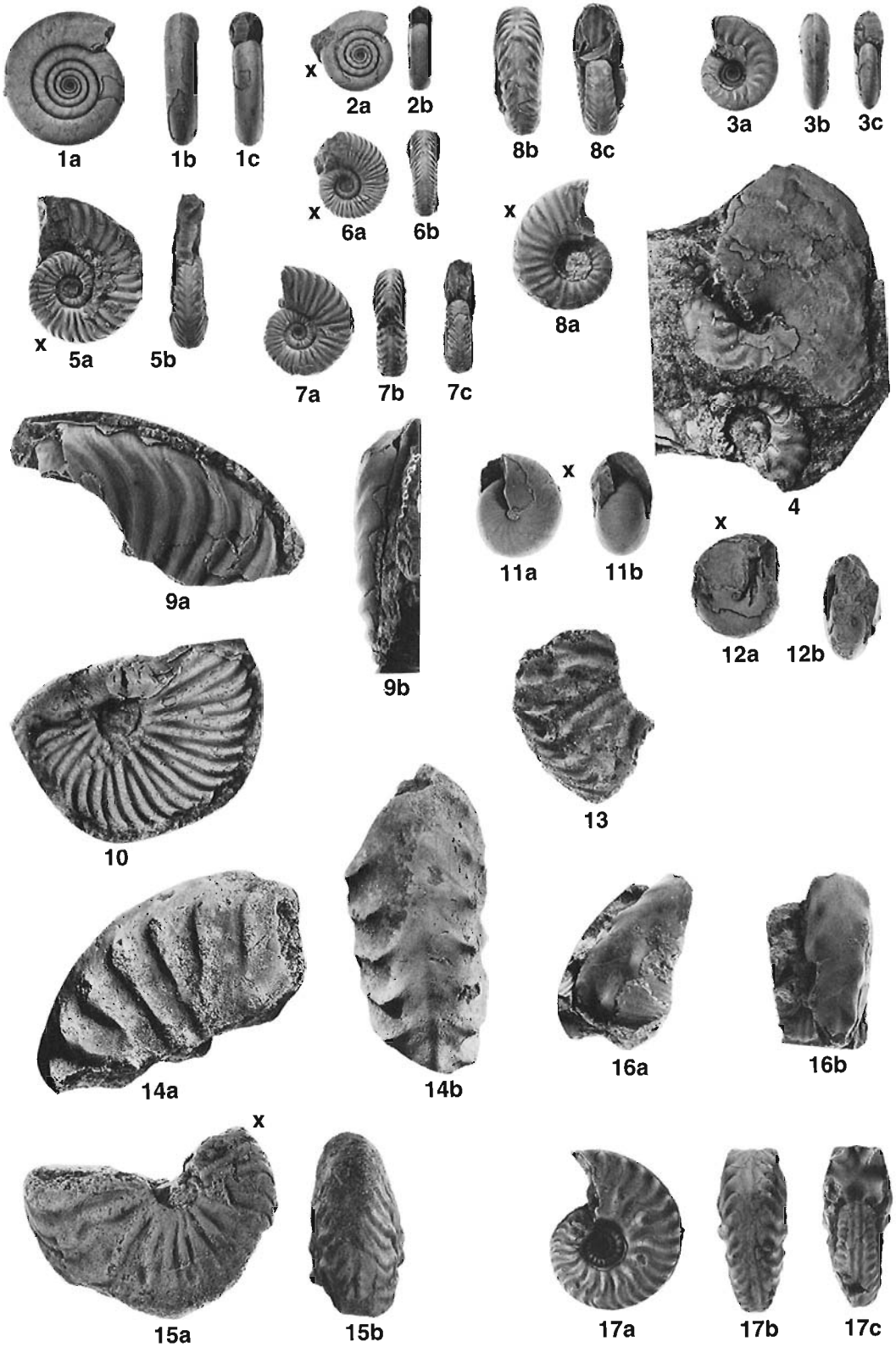
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PLATE 67

MIDDLE TRIASSIC
Ladinian–Matutinum Zone

All specimens from Sulphur Mountain Formation, Llama Member, north of Wapiti Lake, northeastern British Columbia (GSC loc. 46484 = GSC loc. 83862)

Figures 1–4. *Ptychites hamatus* n. sp. (Page 134)
1. Hypotype GSC 28403 (GSC loc. 46484), body chamber.
2a, b. Hypotype GSC 72341 (GSC loc. 46484).
3a, b. Hypotype GSC 28405 (GSC loc. 46484), outer whorl is body chamber.
4a, b. Hypotype GSC 28406 (GSC loc. 46484).

Figures 5, 6. *Eoprotrachyceras matutinum* Tozer (Page 145)
5. Paratype GSC 28633 (GSC loc. 83862), rubber mould from cast on back of GSC 28351 (figures 10a–c).
6a, b. Holotype GSC 28632 (GSC loc. 83862), mostly internal mould, sculpture subdued by preseptal layer.

Figures 7–14. *Pleurofrechites fellersi* n. sp. (Page 122)
7a–c. Paratype GSC 28358 (GSC loc. 46484), about half a whorl is body chamber.
8a, b. Paratype GSC 28354 (GSC loc. 83862).
9a, b. Paratype GSC 28356 (GSC loc. 83862).
10a–c. Holotype GSC 28351 (GSC loc. 83862).
11a–c. Paratype GSC 28357 (GSC loc. 46484).
12a–c. Paratype GSC 28355 (GSC loc. 83862).
13a–c. Paratype GSC 28353 (GSC loc. 83862).
14a, b. Paratype GSC 28352 (GSC loc. 83862).

Figures 15a–c. *Longobardites murrayensis* n. sp. (Page 106)
Hypotype GSC 28563 (GSC loc. 46484).

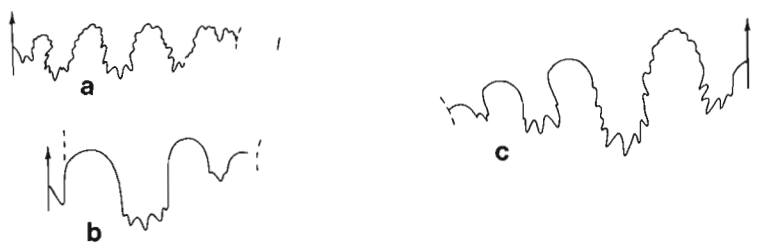

Figure 50. *Sutures. a,* ***Ptychites hamatus*** *n. sp., GSC 28405 (Pl. 67, fig. 3) x4; b,* ***Eoprotrachyceras matutinum*** *Tozer, GSC 28632 (Pl. 67, fig. 6) x2; c,* ***Pleurofrechites fellersi*** *n. sp., GSC 28357 (Pl. 67, fig. 11) x2.*

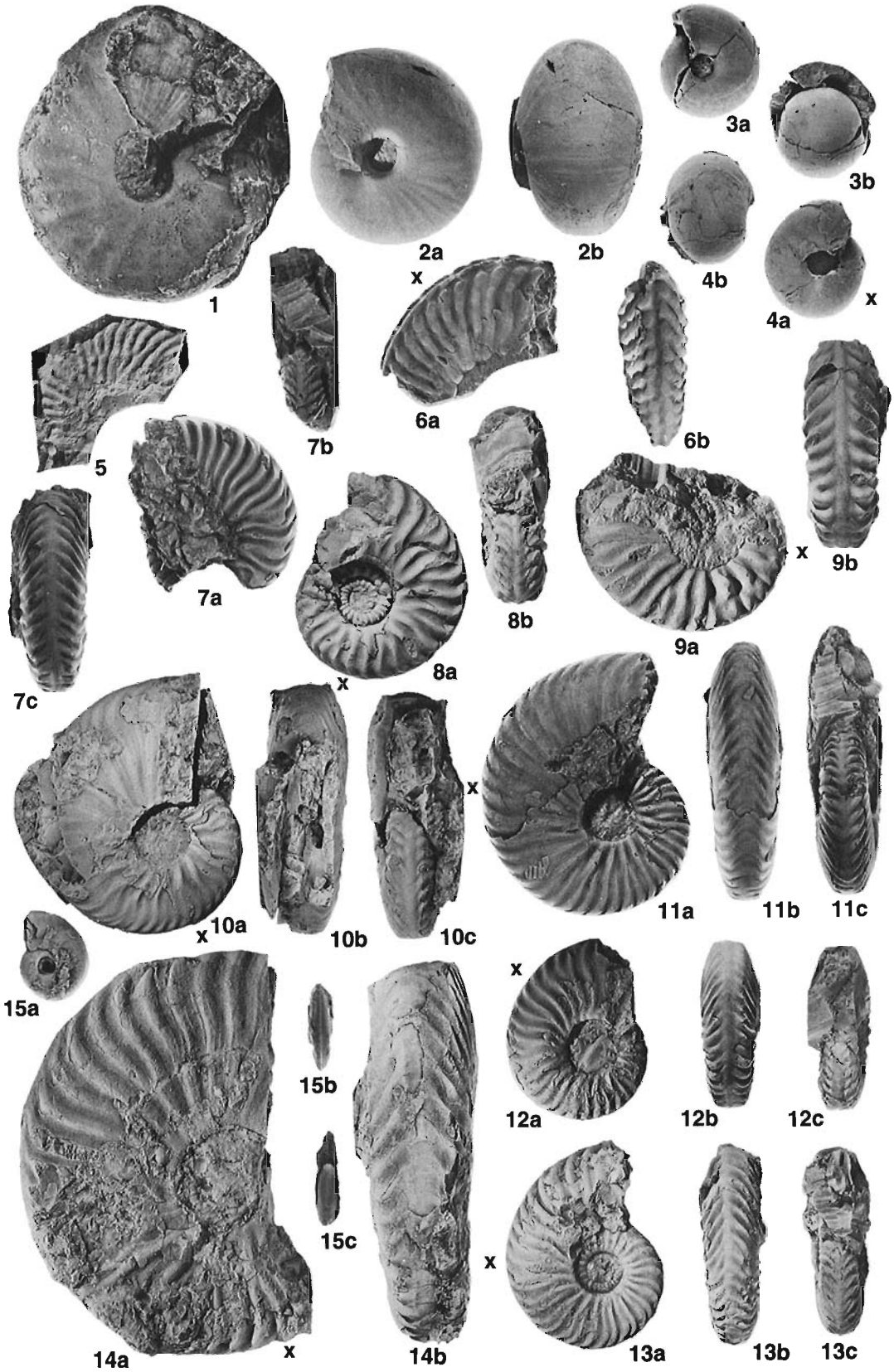
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PLATE 68

MIDDLE TRIASSIC Ladinian

Figures 1, 2. *Longobardites* sp. indet. (Poseidon Zone?) (Pages 303, 317)
1a–c. GSC 28558 (GSC loc. 26110), phragmocone.
2. GSC 28560 (GSC loc. 51616), phragmocone.
Both from *Daonella frami* bed, Schei Point Formation, Bjorne Peninsula, Ellesmere Island.

Figures 3a, b. *Istreites nanuk* (Tozer) (Poseidon Zone?) (Page 135)
Paratype GSC 14100. *Daonella frami* bed, Schei Point Formation, Bjorne Peninsula, Ellesmere Island (GSC loc. 26110).

Figures 4a, b. *Protrachyceras* sp. indet. (Poseidon Zone?) (Page 146)
GSC 14190, partly septate fragment with ammonitic suture line. *Daonella frami* bed, Schei Point Formation, Bjorne Peninsula, Ellesmere Island (GSC loc. 26110).

Figures 5–7. *Tuchodiceras poseidon* (Tozer) (Poseidon Zone) (Page 123)
5a, b. Hypotype GSC 28364 (GSC loc. 83861).
6a, b. Hypotype GSC 28365 (GSC loc. 83861).
7a, b. Hypotype GSC 28366 (GSC loc. 83860).
All from Sulphur Mountain Formation, Llama Member, north of Wapiti Lake, northeastern British Columbia.

Figures 8, 10. *Eoprotrachyceras gibsoni* n. sp. (Matutinum Zone) (Page 145)
8a, b. Holotype GSC 28634, mostly internal mould.
10a, b. Paratype GSC 28635, last half whorl is apparently body chamber.
Both from Sulphur Mountain Formation, Llama Member, Casket Mountain, Alberta (GSC loc. 85533).

Figures 9a, b. *Stolleyites intermedius* (Frebold) (Ladinian or Carnian) (Page 142)
Hypotype GSC 28624, phragmocone. Blaa Mountain Formation, Raanes Peninsula, Ellesmere Island (GSC loc. 26107).

Figure 51. *Sutures. a,* ***Stolleyites intermedius*** *(Frebold), GSC 28624 (Pl. 68, fig. 9) x2. b–d.* ***Longobardites*** *sp. indet. b, GSC 28559* x2; c, d, GSC 28558 (Pl. 68, fig. 1) x2.*

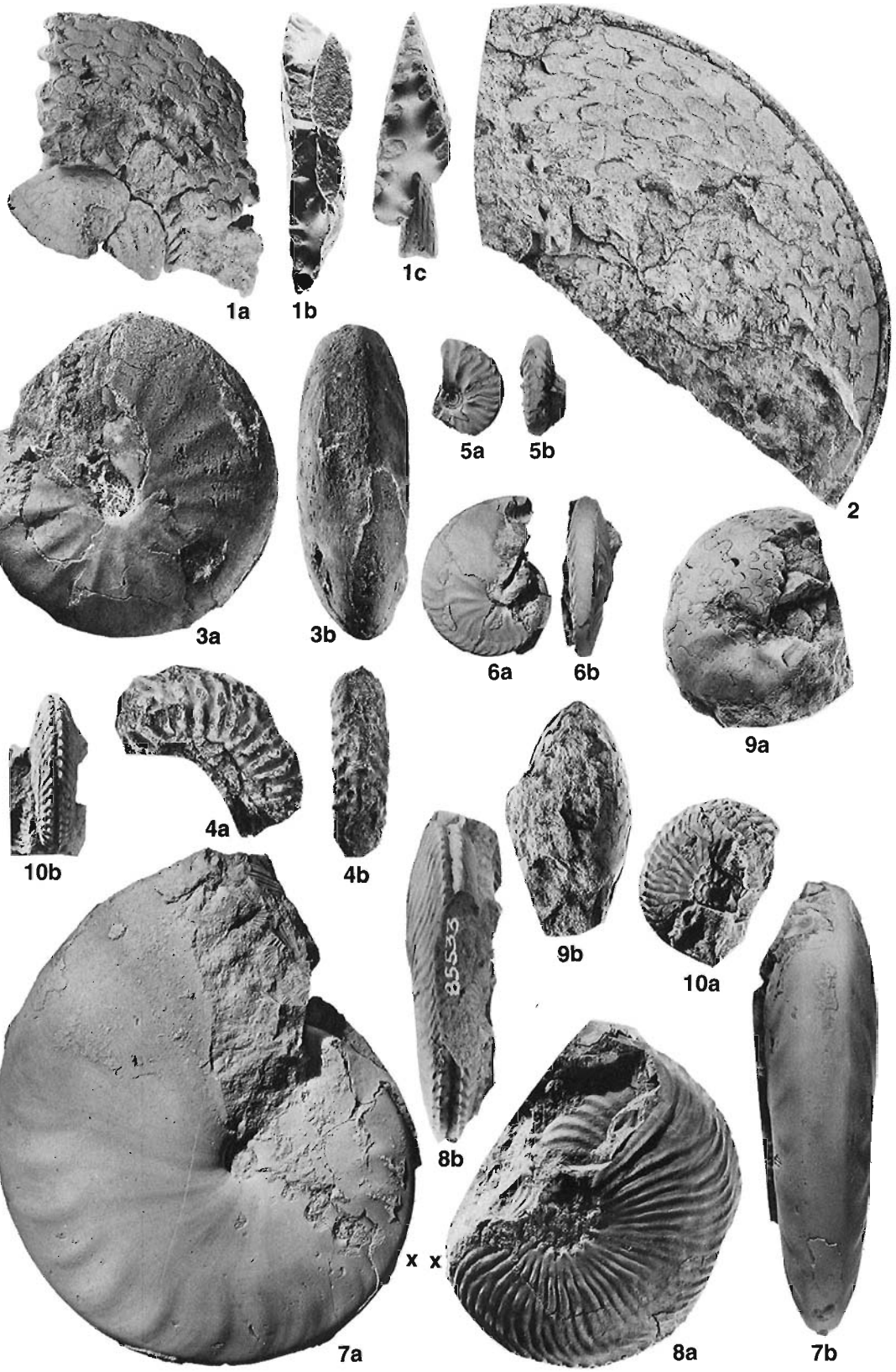
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PLATE 69

MIDDLE TRIASSIC
Ladinian–Poseidon Zone

Figures 1, 2. *Tuchodiceras poseidon* (Tozer) (Page 123)
1a, b. Hypotype GSC 28360, body chamber at least half the outer whorl. Toad Formation, Mount Withrow, northeastern British Columbia (GSC loc. 74757).
2a–c. Hypotype GSC 28362. Tuchodi Lakes area, northeastern British Columbia (GSC loc. 68289).

Figures 3, 4. *Tuchodiceras costatum* n. sp. (Page 123)
3a, b. Holotype GSC 28367 (GSC loc. 68284), body chamber about half a whorl.
4a, b. Paratype GSC 28361 (GSC loc. 68289).
Both from Toad Formation, Tuchodi Lakes area, northeastern British Columbia.

Figures 5, 6. *Arctoptychites lingulatus* n. sp. (Page 135)
5a–c. Holotype GSC 28409 (GSC loc. 68285), phragmocone.
6a–c. Paratype GSC 28410 (GSC loc. 68289).
Both from Toad Formation, Tuchodi Lakes area, northeastern British Columbia.

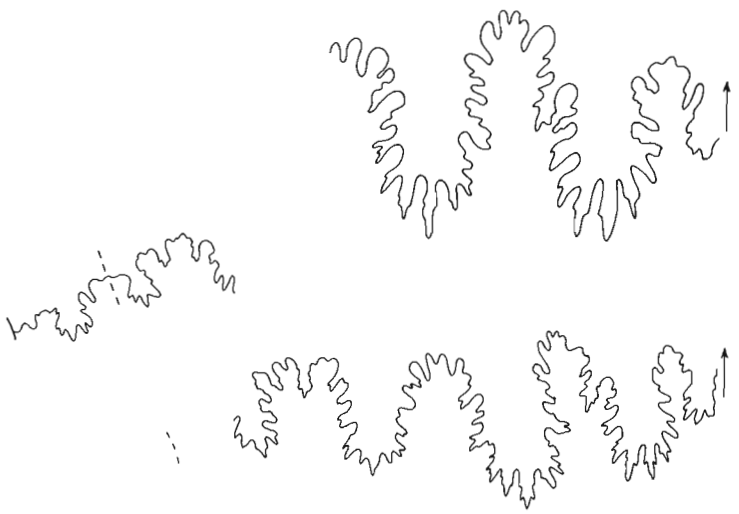

Figure 52. *Sutures.* ***Arctoptychites lingulatus*** *n. sp., GSC 28409 (Pl. 69, fig. 5) x4.*

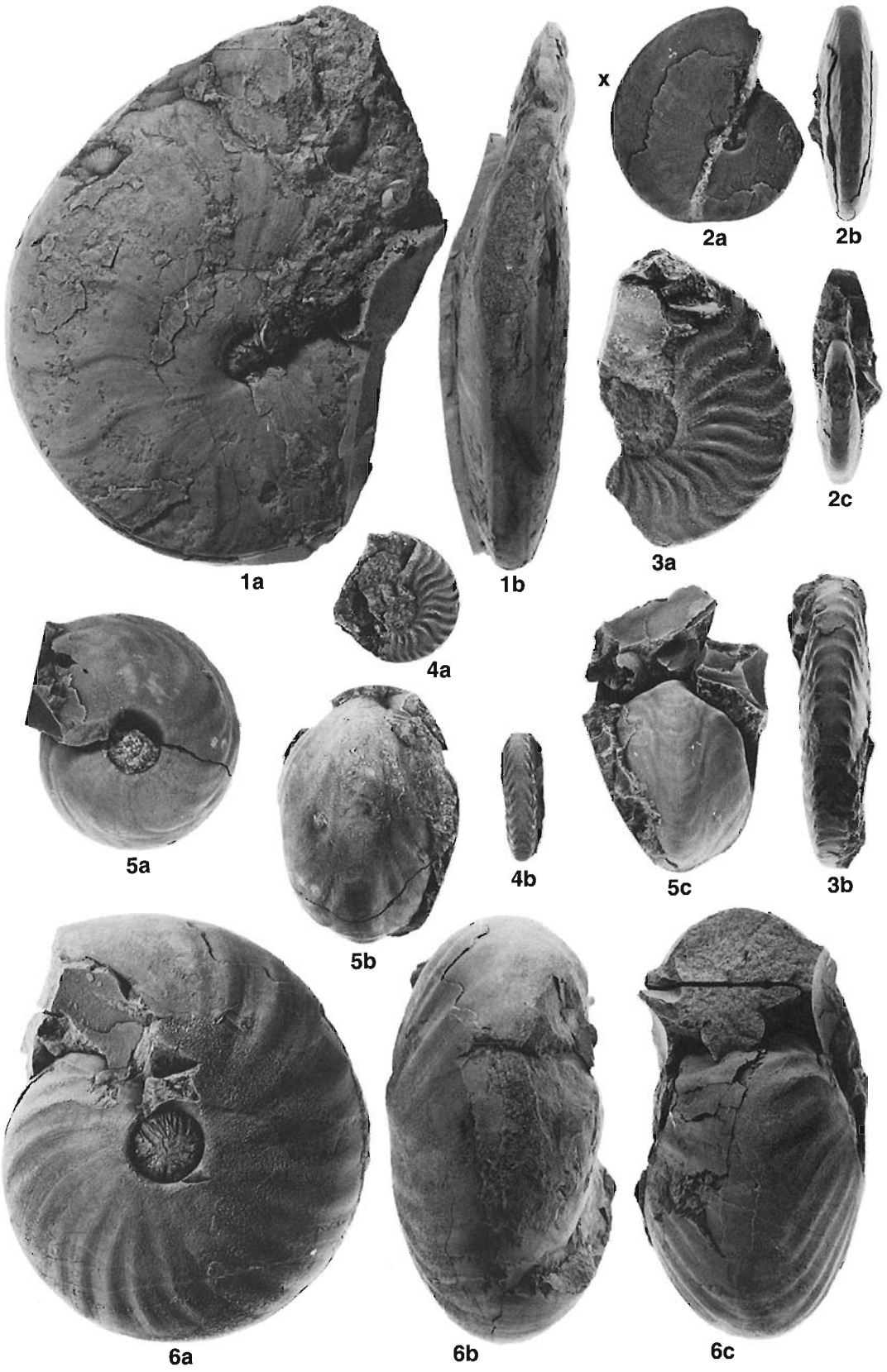
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PLATE 70

MIDDLE TRIASSIC
Ladinian–Poseidon Zone

Figures 1–6. *Eonathorstites dieneri* n. sp. (Page 137)
1a–c. Paratype GSC 28569, phragmocone.
2a–c. Paratype GSC 28570, septa not visible.
3a–d. Paratype GSC 28571, phragmocone, probably complete, with part of body chamber preserved in umbilical area.
4a–c. Holotype GSC 28568, complete phragmocone with occluded umbilicus.
5a–c. Paratype GSC 28572, outer whorl is body chamber.
6. Paratype GSC 28573, structure of umbilicus shows that originally at least half a whorl of additonal body chamber was originally present.
All from Toad Formation, Mount Withrow, northeastern British Columbia (GSC loc. 74758).

Figures 7–18. *Indigirites freboldi* n. sp. (Page 138)
7a–c. Paratype GSC 28577, septa not visible.
8a–c. Paratype GSC 28578, septa not visible.
9a–d. Paratype GSC 28579, septa not visible.
10a–d. Paratype GSC 28580, septa not visible.
11a–c. Holotype GSC 28576, probably complete phragmocone, structure of occluded umbilicus shows that specimen originally had one more whorl, presumably body chamber.
12a–d. Paratype GSC 28581, mostly or wholly phragmocone.
Figures 7–12 from Toad Formation, Tuchodi Lakes area, northeastern British Columbia (GSC loc. 68286).
13a–c. Paratype GSC 28584, septa not visible.
14a–c. Paratype GSC 28585, septa not clearly visible, wrinkle layer (runzelschicht) preserved.
Figures 13–14 from Toad Formation, Tuchodi Lakes area, northeastern British Columbia (GSC loc. 68284).
15a–c. Paratype GSC 28587, septa not clearly visible.
16. Paratype GSC 28586, phragmocone with crushed remains of one whorl of body chamber.
Figures 15, 16 from Toad Formation, Tuchodi Lakes area, northeastern British Columbia (GSC loc. 68289).
17a–c. Paratype GSC 28588, complete phragmocone.
18a–d. Paratype GSC 28589, specimen with wrinkle layer (runzelschicht).
Figures 17, 18 from Toad Formation, Mount Withrow, northeastern British Columbia (GSC loc. 74755).

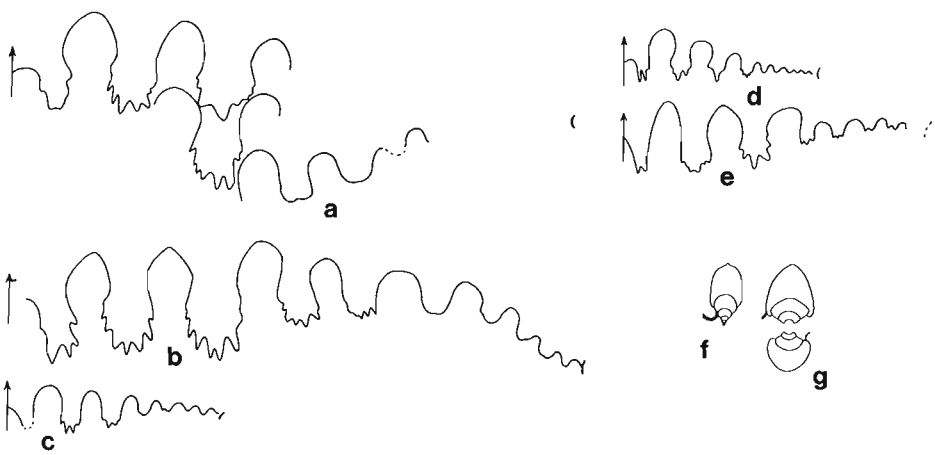

Figure 53. *Sutures and sections. a–c, g.* ***Indigirites freboldi*** *n. sp. a, GSC 28576 (Pl. 70, fig. 11) x4; b, GSC 28589 (Pl. 70, fig. 18) x4; c, GSC 28583* x4; g, GSC 28582 x1. d–f.* ***Eonathorstites dieneri*** *n. sp., d, GSC 28571 (Pl. 70, fig. 3) x4; e, GSC 28568 (Pl. 70, fig. 4) x4; f, GSC 28574* x1.*

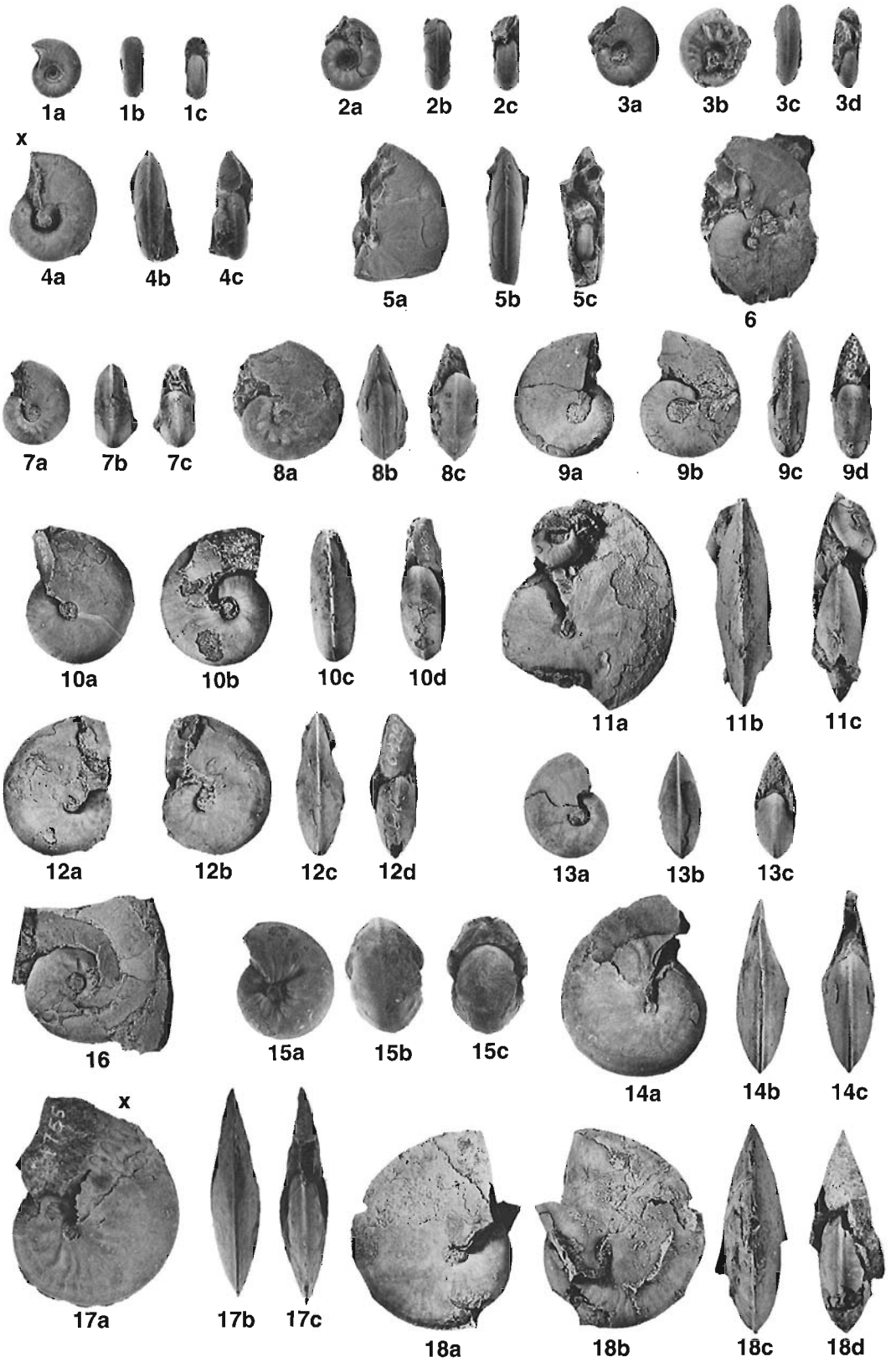
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PLATE 71

MIDDLE TRIASSIC
Ladinian–Poseidon Zone

Figure 1. *Gymnites*(?) sp. indet. (Page 128)
GSC 28381, septate fragment. Toad Formation, Tuchodi Lakes area, northeastern British Columbia (GSC loc. 68284).

Figures 2a, b. *Ptychites hamatus* n. sp. (Page 134)
Hypotype GSC 28408. Toad Formation, Mount Withrow, northeastern British Columbia (GSC loc. 74758).

Figures 3, 4. *Metatirolites withrowi* n. sp. (Page 270)
3a–c. Paratype GSC 32345, phragmocone.
4a, b. Holotype GSC 32344, body chamber about half a whorl.
Both have marginal auriculoids. Both from Toad Formation, Mount Withrow, northeastern British Columbia (GSC loc. 74758).

Figures 5a, b. *Monophyllites aonis* Mojsisovics (Page 270)
Hypotype GSC 32346, apparently body chamber. Toad Formation, Mount Withrow, northeastern British Columbia (GSC loc. 74762).

Figures 6–8. *Protrachyceras sikanianum* McLearn (Page 146)
6a, b. Hypotype GSC 28637 (GSC loc. 68286).
7a–c. Hypotype GSC 28638 (GSC loc. 68289).
Figures 6, 7 from Toad Formation, Tuchodi Lakes area, northeastern British Columbia.
8a, b. Hypotype GSC 28636, small specimen with about half a whorl of body chamber. Toad Formation, Mount Withrow, northeastern British Columbia (GSC loc. 74758).

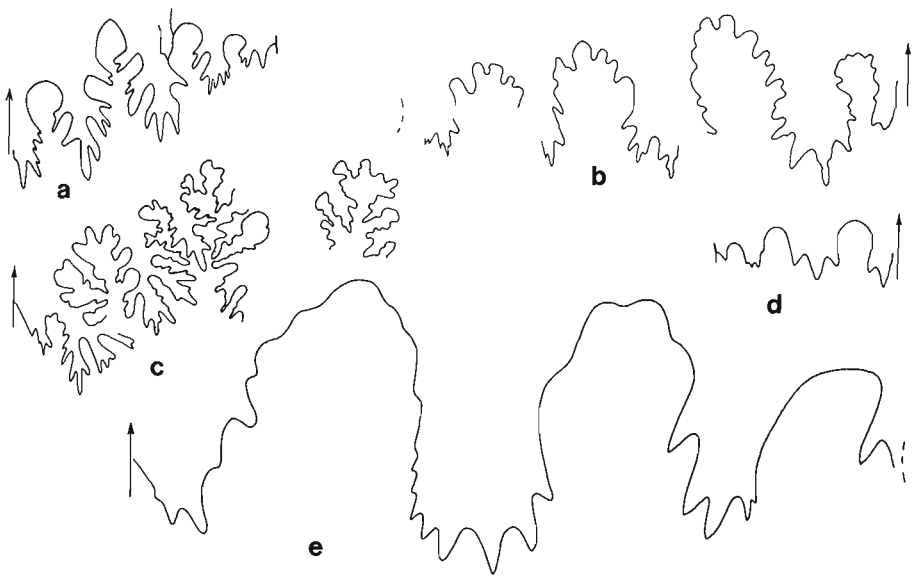

Figure 54. *Sutures. a,* ***Monophyllites aonis*** *Mojsisovics, GSC 32347* x2; b,* ***Ptychites hamatus*** *n. sp., GSC 28408 (Pl. 71, fig. 2) x4; c,* ***Gymnites****(?) sp. indet., GSC 28381 (Pl. 71, fig. 1) x2; d,* ***Metatirolites withrowi*** *n. sp., GSC 32344 (Pl. 71, fig. 4), x4; e,* ***Protrachyceras sikanianum*** *McLearn, GSC 28637 (Pl. 71, fig. 6) x4.*

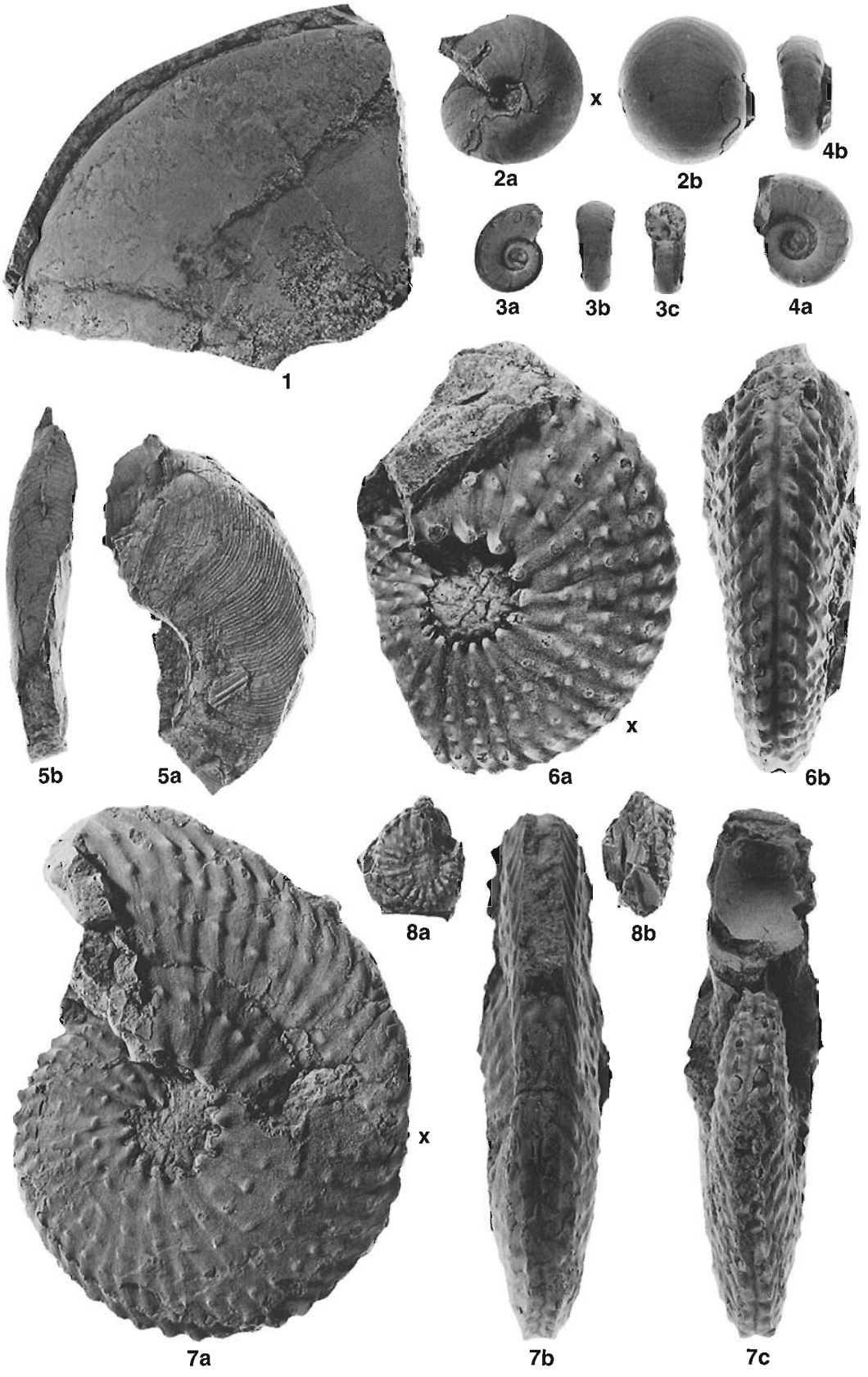
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PLATE 72

MIDDLE TRIASSIC
Ladinian–Meginae Zone

Figures 1–4. *Meginoceras tetsa* (McLearn) (Page 148)
1a, b. Hypotype GSC 28644. Toad Formation, Mount Wooliever, British Columbia (GSC loc. 74748).
2a–c. Holotype GSC 9545, body chamber. Toad Formation, Alaska Highway, British Columbia (GSC loc. 10781).
3. Hypotype GSC 28645, crushed specimen, no septa visible. Toad Formation, Halfway River area, British Columbia (GSC loc. 42535).
4a, b. Paratype GSC 9546. Liard Formation, Toad Formation, Mount Wooliever, British Columbia (GSC loc. 10790).

Figures 5a, b. *Lobites pacianus* McLearn (Page 211)
Hypotype GSC 28947. Toad Formation, Mount Wooliever, northeastern British Columbia (GSC loc. 10790).

Figures 6–10. *Silenticeras bamberi* n. sp. (Page 150)
6a, b. Paratype GSC 28683.
7a, b. Holotype GSC 28680.
8a, b. Paratype GSC 28682.
10a, b. Paratype GSC 28681, body chamber.
Figures 6–8, 10 from Toad Formation, Halfway River area, British Columbia (GSC loc. 42535).
9a–c. Paratype GSC 28684. Toad Formation, south of Muskwa River, British Columbia (GSC loc. 89782).

Figures 11, 12. *Indigirites stolleyi* n. sp. (Page 139)
11a–c. Holotype GSC 28605, outer whorl is partly body chamber. Toad Formation, Mount Wooliever, British Columbia (GSC loc. 10790).
12a–c. Paratype GSC 72207. Liard Formation, Alaska Highway, British Columbia (GSC loc. 98902).

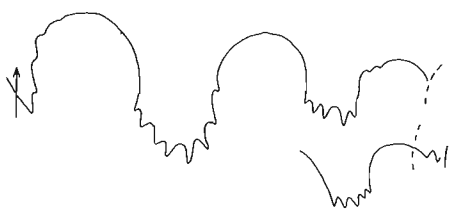

Figure 55. *Suture.* ***Silenticeras bamberi*** *n. sp. GSC 28684 (Pl. 72, fig. 9) x4.*

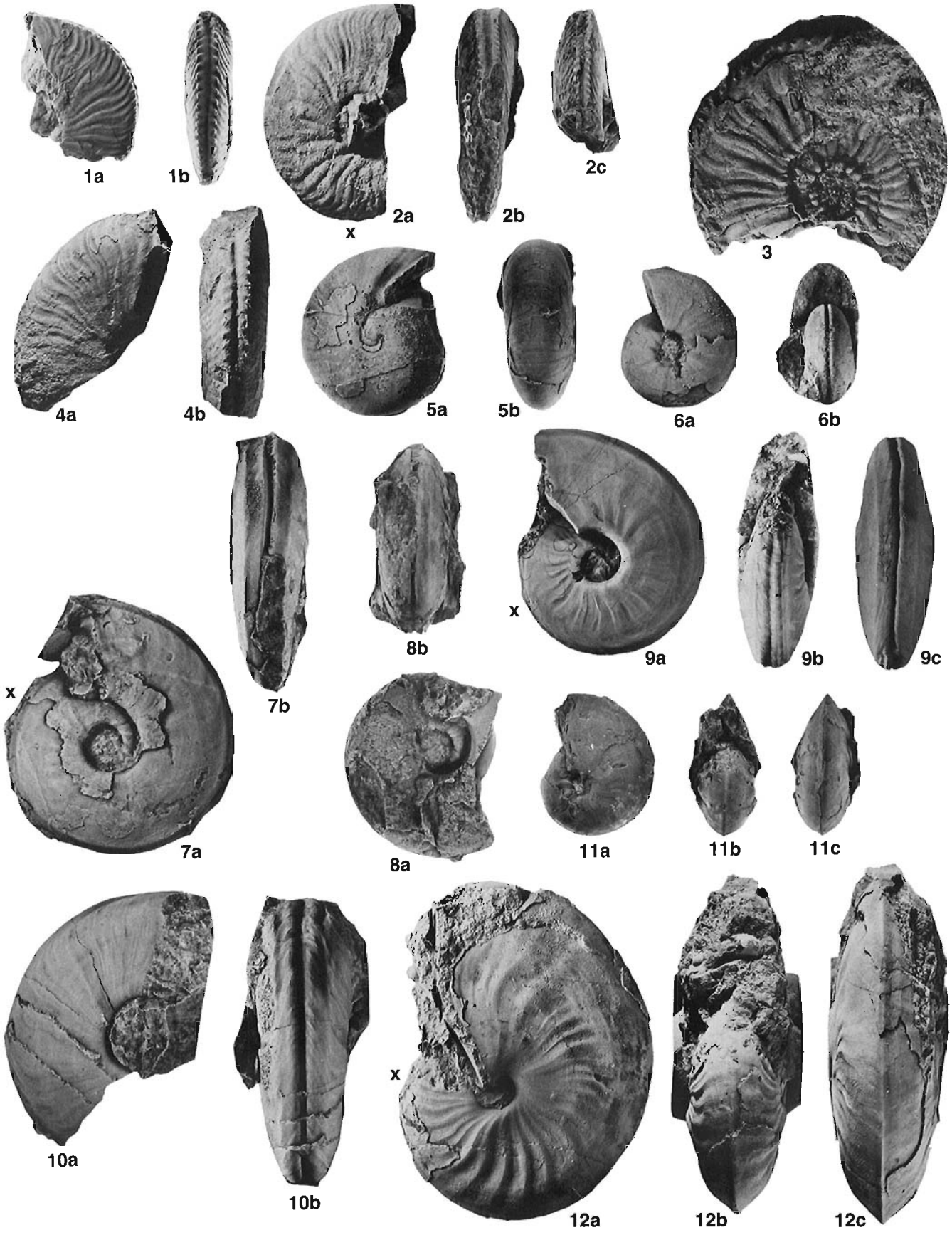
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PLATE 73

MIDDLE TRIASSIC
Ladinian–Meginae Zone

Figures 1–12. *Meginoceras triviale* n. sp. (Subzone 1) (Page 147)

1a, b. Paratype GSC 28652, phragmocone.
2a, b. Paratype GSC 28653, phragmocone.
3a, b. Holotype GSC 28646, body chamber about half a whorl.
4a, b. Paratype GSC 28647.
5. Paratype GSC 28648, body chamber about half a whorl.
6. Paratype GSC 28649, probably body chamber.
7. Paratypes GSC 28650 (below), GSC 28651 (above), body chamber fragments.
Figures 1–7 from Toad Formation, 4 miles northeast of Mount Stearns, northeastern British Columbia (GSC loc. 50006).
8a, b. Paratype GSC 28655, body chamber fragment.
9. Paratype GSC 28654, septa not visible.
Figures 8, 9 from Toad Formation, Mount Withrow, northeastern British Columbia (GSC loc. 74769).
10a, b. Paratype GSC 28656, septa not visible.
11a, b. Paratype GSC 28657, body chamber about half a whorl.
12a, b. Paratype GSC 28658, septa not visible.
Figure 10–12 from Sulphur Mountain Formation, Llama Member, Hook Lake, northeastern British Columbia (GSC loc. 45651).

Figures 13–15. *Meginoceras meginae* McLearn (Subzone 2) (Page 148)

13a–c. Hypotype GSC 28659. Toad Formation, Boiler Canyon, Liard River, northeastern British Columbia (GSC loc. 68244).
14a, b. Hypotype GSC 28660. Toad Formation, Mount Withrow, northeastern British Columbia (GSC loc. 74766).
15a, b. Topotype GSC 9531. Toad Formation, Beattie Ledge, Peace River, northeastern British Columbia (GSC loc. 9131). (Now below Williston Lake.)

Figures 16–20. *Meginoceras aylardi* (McLearn) (Subzone 3) (Page 149)

16a, b. Topotype GSC 28661, body chamber. Liard Formation, Alaska Highway, northeastern British Columbia (GSC loc. 42300).
17. Hypotype GSC 28662, body chamber.
18a, b. Hypotype GSC 28663, body chamber about half a whorl.
19a, b. Hypotype GSC 28664.
Figure 17–19 from Toad Formation, Mount Withrow, northeastern British Columbia (GSC loc. 50043 = GSC loc. 74767).
20a, b. Holotype GSC 9549, septa not visible. Liard Formation, Alaska Highway, northeastern British Columbia (GSC loc. 10781).

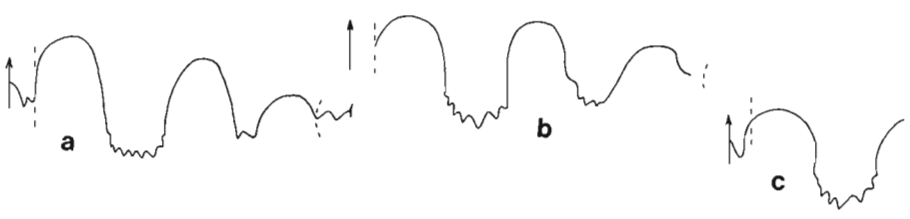

Figure 56. *Sutures. a,* ***Meginoceras triviale*** *n. sp., GSC 28653 (Pl. 73, fig. 2) x4; b, c.* ***Meginoceras meginae*** *McLearn, two sutures of GSC 28659 (Pl. 73, fig. 13) x4.*

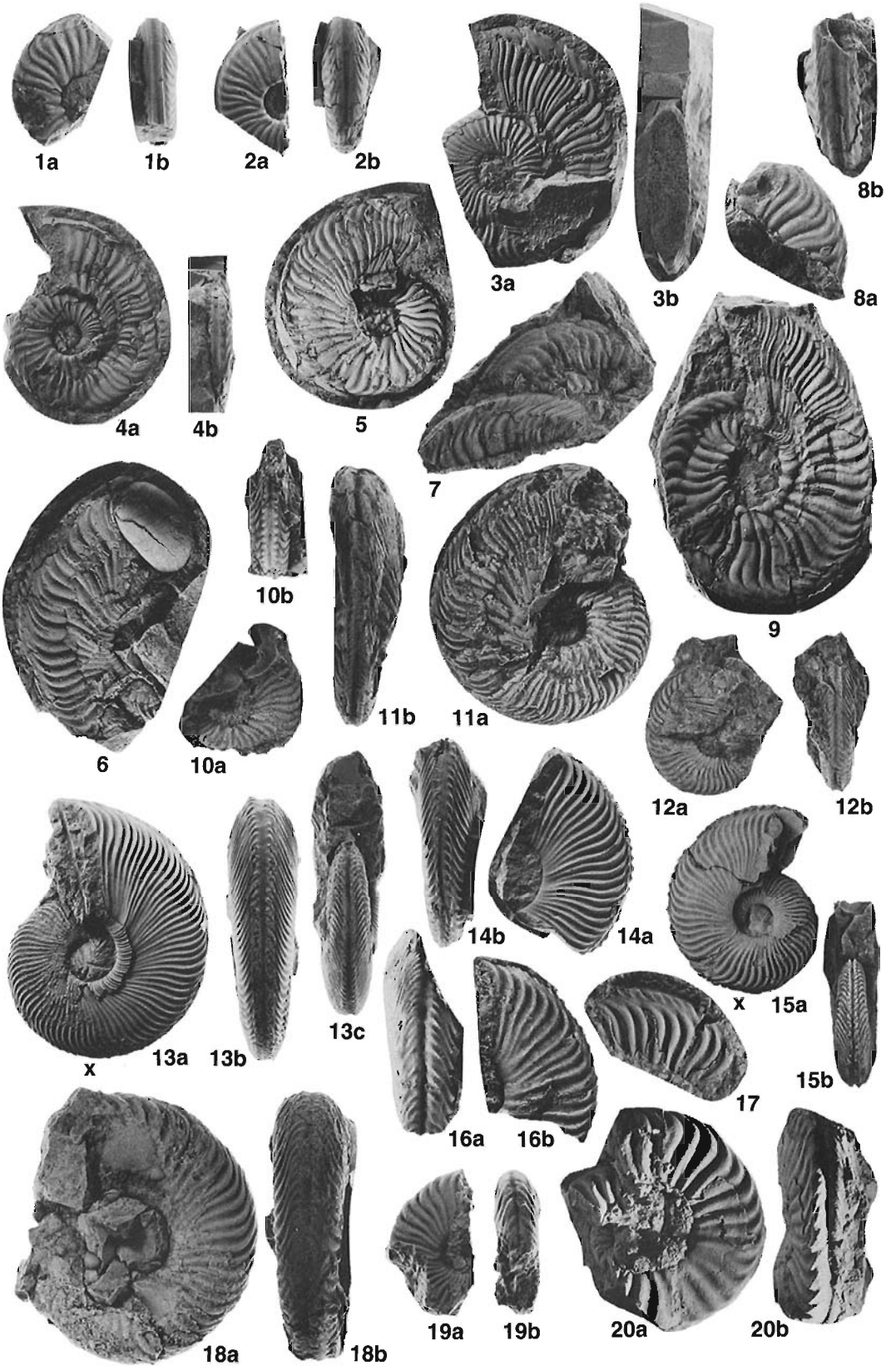
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PLATE 74

MIDDLE TRIASSIC
Ladinian–Meginae Subzone 2

Figures 1–4. *Nitanoceras selwyni* (McLearn) (Page 91)
1a, b. Topotype GSC 9526, peristome partly preserved.
2a–c. Holotype GSC 9047, specimen is complete with peristome.
3a–c. Topotype GSC 28276.
3d, e. Topotype GSC 28277, complete phragmocone.
4a, b. Topotype GSC 9544, holotype of *Nitanoceras leve* McLearn, peristome is partly preserved.
All from Toad Formation, Beattie Ledge, Peace River, northeastern British Columbia (GSC loc. 9131).

Figures 5a–c. *Silenticeras liardense* n. sp. (Page 151)
Holotype GSC 28678, body chamber one whorl. Toad Formation, Boiler Canyon, Liard River, northeastern British Columbia (GSC loc. 68244).

Figures 6–9. *Silenticeras hatae* McLearn (Page 151)
6a–c. Holotype GSC 9043.
7a, b. Topotype GSC 28676.
8. Topotype GSC 9532.
Figures 6–8 from Toad Formation, Beattie Ledge, Peace River, northeastern British Columbia (GSC loc. 9163).
9a, b. Hypotype GSC 28677. Toad Formation, Boiler Canyon, Liard River, northeastern British Columbia (GSC loc. 68245).

Figures 10–14. *Eosagenites gethingi* (McLearn) (Page 136)
10a, b. Topotype GSC 28412 (GSC loc. 9340), body chamber about three quarters of a whorl.
11a, b. Topotype GSC 9529 (GSC loc. 9131).
12a, b. Holotype GSC 8806 (GSC loc. 9131), body chamber about three quarters of a whorl.
13a, b. Topotype GSC 9530 (GSC loc. 9131).
14. Topotype GSC 28411, oblique view of phragmocone (GSC loc. 9131).
All from Toad Formation, Beattie Ledge, Peace River, northeastern British Columbia.

Figures 15–18. *Lobites pacianus* McLearn (Page 211)
15a, b. Hypotype GSC 28946. Toad Formation, Boiler Canyon, Liard River, northeastern British Columbia (GSC loc. 68245).
16. Topotype GSC 9524, oblique view of phragmocone.
17a–c. Topotype GSC 28945.
18a, b. Holotype GSC 8789.
Figure 16–18 from Toad Formation, Beattie Ledge, Peace River, northeastern British Columbia (GSC loc. 9341).

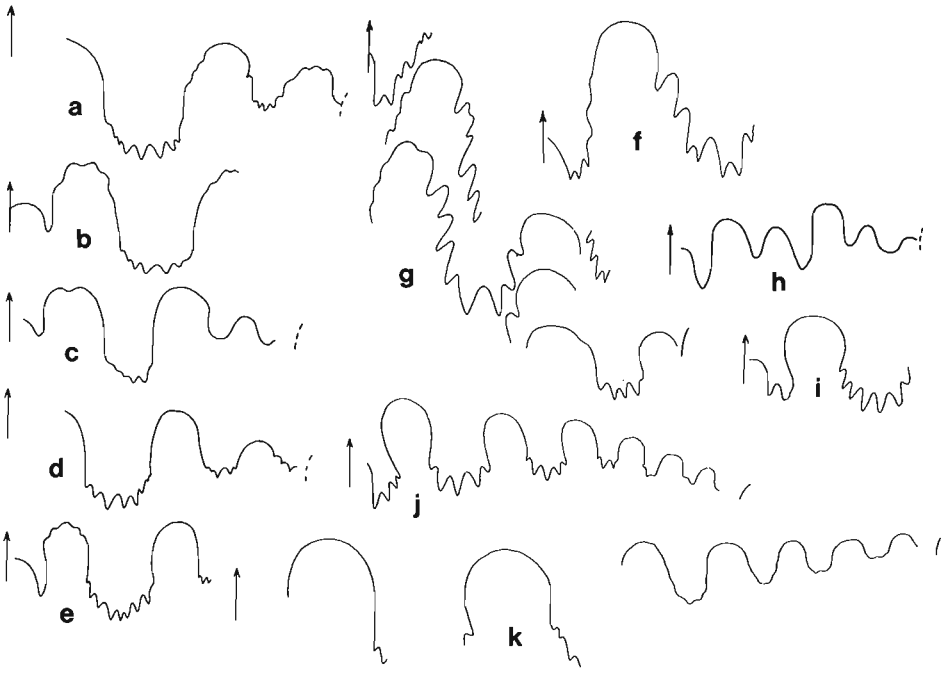

Figure 57. *Sutures. a–e.* ***Silenticeras hatae*** *McLearn. a, b, two sutures of GSC 9043 (Pl. 74, fig. 6) x4; c, GSC 9532 (Pl. 74, fig. 8) x4; d, e, two sutures of GSC 28677 (Pl. 74, fig. 9) x4; f, g.* ***Eosagenites gethingi*** *(McLearn), all of GSC 28411 (Pl. 74, fig. 14) x4; h,* ***Lobites pacianus*** *McLearn, GSC 9524 (Pl. 74, fig. 16) x2; i–k.* ***Nitanoceras selwyni*** *(McLearn). i, GSC 9526 (Pl. 74, fig. 1) x8; j, GSC 28277 (Pl. 74, fig. 3d) x8; k, GSC 9544 (Pl. 74, fig. 4) x8.*

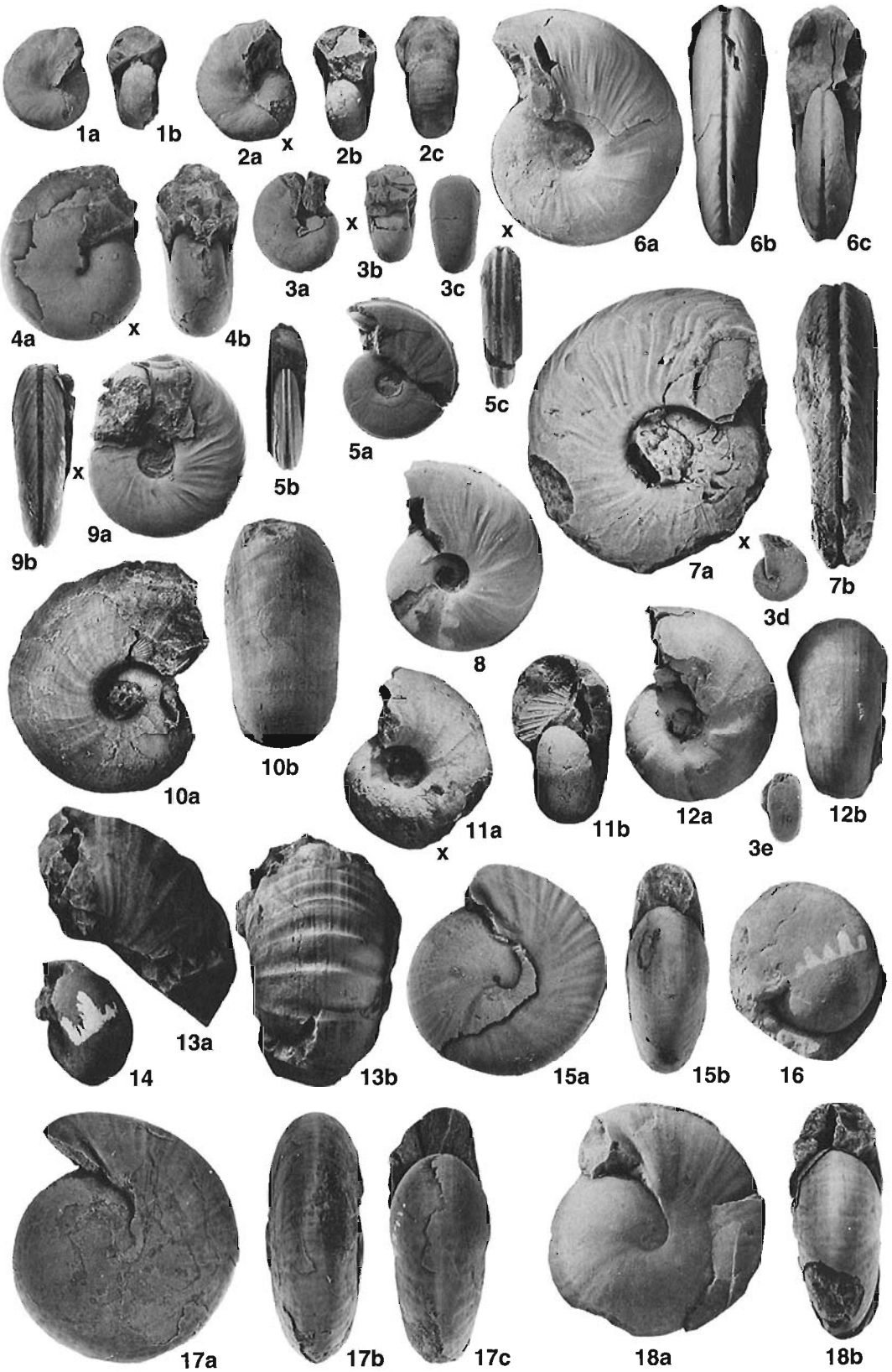
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PLATE 75

MIDDLE TRIASSIC
Ladinian–Meginae Zone

Figures 1–3. *Thanamites schooleri* (McLearn) (Subzone 2) (Page 143)
1a, b. Holotype GSC 9046.
2a, b. Topotype GSC 9528.
3a–c. Topotype GSC 28625.
All from Toad Formation, Beattie Ledge, Peace River, northeastern British Columbia (GSC loc. 9131).

Figures 4, 5. *Thanamites parvus* (McLearn) (Subzone 2) (Page 143)
4a, b. Topotype GSC 9527.
5a–c. Holotype GSC 8793.
Both from Toad Formation, Beattie Ledge, Peace River, northeastern British Columbia (GSC loc. 9131).

Figures 6a–c. *Indoceltites transiens* n. sp. (Subzone 2) (Page 144)
Holotype GSC 28626. Toad Formation, Boiler Canyon, Liard River, northeastern British Columbia (GSC loc. 68351).

Figures 7–10. *Drumoceras tuberculatum* n. sp. (Subzone 2) (Page 144)
7a–c. Paratype GSC 28628 (GSC loc. 50045), outer whorl is body chamber.
8a, b. Paratype GSC 28630 (GSC loc. 74766), outer whorl partly or wholly body chamber.
9a–c. Holotype GSC 28627 (GSC loc. 74768), complete with peristome, length of body chamber more than one whorl.
10a, b. Paratype GSC 28629 (GSC loc. 50045).
All from Toad Formation, Mount Withrow, northeastern British Columbia.

Figures 11a–c. *Drumoceras anodosum* n. sp. (Subzone 2) (Page 145)
Holotype GSC 28631, complete with peristome, length of body chamber more than one whorl. Toad Formation, Mount Withrow, northeastern British Columbia (GSC loc. 74765).

Figures 12, 13. *Protrachyceras sikanianum* McLearn (Subzone 2) (Page 146)
12a, b. Holotype GSC 9044.
13a, b. Topotype GSC 9045, holotype of *Protrachyceras zauwae* McLearn.
Both from Toad Formation, Beattie Ledge, Peace River, northeastern British Columbia (GSC loc. 9131).

Figures 14a, b. *Silenticeras gibsoni* n. sp. (Subzone 1) (Page 150)
Holotype GSC 35313, body chamber at least half a whorl. Sulphur Mountain Formation, Llama Member, near Hook Lake, northeastern British Columbia (GSC loc. 85588).

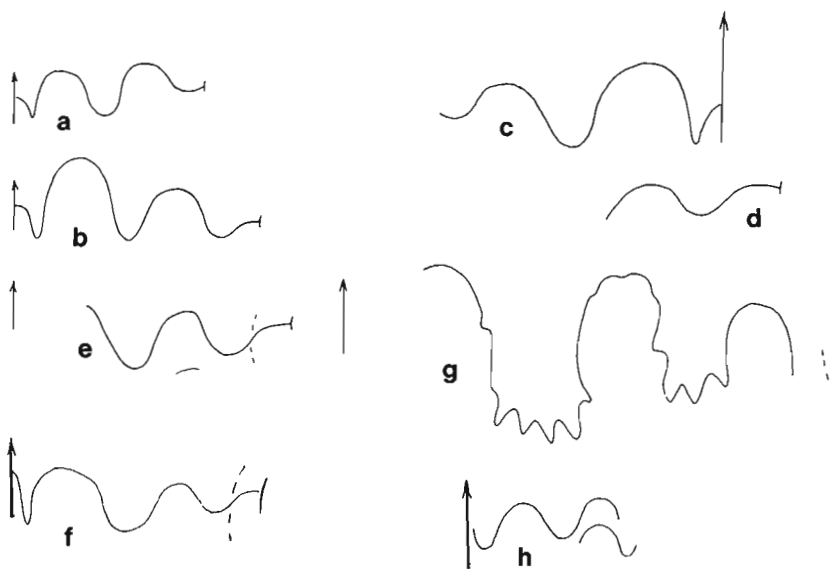

Figure 58. *Sutures. a,* ***Indoceltites transiens*** *n. sp., GSC 28626 (Pl. 75, fig. 6) x4. b–d.* ***Thanamites schooleri*** *(McLearn). b, GSC 28625 (Pl. 75, fig. 3) x4; c, GSC 9528 (Pl. 75, fig. 2) x4; d, GSC 9046 (Pl. 75, fig. 1) x4; e, f,* ***Drumoceras tuberculatum*** *n. sp., GSC 28629 (Pl. 75, fig. 10) x4; g,* ***Protrachyceras sikanianum*** *McLearn, GSC 9044 (Pl. 75, fig. 12) x4; h,* ***Thanamites parvus*** *(McLearn), GSC 35356* x4.*

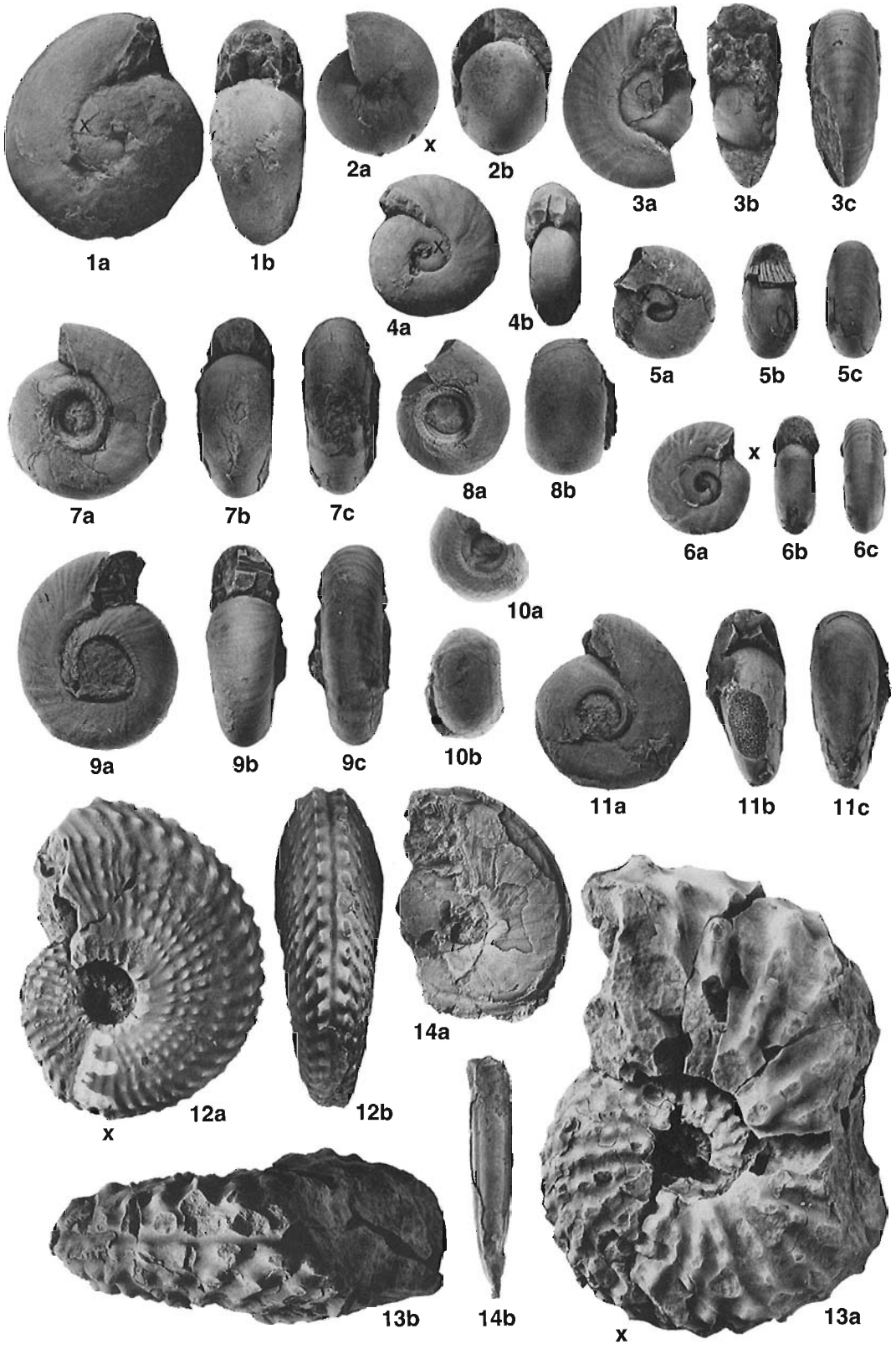
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PLATE 76

MIDDLE TRIASSIC
Ladinian–Meginae Subzone 2

Figures 1–17. *Indigirites boehmi* n. sp. (Page 139)
1a–c. Paratype GSC 28591 (GSC loc. 68248).
2a–c. Paratype GSC 28595 (GSC loc. 68243), phragmocone.
3a–c. Paratype GSC 28596 (GSC loc. 68243), outer whorl probably body chamber.
4a, b. Paratype GSC 28592 (GSC loc. 68248).
5a, b. Paratype GSC 28593 (GSC loc. 68248), phragmocone.
6a–c. Paratype GSC 28597 (GSC loc. 68243), complete (?) phragmocone.
7a, b. Holotype GSC 28590 (GSC loc. 68248), body chamber exactly one whorl, umbilicus occluded.
8a, b. Paratype GSC 28594 (GSC loc. 68248), phragmocone.
9a–c. Paratype GSC 28598 (GSC loc. 68243).
Figures 1–9 from Toad Formation, Boiler Canyon, Liard River, northeastern British Columbia.
10a, b. Paratype GSC 28603 (GSC loc. 9338), phragmocone.
11a, b. Paratype GSC 9523 (GSC loc. 9131), body chamber about one whorl.
12a, b. Paratype GSC 28604 (GSC loc. 9131), mostly if not wholly phragmocone.
13a, b. Paratype GSC 28601 (GSC loc. 9338).
14. Paratype GSC 9520 (GSC loc. 9131).
15a, b. Paratype GSC 9522 (GSC loc. 9131).
16a, b. Paratype GSC 28602 (GSC loc. 9338).
17a, b. Paratype GSC 9521 (GSC loc. 9131).
Figures 10–17 from Toad Formation, Beattie Ledge, Peace River, northeastern British Columbia.

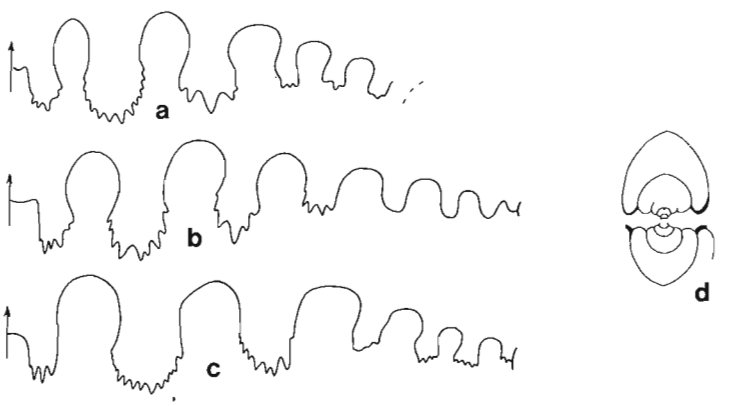

Figure 59. *Sutures and section. a–d.* ***Indigirites boehmi*** *n. sp. a, GSC 28594 (Pl. 76, fig. 8) x4. b, GSC 28598 (Pl. 76, fig. 9) x4. c, GSC 28599* x4. d, GSC 28600* x1.*

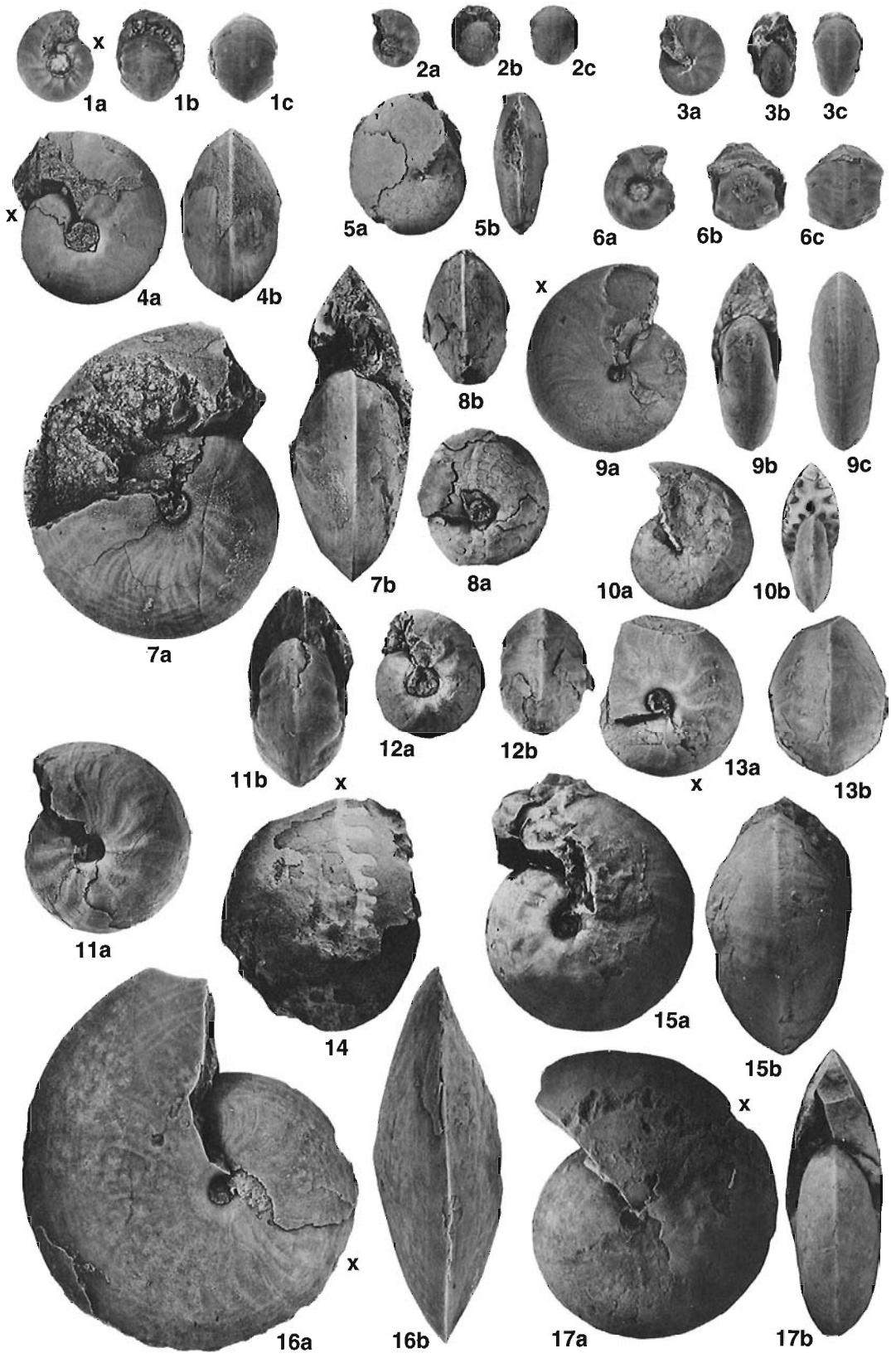
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PLATE 77

MIDDLE TRIASSIC
Ladinian–Maclearni Zone

Figures 1, 2. *Maclearnoceras maclearni* Tozer (Subzone 2) (Page 161)
1a, b. Holotype GSC 14297.
2. Paratype GSC 14296, sectional view showing inner whorls (x2).
Both from Liard Formation, Liard River, northeastern British Columbia (GSC loc. 42355).

Figures 3a, b. *Meginoceras caurinum* (McLearn) (Subzone uncertain) (Page 150)
Topotype(?) GSC 28667. Toad Formation, Beattie Ledge, Peace River, northeastern British Columbia (GSC loc. 9276).

Figures 4, 5. *Liardites whiteavesi* Tozer (Subzone 2) (Page 152)
4a, b. Hypotype GSC 28686, phragmocone and about one quarter whorl of body chamber. Liard Formation, Alaska Highway, northeastern British Columbia (GSC loc. 47486).
5a–c. Holotype GSC 14302. Liard Formation, Liard River, northeastern British Columbia (GSC loc. 42355).

Figures 6a–c. *Protrachyceras sikanianum* McLearn (Subzone 2) (Page 146)
Hypotype GSC 28861, last quarter whorl is internal mould with sculpture subdued by preseptal layer. Toad Formation, Boiler Canyon, Liard River, northeastern British Columbia (GSC loc. 68237).

Figure 7. *Clionitites*(?) *venerabilis* n. sp. (Subzone 2) (Page 174)
Holotype GSC 28688, sectional view showing inner whorl. Liard Formation, Liard River, northeastern British Columbia (GSC loc. 42355). (See also Pl. 79, figs. 1a, b.)

Figures 8, 9. *Anolcites impolitus* n. sp. (Subzone 1) (Page 156)
8a, b. Paratype GSC 28763, at least a quarter of a whorl is body chamber. Toad Formation, Boiler Canyon, Liard River, northeastern British Columbia (GSC loc. 68347).
9. Paratype GSC 28764. Toad Formation, Mount Withrow, northeastern British Columbia (GSC loc. 50042).

Figures 10a, b. *Nitanoceras compressum* n. sp. (Subzone 3) (Page 91)
Paratype GSC 32358, peristome is partly preserved (x2). Toad Formation, Boiler Canyon, Liard River, northeastern British Columbia (GSC loc. 68236).

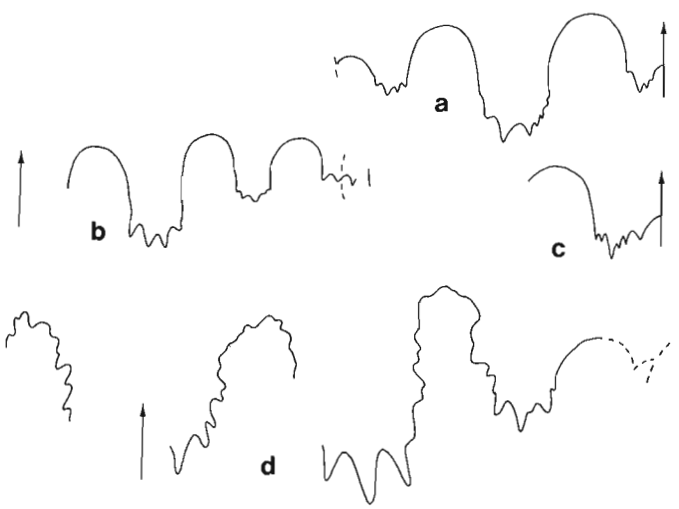

Figure 60. *Sutures. a,* ***Maclearnoceras maclearni*** *Tozer, GSC 14297 (Pl. 77, fig. 1) x4. b, c.* ***Liardites whiteavesi*** *Tozer. b, GSC 14301 (Tozer, 1963b, Pl. 6, fig. 8); c, GSC 14302 (Pl. 77, fig. 5). d,* ***Protrachyceras sikanianum*** *McLearn, GSC 28861 (Pl. 77, fig. 6).*

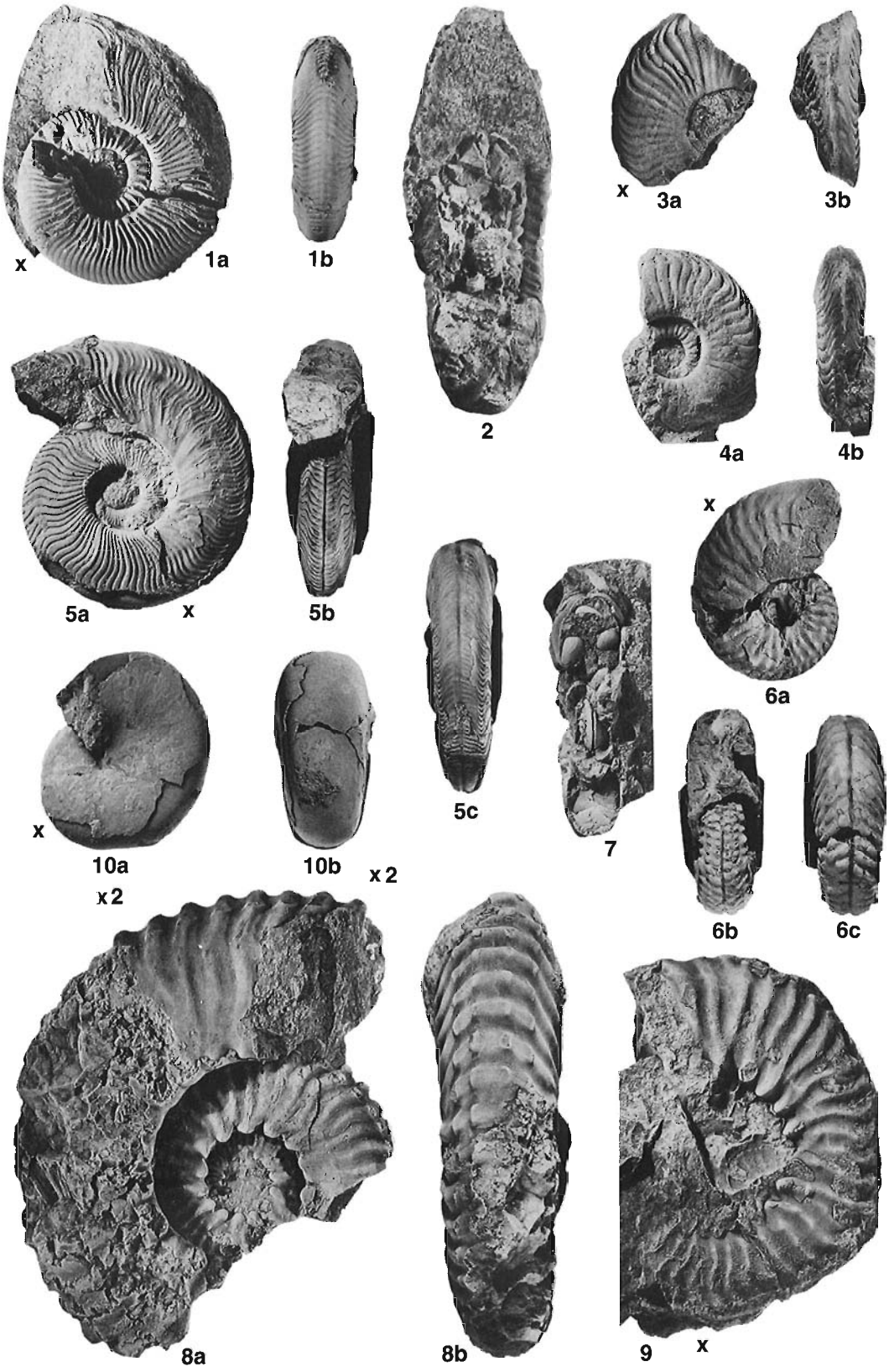
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PLATE 78

MIDDLE TRIASSIC
Ladinian–Maclearni Zone

Figures 1a–c. *Anolcites rasilis* n. sp. (Subzone 2) (Page 157)
Holotype GSC 28766. Toad Formation, Boiler Canyon, Liard River, northeastern British Columbia (GSC loc. 68237).

Figures 2, 3. *Anolcites angustus* n. sp. (Subzone 2) (Page 157)
2a–c. Holotype GSC 28765. Toad Formation, Boiler Canyon, Liard River, northeastern British Columbia (GSC loc. 68237).
3. Paratype GSC 28767, fragment of body chamber. Liard Formation, Liard River, northeastern British Columbia (GSC loc. 42355).

Figures 4a–c. *Meginoceras effervescens* n. sp. (Subzone 1) (Page 149)
Holotype GSC 28665. Toad Formation, Boiler Canyon, Liard River, northeastern British Columbia (GSC loc. 68242).

Figures 5a, b. *Meginoceras caurinum* (McLearn) (Subzone uncertain) (Page 150)
Holotype GSC 9548. Toad Formation, Beattie Ledge, Peace River, northeastern British Columbia (GSC locality not recorded).

Figures 6a–c. *Anolcites papillatus* n. sp. (Subzone 2?) (Page 158)
Holotype GSC 28769, mostly internal mould with sculpture on phragmocone and initial part of body chamber suppressed by preseptal layer. Liard Formation, near Alaska Highway, northeastern British Columbia (GSC loc. 36420).

Figures 7a–d. *Anolcites gemmatus* n. sp. (Subzone 2) (Page 158)
Holotype GSC 28768, arrow indicates end of preseptal layer. Liard Formation, Liard River, northeastern British Columbia (GSC loc. 42355).

Figures 8, 9. *Anolcites politus* n. sp. (Subzone 1) (Page 157)
8a, b. Holotype GSC 28762.
9a–c. Paratype GSC 28761, unbroken whorls are phragmocone, the remainder, body chamber.
Both from Toad Formation, Boiler Canyon, Liard River, northeastern British Columbia (GSC loc. 68242).

Figures 10, 11. *Anolcites impolitus* n. sp. (Subzone 1) (Page 156)
10a, b. Paratype GSC 28760, outer whorl is body chamber.
11a, b. Holotype GSC 28759, body chamber probably about half a whorl but septa are not visible.
Both from Toad Formation, Boiler Canyon, Liard River, northeastern British Columbia (GSC loc. 68242).

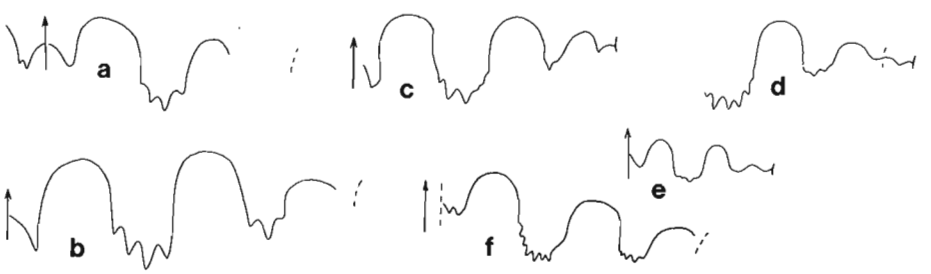

Figure 61. *Sutures. a, b.* ***Anolcites politus*** *n. sp. a, GSC 28762 (Pl. 78, fig. 8) x4; b, GSC 28761 (Pl. 78, fig. 9) x4; c,* ***Anolcites gemmatus*** *n. sp. GSC 28768 (Pl. 78, fig. 7) x4; d, e,* ***Anolcites angustus*** *n. sp., two sutures of GSC 28765 (Pl. 78, fig. 2); f,* ***Meginoceras effervescens*** *n. sp., GSC 28665 (Pl. 78, fig. 4) x4.*

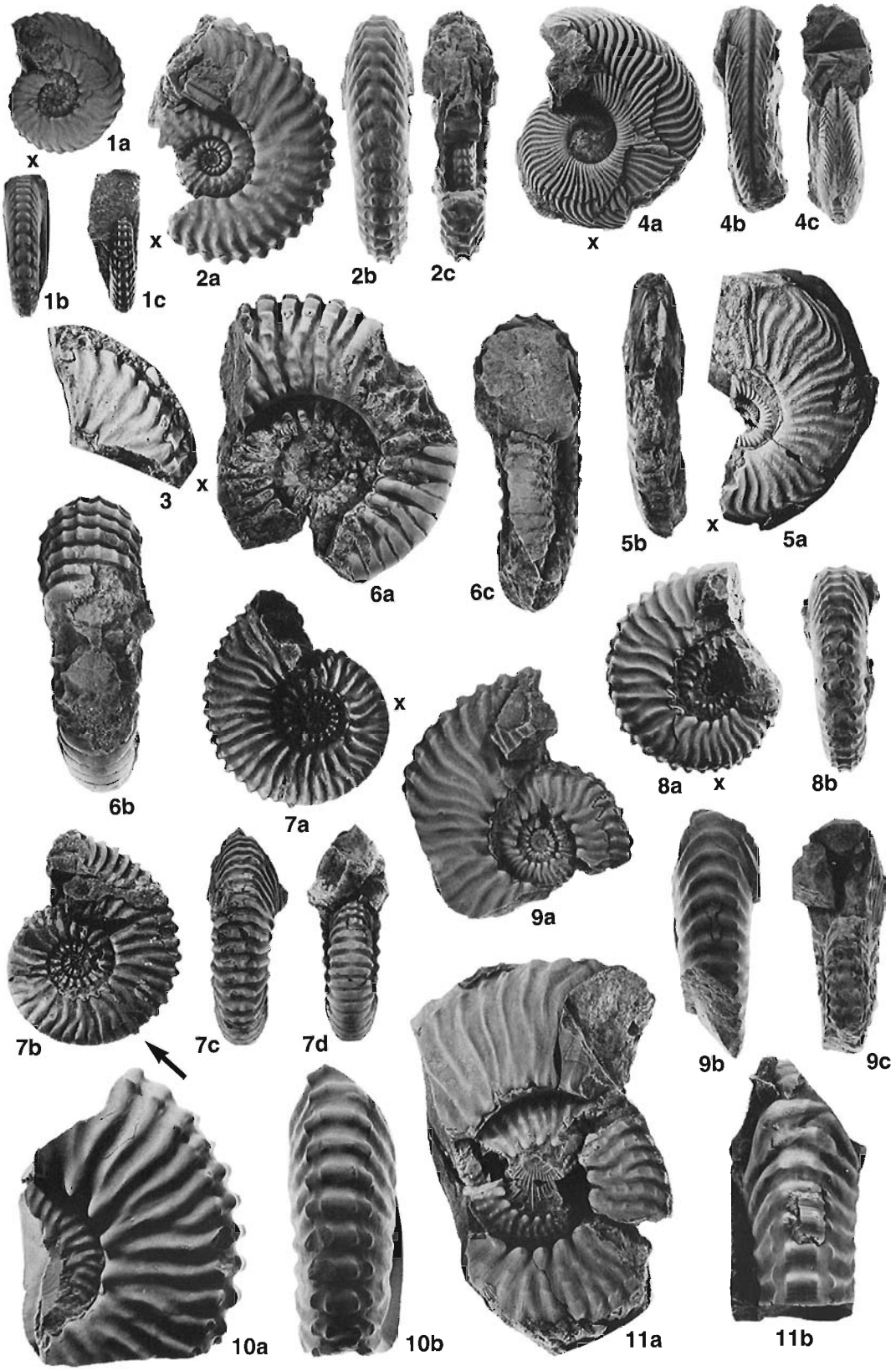
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PLATE 79

MIDDLE TRIASSIC
Ladinian–Maclearni Zone

Figures 1a, b. *Clionitites*(?) *venerabilis* n. sp. (Subzone 2) (Page 174)
Holotype GSC 28688. Liard Formation, Liard River, northeastern British Columbia (GSC loc. 42355) (See also Pl. 77, fig. 7.)

Figures 2–5. *Maclearnoceras ensio* n. sp. (Subzone 3) (Page 161)
2. Paratype GSC 28796, body chamber probably about half a whorl.
3a–d. Holotype GSC 28794, outer whorl preserved mainly as steinkern.
4a–c. Paratype GSC 28795, outer whorl mainly steinkern with some test on the flanks, body chamber about a quarter of a whorl.
5a, b. Paratype GSC 28797, preserved as steinkern with ventral sculpture subdued by preseptal layer except near aperture where layer of test indicates the relief of ribs.
All from Toad Formation, Boiler Canyon, Liard River, northeastern British Columbia (GSC loc. 68236).

Figures 6–13. *Otoarpadites auritus* n. sp. (Subzone 3) (Page 152)
6a, b. Paratype GSC 28672.
7a, b. Paratype GSC 28671.
8a, b. Paratype GSC 28673.
9. Paratype GSC 28670, complete phragmocone.
10a, b. Paratype GSC 28674.
11a, b. Paratype GSC 28669, phragmocone.
12a, b. Holotype GSC 28668, phragmocone and crushed body chamber.
13a, b. Paratype GSC 28675.
All from Toad Formation, Boiler Canyon, Liard River, northeastern British Columbia (GSC loc. 68236).

Figures 14, 15. *Protrachyceras sikanianum* McLearn (Subzone 2) (Page 146)
14a, b. Hypotype GSC 28639.
15a, b. Hypotype GSC 28640.
Both from Liard Formation, Liard River, northeastern British Columbia (GSC loc. 42355).

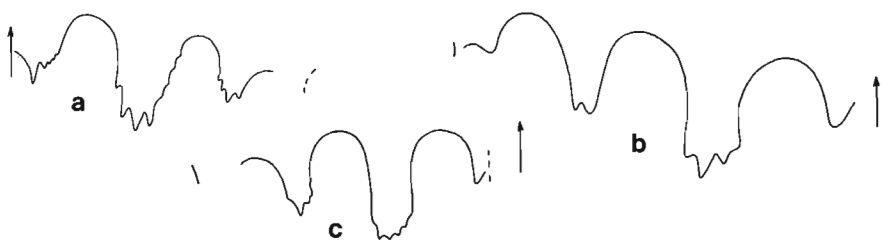

Figure 62. *Sutures. a,* ***Maclearnoceras ensio*** *n. sp., GSC 28794 (Pl. 79, fig. 3) x4; b,* ***Clionitites****(?)* ***venerabilis*** *n. sp., GSC 28688 (Pl. 79, fig. 1) x4; c,* ***Otoarpadites auritus*** *n. sp., GSC 28673 (Pl. 79, fig. 8) x4.*

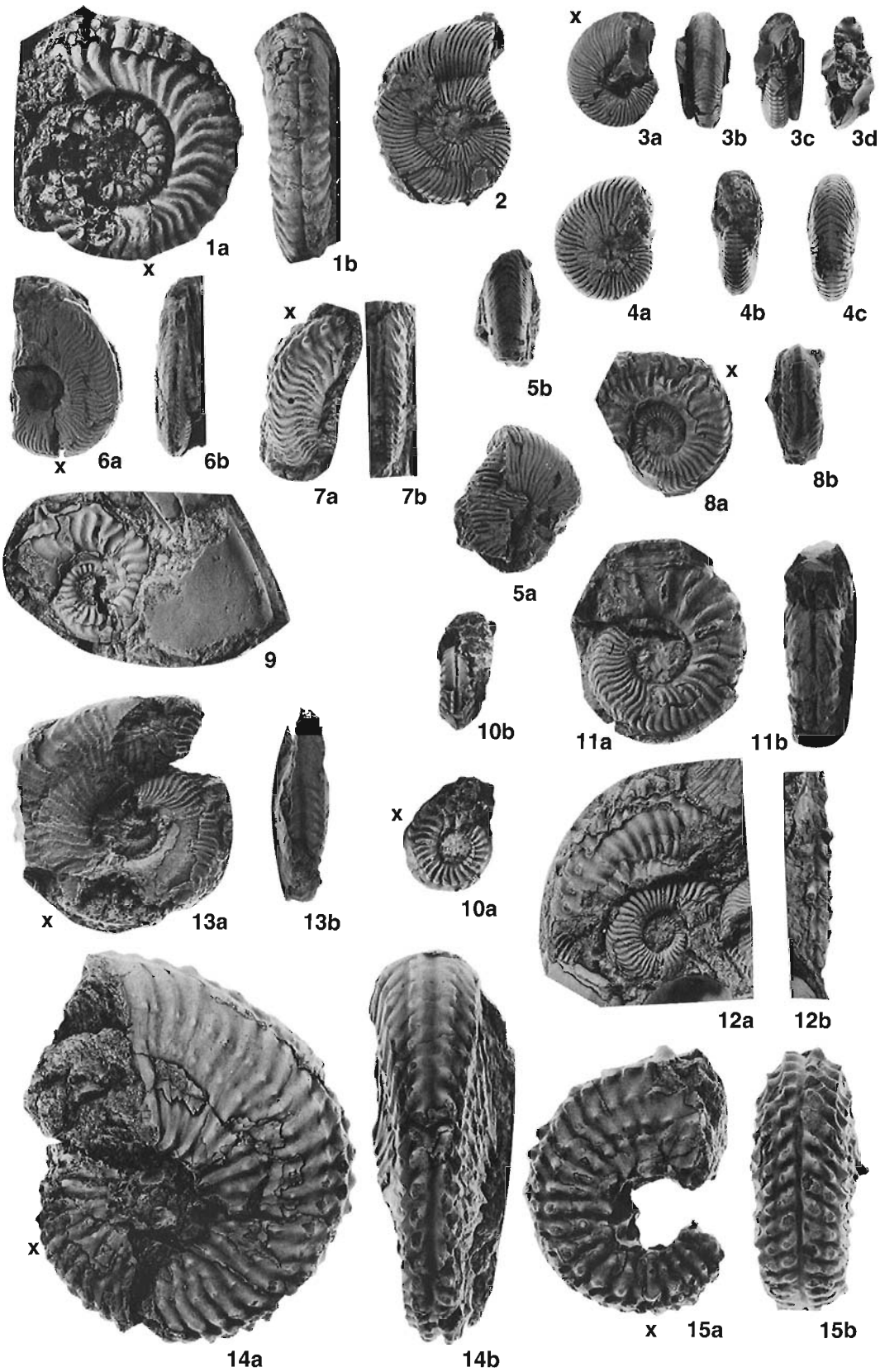
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PLATE 80

MIDDLE TRIASSIC
Ladinian–Maclearni Subzone 3

All specimens from Toad Formation, Boiler Canyon, Liard River, **northeastern British Columbia (GSC loc. 68236)**

Figures 1, 2. *Hungarites inermis* n. sp. (Page 124)
1a, b. Holotype GSC 28368.
2a, b. Paratype GSC 28369.

Figures 3a–c. *Asklepioceras exilis* n. sp. (Page 161)
Holotype GSC 28776.

Figures 4–6. *Asklepioceras altilis* n. sp. (Page 162)
4a–c. Paratype GSC 28779.
5a–c. Holotype GSC 28777.
6a, b. Paratype GSC 28778.

Figures 7, 8, 10. *Anolcites anguinus* n. sp. (Page 159)
7a–c. Paratype GSC 28771.
8a–c. Paratype GSC 28772.
10a–c. Holotype GSC 35362, at least half a whorl is body chamber.

Figures 9a, b. *Zestoceras nitidum* n. sp. (Page 159)
Holotype GSC 28770.

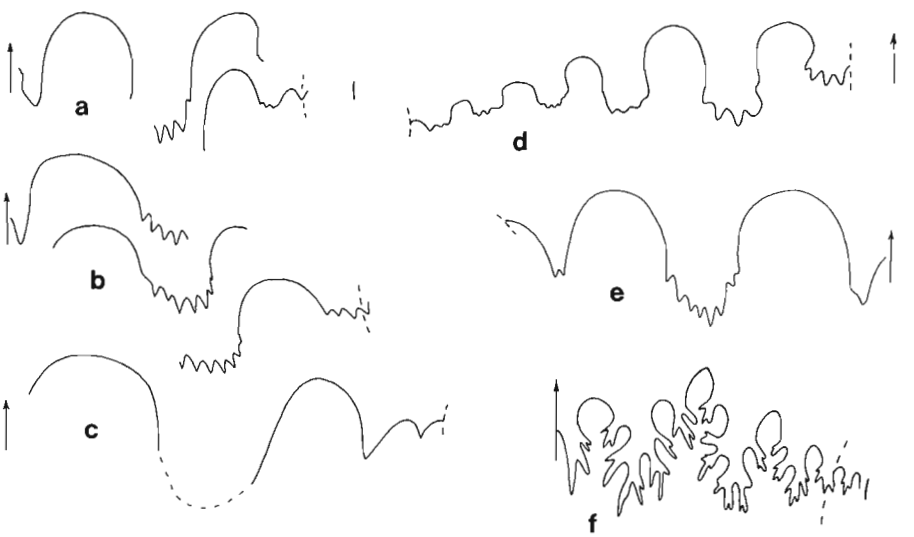

Figure 63. Sutures. a, ***Asklepioceras exilis*** n. sp., GSC 28776 (Pl. 80, fig. 3). b, c. ***Asklepioceras altilis*** n. sp. b, GSC 28777 (Pl. 80, fig. 5) x4; c, GSC 28779 (Pl. 80, fig. 4) x4; d, ***Hungarites inermis*** n. sp., GSC 28368 (Pl. 80, fig. 1) x4; e, ***Zestoceras nitidum*** n. sp., GSC 28770 (Pl. 80, fig. 9), x4; f, ***Monophyllites aonis*** Mojsisovics, GSC 32348* x2.

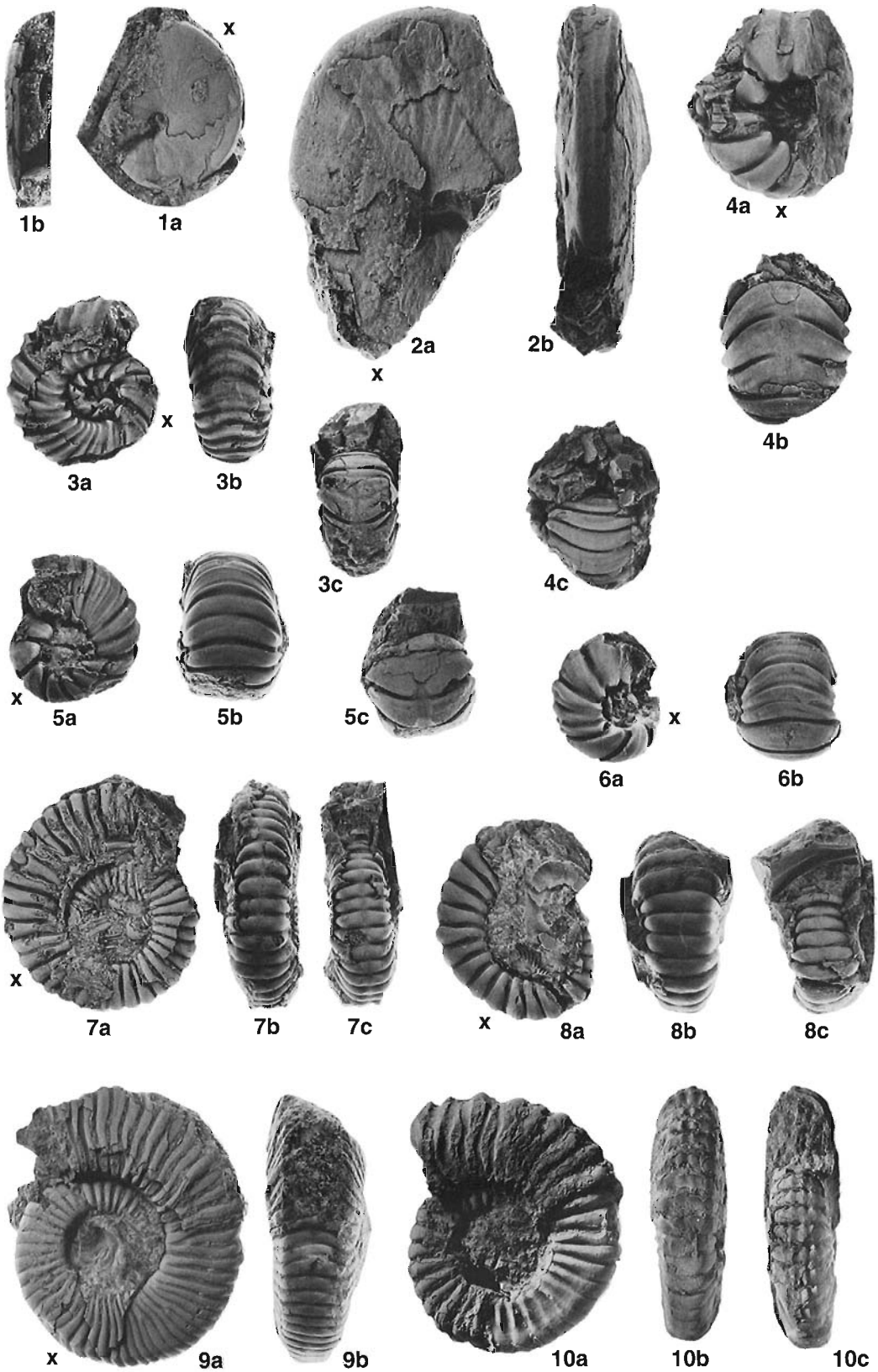
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PLATE 81

MIDDLE TRIASSIC
Ladinian–Maclearni Zone

Figures 1–8. *Nathorstites maclearni* n. sp. (Page 140)

1a–c. Paratype GSC 28611.

3a, b. Paratype GSC 28613.

4a–c. Paratype GSC 28612, 4a shows the occluded umbilicus, 4c is the other side, similarly oriented, showing the nature of the umblical area with the surface of the umbilical callus removed.

Figures 1, 3, 4 from Toad Formation, Boiler Canyon, Liard River, northeastern British Columbia (GSC loc. 68242) (Subzone 1).

2a, b. Paratype GSC 28608, body chamber one whorl.

5a, b. Paratype GSC 28609.

6a, b. Holotype GSC 28606.

7a–c. Paratype GSC 28610, 7c is umbilical area, illustrated as for figure 4, body chamber one whorl.

8a, b. Paratype GSC 28607, body chamber one whorl.

Figures 2, 5–8 from Liard Formation, Liard River, northeastern British Columbia (GSC loc. 42355) (Subzone 2).

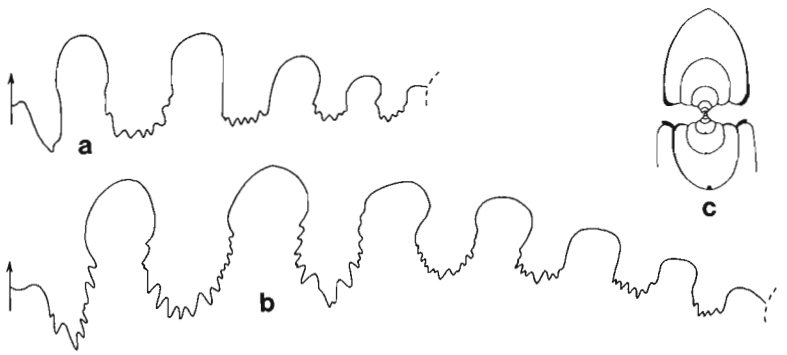

Figure 64. *Sutures and section.* ***Nathorstites maclearni*** *n. sp. a, GSC 28608 (Pl. 81, fig. 2) x4; b, GSC 28606 (Pl. 81, fig. 6) x4; c, GSC 28614* x1.*

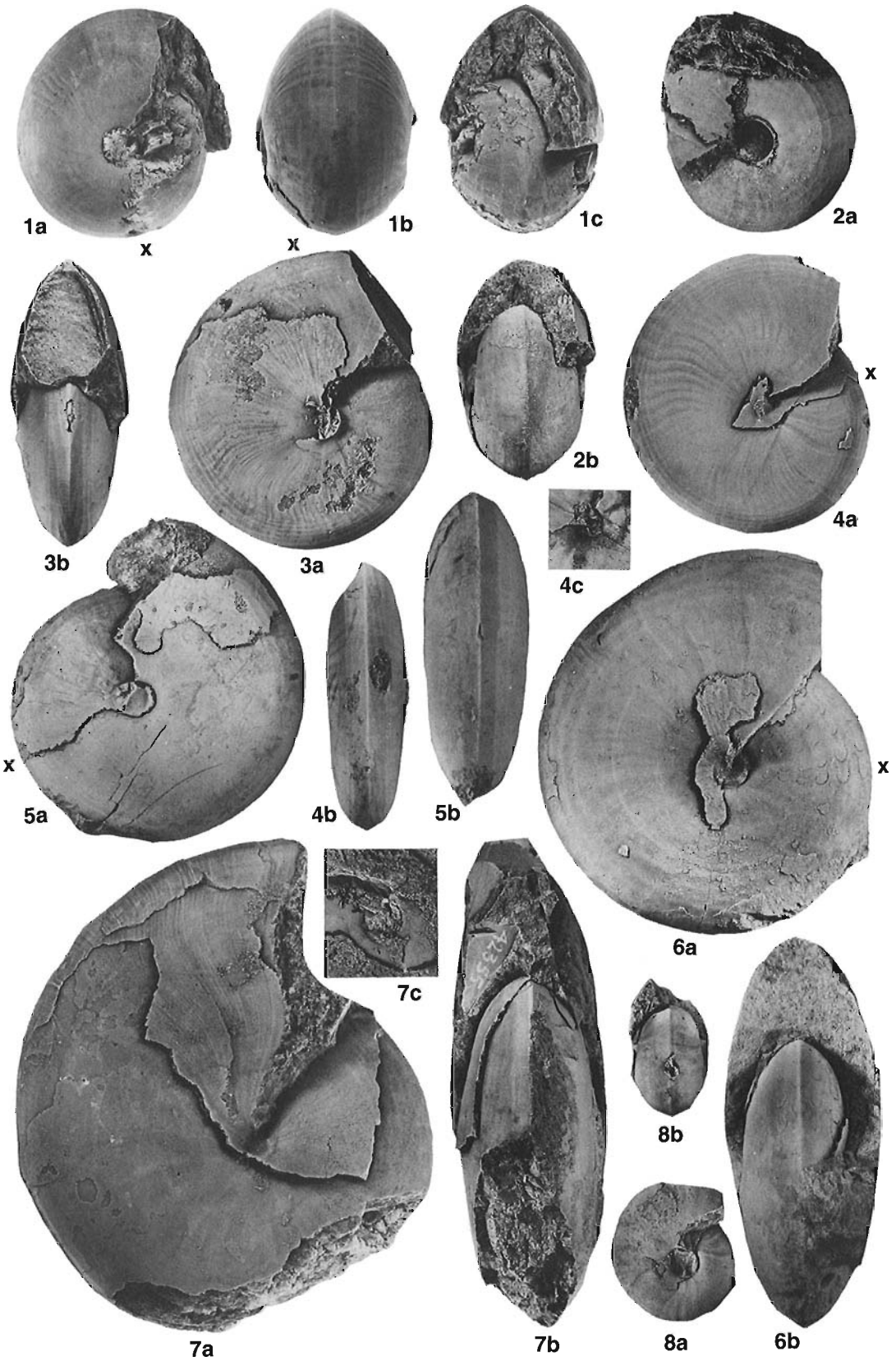
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PLATE 82

MIDDLE TRIASSIC
Ladinian–Sutherlandi Subzone 2

Figures 1a, b. *Sympolycyclus antiquus* n. sp. (Page 176)
Holotype GSC 28828, inner whorl is septate, outer, body chamber. Toad Formation, Liard River, northeastern British Columbia (GSC loc. 42335).

Figures 2, 3, 5. *Zestoceras enode* (Tozer) (Page 160)
2a–d. Holotype GSC 28024, thick preseptal layer has obliterated ribbing on much of the outer whorl where preserved as steinkern. Toad Formation, Boiler Canyon, Liard River, northeastern British Columbia (GSC loc. 68364).
3a, b. Hypotype GSC 28774 (GSC loc. 42351), rubber mould from external cast, septa not visible.
5a, b. Hypotype GSC 28775 (GSC loc. 89784), outer whorl is body chamber.
Figures 3, 5 from Liard Formation, Liard River, northeastern British Columbia.

Figures 4a–e. *Zestoceras cerastes* n. sp. (Page 160)
Holotype GSC 28773, 4d and 4e are of inner whorl removed. Toad Formation, Boiler Canyon, Liard River, northeastern British Columbia (GSC loc. 68363).

Figures 6, 7. *Daxatina megabrotheus* n. sp. (Page 166)
6a, b. Paratype GSC 28822. Toad Formation, Chischa River, northeastern British Columbia (GSC loc. 40084).
7a, b. Holotype GSC 28821. Liard Formation, Liard River, northeastern British Columbia (GSC loc. 89783).

Figures 8a–e. *Muensterites helenae* (Renz) (Page 163)
Hypotype GSC 28793, complete specimen, body chamber about three quarters of a whorl. Toad Formation, Tuchodi Lakes area, northeastern British Columbia (GSC loc. 68279).

Figures 9a, b. *Muensterites delicatulus* (McLearn) (Page 164)
Holotype GSC 9550, body chamber. Toad Formation, Sikanni Chief River, northeastern British Columbia (no GSC locality number).

Figure 10. *Frankites sutherlandi* (McLearn) (Page 165)
Hypotype GSC 18904, apertural view (x2). Liard Formation, Liard River, northeastern British Columbia (GSC loc. 42351). (For other views see Tozer, 1967, Pl. 8, figs. 11a–c.)

Figures 11–13. *Asklepioceras laurenci* McLearn (Page 162)
11a, b. Hypotype GSC 28782, phragmocone preserved as steinkern. Toad Formation, Boiler Canyon, Liard River, northeastern British Columbia (GSC loc. 68231).
12a, b. Hypotype GSC 28783. Toad Formation, Halfway River area, northeastern British Columbia (GSC loc. 82645).
13a, b. Hypotype GSC 28781, outer whorl preserves test. Toad Formation, Mount Ludington, northeastern British Columbia (GSC loc. 82612).

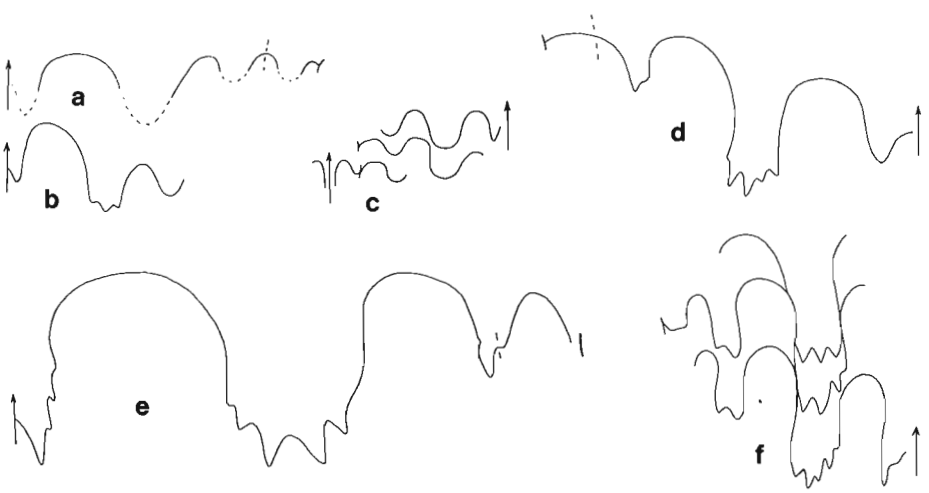

Figure 65. *Sutures. a, b,* ***Asklepioceras laurenci*** *McLearn. a, GSC 28781 (Pl. 82, fig. 13) x4; b, GSC 28782 (Pl. 82, fig. 11) x4; c,* ***Sympolycyclus antiquus*** *n. sp., GSC 28828 (Pl. 82, fig. 1) x4; d,* ***Zestoceras cerastes*** *n. sp., GSC 28773 (Pl. 81, fig. 4) x4; e,* ***Daxatina megabrotheus*** *n. sp., GSC 28821 (Pl. 82, fig. 7) x4; f,* ***Zestoceras enode*** *(Tozer), GSC 28024 (Pl. 82, fig. 2) x4.*

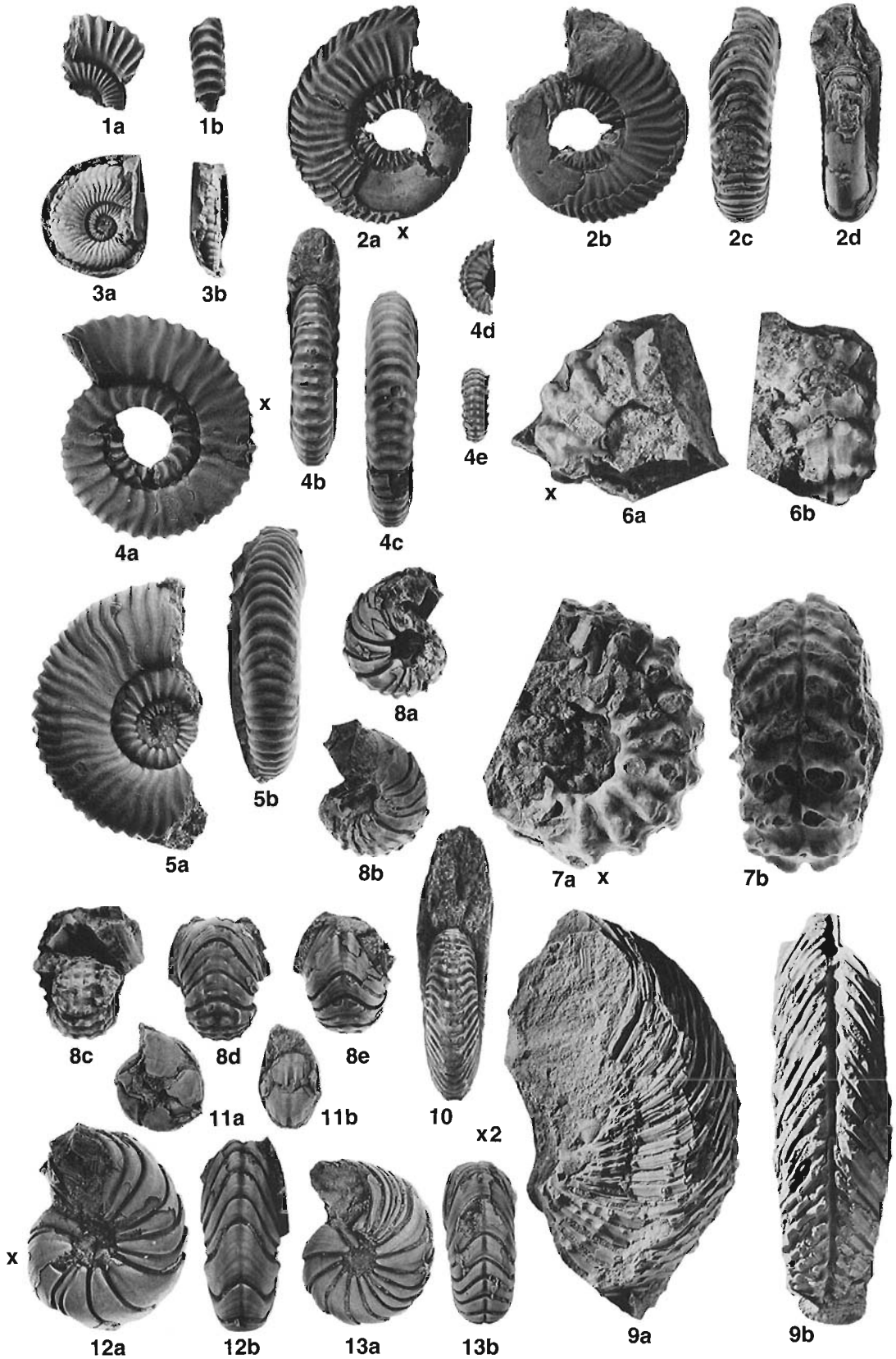
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PLATE 83

MIDDLE TRIASSIC
Ladinian–Sutherlandi Zone

Figures 1–7. *Asklepioceras laurenci* McLearn (Subzone 2) (Page 162)

1. Topotype GSC 9552 (GSC loc. 9800), paratype of *Asklepioceras mahaffii* McLearn, body chamber(?).
2a, b. Topotype GSC 9551 (GSC loc. 9797), holotype of *Asklepioceras mahaffii* McLearn.
3a, b. Topotype GSC 9533 (GSC loc. 9806).
5. Topotype GSC 9534 (GSC loc. 9797), fragment of body chamber.
6a, b. Topotype GSC 9535 (GSC loc. 9800), body chamber.
7a, b. Holotype GSC 8805 (GSC loc. 9806), body chamber.

Figures 1–3, 5–7 from Liard Formation, East Glacier Spur, Peace River, northeastern British Columbia.

4a–c. Hypotype GSC 28780, outer whorl is partly body chamber. Toad Formation, Mount Ludington, northeastern British Columbia (GSC loc. 46960).

Figures 8–12. *Frankites sutherlandi* (McLearn) (Subzone 2) (Page 165)

8a–c. Hypotype GSC 28801, mainly steinkern, body chamber about one quarter whorl.

10a–c. Hypotype GSC 28802, mainly steinkern, some test preserved on flank, subdued sculpture on steinkern to within one eighth volution from aperture is due to presence of preseptal later.

Figure 8, 10 from Toad Formation, Liard River, northeastern British Columbia (GSC loc. 68267).

9a, b. Hypotype GSC 28804, flanks preserve the test, venter mainly steinkern. Toad Formation, Halfway River area, northeastern British Columbia (GSC loc. 49998).

11. Hypotype GSC 28803, crushed specimen, phragmocone preserves test, body chamber mainly steinkern. Toad Formation, Boiler Canyon, Liard River, northeastern British Columbia (GSC loc. 68232).

12a, b. Hypotype GSC 28025, well preserved part is body chamber, some test preserved on flank, venter preserved mainly as steinkern, smooth part is attributed to development of preseptal layer (Tozer, 1972a, p. 650). Liard Formation, Liard River, northeastern British Columbia (GSC loc. 42352).

Figures 13–15. *Frankites glaber* n. sp. (Subzone 1) (Page 164)

13a–c. Paratype GSC 28800, preserved mainly as steinkern.

14a–c. Paratype GSC 28799, body chamber about half a whorl, preseptal layer thin or absent.

15a–c. Holotype GSC 28798, partly with test, partly steinkern, preseptal layer thick to within less than a quarter volution of the aperture.

All from Toad Formation, Boiler Canyon, Liard River, northeastern British Columbia (GSC loc. 68234).

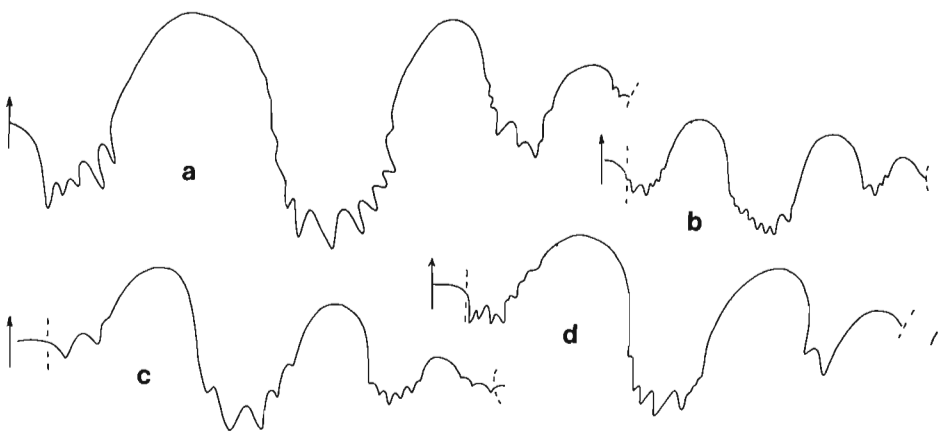

Figure 66. *Sutures. a,* ***Frankites glaber*** *n. sp., GSC 28798 (Pl. 83, fig. 15) x4; b–d.* ***Frankites sutherlandi*** *(McLearn). b, GSC 28802 (Pl. 83, fig. 10) x4; c, GSC 18903 (Tozer, 1967, Pl. 8, fig. 10) x4; d, GSC 9547 (Tozer, 1967, Pl. 8, fig. 12) x4.*

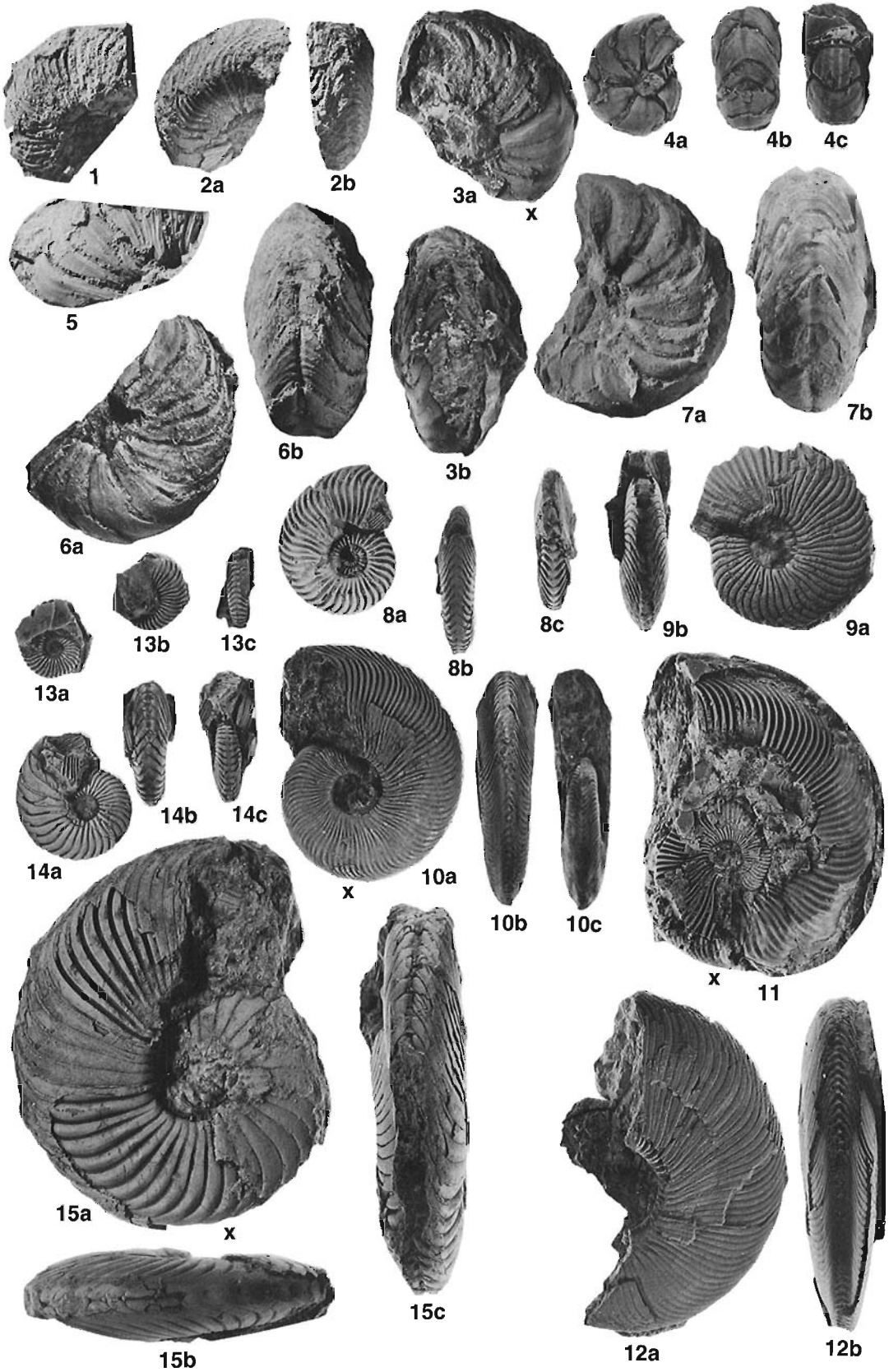
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PLATE 84

MIDDLE TRIASSIC
Ladinian–Sutherlandi Subzone 2

Figures 1–11. *Muensterites glaciensis* (McLearn) (Page 163)

1a–c. Topotype GSC 9536, one side, part of the other and venter; where ribs are smooth, the specimen is steinkern, where tuberculate, test is preserved, smooth surface being attributed to development of preseptal layer.

2a, b. Holotype GSC 8808, last quadrant is body chamber, with test preserved.

Figures 1, 2 from Liard Formation, "East Glacier Spur", Peace River, northeastern British Columbia (GSC loc. 9797).

3a, b. Hypotype GSC 28791, fragment of body chamber, mostly with test preserved.

4a–c. Hypotype GSC 28788, specimen preserving test.

5a–c. Hypotype GSC 28789, steinkern, sculpture is subdued due to preseptal layer except on last half whorl.

6a, b. Hypotype GSC 28785, steinkern.

7a, b. Hypotype GSC 28786, steinkern.

8a–c. Hypotype GSC 28784, mainly steinkern, outer whorl is body chamber.

9a–c. Hypotype GSC 28787, preserved partly with test, partly as steinkern.

10a–c, GSC 28790, preserved partly with test, partly as steinkern.

11a, b. Hypotype GSC 28792, phragmocone is steinkern, subdued sculpture is attributed to development of preseptal layer, body chamber preserves test.

Figures 3–11 from Toad Formation, Tuchodi Lakes area, northeastern British Columbia (GSC loc. 68279 = GSC loc. 79383).

Figure 67. *Suture.* ***Muensterites glaciensis*** *(McLearn), GSC 28792 (Pl. 84, fig. 11) x2.*

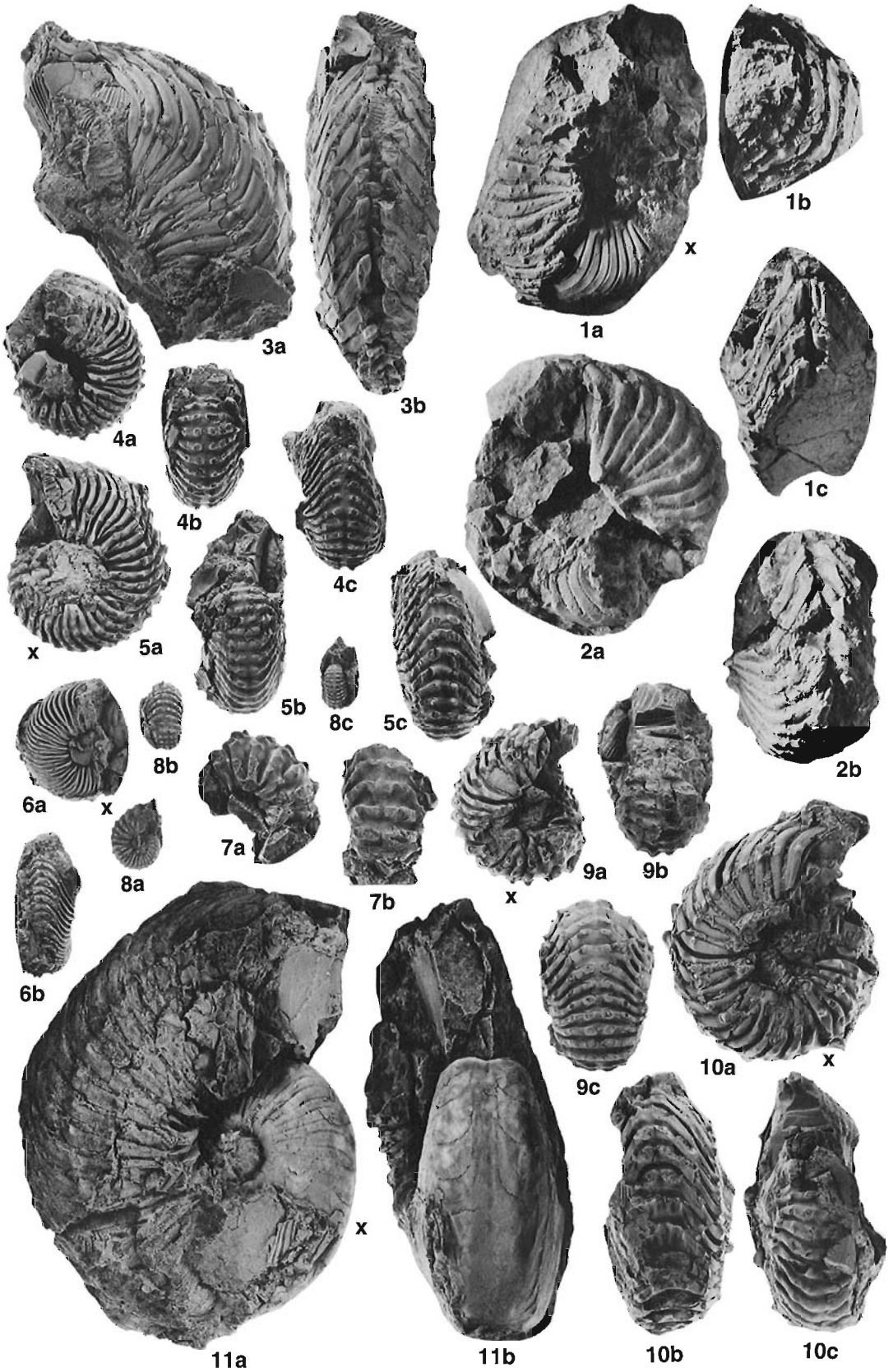
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PLATE 85

MIDDLE TRIASSIC
Ladinian–Sutherlandi Subzone 2

Figures 1a–c. *Daxatina laubei* n. sp. (Page 166)
Holotype GSC 28805, preserved mainly as steinkern. Toad Formation, Middle Canyon, Liard River, British Columbia (GSC loc. 68267).

Figures 2–9. *Daxatina canadensis* (Whiteaves) (Page 165)
2a–c. Hypotype GSC 28806, phragmocone preserving test. Toad Formation, Boiler Canyon, Liard River, British Columbia (GSC loc. 68231).
3a, b. Hypotype GSC 28807, preserved mainly as steinkern. Toad Formation, Boiler Canyon, Liard River, British Columbia (GSC loc. 68229).
4a, b. Hypotype GSC 28810, steinkern. Toad Formation, Middle Canyon, Liard River, British Columbia (GSC loc. 42335).
5. Hypotype GSC 28811, rubber mould from natural cast of venter. Liard Formation, Ewe Mountain, British Columbia (GSC loc. 42316).
6a, b. Hypotype GSC 28812, phragmocone preserves the test, body chamber mainly steinkern. Toad Formation, Mount Stearns, British Columbia (GSC loc. 16002).
7a, b. Hypotype GSC 28808, preserved mainly as steinkern, subdued sculpture on initial part of body chamber is attributed to development of preseptal layer. Toad Formation, Boiler Canyon, Liard River, British Columbia (GSC loc. 68229)
8a, b. Hypotype GSC 28813, preserved partly with test, partly as steinkern. Toad Formation, Middle Canyon, Liard River, British Columbia (GSC loc. 68264).
9a, b. Hypotype GSC 28814, phragmocone preserves test, body chamber mainly steinkern, arrow indicates end of preseptal layer. Toad Formation, Middle Canyon, Liard River, northeastern British Columbia (GSC loc. 68264).

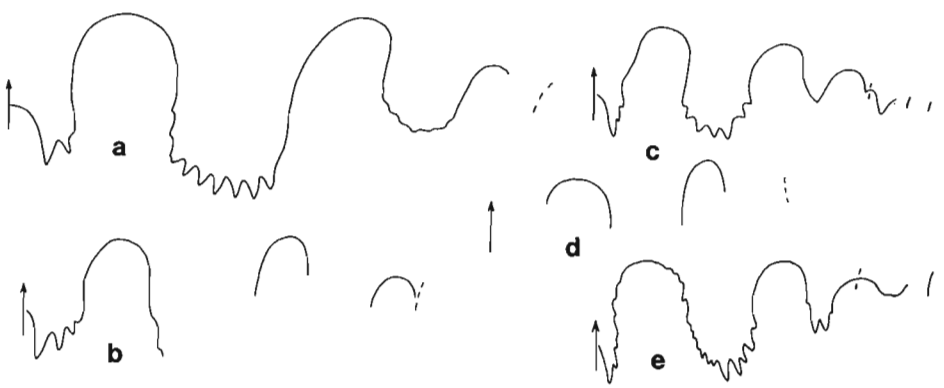

Figure 68. *Sutures. a,* ***Daxatina laubei*** *n. sp., GSC 28805 (Pl. 85, fig. 1) x4. b–e.* ***Daxatina canadensis*** *(Whiteaves). b, GSC 28814 (Pl. 85, fig. 9) x2; c, GSC 4718 (Tozer, 1970, Pl. 17, fig. 21) x2; d, GSC 28809* x2; e, GSC 28810 (Pl. 85, fig. 4) x2.*

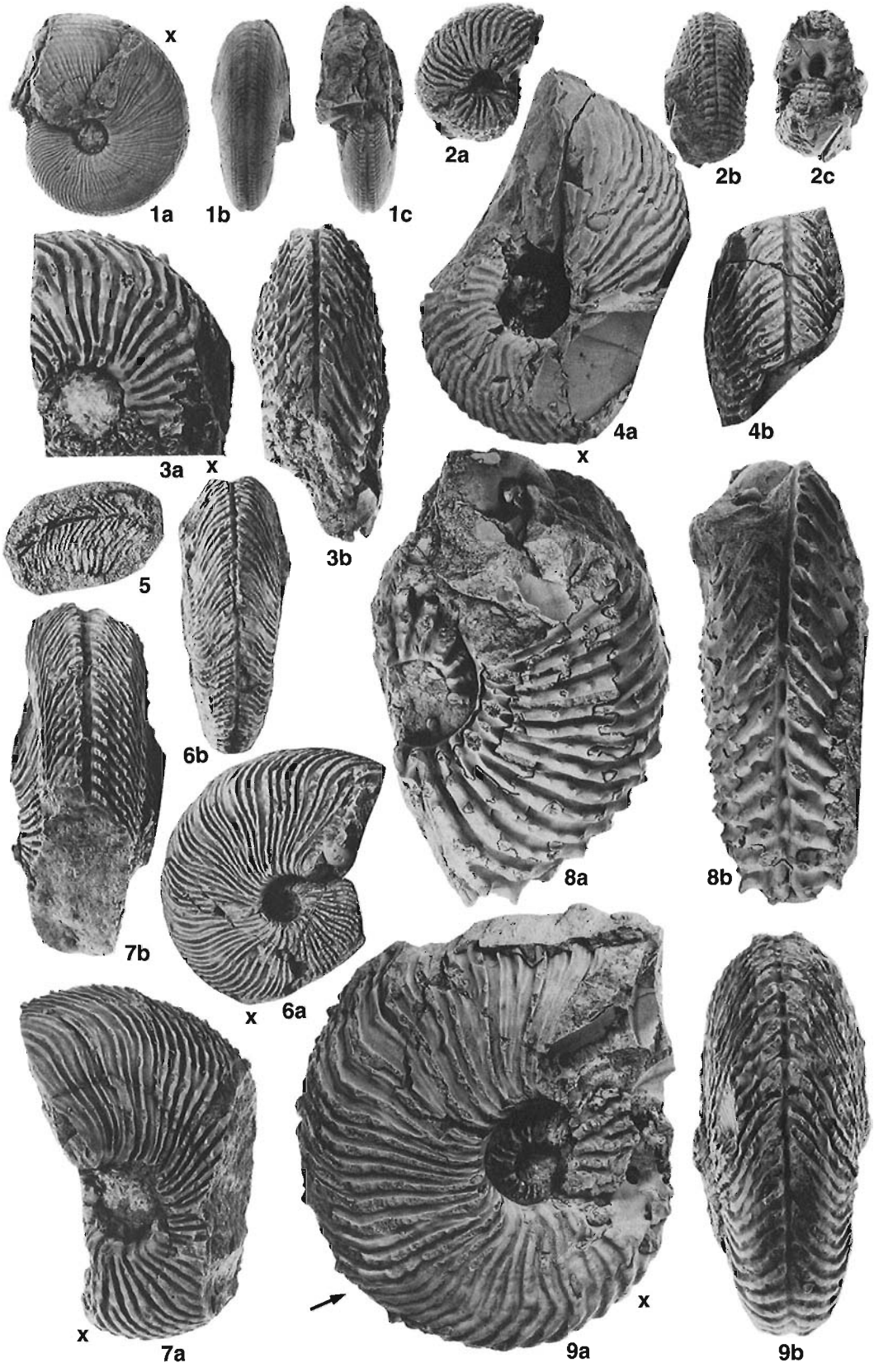
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PLATE 86

MIDDLE TRIASSIC
Ladinian–Sutherlandi Subzone 2

Figures 1–7. *Nathorstites macconnelli* (Whiteaves) (Page 141)

1a, b. GSC 4721, holotype of *Popanoceras mcconnelli* var. *lenticulare* Whiteaves 1889.

2a, b. Holotype GSC 4716, outer whorl is wholly body chamber.

Figures 1, 2 from Liard Formation, "about 30 miles below Devil's Portage", Liard River, northeastern British Columbia (See note, below.)

3a, b. Hypotype GSC 28232 (GSC loc. 42334), small specimen complete with peristome, dissection shows body chamber to be one and one eighth of a whorl.

4a, b. GSC 28015 (GSC loc. 42335), specimen with well preserved wrinkle-layer (runzelschicht).

Figures 3, 4 from Toad Formation, Liard River, northeastern British Columbia.

5a, b. Topotype GSC 28618, body chamber one and one eighth of a whorl.

6a, b. Topotype GSC 28014, body chamber more than one whorl.

7. Topotype GSC 28619, apertural view of the largest known specimen, body chamber more than one whorl. Liard Formation, east limb of anticline, north side Liard River, two miles above Hell Gate Rapids (GSC loc. 42351).

Note: Despite the fact that this locality is about 22, not 30 miles below the Devil's Portage, it appears to be where R.G. McConnell collected the holotype. The discrepancy is due to small inaccuracies in the distances given on McConnell's map.

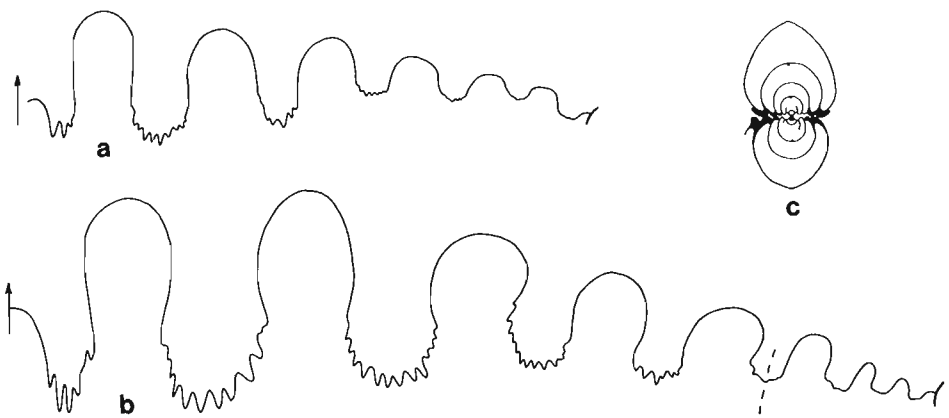

Figure 69. *Sutures and section.* ***Nathorstites macconnelli*** *(Whiteaves). a, GSC 28015 (Pl. 86, fig. 4) x4. b, GSC 28618 (Pl. 86, fig. 5) x4. c, GSC 28027* x1.*

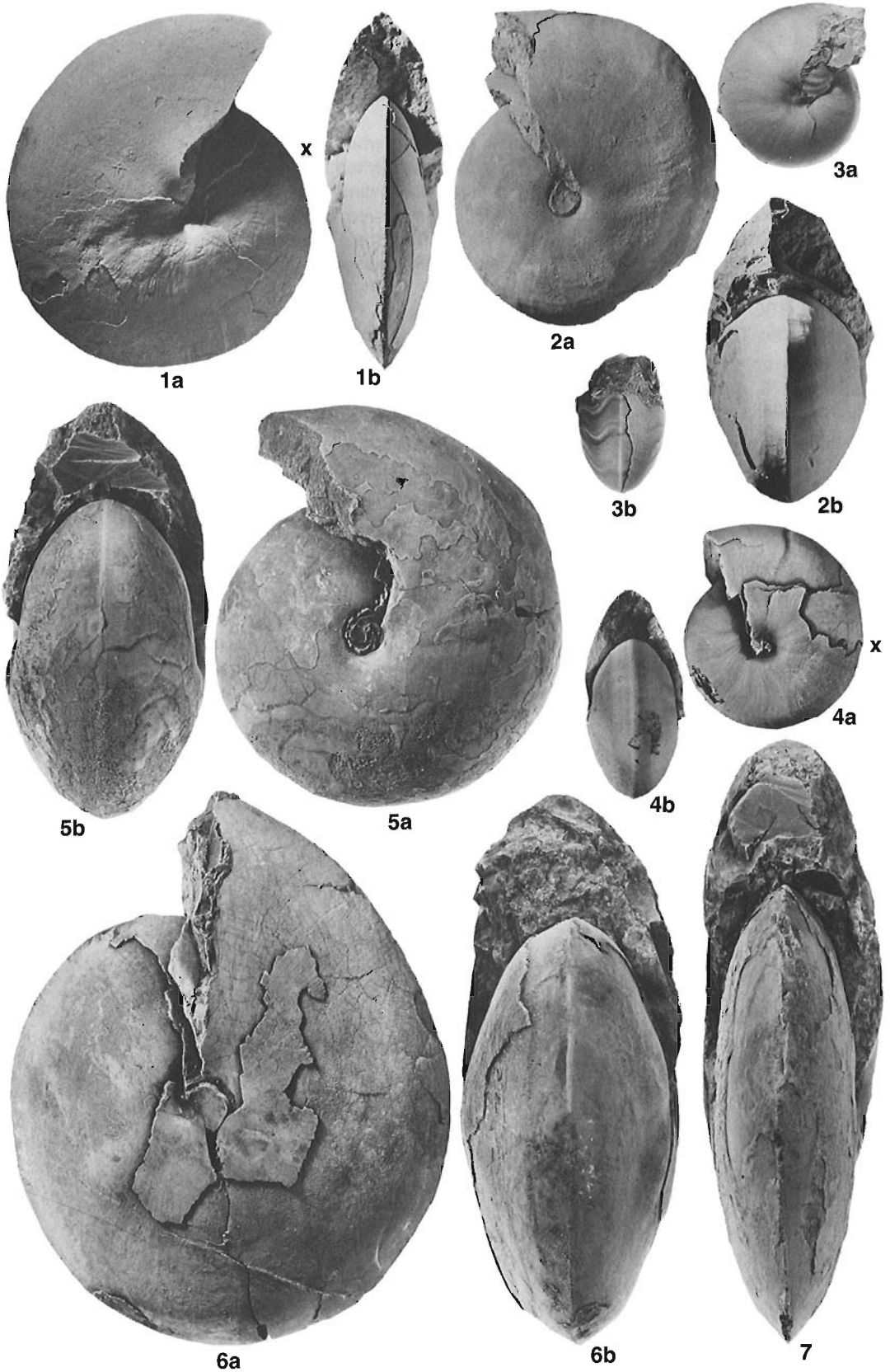
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PLATE 87

MIDDLE TRIASSIC
Ladinian–Sutherlandi Zone

Figures 1–8. *Nathorstites macconnelli* (Whiteaves) (Subzone 2) (Page 141)
1a, b. Topotype GSC 28615, body chamber one whorl.
4a, b. Topotype GSC 28616, body chamber more than one whorl.
6a, b. Topotype GSC 28617, body chamber more than one whorl.
7a, b. GSC 4716a (R.G. McConnell collection), steinkern showing umbilical area with most of callus removed.
8a, b. Topotype GSC 21769, body chamber more than one whorl, umbilicus occluded.
Figures 1, 4, 6–8 from Liard Formation, Liard River, northeastern British Columbia (GSC loc. 42351).
2a, b. Hypotype GSC 28621 (GSC loc. 42335), small phragmocone.
3a, b. Hypotype GSC 28622 (GSC loc. 42335).
5a, b. Hypotype GSC 28620 (GSC loc. 42334), phragmocone.
Figures 2, 3, 5 from Toad Formation, Liard River, northeastern British Columbia.

Figures 9a–c. *Nitanoceras compressum* n. sp. (Subzone 1) (Page 91)
Holotype GSC 28278, complete specimen with peristome. Toad Formation, Boiler Canyon, Liard River, northeastern British Columbia (GSC loc. 68234).

Figures 10a, b. *Lobites* sp. indet. (Subzone 2) (Page 211)
GSC 28954. Toad Formation, Liard River, northeastern British Columbia (GSC loc. 42335).

Figures 11–16. *Lobites ellipticus* (Hauer) (Subzone 2) (Page 211)
11a, b. Hypotype GSC 28948. Toad Formation, Boiler Canyon, Liard River, northeastern British Columbia (GSC loc. 68230).
12a, b. Hypotype GSC 28952. Toad Formation, Tuchodi Lakes area, northeastern British Columbia (GSC loc. 68280).
13a, b. Hypotype GSC 28951. Toad Formation, Boiler Canyon, Liard River (GSC loc. 68229).
14a, b. Hypotype GSC 28949, incomplete specimen showing phragmocone.
15a–c. Hypotype GSC 28950, complete with peristome.
Figures 14, 15 from Liard Formation, Liard River, northeastern British Columbia (GSC loc. 42351).
16a, b. Hypotype GSC 28953, unusually large, incomplete specimen. Toad Formation, Tetsa River, northeastern British Columbia (GSC loc. 36399).

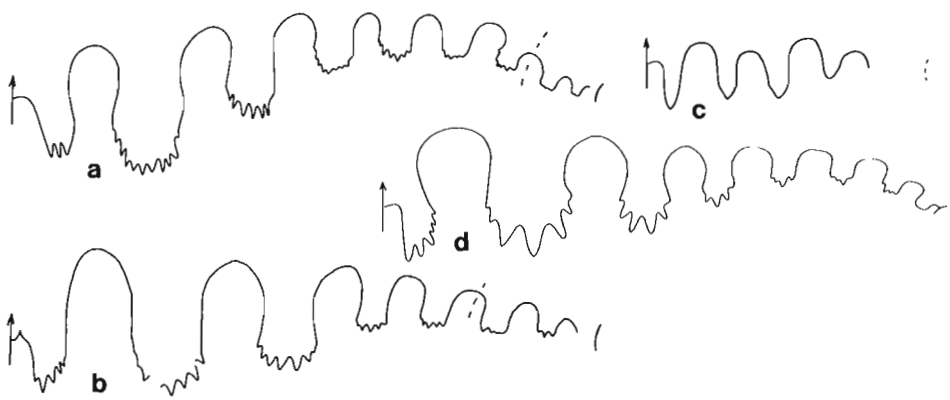

Figure 70. *Sutures. a, b.* ***Nathorstites macconnelli*** *(Whiteaves). a, GSC 28230 (Tozer, 1972, Pl. 1, figs. 7, 8) x4; b, GSC 4716a (Pl. 87, fig. 7) x4; c,* ***Lobites ellipticus*** *(Hauer), GSC 28949 (Pl. 87, fig. 14) x2; d,* ***Nitanoceras compressum*** *n. sp., GSC 28278 (Pl. 87, fig. 9) x8.*

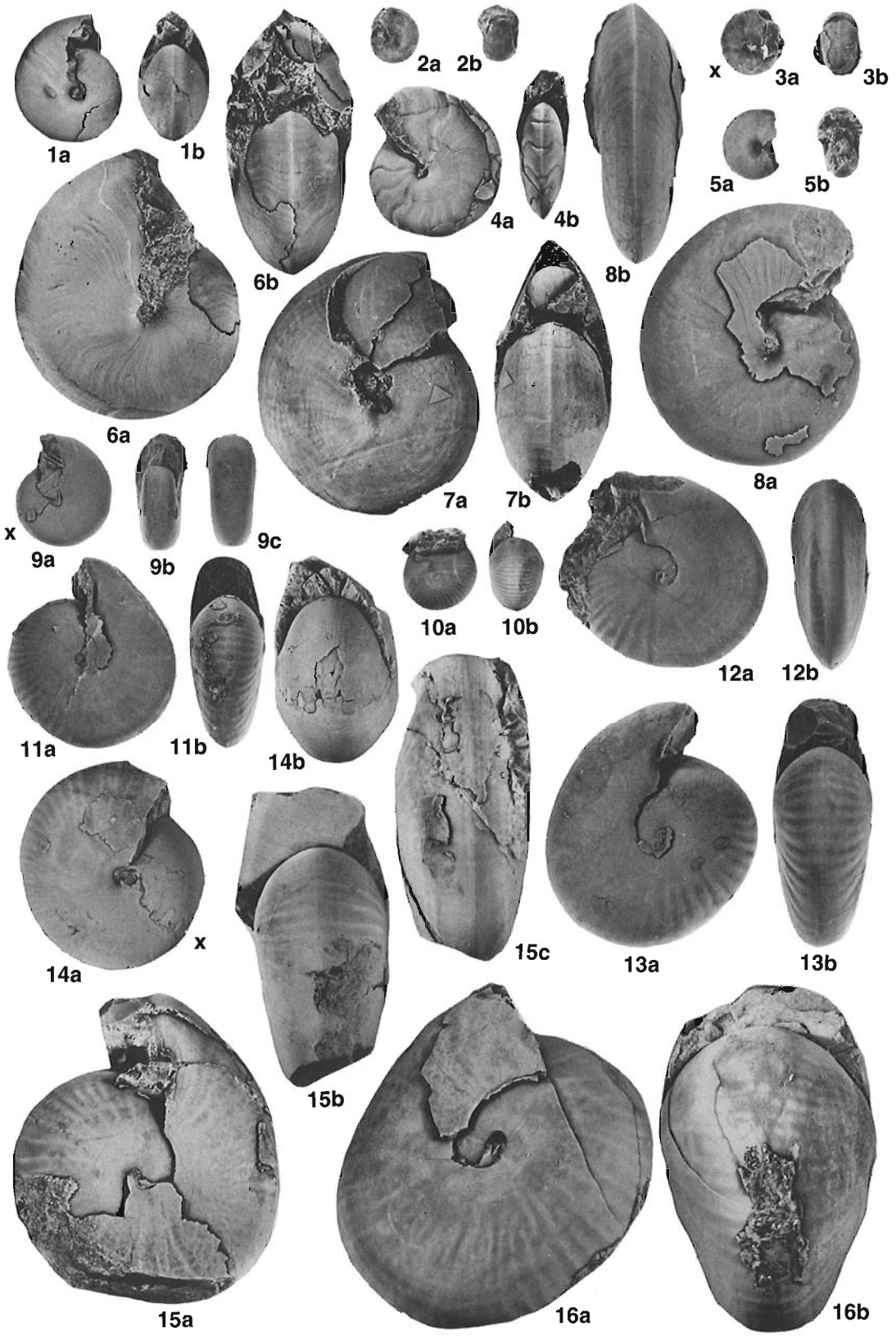
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PLATE 88

UPPER TRIASSIC
Lower Carnian–Desatoyense Zone

All specimens from Liard Formation, Callazon Creek area, northeastern British Columbia

Figures 1–3. *Clionitites callazonensis* n. sp. (Page 174)
1a–c. Holotype GSC 28689.
2a–c. Paratype GSC 28690, mostly or wholly phragmocone.
3a, b. Paratype GSC 28691.
All from GSC loc. 83824.

Figures 4–8. *Clionitites reesidei* (Johnston) (Page 175)
4a, b. Hypotype GSC 28694 (GSC loc. 83824).
5a, b. Hypotype GSC 28695 (GSC loc. 83824).
6. Hypotype GSC 28696 (GSC loc. 84271), phragmocone and crushed body chamber.
7a, b. Hypotype GSC 28692 (GSC loc. 45751).
8a–c. Hypotype GSC 28693 (GSC loc. 45751).
None except GSC 28696 show septa clearly.

Figures 9a, b. *Silenticeras involutum* n. sp. (Page 151)
Holotype GSC 28685 (GSC loc. 83870), phragmocone (x2).

Figures 10, 11. *Coroceras* sp. indet. (Page 212)
10. GSC 28955 (x2).
11a–c. GSC 28956 (x2). (Both GSC loc. 83824.)

Figures 12a, b. *Stolleyites* sp. indet. (Page 142)
GSC 28623 (GSC loc. 83824), phragmocone.

Figures 13a, b. *Protrachyceras*(?) sp. indet. (Page 339)
GSC 28641 (GSC loc. 84271), phragmocone.

Figures 14a, b. *Trachyceras*(?) sp. indet. (Page 339)
GSC 28820 (GSC loc. 84268), body chamber(?).

Figures 15–19. *Daxatina limpida* n. sp. (Page 167)
15a–c. Paratype GSC 28817, phragmocone(?).
16a, b. Holotype GSC 28815.
17a, b. Paratype GSC 28816, phragmocone.
Figures 15–17 from GSC loc. 83824.
18a, b. Hypotype GSC 28819 (GSC loc. 84271), phragmocone.
19. Hypotype GSC 28818 (GSC loc. 83868), fragment of body chamber.

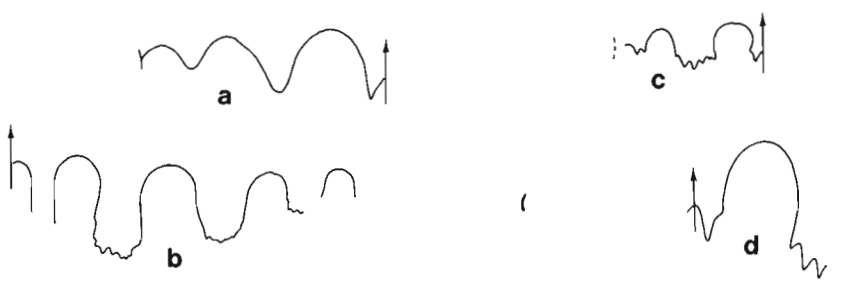

Figure 71. *Sutures. a,* ***Clionitites callazonensis*** *n. sp., GSC 28689 (Pl. 88, fig. 1) x4; b,* ***Stolleyites*** *sp. indet., GSC 28623 (Pl. 88, fig. 12) x4; c, d.* ***Daxatina limpida*** *n. sp. c, GSC 28817 (Pl. 88, fig. 15) x4; d, GSC 288l9 (Pl. 88, fig. 18) x4.*

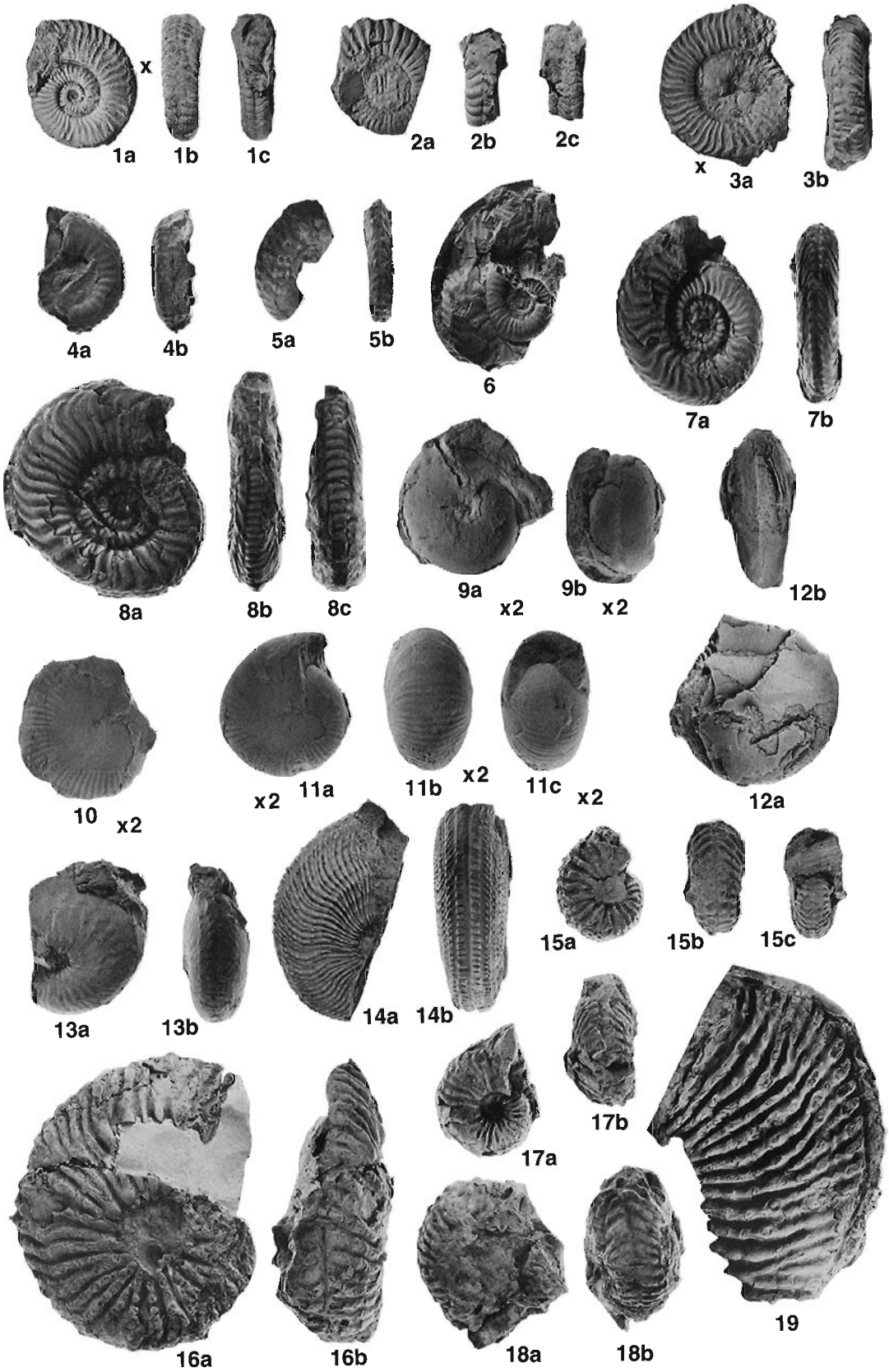
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PLATE 89

UPPER TRIASSIC
Lower Carnian–Desatoyense Zone

Figures 1a–c. *Coroceras nasutum* (Mojsisovics) (Page 211)
Hypotype GSC 28957, complete with peristome. Liard Formation, Callazon Creek area, northeastern British Columbia (GSC loc. 45745).

Figures 2, 3. *Badiotites scapulatus* n. sp. (Page 125)
2a, b. Holotype GSC 28561.
3a, b. Paratype GSC 28562.
Both from Liard Formation, Callazon Creek area, northeastern British Columbia (GSC loc. 84267).

Figures 4–7. *Trachyceras desatoyense* Johnston (Page 168)
4a, b. Hypotype GSC 28823. Ludington Formation, ridge west of Ewe Mountain, northeastern British Columbia (GSC loc. 68217).
5. Hypotype GSC 28826, body chamber.
6a, b. Hypotype GSC 28825, body chamber about half a whorl.
7a, b. GSC 28824, body chamber.
Figures 5–7 from Liard Formation, Callazon Creek area, northeastern British Columbia (GSC loc. 84269).

Figure 8. *Trachyceras aonoides* Mojsisovics (Page 168)
Hypotype GSC 28827, phragmocone with part of body chamber. Liard Formation, Callazon Creek area, northeastern British Columbia (GSC loc. 83872).

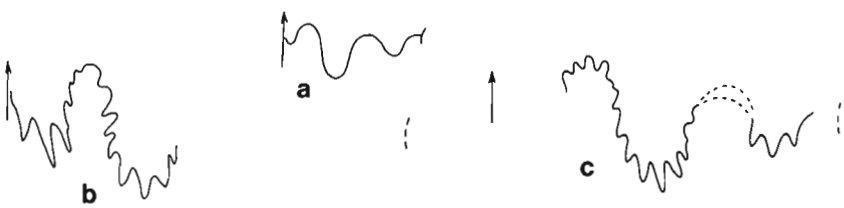

Figure 72. *Sutures. a,* ***Badiotites scapulatus*** *n. sp., GSC 28561 (Pl. 89, fig. 2) x4; b,* ***Trachyceras aonoides*** *Mojsisovics, GSC 28827 (Pl. 89, fig. 8) x2; c,* ***Trachyceras desatoyense*** *Johnston, GSC 28823 (Pl. 89, fig. 4) x2.*

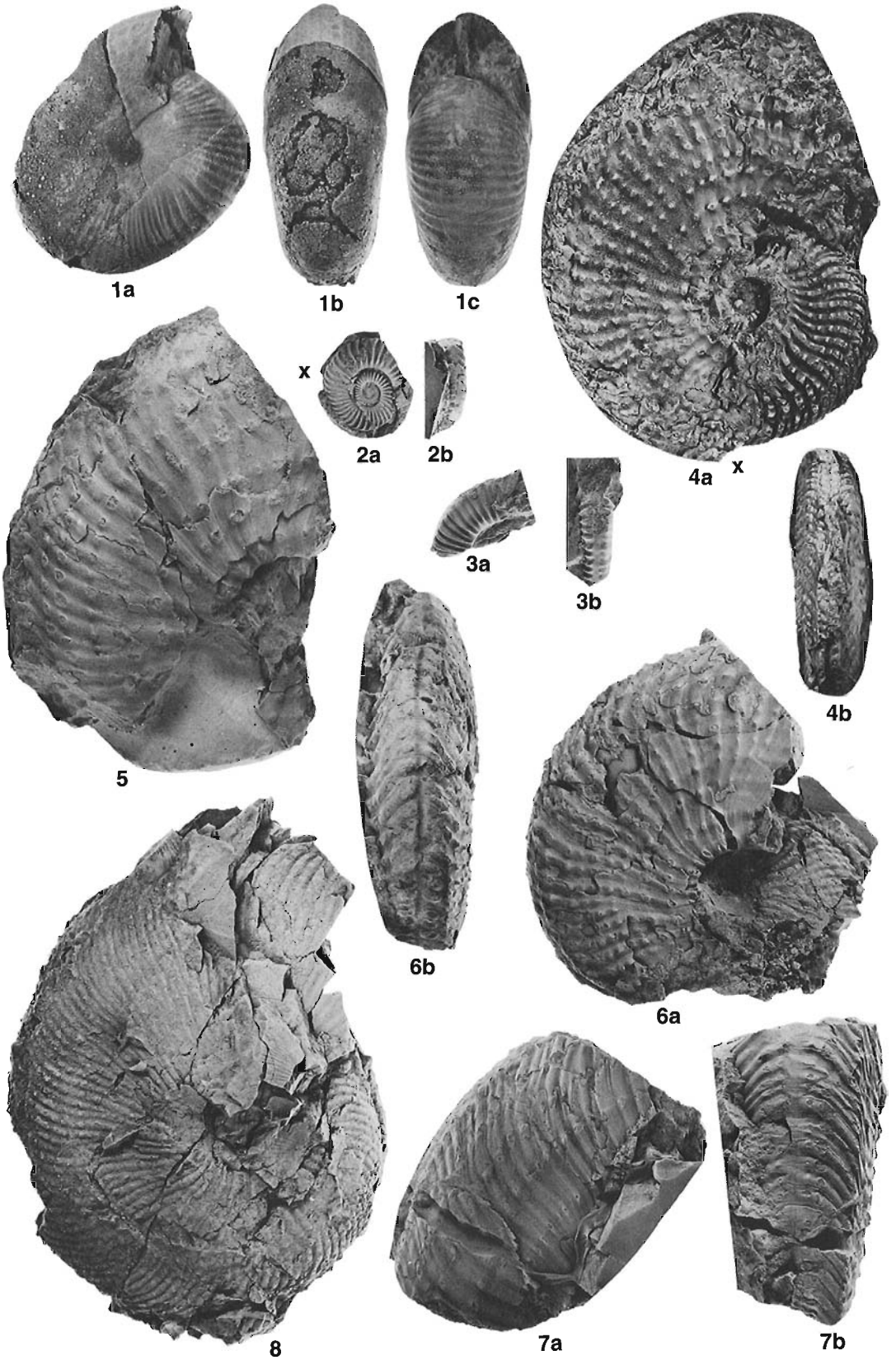
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PLATE 90

UPPER TRIASSIC
Lower Carnian, Desatoyense and Obesum zones

Figure 1. *Trachyceras desatoyense* Johnston (Desatoyense Zone) (Page 168)
Hypotype GSC 72166, last half whorl is probably body chamber. Liard Formation, north of Clearwater Lake, northeastern British Columbia (GSC loc. 84212).

Figures 2, 3, 5, 6. *Austrotrachyceras obesum* (Tozer) (Obesum Zone) (Page 168)
2a, b. Hypotype GSC 72170, fragment of body chamber.
3. Hypotype GSC 72169, venter, rubber cast.
Figures 2, 3 from Liard Formation, north of Clearwater Lake, northeastern British Columbia (GSC loc. 84200).
5. Hypotype GSC 72168, venter. Ludington Formation, lower slope of Mount McLearn, northeastern British Columbia. (GSC loc. 68209).
6a, b. Holotype GSC 14311, body chamber. Ludington Formation, Ewe Mountain, northeastern British Columbia (GSC loc. 42308).

Figure 4. *Sirenites* sp. indet. (Obesum Zone) (Page 169)
GSC 72167. Ludington Formation, lower slope of Mount McLearn, northeastern British Columbia (GSC loc. 68209).

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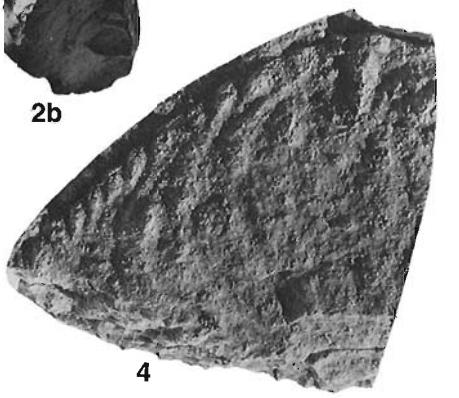

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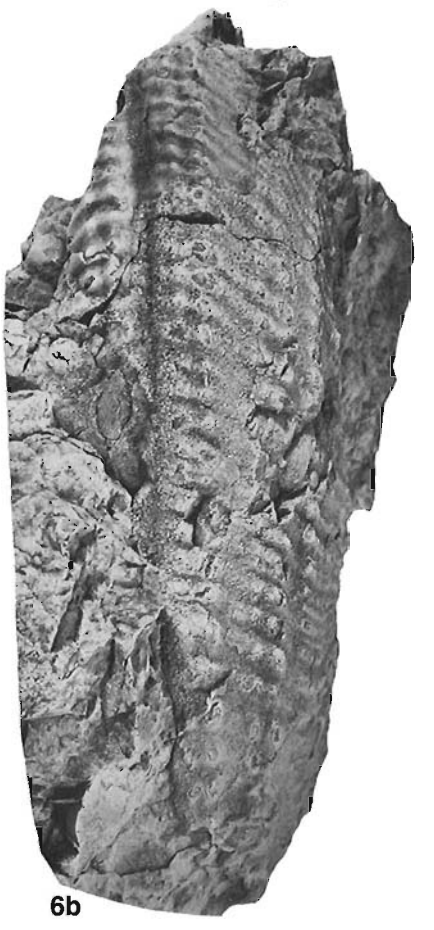

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PLATE 91

UPPER TRIASSIC
Lower Carnian–Nanseni Zone

Figures 1a, b. *Striatosirenites striatofalcatus* (Hauer) (Page 171)
Hypotype GSC 28730, crushed part is probably body chamber. Ludington Formation, Ewe Mountain, northeastern British Columbia (GSC loc. 68361).

Figures 2, 7. *Sirenites ovinus* n. sp. (Page 169)
2. Holotype GSC 14240, body chamber probably about half a whorl.
7a, b. Paratype GSC 28720, septa not visible.
Both from Ludington Formation, Ewe Mountain, northeastern British Columbia (GSC loc. 42311).

Figures 3a, b. *Clionitites arietinus* n. sp. (Page 175)
Holotype GSC 28697. Ludington Formation, Ewe Mountain, northeastern British Columbia (GSC loc. 42311).

Figures 4–6, 8–12. *Sirenites nanseni* Tozer (Page 169)
4a, b. Hypotype GSC 28721.
5a, b. Hypotype GSC 28723, outer whorl probably partly body chamber.
8a, b. Hypotype GSC 28722.
Figures 4, 5, 8 from Ludington Formation, Ewe Mountain, northeastern British Columbia (GSC loc. 42311).
6. Hypotype GSC 28726, mould from natural cast. Ludington Formation, ridge west of Ewe Mountain, northeastern British Columbia (GSC loc. 68215).
9a, b. Hypotype GSC 28724, body chamber.
10. Hypotype GSC 28725, body chamber.
Figures 9, 10 from Ludington Formation, Eight Mile Creek area, northeastern British Columbia (GSC loc. 79387).
11a, b. Hypotype GSC 72171.
12a, b. Hypotype GSC 72172.
Figures 11, 12 from Blaa Mountain Formation, Griesbach Creek, Axel Heiberg Island (GSC loc. 64787).

Figure 73. *Suture.* ***Sirenites nanseni*** *Tozer, GSC 14165 (Tozer, 1961, Pl. 23, fig. 5) x2.*

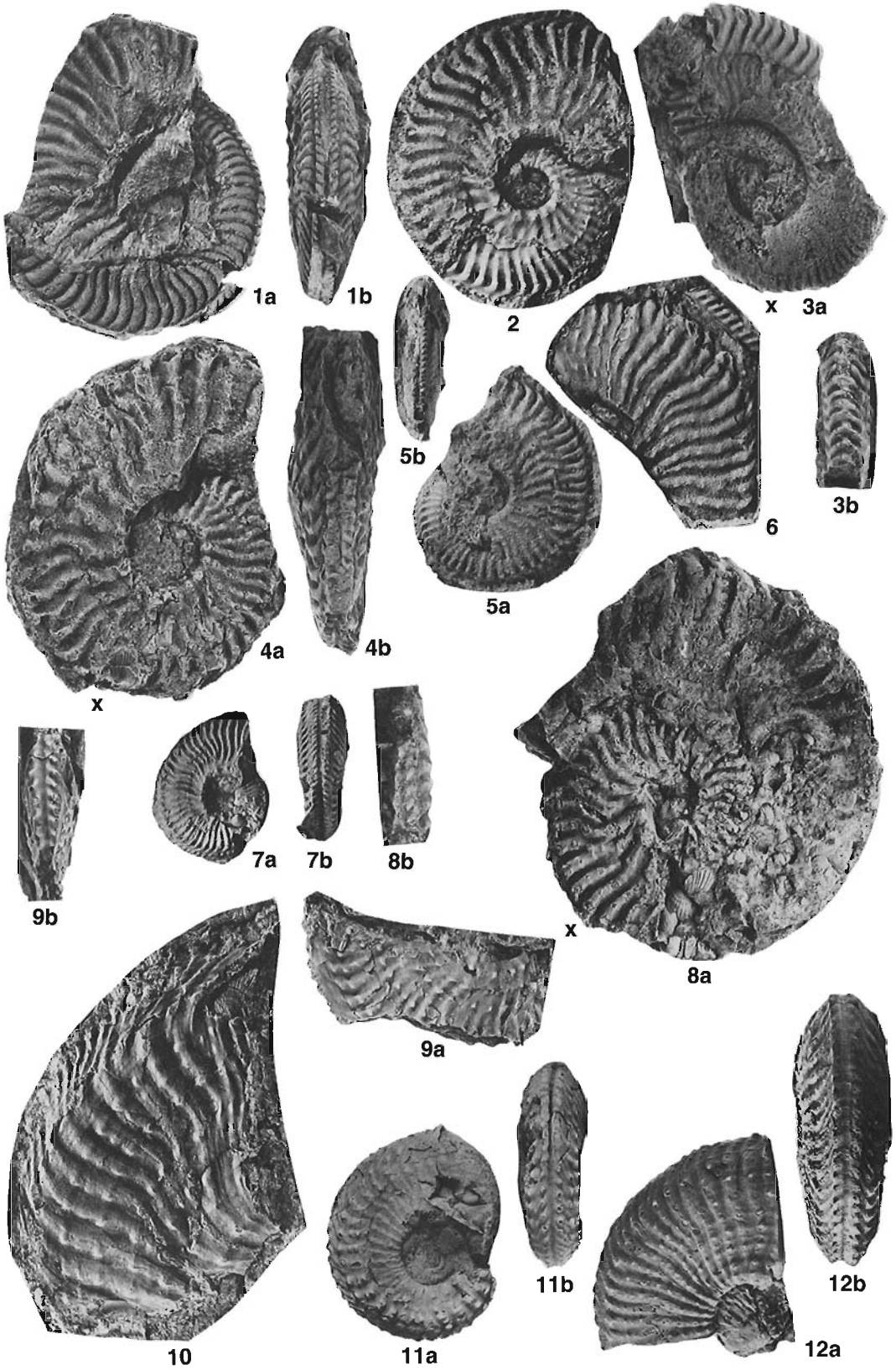
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PLATE 92

UPPER TRIASSIC
Upper Carnian–Dilleri Zone

Figures 1a, b. *Trachystenoceras gabbi* (Hyatt and Smith) (Page 153)
Hypotype GSC 28687, phragmocone. Ludington Formation, Mount McLearn, northeastern British Columbia (GSC loc. 68208).

Figures 2a, b. *Parahauerites* sp. indet. (Page 132)
GSC 28419, phragmocone. Ludington Formation, Mount McLearn, northeastern British Columbia (GSC loc. 68208).

Figures 3–5. *Paratropites sulfurensis* n. sp. (Page 215)
3a, b. Paratype GSC 28975, body chamber about three quarters of a whorl.
4a, b. Holotype GSC 28974, body chamber more than half a whorl.
5a, b. Paratype GSC 28976, body chamber about a quarter of a whorl.
All from Ludington Formation, Mount McLearn, northeastern British Columbia (GSC loc. 68208).

Figures 6–11. *Discotropites sandlingensis* (Hauer) (Page 216)
6. Hypotype GSC 28989.
7. Hypotype GSC 28990.
8a, b. Hypotype GSC 28991.
9. Hypotype GSC 28992.
Figures 6–9 from Ludington Formation, Mount McLearn, northeastern British Columbia (GSC loc. 68208).
10. Hypotype GSC 14238.
11. Hypotype GSC 28988.
Figures 10, 11 from King Salmon Formation, Tulsequah area, British Columbia (GSC loc. 43695).

Figures 12, 14. *Shastites vulcanus* n. sp. (Zone uncertain) (Page 178)
12. Paratype GSC 32561 (GSC loc. 79257), septa not visible.
14a, b. Holotype GSC 32560 (GSC loc. 79255), phragmocone.
Both from Karmutsen Group(?), Texada Island, British Columbia.

Figures 13a, b. *Spirogmoceras shastense* (Smith) (Page 147)
Hypotype GSC 28642, body chamber. Ludington Formation, Mount McLearn, northeastern British Columbia (GSC loc. 68208).

Figures 15a, b. *Gymnotropites americanus* Hyatt and Smith (Page 214)
Hypotype GSC 28958. Open Bay Formation, Quadra Island, British Columbia (GSC loc. 22692).

Figures 16a, b. *Leconteiceras californicum* (Hyatt and Smith) (Page 177)
Hypotype GSC 28832, septa not visible. Open Bay Formation, Quadra Island, British Columbia (GSC loc. 22692).

Figures 17a, b. *Sympolycyclus gunningi* n. sp. (Page 176)
Holotype GSC 14236. Open Bay Formation, Quadra Island, British Columbia (GSC loc. 22691).

Figures 18a, b. *Traskites* sp. indet. (Page 177)
GSC 17982. Open Bay Formation, Quadra Island, British Columbia (Carlisle and Susuki, 1965, p. 475).

Figure 74. *Sutures. a,* ***Trachystenoceras gabbi*** *(Hyatt and Smith), GSC 28687 (Pl. 92, fig. 1) x4; b,* ***Shastites vulcanus*** *n. sp., GSC 32560 (Pl. 92, fig. 14) x4.*

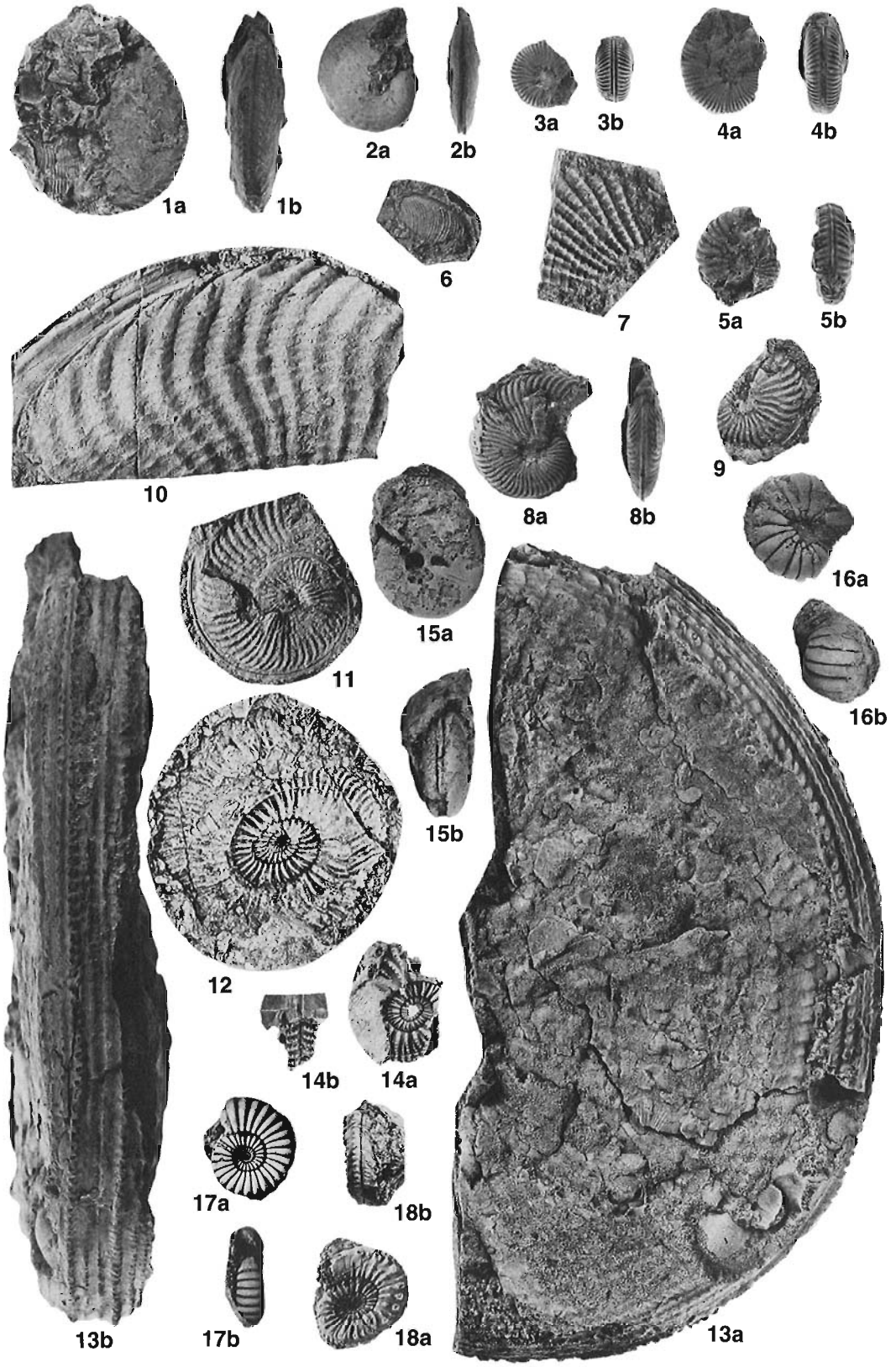
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PLATE 93

UPPER TRIASSIC
Upper Carnian–Dilleri Zone

Figures 1–3, 5, 6. *Pleurotropites gabbi* (Smith) (Page 214)
1a, b. Hypotype GSC 28960.
2. Hypotype GSC 28961.
3. Hypotype GSC 28962.
6. Hypotype GSC 28963.
None of Figures 1–3, 6 show septa clearly. All from Ludington Formation, Mount McLearn, northeastern British Columbia (GSC loc. 68208).
5a, b. Hypotype GSC 28965. Quatsino Limestone(?), Ououkinsh Inlet, Vancouver Island, British Columbia (GSC loc. 23147).

Figures 4a, b. *Pleurotropites* sp. indet. (Page 215)
GSC 32363, phragmocone. Quatsino Limestone(?), Ououkinsh Inlet, Vancouver Island, British Columbia (GSC loc. 82852).

Figures 7–10, 12. *Pleurotropites gracilis* (Smith) (Page 214)
7. Hypotype GSC 28968, septa not visible. Ludington Formation, Mount McLearn, northeastern British Columbia (GSC loc. 68208).
8a, b. Hypotype GSC 28970 (GSC loc. 23147), phragmocone.
9a, b. Hypotype GSC 28971 (GSC loc. 23147), body chamber apparently about half a whorl.
10a, b. Hypotype GSC 28973 (GSC loc. 23939), septa not visible.
12a, b. Hypotype GSC 28969 (GSC loc. 23147), mature specimen.
Figures 8–10, 12 from Quatsino Limestone(?), Ououkinsh Inlet, Vancouver Island, British Columbia.

Figures 11, 14. *Hisnitites janmulleri* n. sp. (Page 153)
11a–c. Holotype GSC 32364 (GSC loc. 82852).
14. Paratype GSC 35358 (GSC loc. 23939).
Both from Quatsino Limestone(?), Ououkinsh Inlet, Vancouver Island, British Columbia.

Figures 13a, b. *Tropites keiliformis* n. sp. (Page 212)
Holotype GSC 18877. Open Bay Formation, Quadra Island, British Columbia (GSC loc. 22691).

Figure 75. *Suture.* ***Hisnitites janmulleri*** *n. sp., GSC 32364 (Pl. 93, fig. 11) x2.*

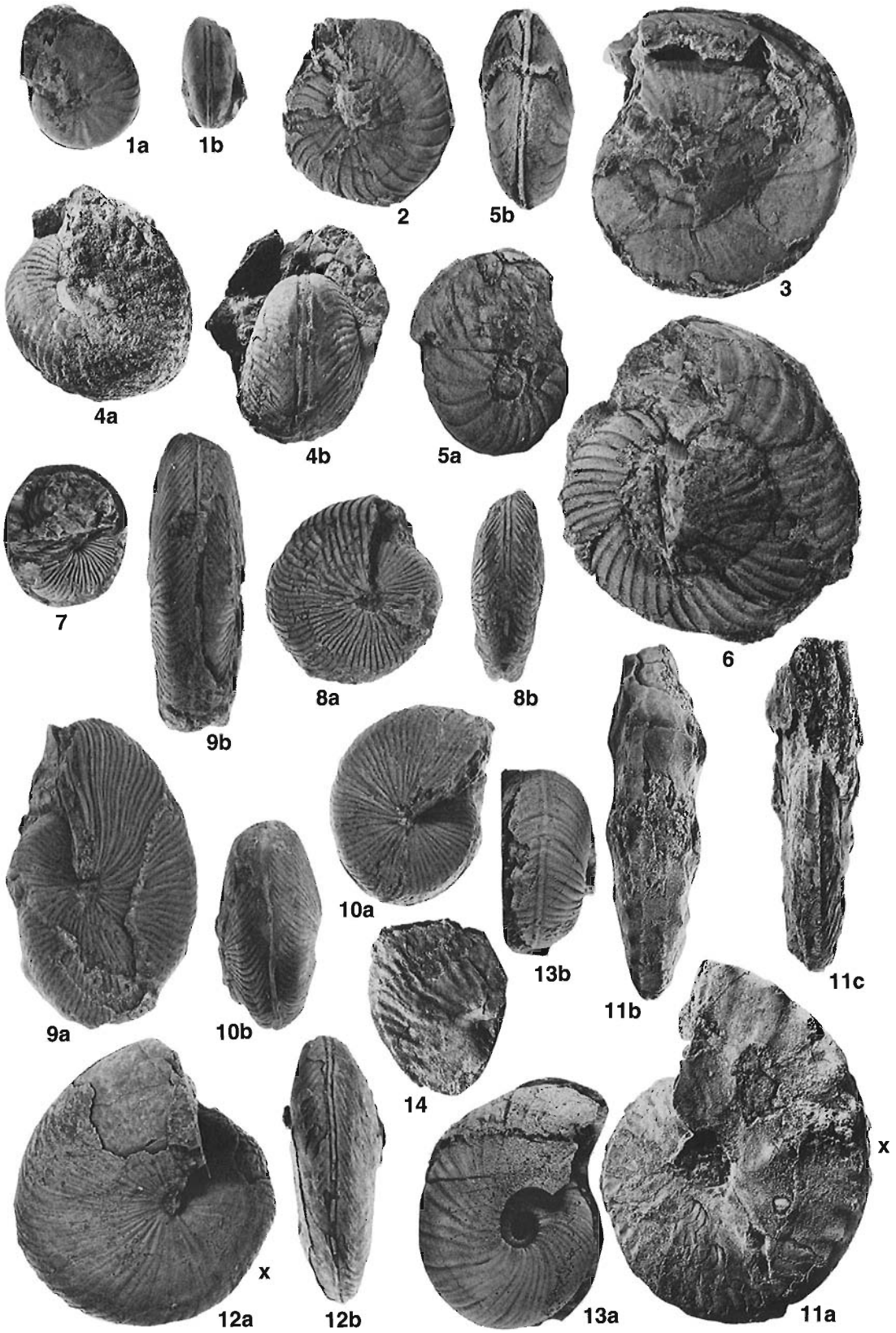
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PLATE 94

UPPER TRIASSIC
Upper Carnian–Dilleri and Welleri zones

Figures 1a, b. *Indonesites sphaericus* (Smith) (Dilleri Zone) (Page 217)
Hypotype GSC 28959. Quatsino Limestone, near Klaskino Inlet, Vancouver Island, British Columbia (GSC loc. 86293).

Figures 2, 3. *Pleurotropites gabbi* (Smith) (Dilleri Zone) (Page 214)
2a, b. Hypotype GSC 28966, no septa visible.
3a, b. Hypotype GSC 28967, specimen has crystalline core, probably phragmocone, indicating body chamber one and one eighth of a whorl in length.
Both from Quatsino Limestone, near Klaskino Inlet, Vancouver Island, British Columbia (GSC loc. 86293).

Figures 4a, b. *Tropites dilleri* Smith (Dilleri Zone) (Page 212)
Hypotype GSC 28981, phragmocone(?). Quatsino Limestone, near Klaskino Inlet, Vancouver Island, British Columbia (GSC loc. 86293).

Figures 5a, b. *Trachysagenites* sp. indet. (Dilleri Zone) (Page 168)
GSC 28413, phragmocone. Quatsino Limestone(?), Ououkinsh Inlet, Vancouver Island, British Columbia (GSC loc. 23147).

Figures 6a, b. *Pamphagosirenites pacificus* n. sp. (Welleri Subzone 1) (Page 171)
Holotype GSC 28731, phragmocone. Quatsino Limestone, near Klaskino Inlet, Vancouver Island, British Columbia (GSC loc. 82936).

Figures 7a, b. *Projuvavites brockensis* (Smith) (Welleri Subzone 1) (Page 234)
Hypotype GSC 32151, septa not preserved. Quatsino Limestone, near Klaskino Inlet, Vancouver Island, British Columbia (GSC loc. 86284).

Figures 8a, b. *Bacchites hyatti* (Smith) (Welleri Subzone 1) (Page 233)
Hypotype GSC 32144, septa not visible. Quatsino Limestone, near Klaskino Inlet, Vancouver Island, British Columbia (GSC loc. 82936).

Figures 9a, b. *Tardeceras parvum* Hyatt and Smith (Welleri Subzone 1) (Page 226)
Hypotype GSC 32124, outer whorl probably body chamber. Quatsino Limestone, near Klaskino Inlet, Vancouver Island, British Columbia (GSC loc. 82936).

Figure 10. *Trachysagenites* sp. indet. (Welleri Subzone 1) (Page 168)
GSC 28414, phragmocone 30 mm wide. Quatsino Limestone, near Klaskino Inlet, Vancouver Island, British Columbia (GSC loc. 82936).

Figures 11a–d. *Jovites ellipticus* n. sp. (Welleri Subzone 1) (Page 221)
Holotype GSC 70995. Ludington Formation, Mount Laurier, northeastern British Columbia (GSC loc. 94736).

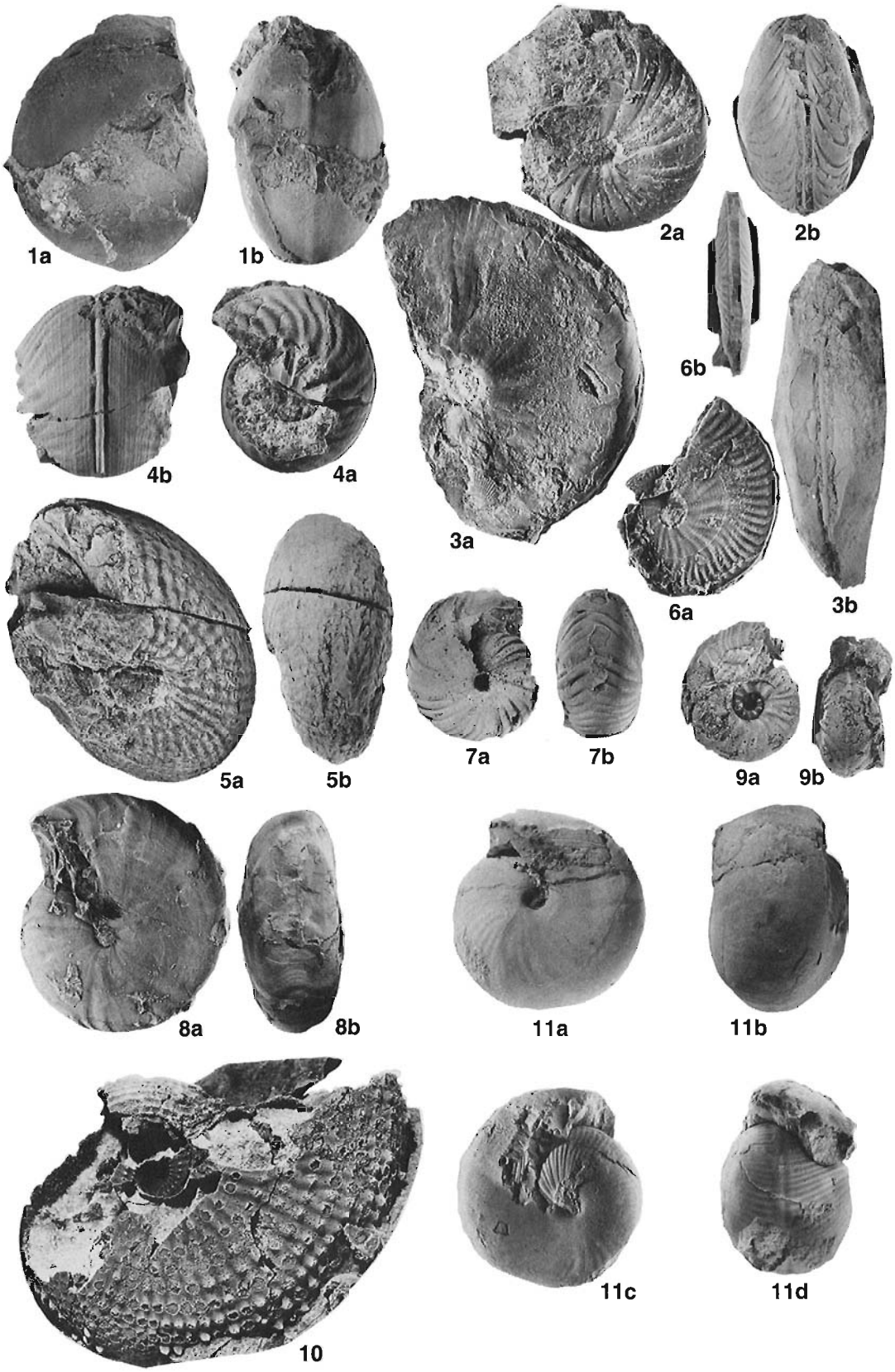
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PLATE 95

UPPER TRIASSIC
Upper Carnian–Welleri Zone

Figures 1–3. *Sympolycyclus kellyi* (Smith) (Subzone 2) (Page 177)
1a, b. Hypotype GSC 28829 (GSC loc. 42389).
2. Hypotype GSC 28830 (GSC loc. 42378), internal mould.
3a, b. Hypotype GSC 28831 (GSC loc. 42386), internal mould, mostly or wholly phragmocone.
All from Pardonet Formation, Alaska Highway, northeastern British Columbia.

Figures 4, 8, 9. *Tropites bufonis* n. sp. (Subzone 2) (Page 213)
4a–c. Paratype GSC 28984, phragmocone.
8a, b. Paratype GSC 28983, phragmocone.
9a, b. Holotype GSC 28982, last half whorl is crushed and probably body chamber.
All from Pardonet Formation, Alaska Highway, northeastern British Columbia (GSC loc. 42389).

Figures 5–7, 11. *Paratropites teres* n. sp. (Subzone 2) (Page 216)
5a, b. Paratype GSC 28980.
6a–c. Paratype GSC 28978.
7a–c. Paratype GSC 28979. Figures 5–7 are probably phragmocones; all from Pardonet Formation, Alaska Highway, northeastern British Columbia (GSC loc. 42386).
11a, b. Holotype GSC 28977, outer whorl is apparently body chamber. Baldonnel Formation, Mount McLearn, northeastern British Columbia (GSC loc. 42320).

Figures 10a, b. *Tropites izardi* n. sp. (Subzone 1) (Page 213)
Holotype GSC 28985, septa not visible. Quatsino Formation, Ououkinsh Inlet, Vancouver Island, British Columbia (GSC loc. 23066).

Figures 12a, b. *Margaritropites kokeni* (Smith) (Subzone 1) (Page 219)
Hypotype GSC 29010. Unnamed formation, Iskut River area, British Columbia (GSC loc. 28941).

Figures 13–15. *Margaritropites johnsoni* (Smith) (Subzone 1) (Page 219)
13. Hypotype GSC 29008.
14. Hypotype GSC 29009.
Figures 13, 14 body chamber fragments from Ludington Formation(?), Alaska Highway, northeastern British Columbia (GSC loc. 42306).
15a–d. Hypotype GSC 14243. 15 b–d are of phragmocone. 15a is impression from natural cast, showing part of the body chamber. Unnamed formation, Iskut River area, British Columbia (GSC loc. 28941).

Figure 76. *Suture.* ***Sympolycyclus kellyi*** *(Smith), GSC 28830 (Pl. 95, fig. 2) x4.*

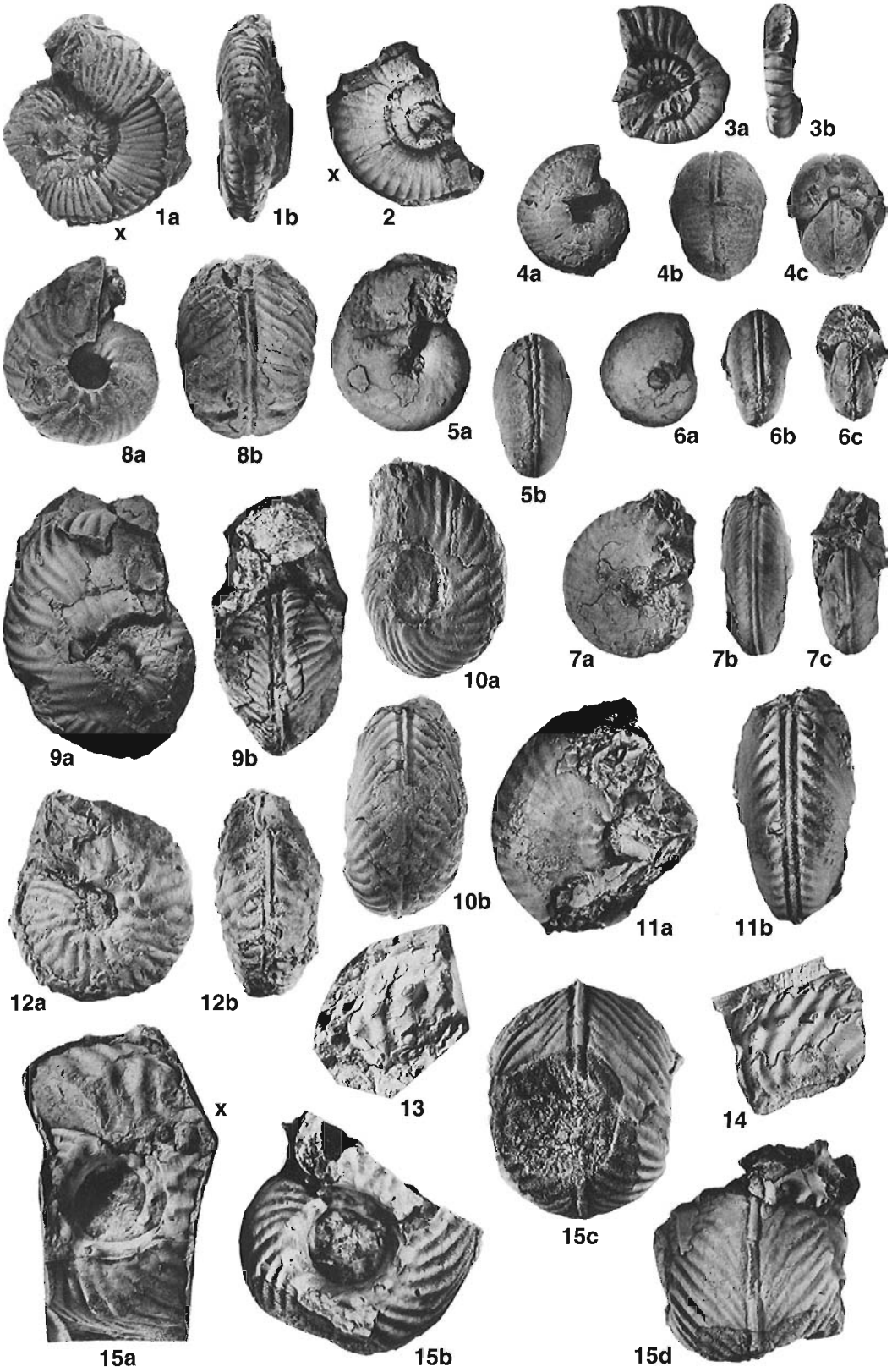
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PLATE 96

UPPER TRIASSIC
Upper Carnian–Welleri Zone

Figures 1–7. *Discotropites smithi* Kutassy (Subzone 1) (Page 217)
1a, b. Hypotype GSC 28994, phragmocone.
2a, b. Hypotype GSC 28995, phragmocone.
3a–c. Hypotype GSC 28996, phragmocone.
4a–c. Hypotype GSC 14237, phragmocone.
5a, b. Hypotype GSC 28997, phragmocone.
Figures 1–5 from Ludington Formation(?), Alaska Highway, northeastern British Columbia (GSC loc. 42306).
6a, b. Hypotype GSC 28999 (GSC loc. 51265), body chamber(?).
7a, b. GSC 29000 (GSC loc. 56250).
Figures 6, 7 from Ludington Formation, 8 km northeast of Mount Laurier, northeastern British Columbia.

Figures 8–15. *Discotropites theron* (Dittmar) (Subzone 2) (Page 217)
8a–c. Hypotype GSC 29003 (GSC loc. 42389), phragmocone(?).
11a, b. Hypotype GSC 29002 (GSC loc. 42389), phragmocone.
12. Hypotype GSC 28023 (GSC loc. 42389), phragmocone, beginning of outer whorl preserves dorsal shield layer (Tozer, 1972, p. 642).
13a, b. Hypotype GSC 14239 (GSC loc. 42389), phragmocone.
14. Hypotype GSC 29007 (GSC loc. 42377), venter of body chamber fragment.
15a–c. Hypotype GSC 29004 (GSC loc. 42389), both sides and venter.
Figures 8, 11–15 from Pardonet Formation, Alaska Highway, northeastern British Columbia.
9a, b. Hypotype GSC 29005 (GSC loc. 42320).
10a, b. Hypotype GSC 29006 (GSC loc. 42321), phragmocone(?).
Figures 9, 10 from Baldonnel Formation, Mount McLearn, northeastern British Columbia.

Figure 77. *Sutures.* ***Discotropites smithi*** *Kutassy. a, GSC 14237 (Pl. 96, fig. 4) x2; b, GSC 28998* x2.*

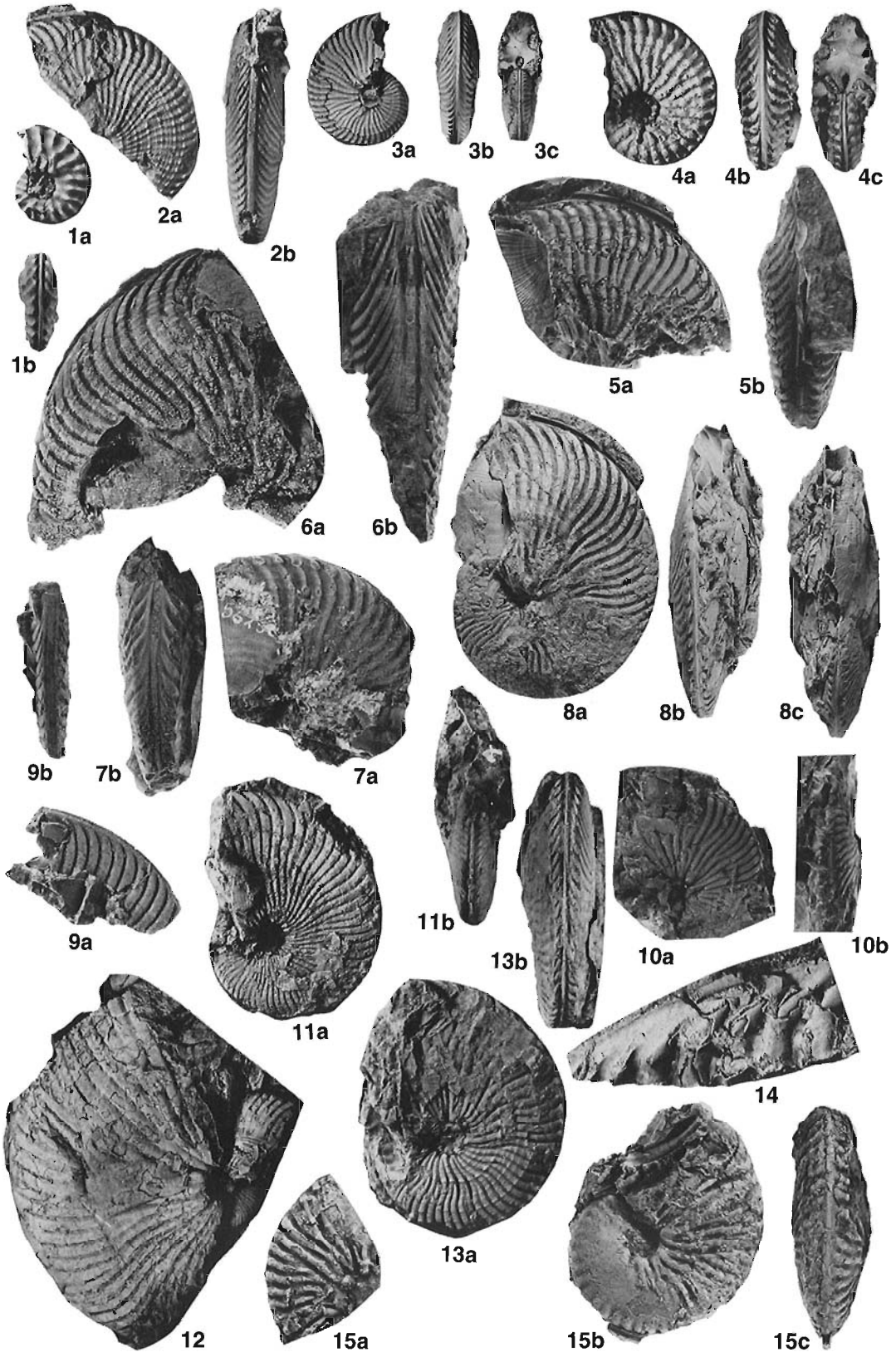
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PLATE 97

UPPER TRIASSIC
Upper Carnian–Welleri Zone

Figures 1, 2. *Arctosirenites columbianus* n. sp. (Subzone 1) (Page 155)
1a, b. Holotype GSC 14313.
2a–c. Hypotype GSC 14312.
Both appear to have body chamber, both from Ludington Formation (?), Alaska Highway, northeastern British Columbia (GSC loc. 42306).

Figure 3. *Pamphagosirenites pacificus* n. sp. (Subzone 1) (Page 171)
Paratype GSC 28733, no septa are visible. Unnamed formation, Telegraph Creek area, British Columbia (GSC loc. 28941).

Figures 4a–c. *Pamphagosirenites pamphagus* (Dittmar) (Page 171)
Hypotype GSC 17013, phragmocone. Quatsino Limestone, Izard Point, Vancouver Island, British Columbia (GSC loc. 22270).

Figures 5, 6. *Hoplotropites*(?) *globosus* n. sp. (Subzone 2) (Page 220)
5a, b. Holotype GSC 32098, no septa are visible. Pardonet Formation, Alaska Highway, northeastern British Columbia (GSC loc. 42380).
6a, b. Paratype GSC 32097, no septa are visible. Baldonnel Formation, Mount McLearn, northeastern British Columbia (GSC loc. 42320).

Figures 7, 8. *Hoplotropites*(?) *intermedius* n. sp. (Subzone 2) (Page 221)
7a, b. Paratype GSC 32096 (GSC loc. 42320).
8a, b. Holotype GSC 32095 (GSC loc. 42398).
Both from Baldonnel Formation, Mount McLearn, northeastern British Columbia.

Figures 9a, b. *Hoplotropites marii* (Gemmellaro) (Subzone 2) (Page 220)
Hypotype GSC 29011, no septa are visible. Baldonnel Formation, near Mount McLearn, British Columbia (GSC loc. 68179).

Figures 10–18. *Hoplotropites auctus* (Dittmar) (Subzone 2) (Page 220)
10a, b. Hypotype GSC 32094, no septa are visible. Baldonnel Formation, Mount McLearn, northeastern British Columbia (GSC loc. 68360).
11a–c. Hypotype GSC 32087 (GSC loc. 42389), phragmocone.
12a–c. Hypotype GSC 32090 (GSC loc. 42389), no septa are visible.
13a, b. Hypotype GSC 32093 (GSC loc. 42386), phragmocone(?).
14a–c. Hypotype GSC 32091 (GSC loc. 42388), phragmocone.
15a, b. Hypotype GSC 32089 (GSC loc. 42389), phragmocone(?).
16a, b. Hypotype GSC 14242 (GSC loc. 42389), phragmocone.
17a, b. Hypotype GSC 32088 (GSC loc. 42389), phragmocone(?).
18a, b. Hypotype GSC 14241 (GSC loc. 42389), phragmocone.
Figures 11–18 from Pardonet Formation, Alaska Highway, northeastern British Columbia.

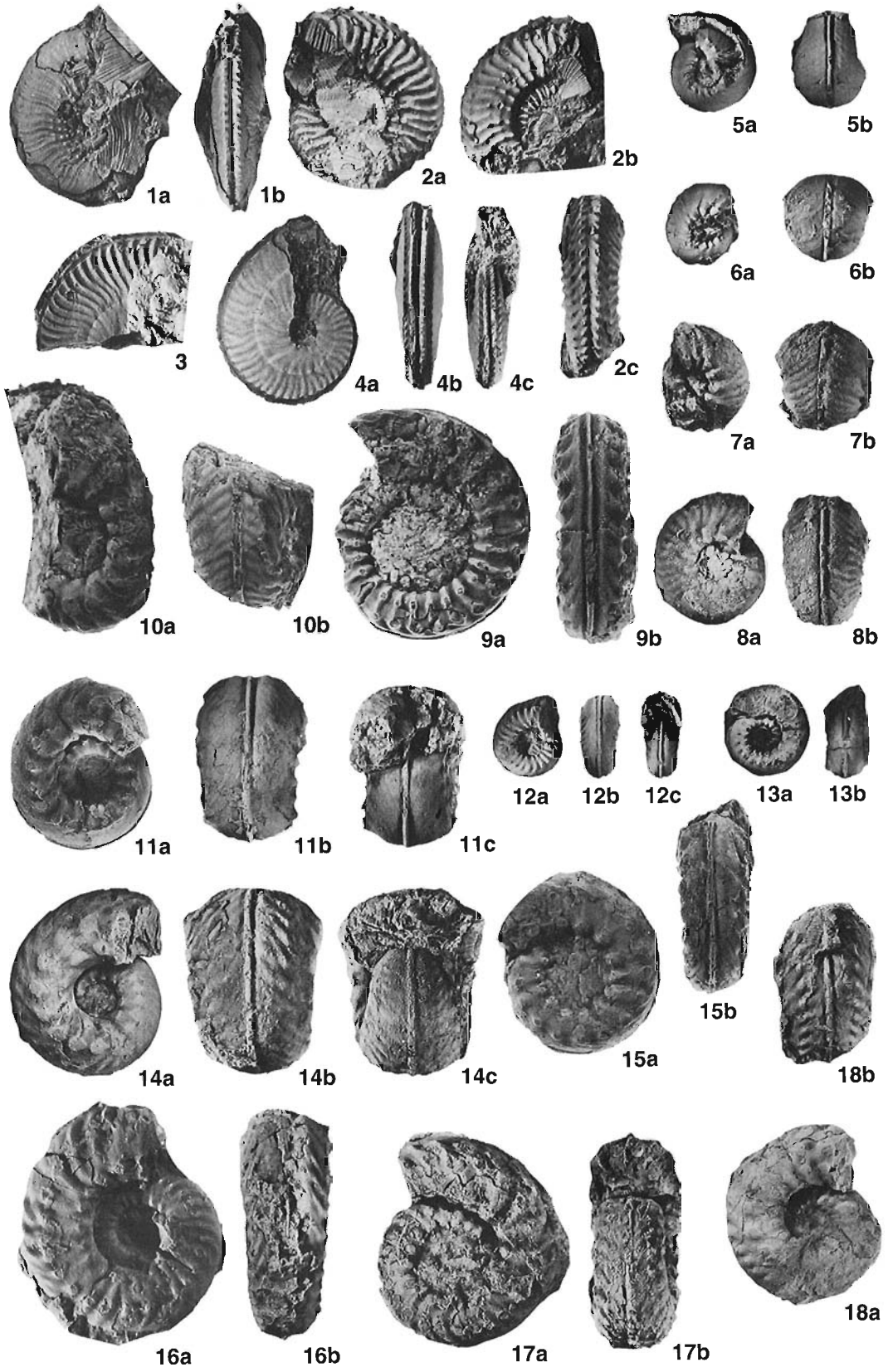
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PLATE 98

UPPER TRIASSIC
Upper Carnian–Welleri Zone

Figures 1–4. *Homerites semiglobosus* (Hauer) (Subzone 1) (Page 218)
1a, b. Hypotype GSC 32100.
2a–c. Hypotype GSC 14235.
Figures 1, 2 from Ludington Formation, Alaska Highway, northeastern British Columbia (GSC loc. 42384).
3a–c. Hypotype GSC 32101. Unnamed formation, Iskut River area, British Columbia (GSC loc. 28941).
4a–c. Hypotype GSC 32102. Specimen complete with horns, Quatsino Limestone, Ououkinsh Inlet, Vancouver Island, British Columbia (GSC loc. 23161).

Figures 5–7. *Homeroceras grandis* n. sp. (Subzone 1) (Page 218)
5a, b. Paratype GSC 32104 (GSC loc. 51265).
6a–c. Holotype GSC 32103 (GSC loc. 56250).
7a–c. Paratype GSC 32105 (GSC loc. 51265).
None of the figures show septa, all from Ludington Formation, 8 km northeast of Mount Laurier, northeastern British Columbia.

Figures 8, 9. *Jovites bosnensis* Mojsisovics (Subzone 2) (Page 221)
8a, b. Hypotype GSC 14314 (GSC loc. 42377).
9a–c. Hypotype GSC 32099 (GSC loc. 42379).
Both from Pardonet Formation, Alaska Highway, northeastern British Columbia.

Figures 10a–c. *Hoplotropites auctus* (Dittmar) (Subzone 2) (Page 220)
Hypotype GSC 32092, phragmocone(?). Pardonet Formation, Alaska Highway, northeastern British Columbia (GSC loc. 42386).

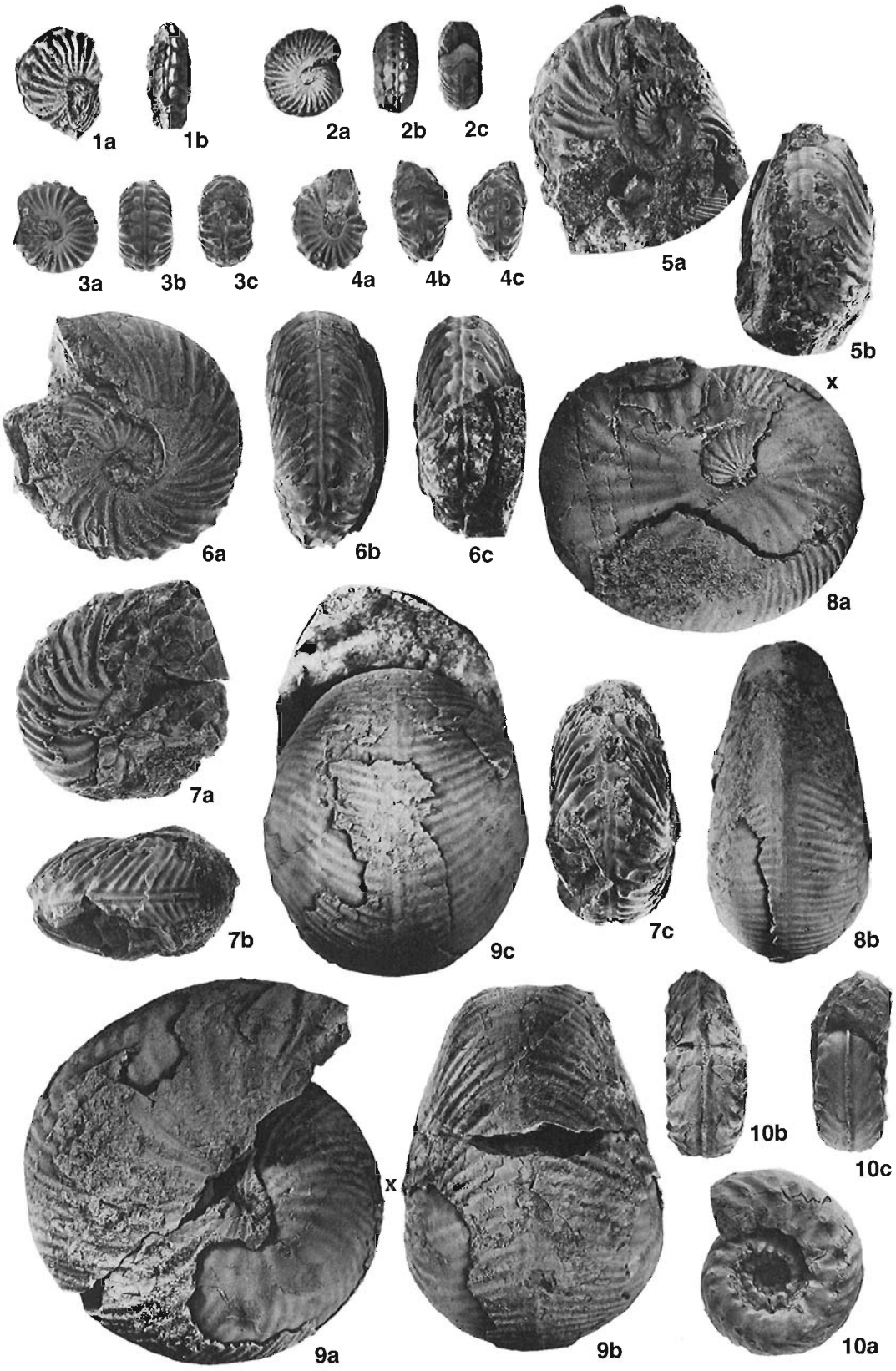
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PLATE 99

UPPER TRIASSIC
Upper Carnian–Welleri Zone

Figures 1–4. *Tardeceras parvum* Hyatt and Smith (Subzone 1) (Page 226)
1a, b. Hypotype GSC 32125.
2. Hypotype GSC 32126.
3a, b. Hypotype GSC 32127.
4a, b. Hypotype GSC 32128.
None of the figures show septa but all probably preserve the body chamber. All from Quatsino Limestone, Kyuquot Sound, Vancouver Island, British Columbia (GSC loc. 20236).

Figures 5, 6. *Klamathites* sp. indet. (Subzone 2) (Page 132)
5a, b. GSC 28420, phragmocone.
6a, b. GSC 28421, phragmocone.
Both from Pardonet Formation, Alaska Highway, northeastern British Columbia (GSC loc. 42389).

Figures 7–10. *Projuvavites brockensis* (Smith) (Subzone 1) (Page 234)
7a–c. Hypotype GSC 32146, outer whorl is apparently body chamber.
8a–c. Hypotype GSC 32147.
9a–c. Hypotype GSC 32148.
10a–c. Hypotype GSC 32149.
All from Ludington Formation(?), Alaska Highway, northeastern British Columbia (GSC loc. 42306).

Figures 11a–c. *Projuvavites strongi* (Smith) (Subzone 1) (Page 234)
Hypotype GSC 32150. Ludington Formation(?), Alaska Highway, northeastern British Columbia (GSC loc. 42306).

Figures 12–14. *Bacchites hyatti* (Smith) (Subzone 1) (Page 233)
12a, b. Hypotype GSC 32143. Ludington Formation, 8 km northeast of Mount Laurier, northeastern British Columbia (GSC loc. 56250).
13a, b. Hypotype GSC 32142, complete phragmocone.
14a–c. Hypotype GSC 14245, body chamber one whorl.
Figures 13, 14 from Ludington Formation(?), Alaska Highway, northeastern British Columbia (GSC loc. 42306).

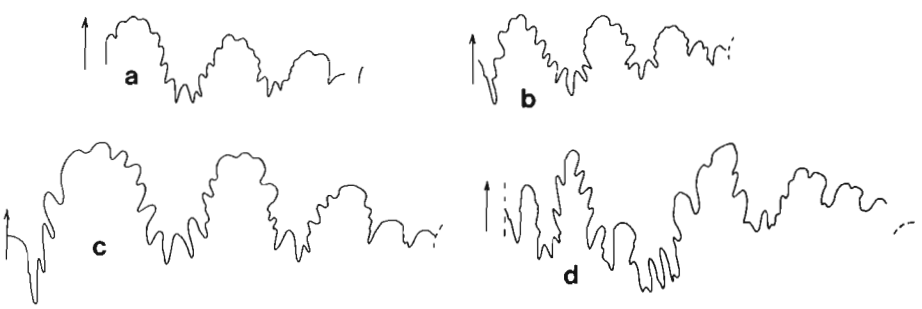

Figure 78. *Sutures. a,* ***Projuvavites strongi*** *(Smith), GSC 32150 (Pl. 99, fig. 11) x2; b,* ***Projuvavites brockensis*** *(Smith), GSC 32149 (Pl. 99, fig. 10) x2; c,* ***Bacchites hyatti*** *(Smith), GSC 14245 (Pl. 99, fig. 14) x2; d,* ***Klamathites*** *sp. indet., GSC 28420 (Pl. 99, fig. 5) x4.*

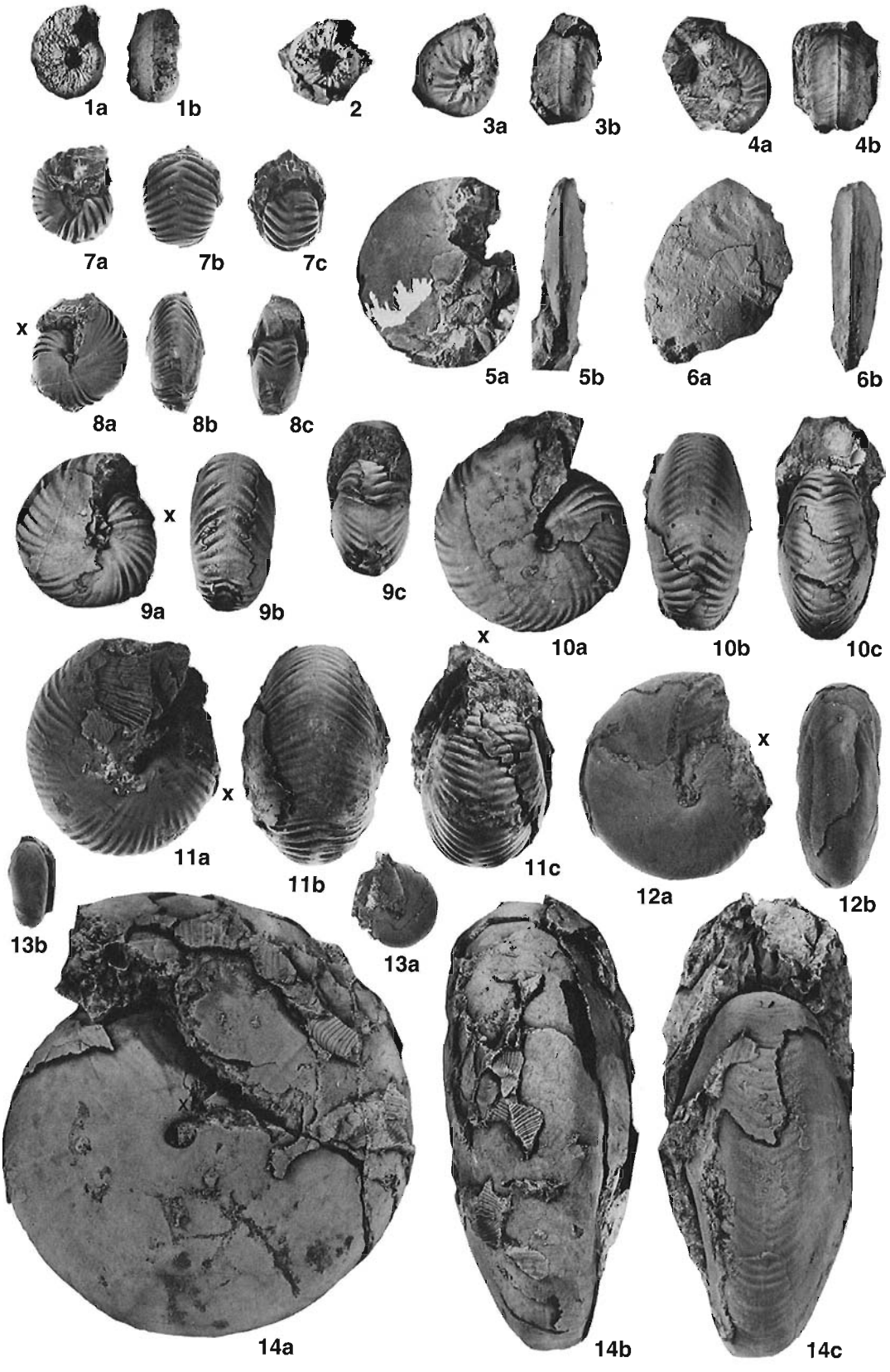
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PLATE 100

UPPER TRIASSIC
Upper Carnian–Welleri Subzone 2

All specimens from Pardonet Formation Alaska Highway, northeastern British Columbia (GSC loc. 42389)

Figures 1–6. *Goniojuvavites kellyi* (Smith) (Page 235)
1a–c. Hypotype GSC 32157, phragmocone.
2a, b. Hypotype GSC 32158, phragmocone.
3a–c. Hypotype GSC 32159, phragmocone.
4a, b. Hypotype GSC 32156, mainly or wholly phragmocone.
5a, b. Hypotype GSC 32155, phragmocone.
6a–c. Hypotype GSC 32160, complete phragmocone with crushed remains of body chamber.

Figure 79. *Suture.* ***Goniojuvavites kellyi*** *(Smith), GSC 32159 (Pl. 100, fig. 3) x2.*

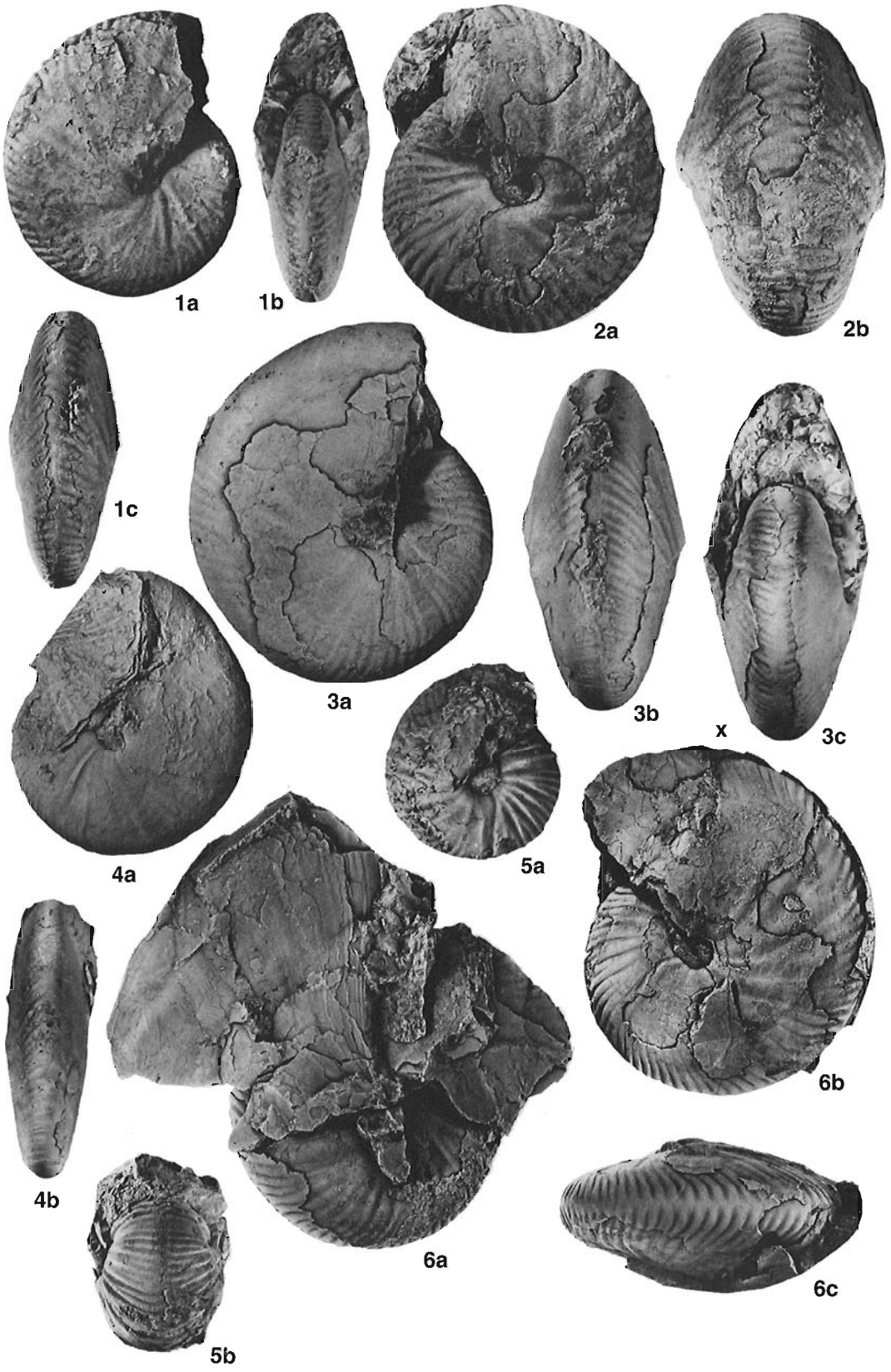
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PLATE 101

UPPER TRIASSIC
Upper Carnian–Welleri Zone

Figures 1–9. *Goniojuvavites kellyi* (Smith) (Subzone 2) (Page 235)

1a–c. Hypotype GSC 32152.

2a–c. Hypotype GSC 32153.

7a, b. Hypotype GSC 32154.

8a, b. Hypotype GSC 14244.

Figures 1, 2, 7, 8 are probably phragmocones. All from Pardonet Formation, Alaska Highway, northeastern British Columbia (GSC loc. 42389).

3a–c. Hypotype GSC 32161 (GSC loc. 42388).

4a–c. Hypotype GSC 32162 (GSC loc. 42320).

5a, b. Hypotype GSC 32164 (GSC loc. 68360).

6a–c. Hypotype GSC 32163 (GSC loc. 42325).

Figures 3–6 are probably phragmocones. All from Baldonnel Formation, Mount McLearn, northeastern British Columbia.

9a, b. Hypotype GSC 32165, specimen probably preserving body chamber. Pardonet Formation, Alaska Highway, northeastern British Columbia (GSC loc. 42378).

Figures 10a, b. *Trachysagenites* sp. indet. (Subzone 1) (Page 177)

GSC 14246, phragmocone. Quatsino Limestone, Ououkinsh Inlet, Vancouver Island, British Columbia (GSC loc. 23066).

Figure 80. *Sutures.* ***Goniojuvavites kellyi*** *(Smith), GSC 32154 (Pl. 101, fig. 7) x2.*

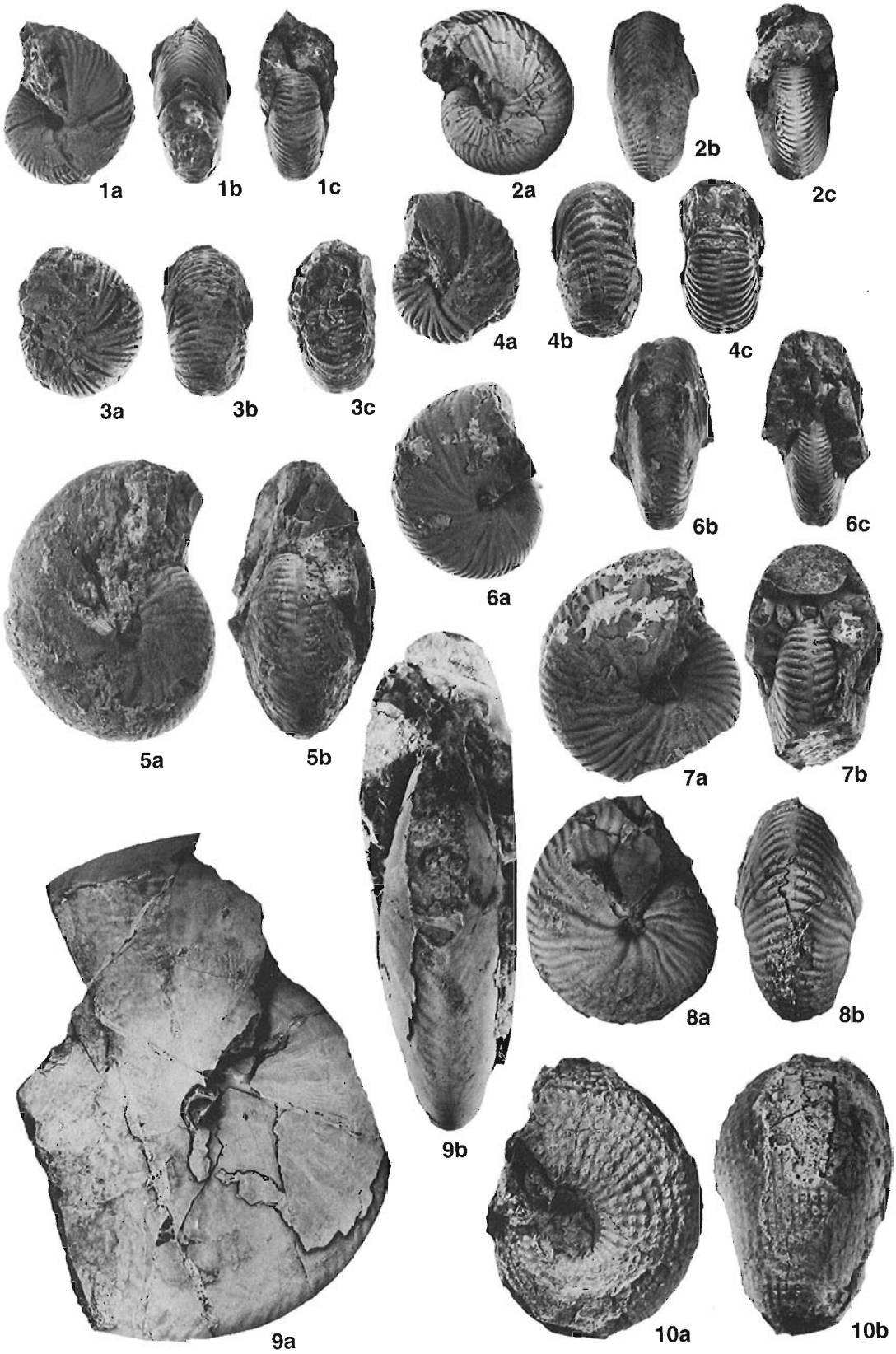
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PLATE 102

UPPER TRIASSIC
Upper Carnian

Figures 1a, b. *Yakutosirenites pentastichus* (Vozin) (Page 156)
Hypotype GSC 72173, septate. Blaa Mountain Formation, Buchanan Lake, Axel Heiberg Island (GSC loc. 28429).

Figures 2, 4–9. *Sirenites serotinus* n. sp. (Page 170)
2a, b. Hypotype GSC 72174, septate. Blaa Mountain Formation, Buchanan Lake, Axel Heiberg Island (GSC loc. 28429).
4a, b. Paratype GSC 14148.
5a, b. Holotype GSC 14149 (x2).
Figures 4, 5 from Schei Point Formation, Table Island (GSC loc. 30369).
6a, b. Hypotype GSC 72175.
7a, b. Hypotype GSC 72176.
8a–c. Hypotype GSC 72177.
Figures 6–8 from Otuk Formation, Rackla River, Yukon (GSC loc. 97561).
9. Hypotype GSC 28728. Blaa Mountain Formation, Blaa Mountain, Ellesmere Island (GSC loc. 55479).

Figures 3a, b. *Arctosirenites southeri* n. sp. (Page 155)
Holotype GSC 14141. Blaa Mountain Formation, Buchanan Lake, Axel Heiberg Island (GSC loc. 26167).

Figure 10. *Sirenites yakutensis* Kiparisova (Page 170)
Hypotype GSC 28727. Blaa Mountain Formation, Svartefjeld Peninsula, Ellesmere Island (GSC loc. 28428).

Figures 11a, b. *Arctoarpadites costatus* (Tozer) (Page 154)
Holotype GSC 14143. Blaa Mountain Formation, Buchanan Lake, Axel Heiberg Island (GSC loc. 28454).

Figure 12. *Arctosirenites(?) sverdrupi* (Kittl) (Page 155)
Plaster cast of originals of *Protrachyceras sverdrupi* Kittl, Palaeontologisk Museum Oslo 65774. Schei Point Formation, Ammonite Mountain, Bjorne Peninsula, Ellesmere Island.

Figures 13–15. *Arctosirenites canadensis* Tozer (Page 154)
13. Hypotype GSC 72184. Blaa Mountain Formation, Griesbach Creek, Axel Heiberg Island (GSC loc. 47619).
14a, b. Hypotype GSC 72185.
15a, b. Hypotype GSC 72186.
Figures 13, 14 from Blaa Mountain Formation, east of Expedition Fiord, Axel Heiberg Island (GSC loc. 89714).

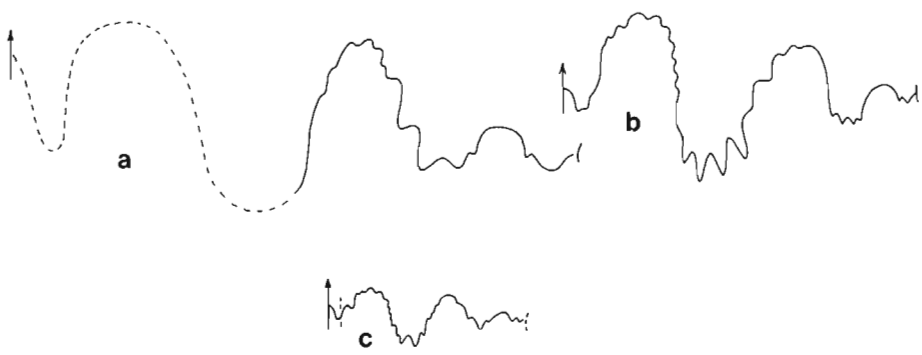

Figure 81. *Sutures. a, b.* ***Arctosirenites canadensis*** *Tozer. a, GSC 14136 (Tozer, 1961, Pl. 25, fig. 8) x8; b, GSC 14123 (ibid., Pl. 24, fig. 5) x8. c,* ***Sirenites serotinus*** *n. sp., GSC 14149 (Pl. 102, fig. 5) x2.*

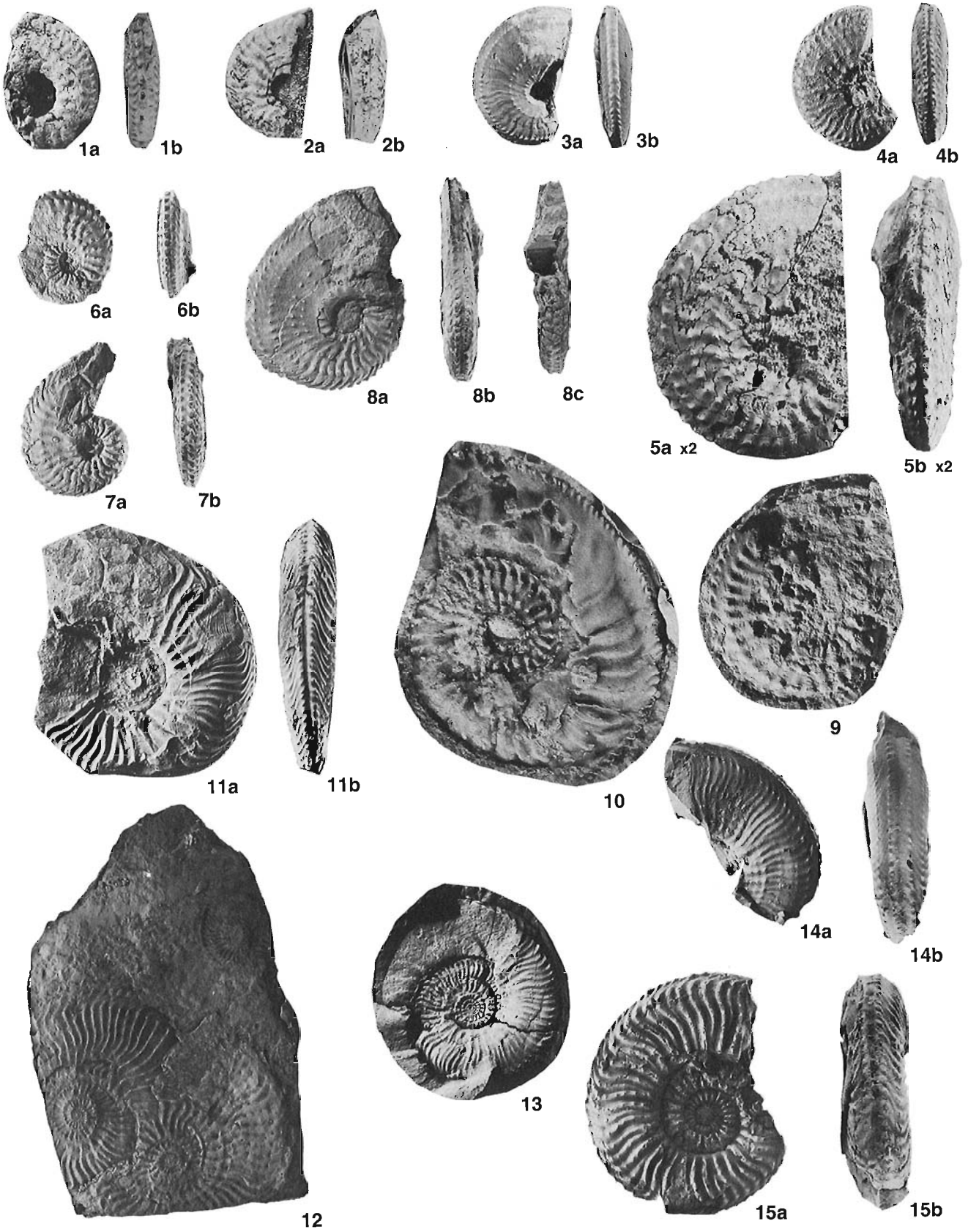
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PLATE 103

UPPER TRIASSIC
Upper Carnian

Figures 1a, b. *Orthoceltites belcheri* n. sp. (Page 125)
Holotype GSC 72182, phragmocone. Schei Point Formation, Table Island (GSC loc. 30369).

Figures 2a–c. *Epiceratites yukonensis* n. sp. (x2) (Page 110)
Holotype GSC 72181. Otuk Formation, Rackla River, Yukon (GSC loc. 97561).

Figures 3–5. *Acanthotropites racklaensis* n. sp. (Page 222)
3a, b. Paratype GSC 72180, (x2).
4a, b. Holotype GSC 72179.
5a, b. Paratype GSC 72178, phragmocone with part of crushed body chamber.
All from Otuk Formation, Rackla River, Yukon (GSC loc. 97561).

Figures 6a–c. *Jovites borealis* Tozer (Page 222)
Holotype GSC 14112. Blaa Mountain Formation, Buchanan Lake, Ellesmere Island (GSC loc. 28435).

Figures 7–9. *Paratropites arcticus* n. sp. (Page 216)
7. Hypotype GSC 72187. Blaa Mountain Formation, east of Expedition Fiord, Axel Heiberg Island (GSC loc. 98716).
8a, b. Paratype GSC 72188 (GSC loc. 25868).
9a, b. Holotype GSC 72189 (GSC loc. 35611).
Figures 8, 9 from Schei Point Formation, Cameron Island.

Figures 10a, b. *Arctotropites richardsi* (Tozer) (Page 222)
Holotype GSC 14118. Schei Point Formation, Cameron Island (GSC loc. 35611).

Figure 82. Sutures. a, ***Jovites borealis*** Tozer, GSC 14109 (Tozer, 1961, Pl. 26, fig. 3); b, ***Orthoceltites belcheri*** n. sp., GSC 72182 (Pl. 103, fig. 1) x2.


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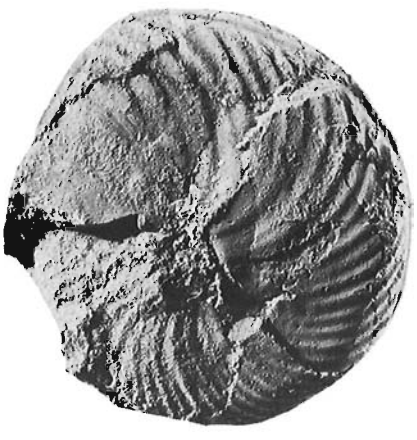
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10b

PLATE 104

UPPER TRIASSIC
Upper Carnian–Dilleri, Welleri and Macrolobatus zones

Figures 1a, b. *Sandlingites oribasus* (Dittmar) (Dilleri Zone) (Page 177)
Hypotype GSC 85780. Sadler Limestone, Huston Inlet, Moresbey Island, Queen Charlotte Archipelago (GSC loc. C–157006).

Figures 2a, b. *Neotenoceras simplex* n. sp. (Welleri Subzone 2) (Page 263)
Holotype GSC 85809 (x2). Peril Formation, Kunghit Island, Queen Charlotte Archipelago (GSC loc. C–157373).

Figures 3a–c. *Thisbites huxleyi* n. sp. (Macrolobatus Zone) (Page 229)
Holotype GSC 85786. Peril Formation, Huxley Island, Queen Charlotte Archipelago (GSC loc. C–157119).

Figures 4–6. *Styrites dawsoni* n. sp. (Macrolobatus Zone) (Page 227)
4. Holotype GSC 85788.
5. Paratype GSC 85789.
6a, b. Paratype GSC 85790.
All from Peril Formation, Huxley Island, Queen Charlotte Archipelago (GSC loc. C–157123).

Figures 7a, b. *Tropiceltites pacificus* n. sp. (Macrolobatus Zone) (Page 227)
Holotype GSC 85787. Peril Formation, Huxley Island, Queen Charlotte Archipelago (GSC loc. C–157119).

Figures 8–10. *Tropithisbites densicostatus* (Silberling) (Macrolobatus Zone) (Page 232)
8. Hypotype GSC 85791. Peril Formation, Huxley Island, Queen Charlotte Archipelago (GSC loc. C–157119).
9. Hypotype GSC 85792.
10. Hypotype GSC 85793 (x2).
Figures 9, 10 from Peril Formation, Kunghit Island, Queen Charlotte Archipelago (GSC loc. C–157382).

Figure 11. *Margarijuvavites carlottensis* (Whiteaves) (Macrolobatus Zone) (Page 240)
Topotype, GSC 85795. Peril Formation, Kunghit Island, Queen Charlotte Archipelago (GSC loc. C–157382).

Figures 12a–c. *Anatropites* sp. indet. (Macrolobatus Zone) (Page 225)
GSC 85818. Peril Formation, Huxley Island, Queen Charlotte Archipelago (GSC loc. C–157119).

Figures 13a, b. *Hoplotropites circumspinatus* (Mojsisovics) (Welleri Subzone 2) (Page 219)
Hypotype GSC 85785. Peril Formation, Burnaby Island, Queen Charlotte Archipelago (GSC loc. C–157295).

Figures 14a, b. *Discotropites smithi* Kutassy (Welleri Subzone 1) (Page 217)
Hypotype GSC 29001. Quatsino Limestone, near Klaskino Inlet, Vancouver Island (GSC loc. 53340).

Figure 83. *Suture.* ***Neotenoceras simplex*** *n. sp., GSC 85809 (Pl. 104, fig. 2) x5.*

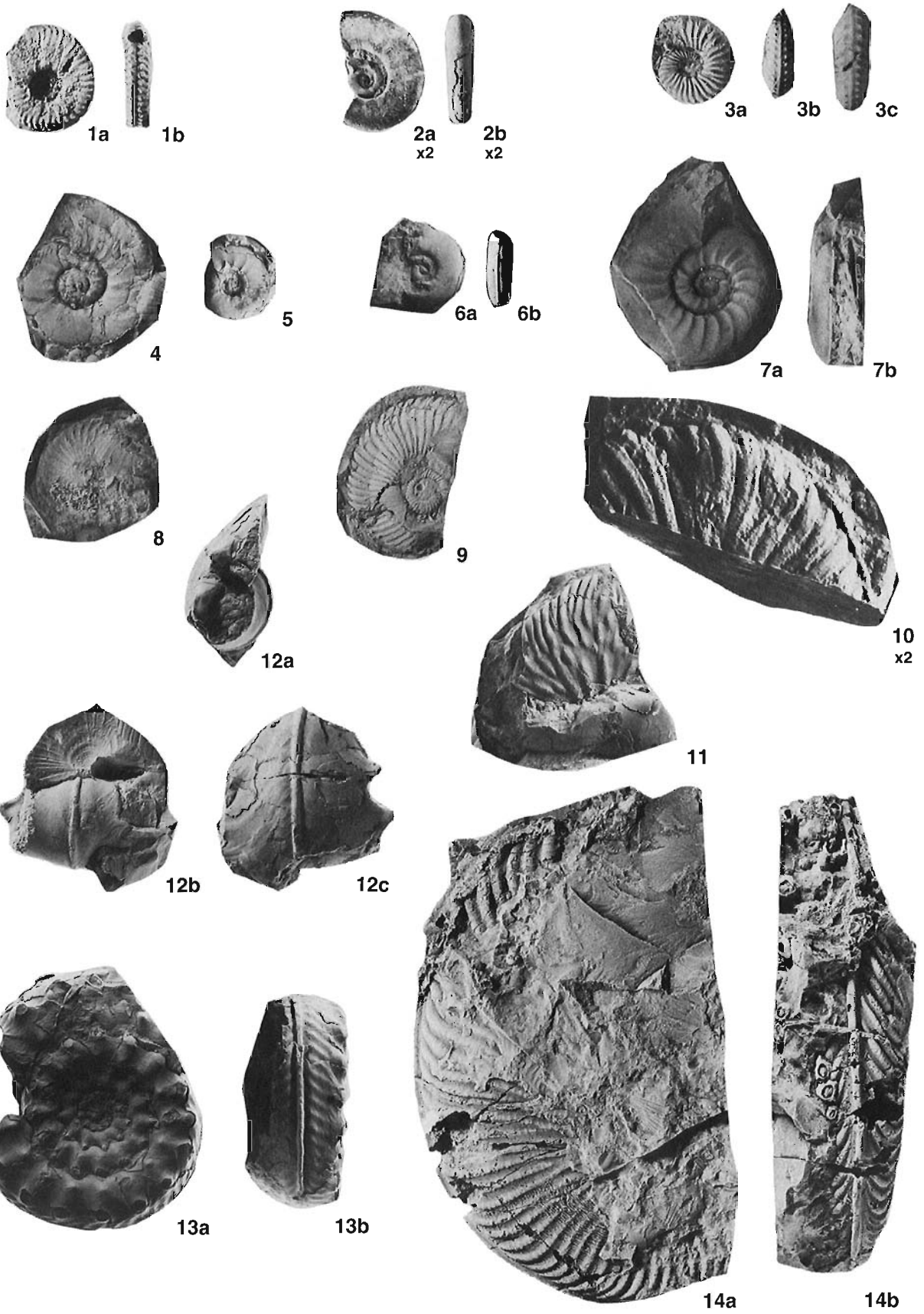
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PLATE 105

UPPER TRIASSIC
Upper Carnian–Macrolobatus Zone

Figures 1a, b. *Gonionotites avarus* n. sp. (Page 235)
Hypotype GSC 71027, phragmocone(?). Ludington Formation, northeast spur of Mount Laurier, northeastern British Columbia (GSC loc. 94738).

Figures 2a–c. *Anatropites silberlingi* n. sp. (Page 224)
Holotype GSC 71028. Ludington Formation, northeast spur of Mount Laurier, northeastern British Columbia (GSC loc. 94738).

Figures 3a, b. *Anatropites cupressus* n. sp. (Page 223)
Holotype GSC 71029. Ludington Formation, northeast spur of Mount Laurier, northeastern British Columbia (GSC loc. 94738).

Figures 4a, b. *Anatropites cascadensis* n. sp. (Page 224)
Holotype GSC 12594. Pardonet Formation, Cascades Creek, Pardonet Hill, northeastern British Columbia (GSC loc. 9688).

Figures 5a–c. *Anatropites ausoniformis* n. sp. (Page 224)
Holotype GSC 71031. Ludington Formation, northeast spur of Mount Laurier, northeastern British Columbia (GSC loc. 94738).

Figures 6a, b. *Anatropites maclearni* n. sp. (Page 223)
Hypotype GSC 71030. Ludington Formation, northeast spur of Mount Laurier, northeastern British Columbia (GSC loc. 94738).

Figures 7–9. *Margarijuvavites carlottensis* (Whiteaves) (Page 240)
7a, b. Hypotype GSC 38627. Pardonet Formation, Cascades Creek, Pardonet Hill, northeastern British Columbia (GSC loc. 9687).
8a, b. Lectotype GSC 4717.
9. Paralectotype, GSC 4717a.
Figures 8, 9 from Peril Formation, Kunghit Island, Houston Stewart Channel, Queen Charlotte Islands, British Columbia.

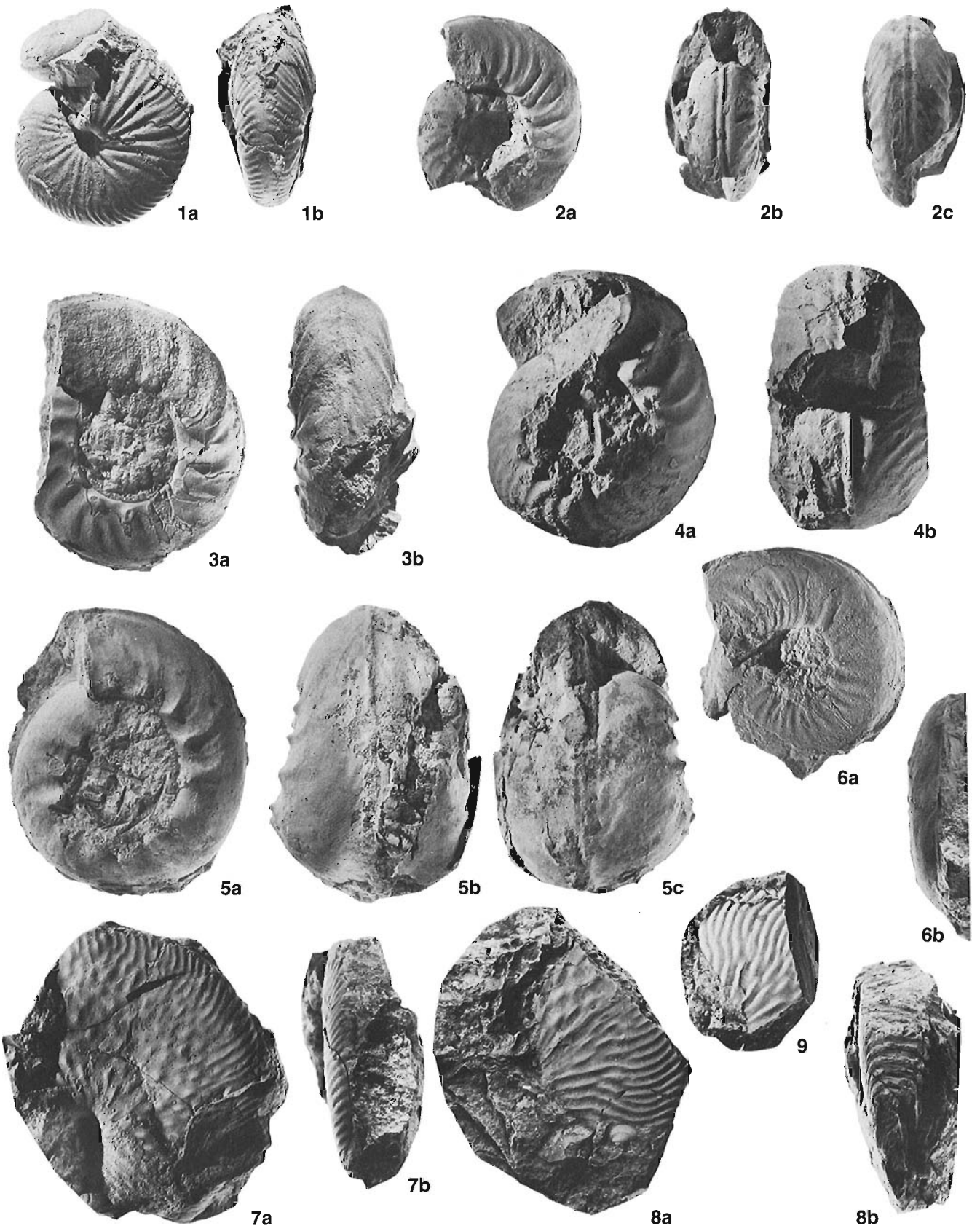
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PLATE 106

UPPER TRIASSIC
Upper Carnian–Macrolobatus Zone

Figures 1, 8. *Griesbachites auctoris* n. sp. (Page 237)
1a, b. Hypotype GSC 32175, phragmocone.
8a, b. Holotype GSC 32176, body chamber is more than half a whorl.
Both from Pardonet Formation, west side Pardonet Hill, northeastern British Columbia (GSC loc. 64628).

Figures 2–7. *Gonionotites nobilis* n. sp. (Page 235)
2a, b. Paratype GSC 32172, phragmocone.
3a, b. Paratype GSC 32173, phragmocone.
4a–c. Holotype GSC 32171, complete phragmocone with part of body chamber in umbilical area.
5. Paratype GSC 32174, body chamber.
Figures 2–5 from Pardonet Formation, west side Pardonet Hill, northeastern British Columbia (GSC loc. 64628).
6a, b. Paratype GSC 32177, phragmocone.
7a–c. Paratype GSC 32178, phragmocone.
Figures 6, 7 from Pardonet Formation, west of Mount McLearn, northeastern British Columbia (GSC loc. 68202).

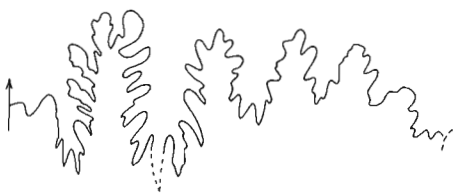

Figure 84. *Suture.* ***Gonionotites nobilis*** *n. sp., GSC 32178 (Pl. 106, fig. 7) x2.*

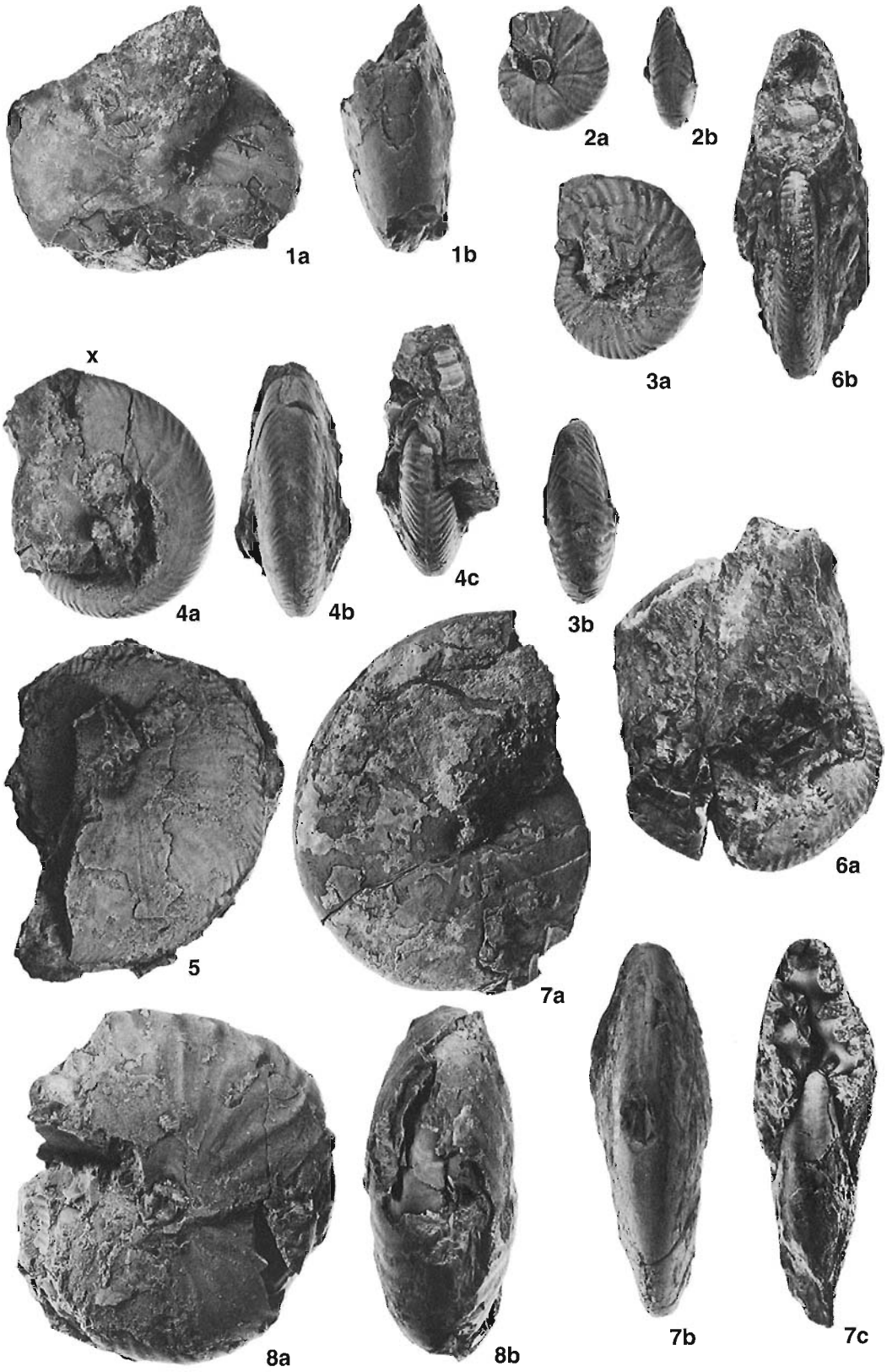
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PLATE 107

UPPER TRIASSIC
Upper Carnian–Macrolobatus Zone

Figures 1, 2. *Hadrothisbites taylori* n. sp. (Page 231)
1a–c. Holotype GSC 29012, last half whorl is body chamber.
2a, b. Paratype GSC 29013, apparently body chamber.
Both from Pardonet Formation, west of Mount McLearn, northeastern British Columbia (GSC loc. 68202).

Figures 3–6. *Gonionotites avarus* n. sp. (Page 235)
3a, b. Paratype GSC 32170.
4a, b. Paratype GSC 32169, phragmocone.
5a–c. Paratype GSC 32168, phragmocone.
6a–c. Holotype GSC 32167.
All from Pardonet Formation, west of Mount McLearn, northeastern British Columbia (GSC loc. 68202).

Figures 7, 8. *Euisculites krystyni* n. sp. (Page 225)
7a, b. Holotype GSC 43084, specimen is apparently complete, the whole of the outer whorl being body chamber, in part slightly crushed.
8a, b. Paratype GSC 43085, phragmocone.
Both from Pardonet Formation, near Mount Prudence, northeastern British Columbia (GSC loc. 68221).

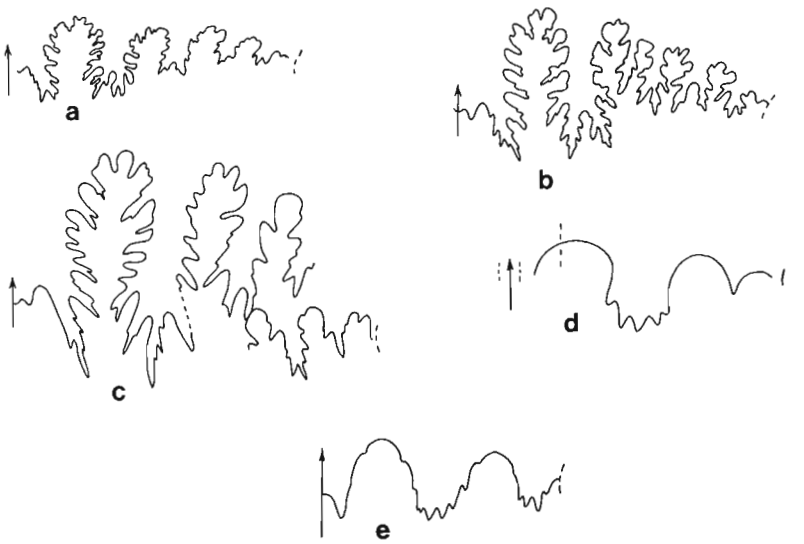

Figure 85. *Sutures. a–c.* ***Gonionotites avarus*** *n. sp. a, GSC 32170 (Pl. 107, fig. 3) x2; b, GSC 32169 (Pl. 107, fig. 4) x2; c, GSC 32168 (Pl. 107, fig. 5) x2; d,* ***Hadrothisbites taylori*** *n. sp., GSC 29012 (Pl. 107, fig. 1) x4; e,* ***Euisculites krystyni*** *n. sp., GSC 43085 (Pl. 107, fig. 8) x4.*

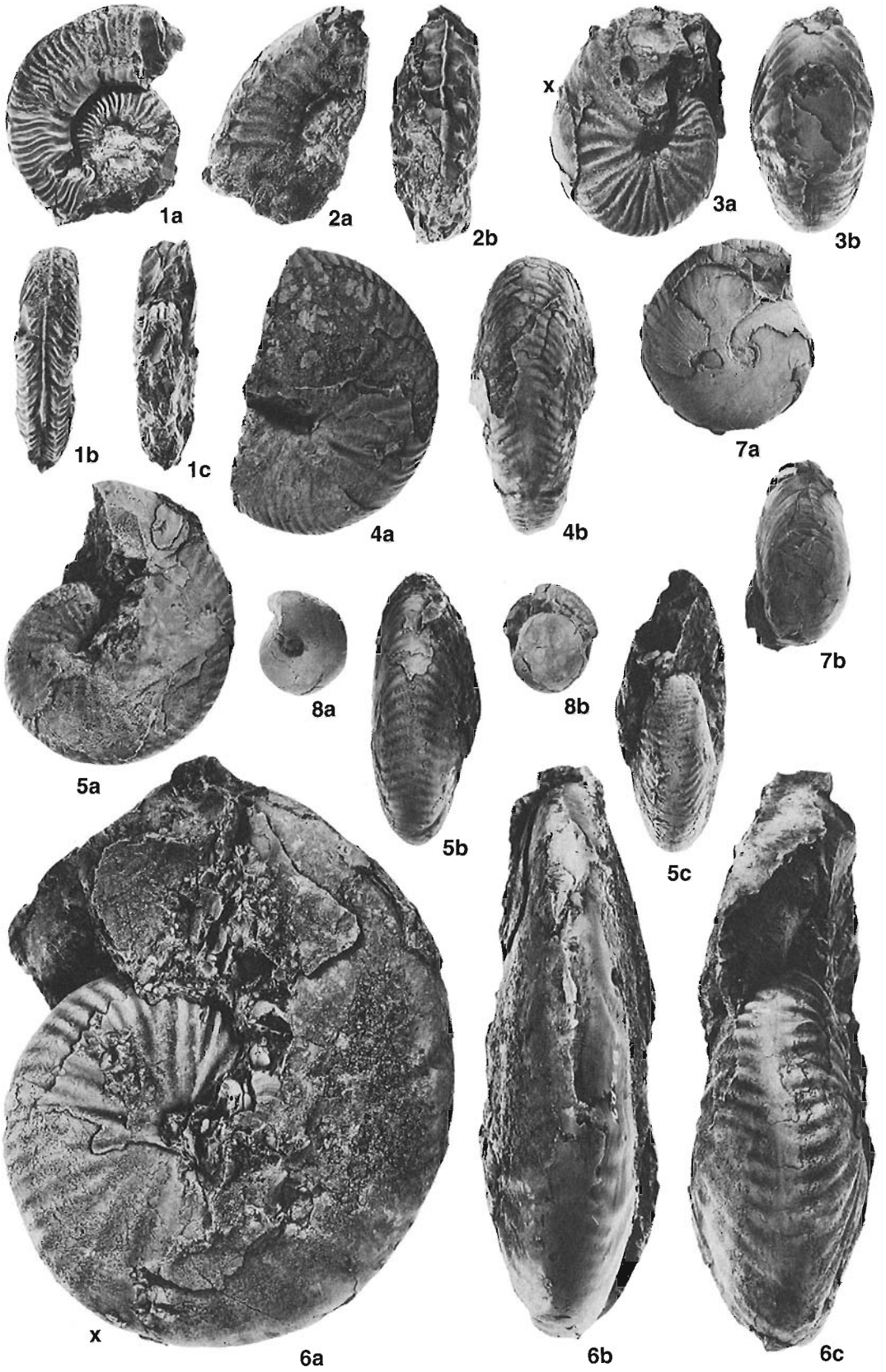
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PLATE 108

UPPER TRIASSIC
Upper Carnian–Macrolobatus Zone
Lower Norian–Kerri Zone

Figures 1, 2. *Thisbites selwyni* n. sp. (Macrolobatus Zone) (Page 229)
1a–c. Holotype GSC 32293 (GSC loc. 64628).
2a, b. Paratype GSC 32294 (GSC loc. 64617), septa are not preserved.
Both from Pardonet Formation, west side of Pardonet Hill, northeastern British Columbia.

Figures 3, 4. *Thisbites petralis* n. sp. (Kerri Subzone 1) (Page 230)
3a–c. Paratype GSC 8791 (GSC loc. 9663).
4a–c. Holotype GSC 14330 (GSC loc. 9638), septa not clear.
Both from Juvavites Gully, Pardonet Hill, northeastern British Columbia.

Figures 5–8. *Thisbites custi* McLearn (Kerri Subzone 1) (Page 230)
5a–c. Hypotype GSC 32295, body chamber about half a whorl.
6a–c. Hypotype GSC 32296.
7a, b. Hypotype GSC 32297, outer whorl apparently body chamber.
8a, b. Hypotype GSC 32298, apparently body chamber.
All from Pardonet Formation, west of Mount McLearn, northeastern British Columbia (GSC loc. 68181).

Figures 9, 10. *Anatropites sulfurensis* n. sp. (Macrolobatus Zone) (Page 225)
9a–d. Holotype GSC 32108, body chamber more than one whorl.
10a, b. Paratype GSC 32109, phragmocone.
Both from Pardonet Formation, west of Mount McLearn, northeastern British Columbia (GSC loc. 68202).

Figures 11, 12. *Anatropites maclearni* n. sp. (Macrolobatus Zone) (Page 223)
11a–c. Holotype GSC 32111, body chamber one whorl.
12a, b. Paratype GSC 32112, phragmocone.
Both from Pardonet Formation, west of Mount McLearn, northeastern British Columbia (GSC loc. 68202).

Figures 13–15. *Anatropites pardoneti* n. sp. (Macrolobatus Zone) (Page 224)
13a, b. Paratype GSC 32106 (GSC loc. 64627).
14a, b. Holotype GSC 18911 (GSC loc. 64627).
15a, b. Paratype GSC 32107 (GSC loc. 64616).
None of the specimens show septa. All from Pardonet Formation, west side Pardonet Hill, northeastern British Columbia.

Figures 16a, b. *Anatropites cascadensis* n. sp. (Macrolobatus Zone) (Page 224)
Hypotype, GSC 32113, apparently body chamber. Pardonet Formation, west side Pardonet Hill, northeastern British Columbia (GSC loc. 64628).

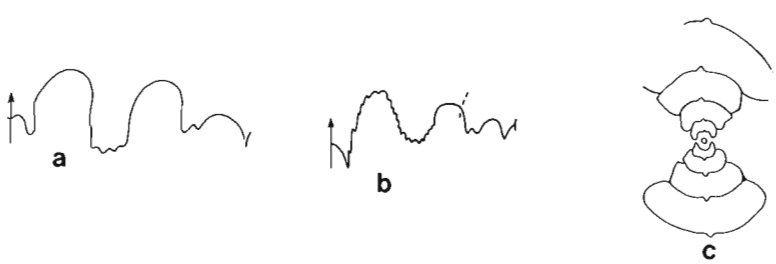

Figure 86. *Sutures and section. a,* ***Thisbites custi*** *McLearn, GSC 12588, (McLearn, 1960, Pl. 6, fig. 4) x4; b, c.* ***Anatropites sulfurensis*** *n. sp. b, GSC 32110* x2; c, GSC 32109 (Pl. 108, fig. 10) x1.*

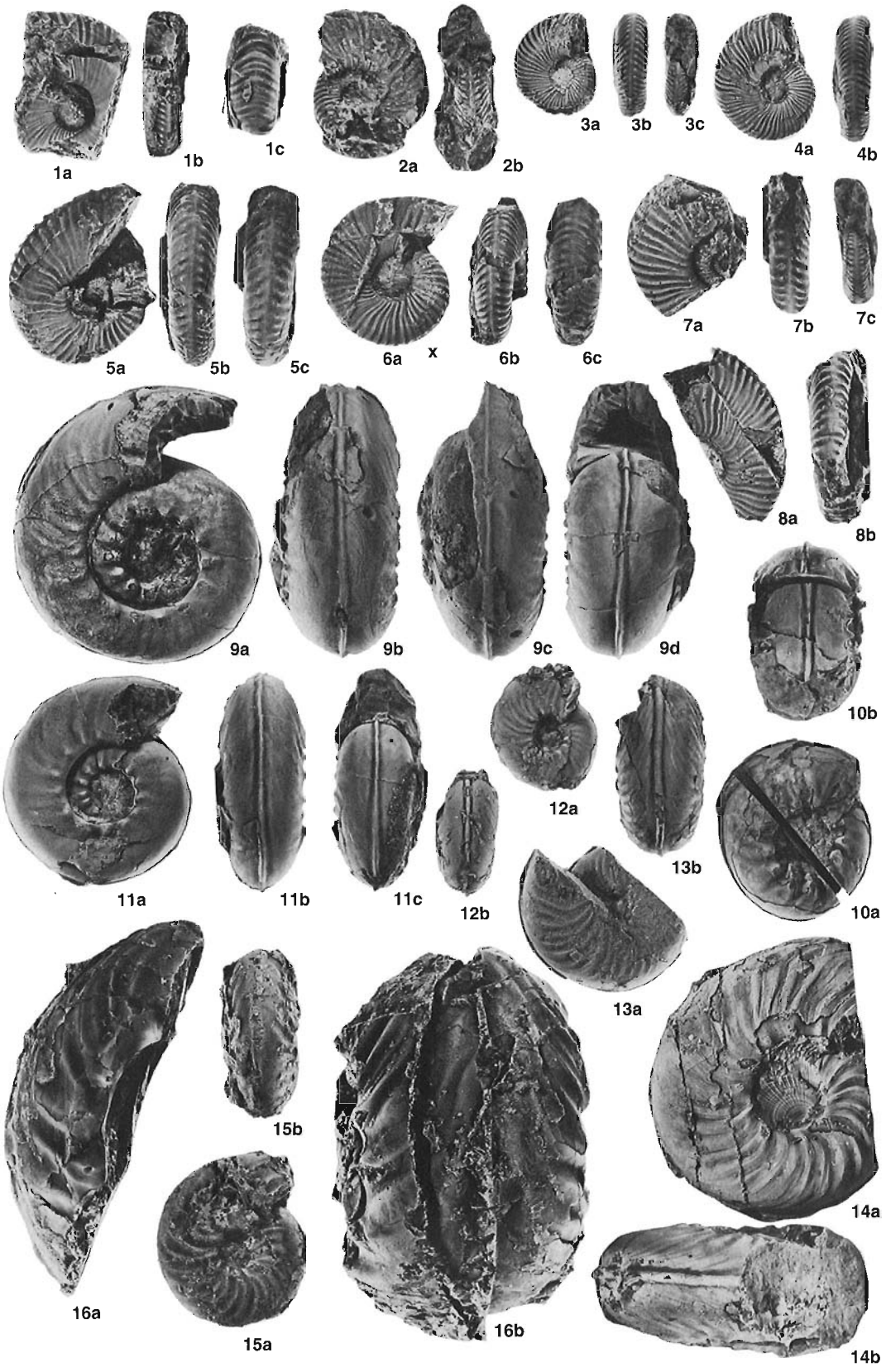
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PLATE 109

UPPER TRIASSIC
Lower Norian–Kerri Zone

Figures 1, 2. *Tropiceltites inflatus* n. sp. (Subzone 2) (Page 228)
1a–c. Paratype GSC 32136, outer whorl apparently body chamber.
2a–c. Holotype GSC 32135.
Both from Pardonet Formation, west of Mount McLearn, northeastern British Columbia (GSC loc. 68180).

Figures 3–7. *Tropiceltites columbianus* (McLearn) (Page 228)
3a–c. Topotype GSC 32138 (GSC loc. 9663).
5a–c. Topotype GSC 32139 (GSC loc. 9662).
6a–c. Topotype GSC 32140 (GSC loc. 9661), septate to break, body chamber beyond.
7a–c. Topotype GSC 32137 (GSC loc. 9663), probably phragmocone but septa not clearly visible.
Figures 3, 5–7 from Pardonet Formation, Juvavites Gully, Pardonet Hill, northeastern British Columbia (Subzone 1).
4a–d. Hypotype GSC 32141. Pardonet Formation, west of Mount McLearn, northeastern British Columbia (GSC loc. 68180) (Subzone 2).

Figures 8a, b. *Discostyrites ireneanus* (McLearn) (Subzone 1) (Page 229)
Hypotype GSC 32134. Pardonet Formation, northeast side Pardonet Hill, northeastern British Columbia (GSC loc. 64597).

Figures 9, 10. *Styrites communis* Mojsisovics (Subzone 2) (Page 227)
9a, b. Hypotype GSC 32129.
10a, b. Hypotype GSC 32130, phragmocone.
Both from Pardonet Formation, west of Mount McLearn, northeastern British Columbia (GSC loc. 68180).

Figures 11–13. *Metathisbites dawsoni* (McLearn) (Page 232)
11a, b. Topotype GSC 12587. Pardonet Formation, talus block at Juvavites Gully, Pardonet Hill, northeastern British Columbia (GSC loc. 9643) (Subzone 2?).
12a–d. Hypotype GSC 32300.
13a–d. Hypotype GSC 32301.
Figures 12, 13 from Pardonet Formation, west of Mount McLearn, northeastern British Columbia (GSC loc. 68180) (Subzone 2).

Figures 14a–d. *Clionitites punctulus* n. sp. (Subzone 2) (Page 176)
Holotype GSC 28698. Pardonet Formation, west of Mount McLearn, northeastern British Columbia (GSC loc. 68180).

Figures 15a–d. *Clionitites laevis* n. sp. (Subzone 2) (Page 176)
Holotype GSC 28699. Pardonet Formation, west of Mount McLearrn, northeastern British Columbia (GSC loc. 68180).

Figures 16a–c. *Metathisbites*(?) *griphus* n. sp. (Zone uncertain) (Page 232)
Holotype GSC 32299. Pardonet Formation, north side Pardonet Hill, northeastern British Columbia (GSC loc. 64625).

Figures 17–20. *Stikinoceras kerri* McLearn (Subzone 2) (Page 233)
17a, b. Hypotype GSC 32304. Pardonet Formation, west side of Pardonet Hill, northeastern British Columbia (GSC loc. 64607).
18a, b. Hypotype GSC 32306. Quatsino Limestone, Rupert Inlet, Vancouver Island, British Columbia (GSC loc. 23266).
19a, b. Hypotype GSC 32305, septate to break, body chamber beyond. Pardonet Formation, west of Mount Mclearn, northeastern British Columbia (GSC loc. 68180).
20a–c. Topotype GSC 32302. Pardonet Formation, Brown Hill, northeastern British Columbia (GSC loc. 64654).

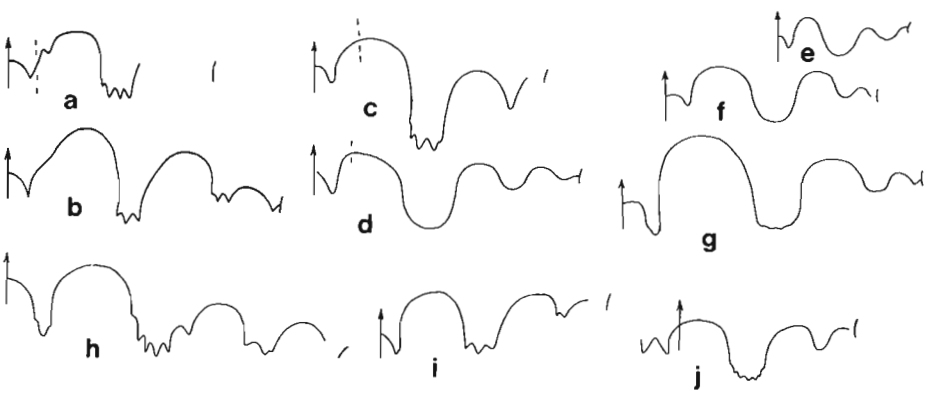
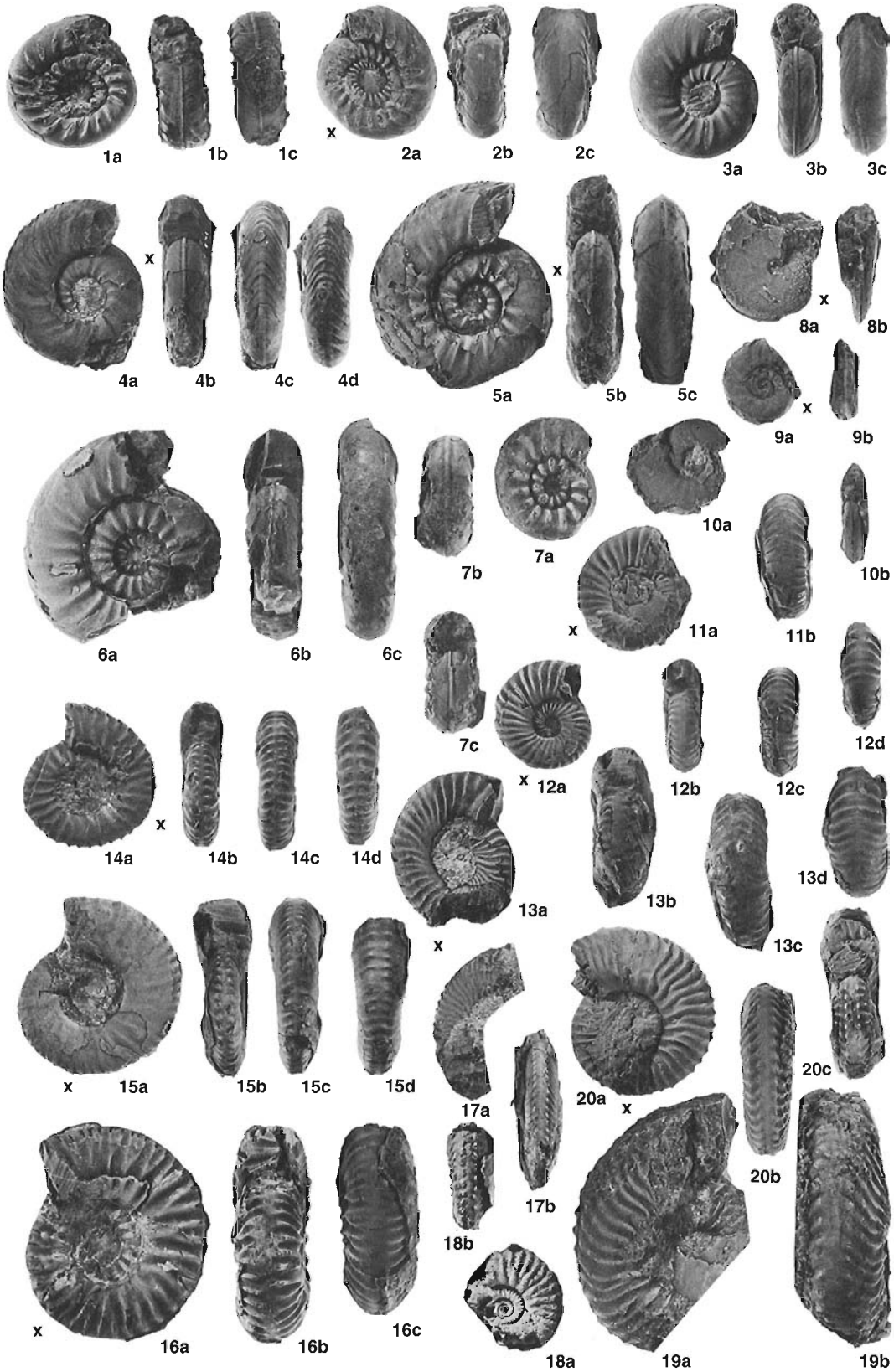


Figure 87. *Sutures. a, b.* ***Stikinoceras kerri*** *McLearn. a, GSC 32302 (Pl. 109, fig. 20) x4; b, GSC 32303* x4; c,* ***Clionitites punctulus*** *n. sp., GSC 28698 (Pl. 109, fig. 14) x4; d,* ***Clionitites laevis****, GSC 28699 (Pl. 109, fig. 15) x4. e, f.* ***Styrites communis*** *Mojsisovics. e, GSC 32129 (Pl. 109, fig. 9) x4. f, GSC 32130 (Pl. 109, fig. 10) x4. g,* ***Tropiceltites columbianus*** *(McLearn), GSC 32139 (Pl. 109, fig. 5) x4; h,* ***Metathisbites? griphus*** *n. sp., GSC 32299 (Pl. 109, fig. 16) x4. i, j.* ***Metathisbites dawsoni*** *(McLearn). i, GSC 12587 (Pl. 109, fig. 11) x4; j, GSC 32300 (Pl. 109, fig. 12) x4.*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19b

PLATE 110

UPPER TRIASSIC
Lower Norian–Kerri Zone

Figures 1–3. *Discostyrites ireneanus* (McLearn) (Subzone 1) (Page 229)
1a, b. Topotype GSC 32131.
2a–c. Topotype GSC 32132.
3a, b. Topotype GSC 32133, body chamber about half a whorl, peristome is preserved at the venter.
All from Pardonet Formation, Juvavites Gully, Pardonet Hill, northeastern British Columbia (GSC loc. 9663).

Figures 4a, b. *Pinacoceras* sp. indet. (Subzone 1) (Page 131)
GSC 28422, mainly or wholly phragmocone. Pardonet Formation, near head of Carbon Creek, northeastern British Columbia (GSC loc. 83826).

Figures 5a, b. Tibetitid indet. (Page 340)
GSC 72318. Nicola Group, southern British Columbia (GSC loc. 90808).

Figures 6–10. *Pterosirenites auritus* Tozer (Subzone 1) (Page 172)
6a–c. Hypotype GSC 28741.
7a–c. Hypotype GSC 28743.
8. Hypotype GSC 28742, outer whorl probably partly body chamber.
9. Hypotype GSC 28739, outer whorl probably partly body chamber.
10a, b. Hypotype GSC 28740.
All from Pardonet Formation, near head of Carbon Creek, northeastern British Columbia (GSC loc. 83826).

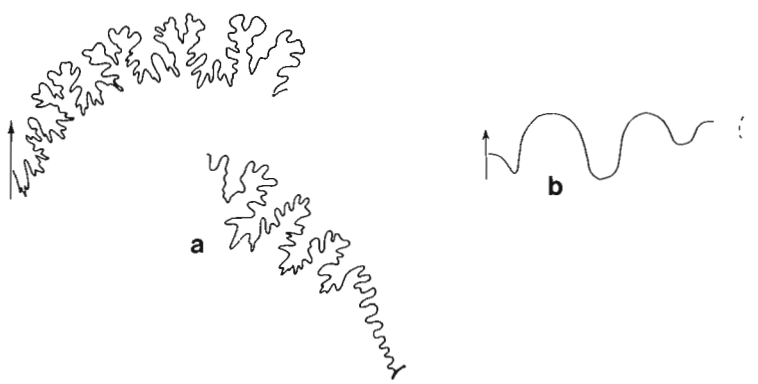

Figure 88. *Sutures. a,* ***Pinacoceras*** *sp. indet., two sutures of GSC 28422 (Pl. 110, fig. 4) x4; b,* ***Discostyrites ireneanus*** *(McLearn), GSC 32131 (Pl. 110, fig. 1) x4.*

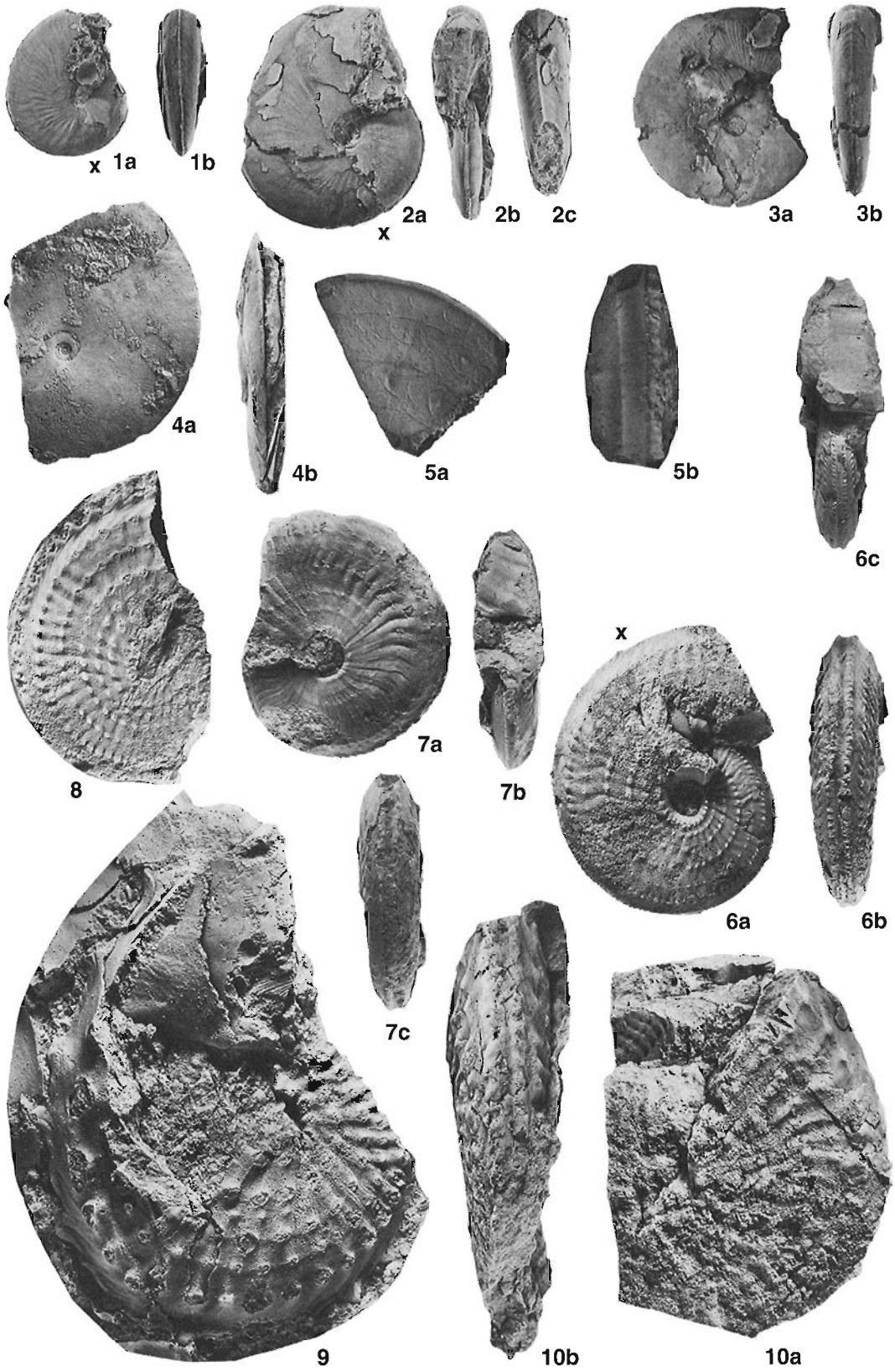
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PLATE 111

UPPER TRIASSIC
Lower Norian–Kerri Subzone 2

All specimens from Pardonet Formation, west of Mount McLearn, northeastern British Columbia (GSC loc. 68180)

Figures 1a, b. *Discophyllites ebneri* (Mojsisovics) (Page 271)
Hypotype GSC 32352.

Figures 2–6. *Pterosirenites auritus* Tozer (Page 172)
2a, b. Paratype GSC 28736, phragmocone.
3a–c. Paratype GSC 28735, mostly if not wholly phragmocone.
4a, b. Holotype GSC 28734, complete(?) phragmocone.
5a, b. Paratype GSC 28737, body chamber(?).
6a, b. Paratype GSC 28738, phragmocone.

Figures 7a, b. *Metathisbites dawsoni* (McLearn) (Page 232)
Hypotype GSC 34606, half a whorl is body chamber.

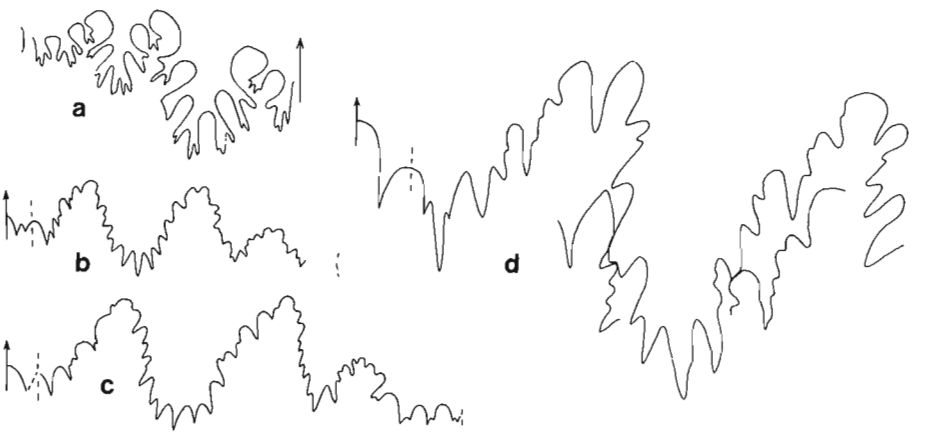

Figure 89. *Sutures. a,* ***Discophyllites ebneri*** *(Mojsisovics), GSC 32352 (Pl. 111, fig. 1) x2. b–d.* ***Pterosirenites auritus*** *n. sp. b, GSC 28735 (Pl. 111, fig. 3) x2; c, GSC 28734 (Pl. 111, fig. 4) x2; d, GSC 28738 (Pl. 111, fig. 6) x4.*

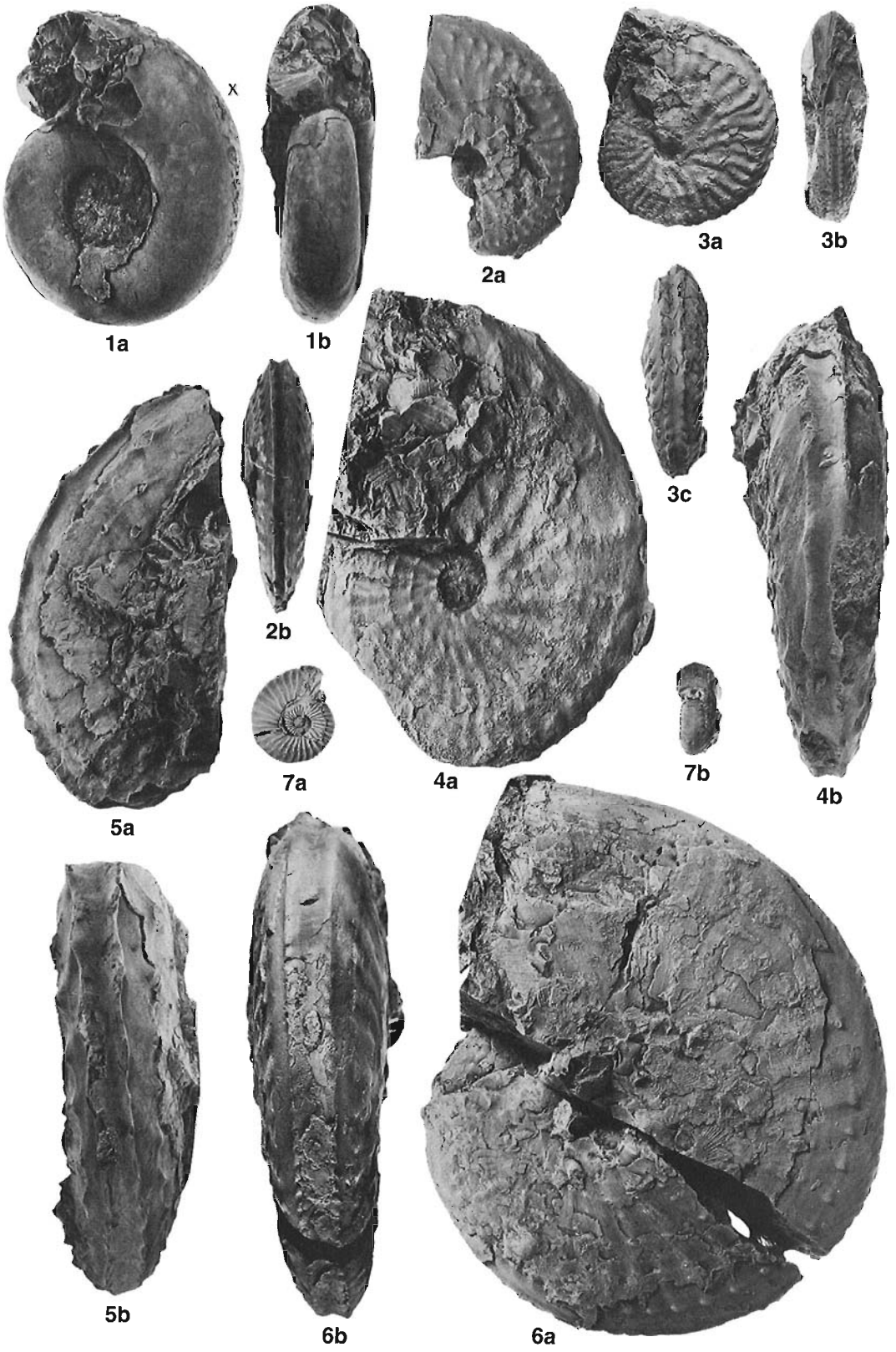
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PLATE 112

UPPER TRIASSIC
Lower Norian–Kerri Zone

Figures 1–3. *Griesbachites borealis* n. sp. (Subzone 2) (Page 239)
1a, b. Paratype GSC 32194.
2a–c. Paratype GSC 32195, phragmocone.
3a, b. Paratype GSC 32196.
All from Pardonet Formation, west of Mount McLearn, northeastern British Columbia (GSC loc. 68180).

Figures 4a–c. *Thisbites robustus* n. sp. (Subzone 1) (Page 230)
Holotype GSC 13481. Pardonet Formation, Juvavites Gully, Pardonet Hill, northeastern British Columbia (GSC loc. 9672).

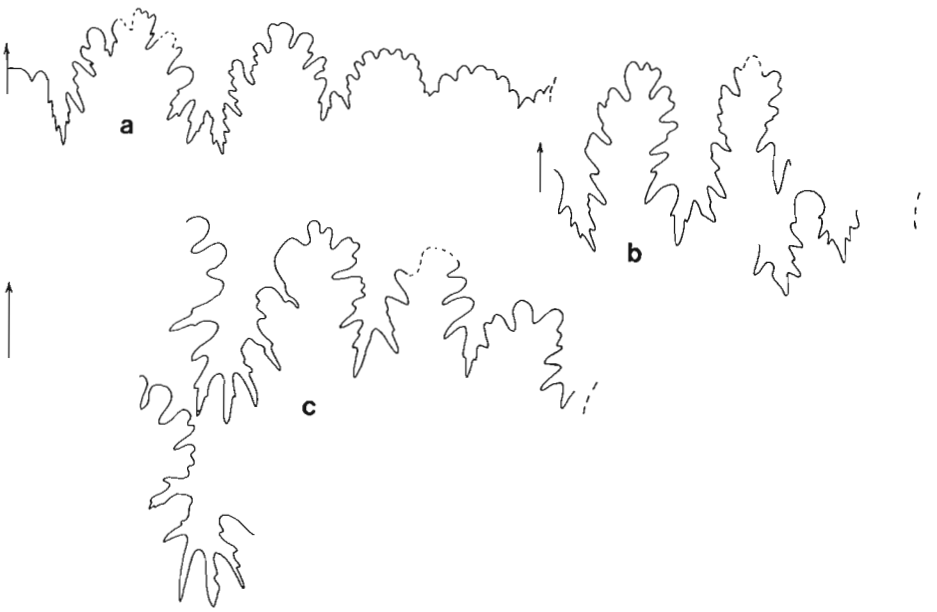

Figure 90. *Sutures.* ***Griesbachites borealis*** *n. sp. a, GSC 32194 (Pl. 112, fig. 1) x2; b, GSC 32195 (Pl. 112, fig. 2) x2; c, GSC 32196 (Pl. 112, fig. 3) x2.*

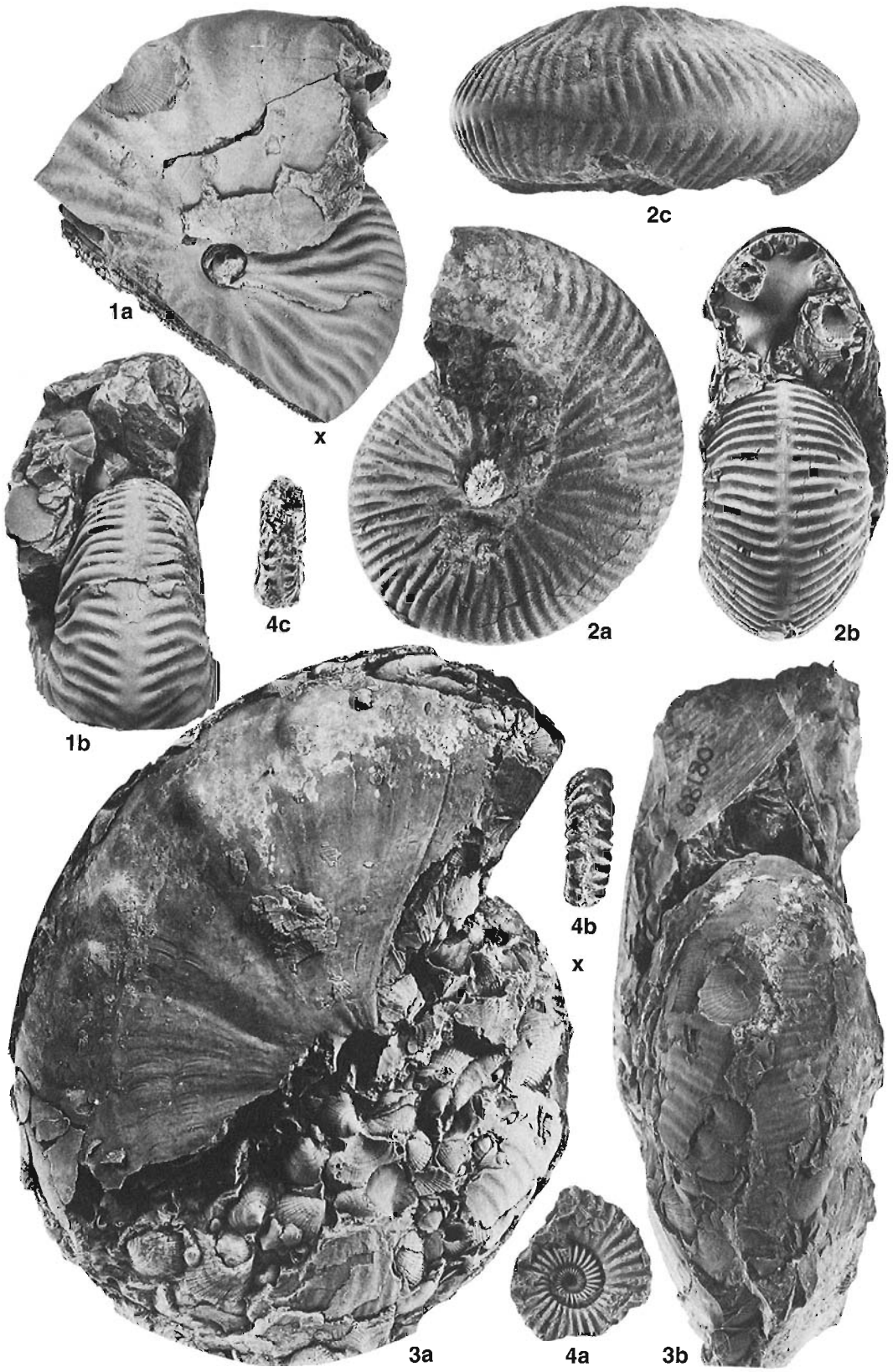
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PLATE 113

UPPER TRIASSIC
Lower Norian–Kerri Zone

Figures 1–5. *Griesbachites borealis* n. sp. (Subzone 2) (Page 239)
1a–c. Holotype GSC 32197, at least half a whorl is body chamber.
2a, b. Paratype GSC 32198.
3a–c. Paratype GSC 32199.
4a, b. Paratype GSC 32200.
5a, b. Paratype GSC 32201, septate to break, body chamber beyond.
All from Pardonet Formation, west of Mount McLearn, northeastern British Columbia (GSC loc. 68180).

Figures 6a, b. *Metathisbites(?) griphus* n. sp. (Zone uncertain) (Page 232)
Hypotype GSC 35360. Pardonet Formation, talus, north side of Pardonet Hill, northeastern British Columbia (GSC loc. 9694).

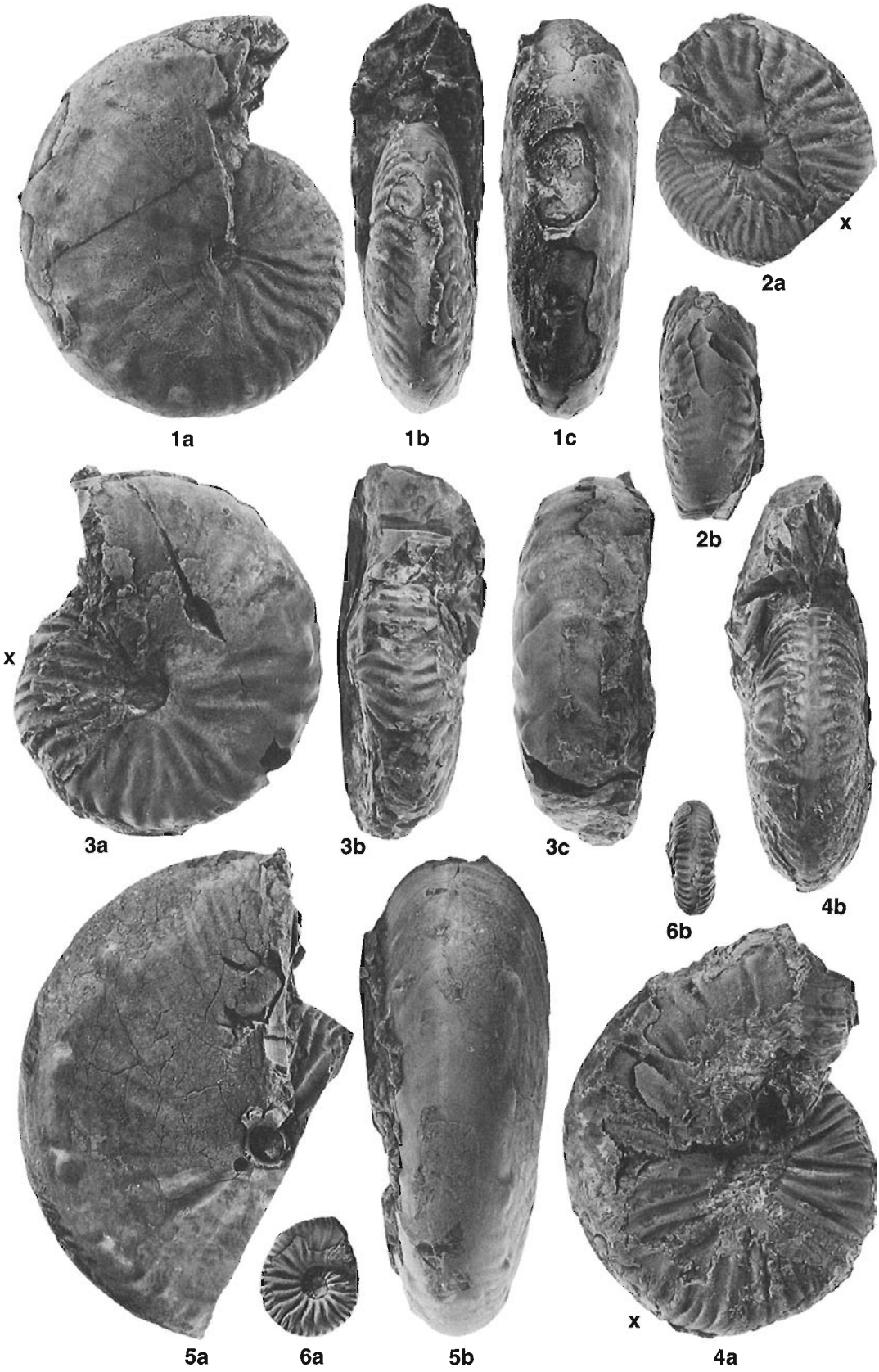
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PLATE 114

UPPER TRIASSIC
Lower Norian–Kerri Zone

Figures 1–3. *Dimorphites pardonetiensis* McLearn (Page 240)
1a–c. Hypotype GSC 32220, outer whorl is partly body chamber. Pardonet Formation, headwaters of Carbon Creek, northeastern British Columbia (GSC loc. 42444) (Subzone 1).
2a, b. Hypotype GSC 32219, phragmocone. Pardonet Formation, west of Mount McLearn, northeastern British Columbia (GSC loc. 68180) (Subzone 2).
3a, b. Topotype GSC 34600, phragmocone. Pardonet Formation, Brown Hill, northeastern British Columbia (GSC loc. 64666) (Subzone 2).

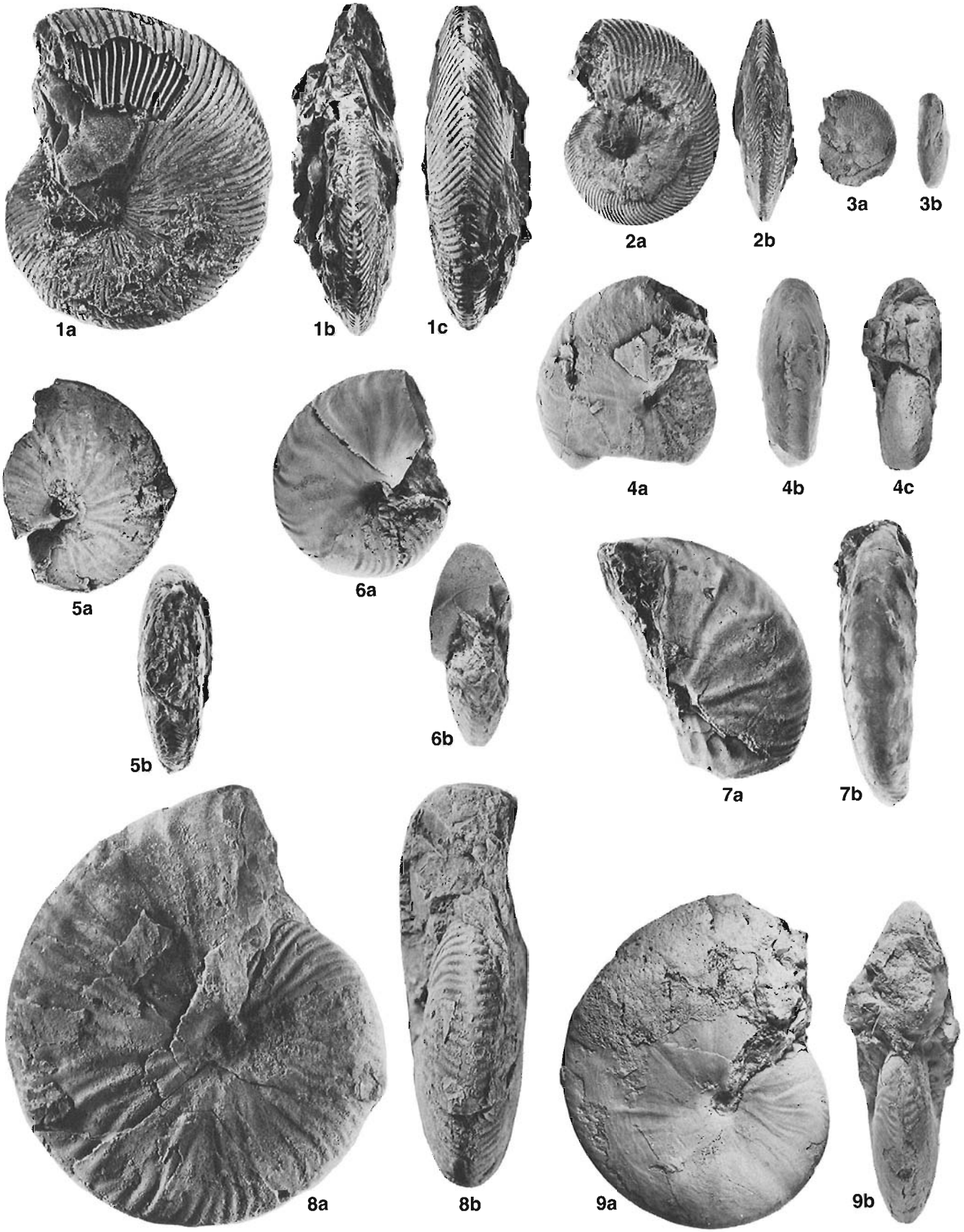
Figures 4a–c. *Gonionotites gethingi* McLearn (Subzone 1) (Page 236) topotype GSC 32203, no septa visible. Pardonet Formation, Juvavites Gully, Pardonet Hill, northeastern British Columbia (GSC loc. 9640).

Figures 5–7. *Griesbachites laevis* n. sp. (Subzone 2) (Page 238)
5a, b. Paratype GSC 32206 (GSC loc. 64666), phragmocone.
6a, b. Paratype GSC 32207 (GSC loc. 9157).
7a, b. Holotype GSC 32205 (GSC loc. 64666), body chamber.
All from Pardonet Formation, Brown Hill, northeastern British Columbia.

Figures 8a, b. *Griesbachites selwyni* (McLearn) (Page 239)
Holotype GSC 8820, outer whorl probably mostly body chamber, Pardonet Formation, near Juvavites Gully, Pardonet Hill, northeastern British Columbia (GSC loc. 9636).

Figures 9a, b. *Gonionotites spiekeri* McLearn (Subzone 1) (Page 236)
Hypotype GSC 32180, phragmocone. Pardonet Formation, headwaters of Carbon Creek, northeastern British Columbia (GSC loc. 83826).

Figure 91. *Sutures. a, b.* ***Griesbachites laevis*** *n. sp. a, GSC 32206 (Pl. 114, fig. 5) x2; b, GSC 32207 (Pl. 114, fig. 6) x2; c,* ***Dimorphites pardonetiensis*** *McLearn, GSC 12602 (McLearn, 1960a Pl. 16, figs. 1a–c); d,* ***Gonionotites spiekeri*** *McLearn, GSC 8807 (McLearn, 1960a, Pl. 14, fig. 1) x4.*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9b

PLATE 115

UPPER TRIASSIC
Lower Norian–Kerri Zone

Figures 1–7. *Griesbachites humi* (McLearn) (Subzone 2) (Page 238)

1a, b. Holotype GSC 8799. Pardonet Formation, Brown Hill, British Columbia (GSC loc. 9157).

2a, b. Hypotype GSC 72338.

3a–c. Hypotype GSC 72337.

Figures 2, 3 from Pardonet Formation, west of Juvavites Cove, Pardonet Hill, British Columbia (GSC loc. 98562).

4a, b. Hypotype GSC 9511, body chamber one quarter of whorl. Pardonet Formation, Brown Hill, British Columbia (GSC loc. 9719).

5a, b. Topotype GSC 32208.

6a, b. Topotype GSC 9489. Holotype of *Juvavites* (*Griesbachites*) *caurinus* McLearn.

Figures 5, 6 from Pardonet Formation, Brown Hill, British Columbia (GSC loc. 9851).

7a, b. Hypotype GSC 72339, specimen with body chamber, probably complete. Pardonet Formation, west of Juvavites Cove, Pardonet Hill, British Columbia (GSC loc. 98562).

Figures 8, 9. *Griesbachites pinensis* n. sp. (Subzone 1) (Page 237)

8a, b. Holotype GSC 32209, body chamber one half of outer whorl. Pardonet Formation, headwaters of Carbon Creek, British Columbia (GSC loc. 83826).

9a, b. Paratype GSC 32204, body chamber. Pardonet Formation, Juvavites Gully, Pardonet Hill, British Columbia (GSC loc. 9640).

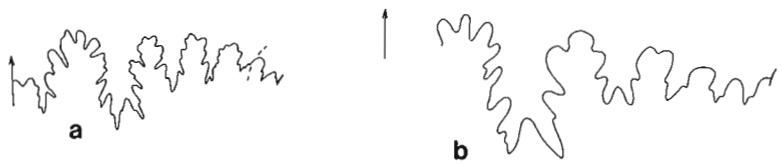
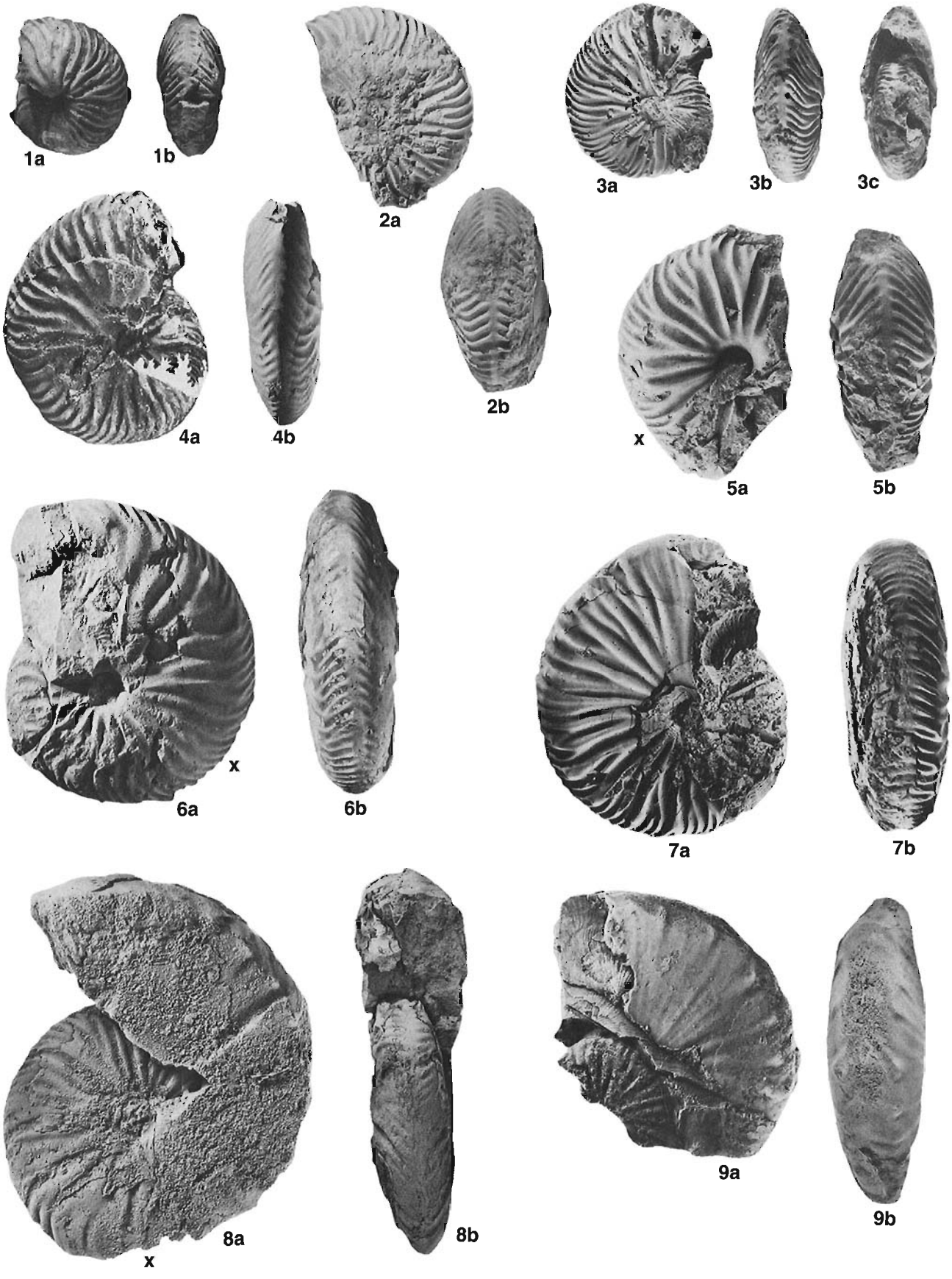


Figure 92. *Sutures.* ***Griesbachites humi*** *(McLearn). a, GSC 9511 (Pl. 115, fig. 4) x2; b, GSC 8799 (Pl. 115, fig. 1), x4.*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9b

PLATE 116

UPPER TRIASSIC
Lower Norian–Kerri Subzone 1

Figures 1–3. *Gonionotites scapulatus* n. sp. (Page 236)

1a, b. Paratype GSC 32181. Pardonet Formation, headwaters of Carbon Creek, British Columbia (GSC loc. 42444).

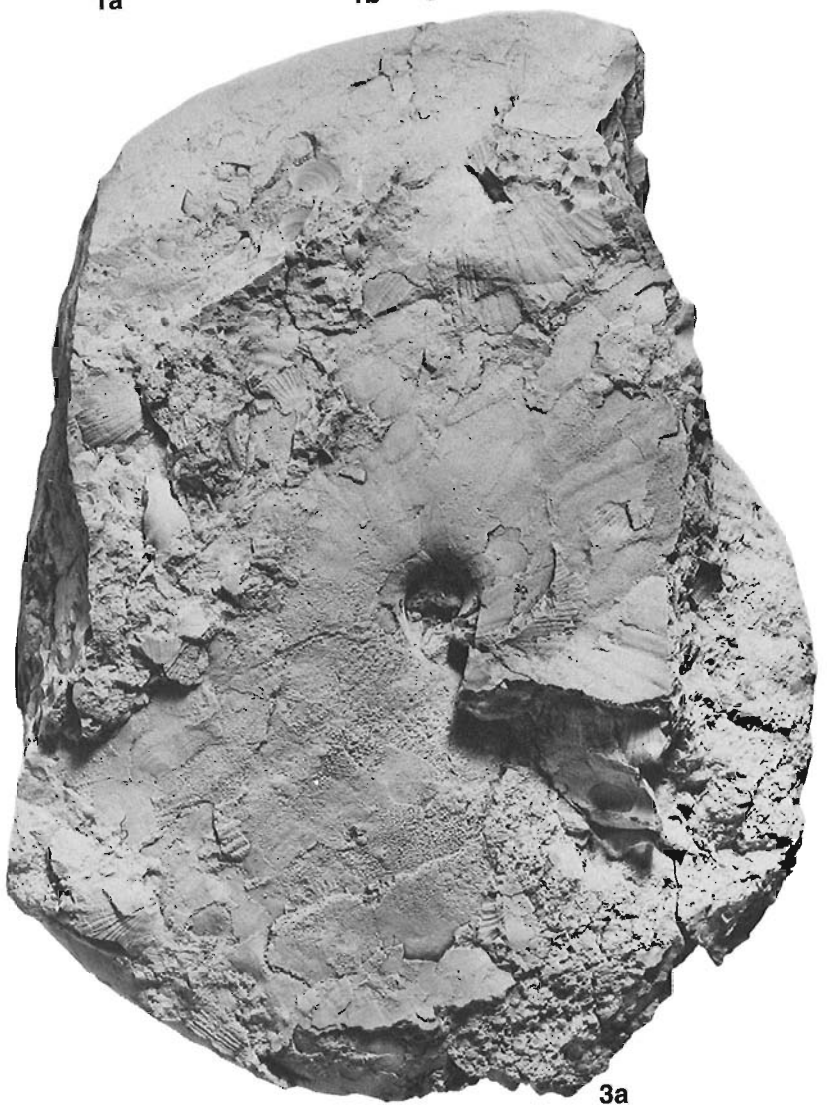
2. Holotype GSC 72335. Pardonet Formation, Juvavites Gully, Pardonet Hill, British Columbia (GSC loc. 9640).

3a, b. Paratype GSC 72336. Pardonet Formation, Juvavites Gully, Pardonet Hill (GSC loc. 9672).

1a

1b

2



3a

3b

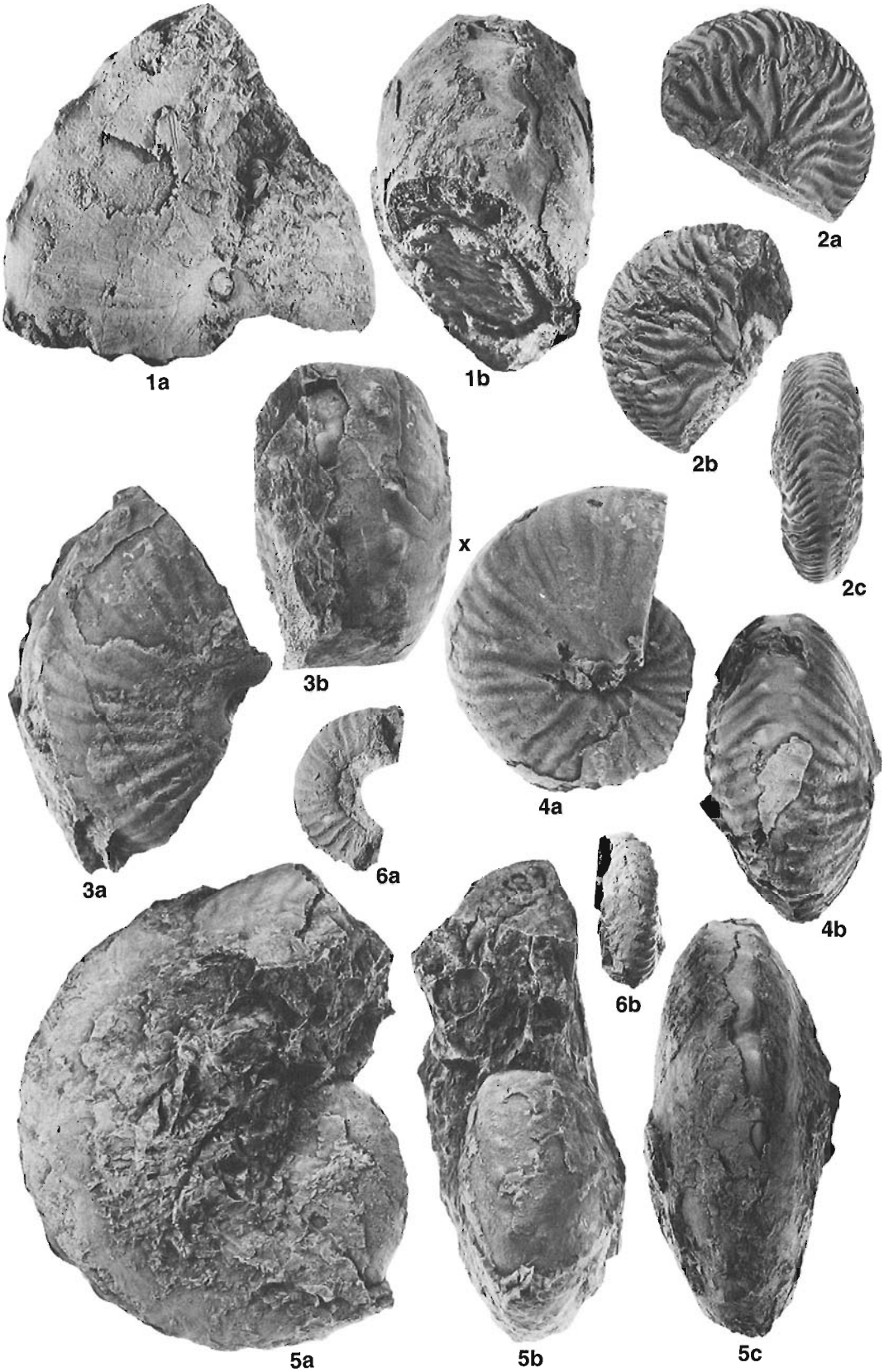
PLATE 117

UPPER TRIASSIC
Lower Norian–Kerri Zone

Figures 1, 3–5. *Guembelites jandianus* Mojsisovics (Subzone 2) (Page 241)
1a, b. Hypotype GSC 32211, no septa visible. Pardonet Formation, head of east fork of Carbon Creek, northeastern British Columbia (GSC loc. 40295).
3a, b. Hypotype GSC 32214, no septa visible.
4a, b. Hypotype GSC 32213.
5a–c. Hypotype GSC 32212, last half whorl is probably body chamber.
Figures 3–5 from Pardonet Formation, west of Mount McLearn, northeastern British Columbia (GSC loc. 68180).

Figures 2a–c. *Griesbachites humi* (McLearn) (Subzone 2) (Page 238)
Hypotype GSC 32202, no septa visible. Pardonet Formation, west of Mount McLearn, northeastern British Columbia (GSC loc. 68180).

Figures 6a, b. *Metathisbites dawsoni* (McLearn) (Page 232)
Hypotype GSC 34607, probably body chamber. Pardonet Formation, Brown Hill, northeastern British Columbia (GSC loc. 9856).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3a
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5b
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PLATE 118

UPPER TRIASSIC
Lower Norian–Kerri Subzone 1

Figures 1–4. *Guembelites clavatus* (McLearn) (Page 240)
1a, b. Hypotype GSC 32216 (GSC loc. 83826).
2a, b. Hypotype GSC 32217 (GSC loc. 83826), other side of specimen closely resembles GSC 14247 (4a, b).
3a–c. Hypotype GSC 32218 (GSC loc. 83826).
4a, b. Hypotype GSC 14247 (GSC loc. 42444).
All from Pardonet Formation, headwaters of Carbon Creek, northeastern British Columbia.

Figures 5a, b. *Tornquistites transiens* n. sp. (Page 226)
Holotype GSC 34604, body chamber about one whorl. Pardonet Formation, west of Mount McLearn, northeastern British Columbia (GSC loc. 68181).

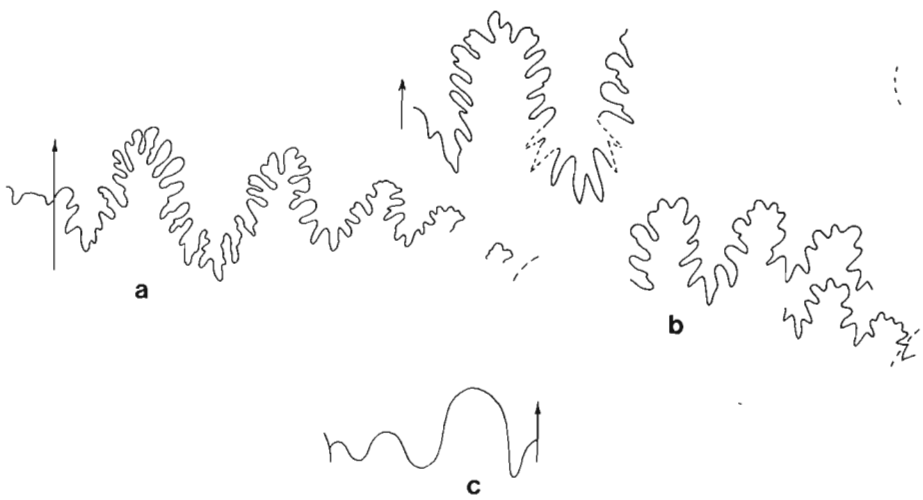
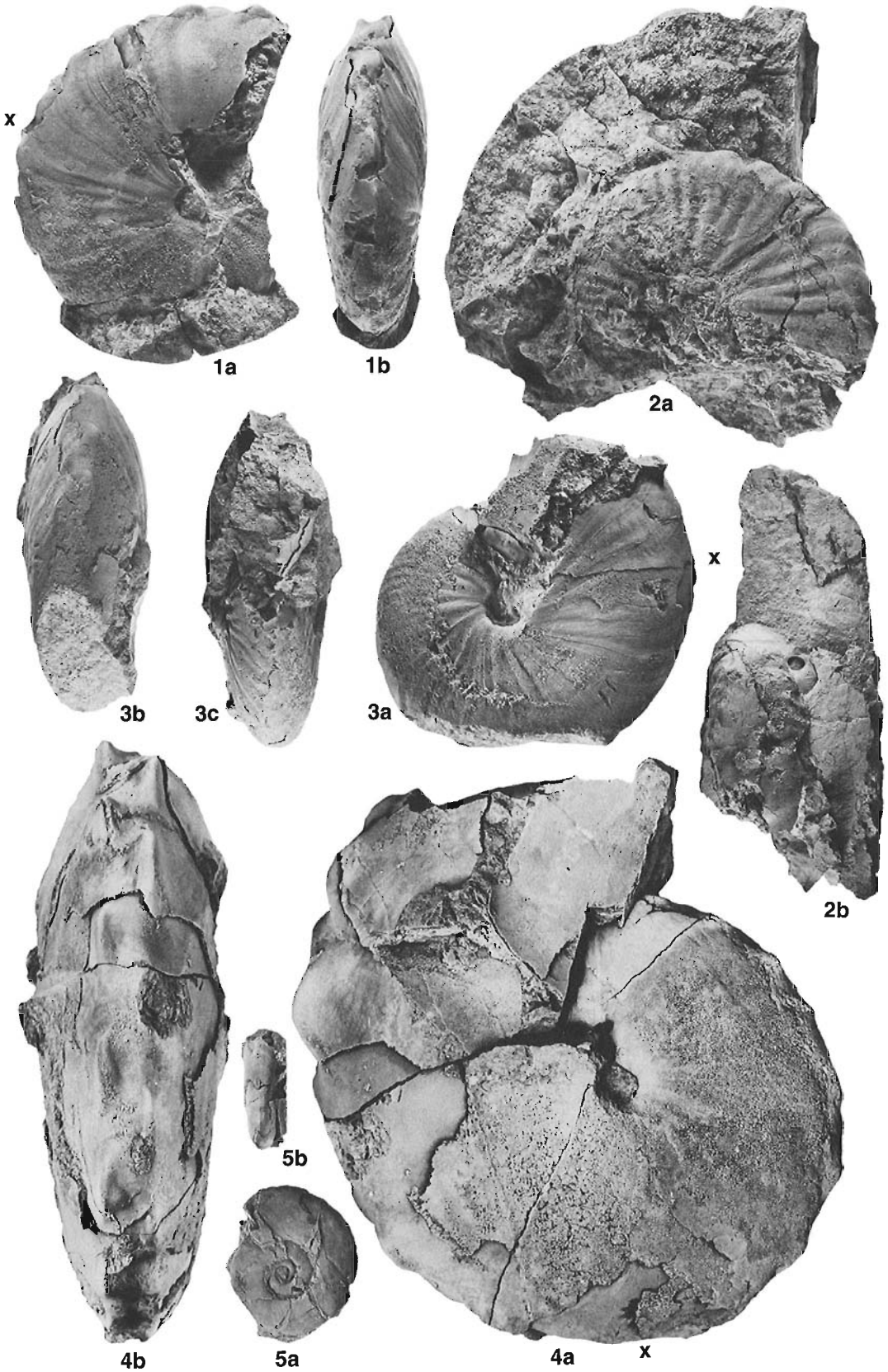


Figure 93. *Sutures. a, b.* ***Guembelites clavatus*** *(McLearn). a, GSC 32218 (Pl. 118, fig. 3) x2; b, two sutures of GSC 32215* x2; c,* ***Tornquistites transiens*** *n. sp., GSC 34604 (Pl. 118, fig. 5) x4.*


x
1a
1b
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3b
3c
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x
2b
4b
5b
5a
4a
x

PLATE 119

UPPER TRIASSIC
Lower Norian–Kerri and Dawsoni zones

Figures 1a, b. *Stikinoceras kerri* McLearn (Kerri Subzone 2) (Page 233)
Topotype GSC 8839. Holotype of *Stikinoceras robustum* McLearn. Pardonet Formation, Brown Hill, northeastern British Columbia (GSC loc. 9851).

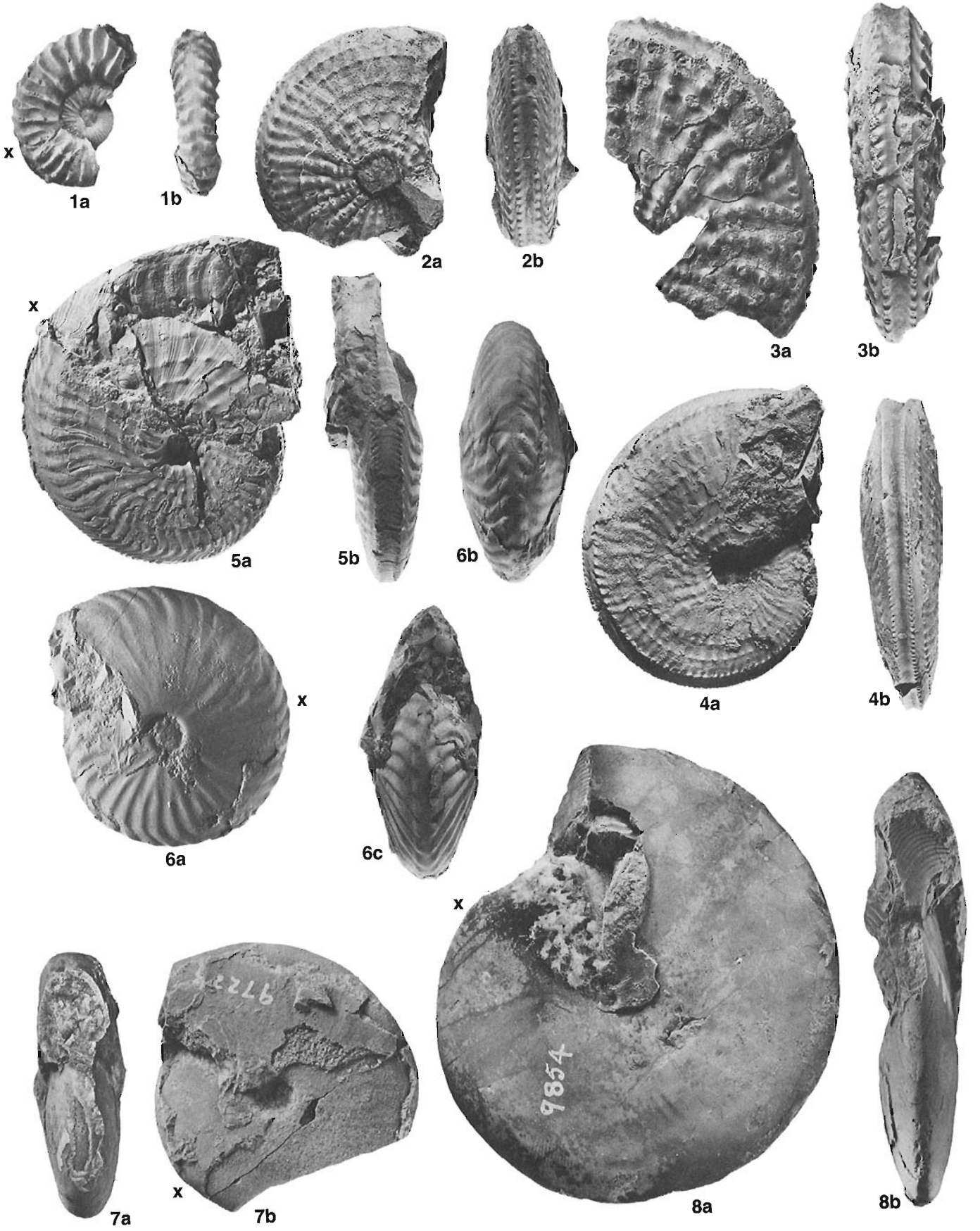
Figures 2–5. *Norosirenites krystyni* n. sp. (Dawsoni Subzone 1) (Page 172)
2a, b. Paratype GSC 71024, phragmocone(?).
3a, b. Paratype GSC 71025, body chamber(?).
4a, b. Paratype GSC 71026, septa not visible.
Figures 2–4 from Pardonet Formation, hills about 15 km south of Christina Falls, northeastern British Columbia (GSC loc. 47005).
5a, b. Holotype GSC 71023, crushed part is evidently body chamber. Pardonet Formation, Brown Hill, northeastern British Columbia (GSC loc. 97546).

Figures 6a–c. *Dryojuvavites orchardi* n. sp. (Dawsoni Subzone 2) (Page 242)
Holotype GSC 71022. Pardonet Formation, Brown Hill, northeastern British Columbia (GSC loc. 97576).

Figures 7a, b. *Omojuvavites fuscus* (McLearn) (Dawsoni Subzone 2) (Page 245)
Holotype GSC 8835, about three quarters of a whorl is body chamber. Pardonet Formation, talus block, Cascades Creek, Pardonet Hill, northeastern British Columbia (GSC loc. 9722).

Figures 8a, b. *Gonionotites rarus* McLearn (Kerri Subzone 2) (Page 235)
Holotype GSC 8830, body chamber more than three quarters of a whorl, periphery widens at aperture, specimen probably complete. Pardonet Formation, Brown Hill, northeastern British Columbia (GSC loc. 9854).

Figure 94. *Suture.* ***Gonionotites rarus*** *McLearn, GSC 32179* x2.*


x
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4b
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6a
6c
x
8a
8b
7a
x
7b

PLATE 120

UPPER TRIASSIC
Lower Norian–Dawsoni Subzone 1

Figures 1–6. *Wangoceras pax* (Tozer) (Page 198)

1a, b. Paratype GSC 28747 (GSC loc. 9373), phragmocone.
2a, b. Paratype GSC 28749 (GSC loc. 64606), septa not visible.
3a, b. Holotype GSC 28745 (GSC loc. 9373) phragmocone.
5a–c. Paratype GSC 28746 (GSC loc. 9373), septate to within at least a quarter whorl of the aperture.
6a, b. Paratype GSC 12583 (GSC loc. 9161), phragmocone.
Figures 1–3, 5, 6 from Pardonet Formation, west side of Pardonet Hill, northeastern British Columbia.
4a, b. Paratype GSC 28748. Pardonet Formation, Brown Hill, northeastern British Columbia (GSC loc. 64664).

Figures 7a, b. *Norosirenites krystyni* n. sp. (Page 172)

Paratype GSC 28744, phragmocone. Pardonet Formation, Brown Hill, northeastern British Columbia (GSC loc. 64664).

Figures 8–13. *Malayites bococki* (McLearn) (Page 241)

8a, b. Hypotype GSC 32224 (GSC loc. 64606), phragmocone, probably complete, surface has delicate spiral sculpture.
9a, b. Hypotype GSC 32226 (GSC loc. 64606), outer whorl is partly body chamber.
10a, b. Hypotype GSC 32227 (GSC loc. 64606), last half whorl is probably body chamber.
11a, b. Hypotype GSC 32225 (GSC loc. 64606), phragmocone (uncrushed) and body chamber (crushed), delicate spiral sculpture preserved at venter.
12a, b. Topotype GSC 32223 (GSC loc. 9161).
13a, b. Topotype GSC 8796. Paratype of *Juvavites mertoni* McLearn, septa not visible (GSC loc. 9161).
All from Pardonet Formation, west side of Pardonet Hill, northeastern British Columbia.

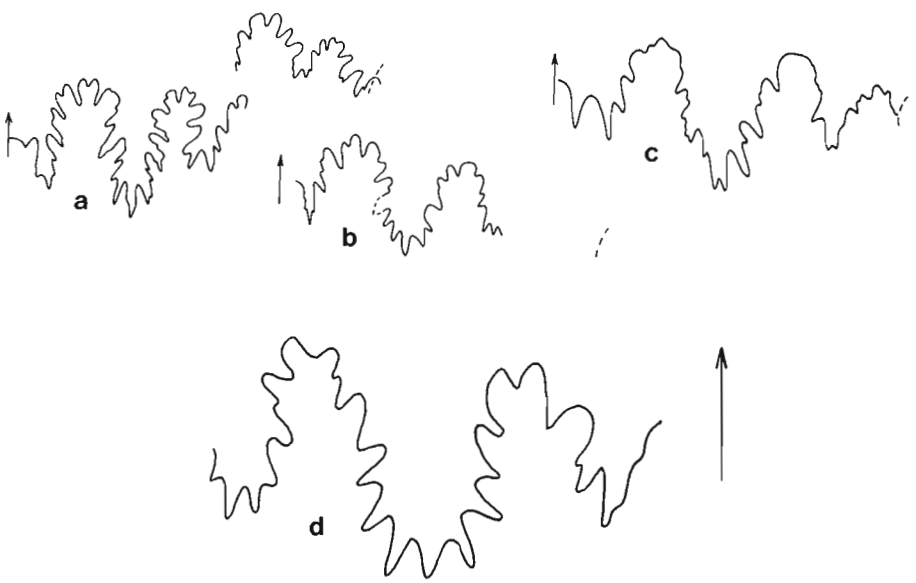
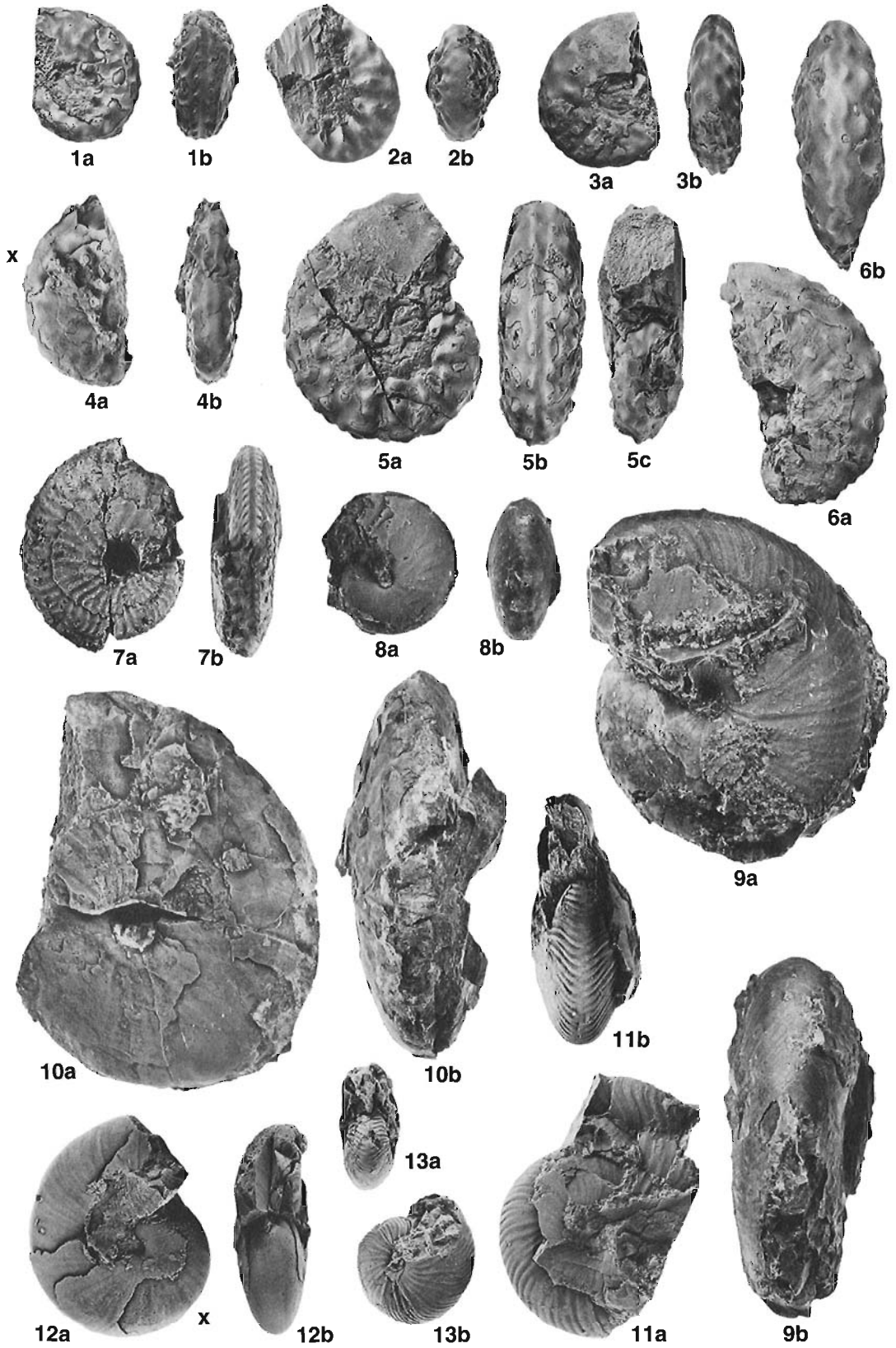


Figure 95. *Sutures. a, b.* ***Malayites bococki*** *(McLearn). a, GSC 12607 (McLearn, 1960a, Pl. 18, fig. 2) x2; b, GSC 32226 (Pl. 120, fig. 9) x2; c,* ***Wangoceras pax*** *(Tozer), GSC 28745 (Pl. 120, fig. 3) x4; d,* ***Norosirenites krystyni*** *n. sp., GSC 28744 (Pl. 120, fig. 7) x6.*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x
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13b
11a
9b

PLATE 121

UPPER TRIASSIC
Lower Norian–Dawsoni Zone

Figures 1a–c. *Pseudocardioceras acutum* (Mojsisovics) (Subzone 2) (Page 243)
Hypotype GSC 32234, septa not visible. Pardonet Formation, northwest of Mount McLearn, northeastern British Columbia (GSC loc. 68200).

Figures 2a, b. *Pseudocardioceras idunae* (Diener) (Subzone 2) (Page 243)
Hypotype GSC 32235, one quarter whorl is probably body chamber. Pardonet Formation, Mount McLearn, northeastern British Columbia (GSC loc. 42329).

Figures 3–5. *Discomalayites carinatus* n. sp. (Subzone 3) (Page 244)
3a–c. Holotype GSC 32236, phragmocone.
4a–c. Paratype GSC 32237, phragmocone.
5a, b. Paratype GSC 32238, fragment of body chamber.
All from Pardonet Formation, northwest of Mount McLearn, northeastern British Columbia (GSC loc. 68193).

Figures 6a–c. *Omojuvavites magnumbilicatus* n. sp. (Subzone 2) (Page 245)
Holotype GSC 32182. Pardonet Formation, Mount McLearn, northeastern British Columbia (GSC loc. 42328).

Figures 7a–c. *Omojuvavites minor* n. sp. (Subzone 2) (Page 246)
Holotype GSC 32183. Pardonet Formation, Mount McLearn, northeastern British Columbia (GSC loc. 42328).

Figures 8–13. *Malayites dawsoni* McLearn (Subzone 2) (Page 242)
8a, b. Hypotype GSC 32230, phragmocone. Pardonet Formation, west side of Pardonet Hill, northeastern British Columbia (GSC loc. 64605).
9a, b. Hypotype GSC 32228, phragmocone (GSC loc. 68190).
13a, b. Hypotype 32229, phragmocone (GSC loc. 68200).
Figures 9, 13 from Pardonet Formation, northwest of Mount McLearn, northeastern British Columbia.
10. Hypotype GSC 32232 (GSC loc. 64626).
12. Hypotype GSC 32231 (GSC loc. 64602).
Figures 10, 12 are body chamber fragments from Pardonet Formation, northeast side of Pardonet Hill, northeastern British Columbia.
11a, b. Hypotype GSC 32233, outer whorl is apparently mainly body chamber. Pardonet Formation, Brown Hill, northeastern British Columbia (GSC loc. 9850).

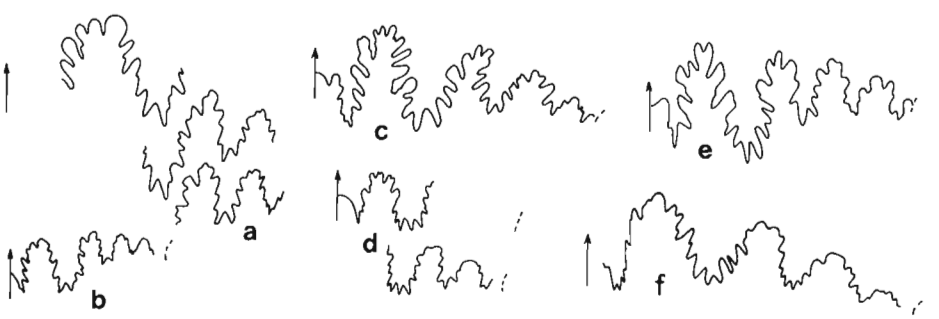

Figure 96. *Sutures. a, b.* ***Discomalayites carinatus*** *n. sp. GSC 32239* x2. a, three adjacent sutures; b, one suture at a smaller diameter; c,* ***Pseudocardioceras acutum*** *(Mojsisovics), GSC 12596 (McLearn, 1960a, Pl. 8, fig. 8) x2; d,* ***Pseudocardioceras idunae*** *(Diener), GSC 12609 (McLearn, 1960a, Pl. 17, fig. 4) x2; e,* ***Malayites dawsoni*** *McLearn, GSC 12604 (Mclearn, 1960a, Pl. 17, fig. 7) x2; f,* ***Omojuvavites magnumbilicatus*** *n. sp., GSC 32182 (Pl. 121, fig. 6) x2.*

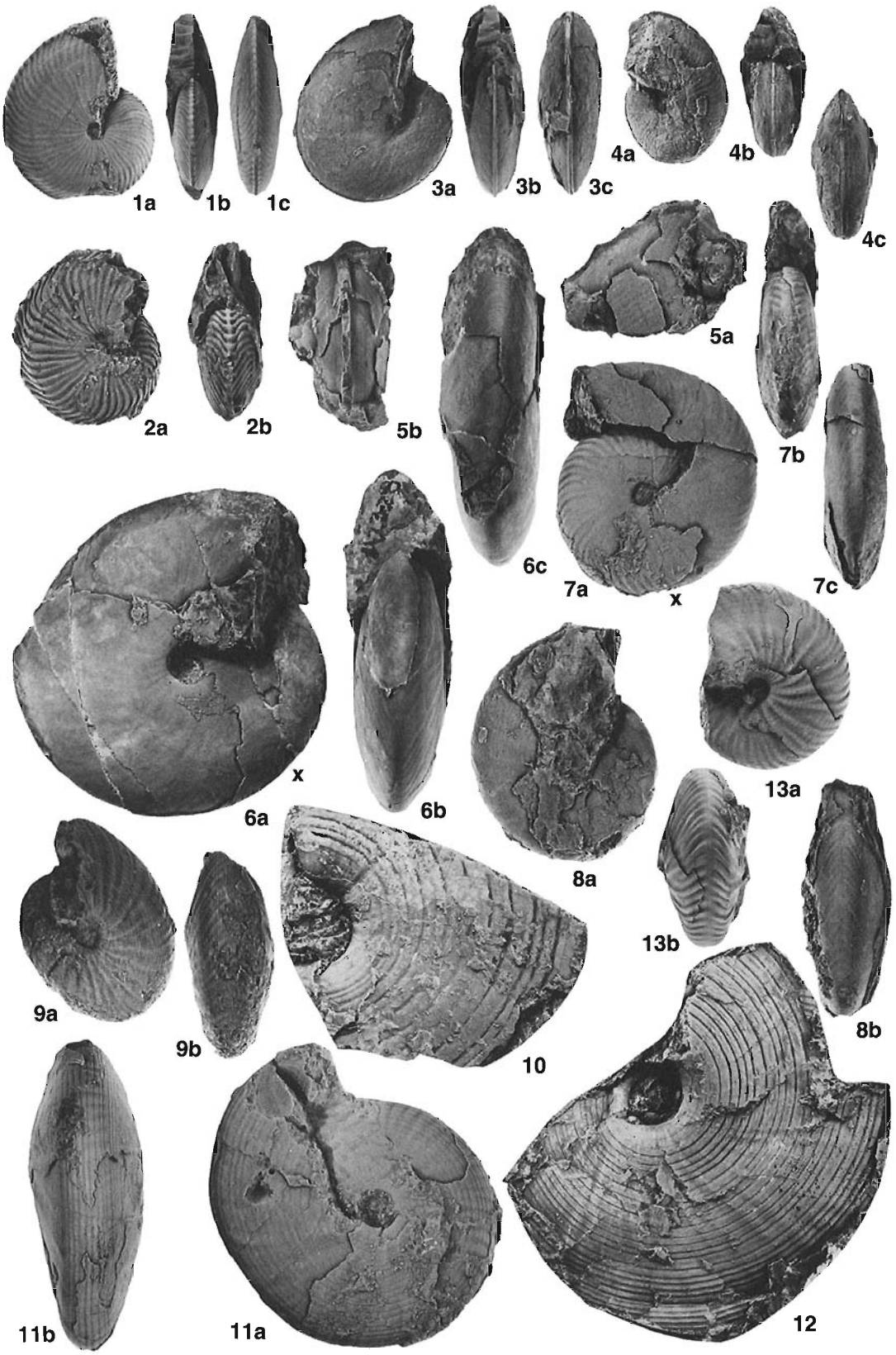
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PLATE 122

UPPER TRIASSIC
Lower Norian–Dawsoni and Magnus zones

Figures 1a–c. *Omojuvavites rostratus* n. sp. (Dawsoni Subzone 3) (Page 246)
Holotype GSC 32186. Pardonet Formation, northwest of Mount McLearn, northeastern British Columbia (GSC loc. 68193).

Figures 2–5. *Omojuvavites ventroplicatus* n. sp. (Dawsoni Subzone 3) (Page 246)
2a–c. Paratype GSC 32188.
3a, b. Paratype GSC 32185.
4a–c. Paratype GSC 32187.
5a–c. Holotype GSC 32184.
All from Pardonet Formation, northwest of Mount McLearn, northeastern British Columbia (GSC loc. 68193).

Figures 6–8. *Epijuvavites transiens* n. sp. (Magnus Zone, Subzone 1?) (Page 248)
6a–c. Paratype GSC 32192.
7a, b. Paratype GSC 32191.
8a–c. Holotype GSC 32193.
All from Pardonet Formation, northwest of Mount McLearn, northeastern British Columbia (GSC loc. 68199).

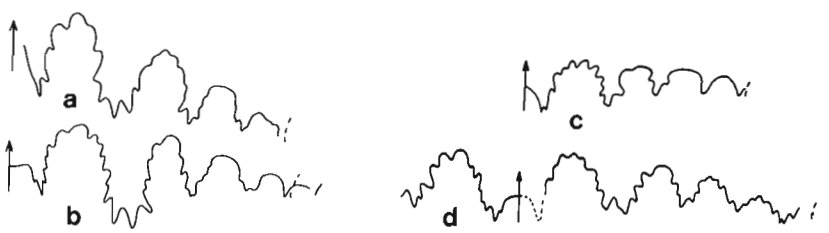

Figure 97. *Sutures. a, b.* ***Epijuvavites transiens*** *n. sp. a, GSC 32192 (Pl. 122, fig. 6) x2; b, GSC 32193 (Pl. 122, fig. 8) x2; c, d.* ***Omojuvavites ventroplicatus*** *n. sp. c, GSC 32187 (Pl. 122, fig. 4) x2; d, GSC 32185 (Pl. 122, fig. 3) x2.*

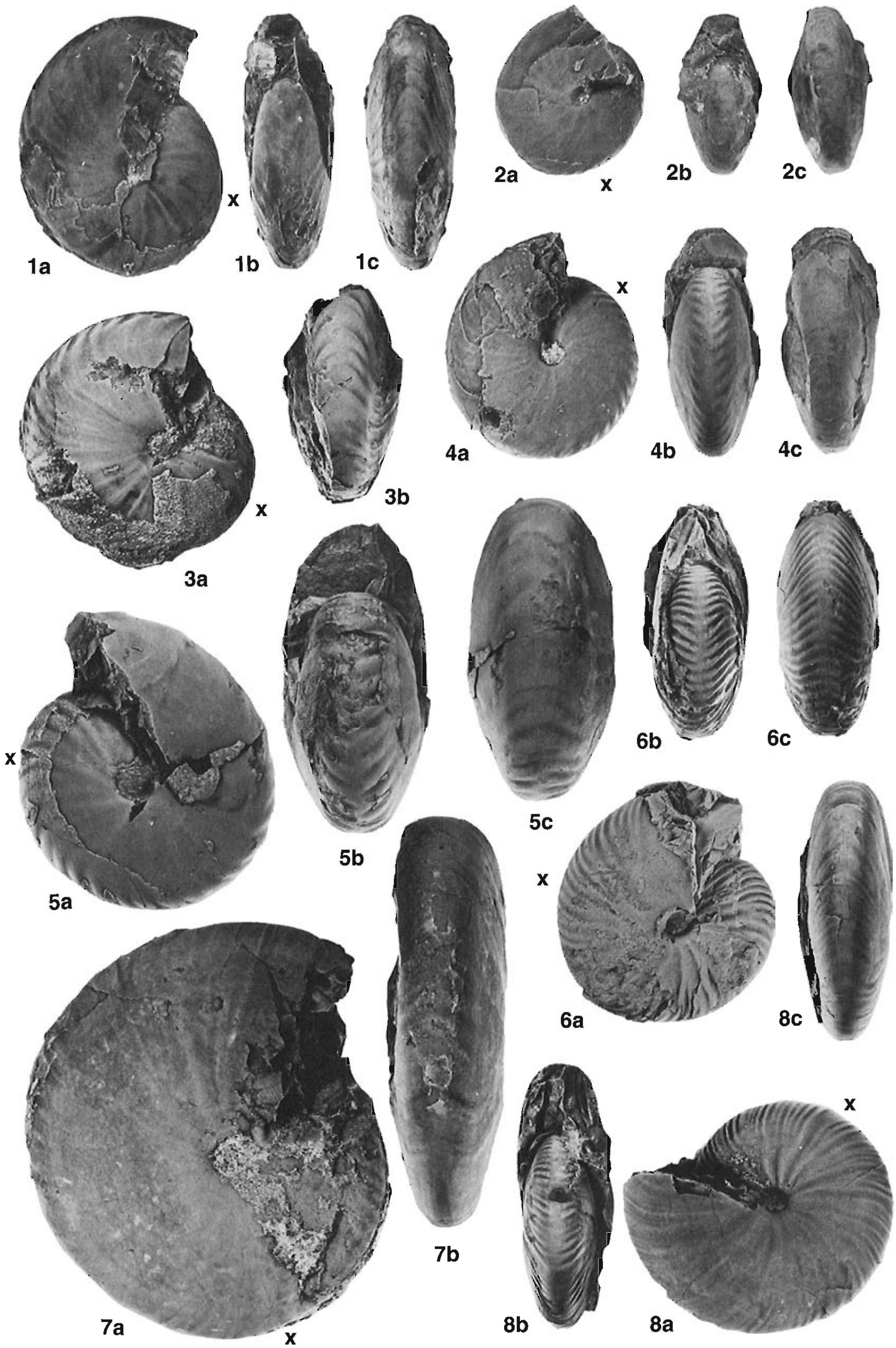
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PLATE 123

UPPER TRIASSIC
Lower Norian–Magnus Zone

Figures 1a, b. *Indojuvavites brunneus* n. sp. (Subzone 1) (Page 247)
Holotype GSC 32189, phragmocone with crushed body chamber. Pardonet Formation, Brown Hill, northeastern British Columbia (GSC loc. 9845).

Figures 2–5. *Indojuvavites laurieri* n. sp. (Subzone 1) (Page 247)
2a, b. Paratype GSC 32259 (GSC loc. 45697), body chamber about one quarter of a whorl.
3a, b. Paratype GSC 32260 (GSC loc. 83894), body chamber about three quarters of a whorl.
4a–c. Holotype GSC 32257 (GSC loc. 45697).
5a–c. Paratype GSC 32258 (GSC loc. 45697), body chamber about half a whorl.
All from Pardonet Formation, Mount Laurier, northeastern British Columbia.

Figures 6a, b. *Juvavites concretus* McLearn (Subzone 2) (Page 250)
Hypotype GSC 32248. Pardonet Formation, 5 km southwest of Mount Stearns, northeastern British Columbia (GSC loc. 82452).

Figures 7a–c. *Juvavites levigatus* n. sp. (Subzone 2) (Page 251)
Hypotype GSC 32244. Pardonet Formation, Crying Girl Prairie Creek, northeastern British Columbia (GSC loc. 83829).

Figures 8a, b. *Juvavites magnus* McLearn (Subzone 2) (Page 249)
Hypotype GSC 32243. Pardonet Formation, Crying Girl Prairie Creek, northeastern British Columbia (GSC loc. 83829).

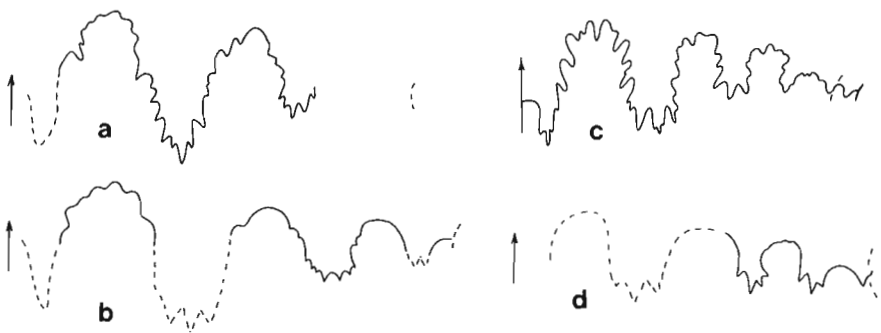
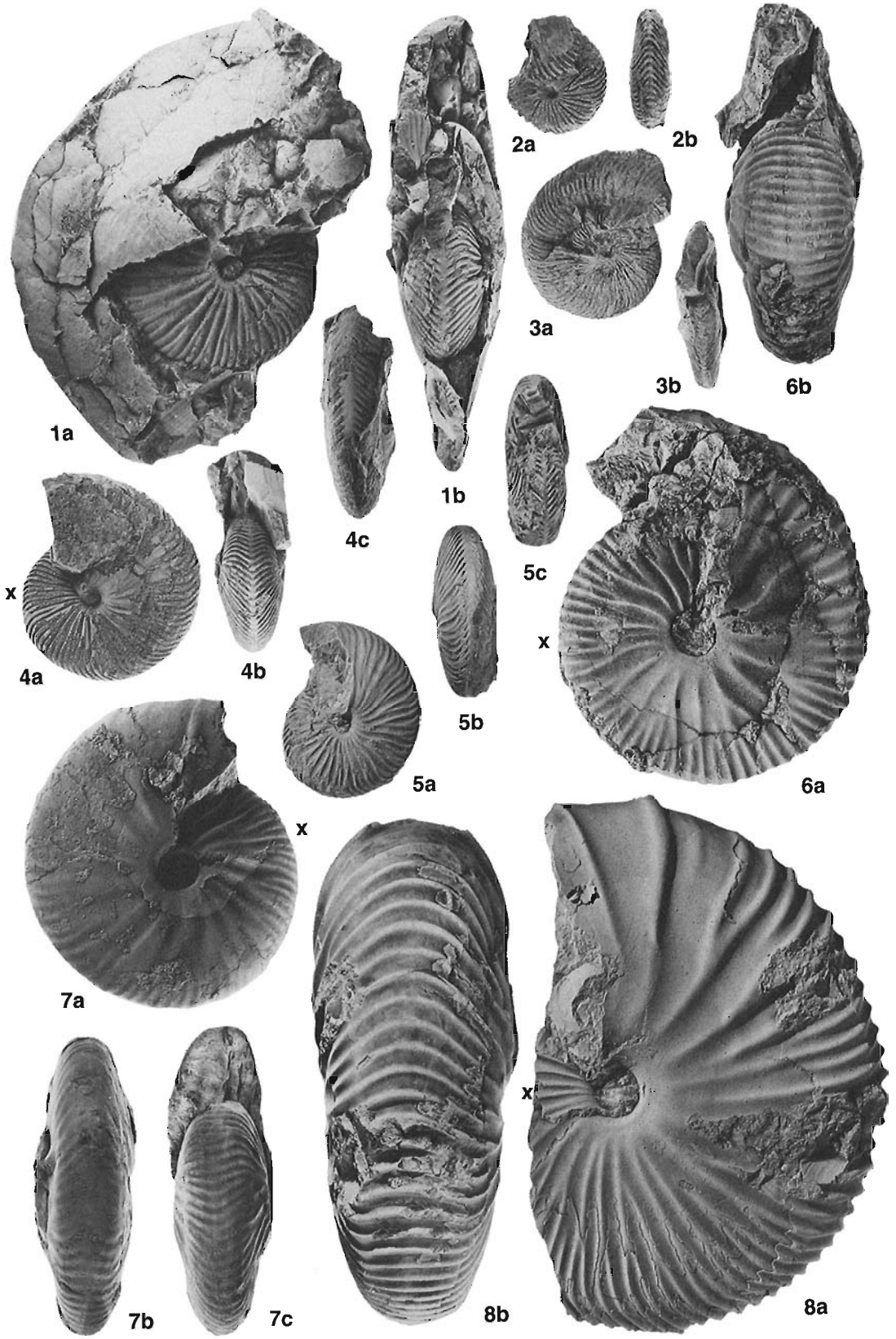


Figure 98. *Sutures. a, d.* ***Juvavites concretus*** *McLearn. a, GSC 8818 (McLearn, 1960a, Pl. 9, fig. 2) x2; d, GSC 32248 (Pl. 123, fig. 6) x2; b,* ***Juvavites magnus*** *McLearn, GSC 8837 (McLearn, 1960a, Pl. 9, fig. 1) x2; c,* ***Juvavites levigatus*** *n. sp., GSC 32244 (Pl. 121, fig. 7) x2.*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8a
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PLATE 124

UPPER TRIASSIC
Lower Norian–Magnus Subzone 2

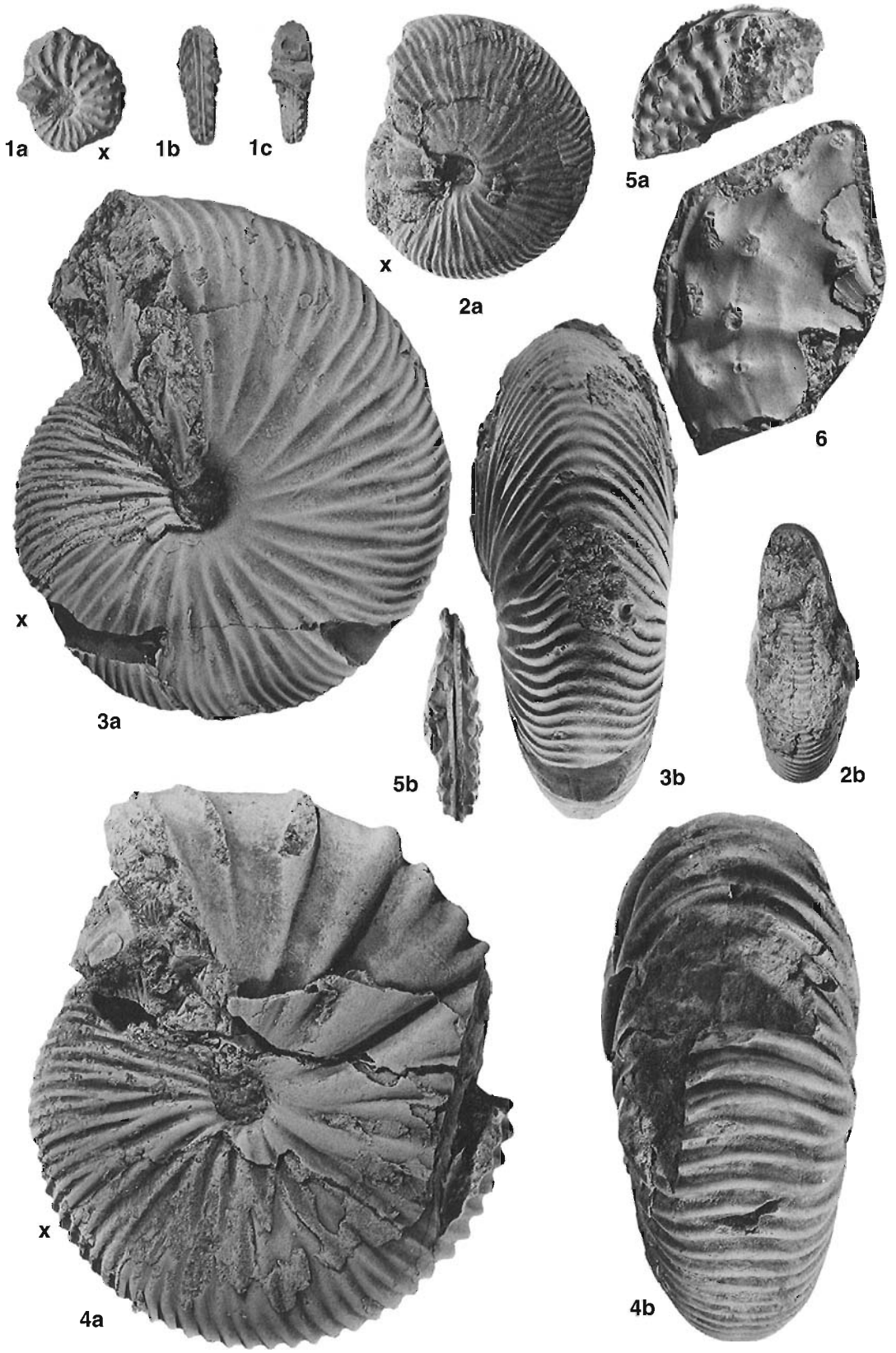
Figures 1, 5, 6. *Acanthinites magnificus* (McLearn) (Page 188)
1a–c. Topotype GSC 28843.
5a, b. Topotype GSC 35363, body chamber.
6. Topotype GSC 35364, body chamber fragment.
All from Pardonet Formation, Brown Hill, northeastern British Columbia (GSC loc. 9836).

Figures 2a, b. *Juvavites biornatus* McLearn (Page 250)
Hypotype GSC 32247. Pardonet Formation, 5 km southwest of Mount Stearns, northeastern British Columbia (GSC loc. 82452).

Figures 3a, b. *Juvavites concretus* McLearn (Page 250)
Hypotype GSC 32242. Pardonet Formation, Crying Girl Prairie Creek, northeastern British Columbia (GSC loc. 83829).

Figures 4a, b. *Juvavites magnus* McLearn (Page 249)
Hypotype GSC 32241. Pardonet Formation, Crying Girl Prairie Creek, northeastern British Columbia (GSC loc. 83829).

Figure 99. *Sutures. a,* ***Acanthinites magnificus*** *(McLearn), GSC 28843 (Pl. 124, fig. 1) x4; b,* ***Juvavites biornatus*** *McLearn, GSC 32247 (Pl. 124, fig. 2) x2.*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2a
5a
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3a
5b
3b
2b
x
4a
4b

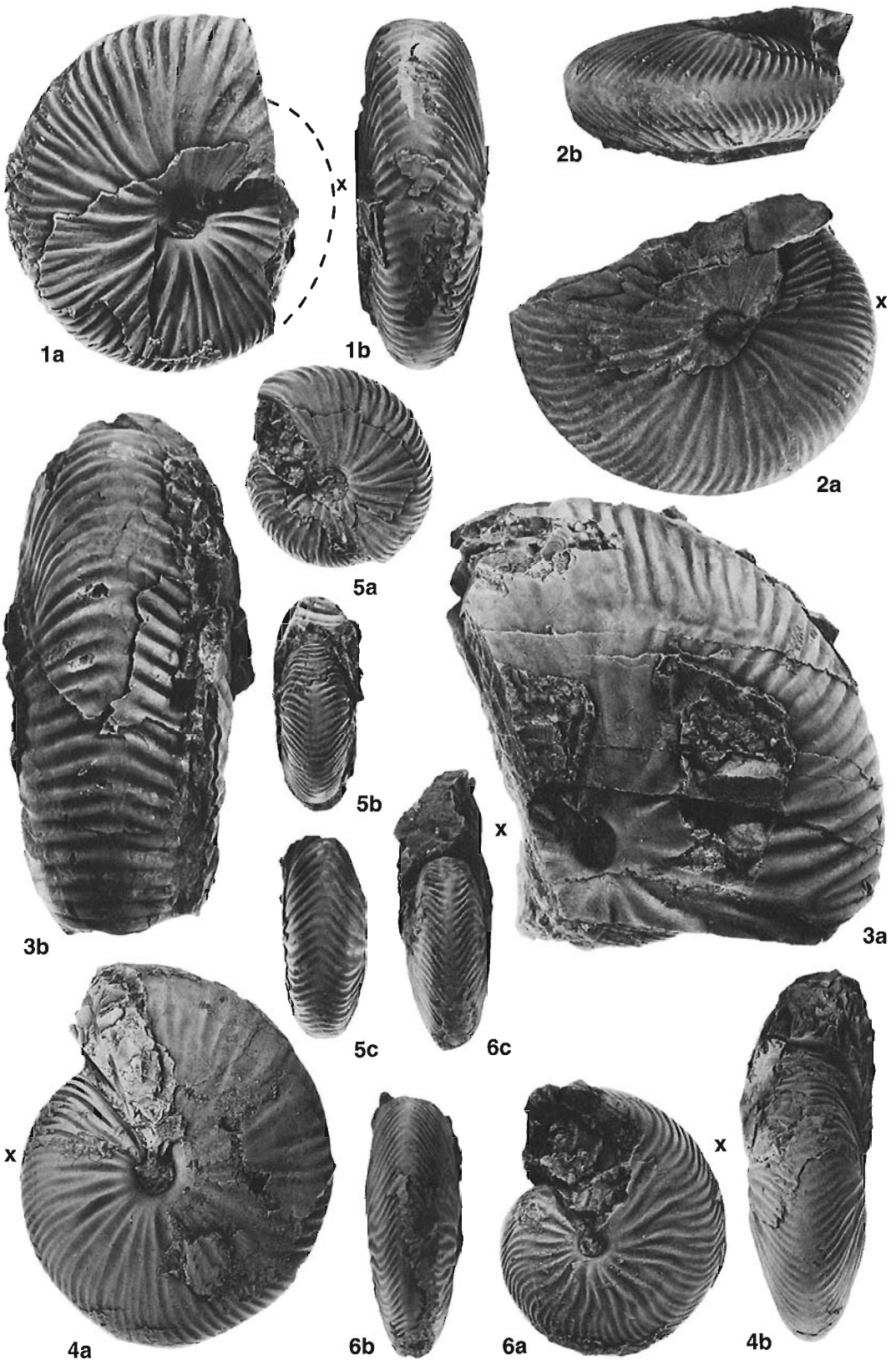
PLATE 125

UPPER TRIASSIC
Lower Norian–Magnus Zone

Figures 1–5. *Juvavites subangulatus* n. sp. (Page 249)
1a, b. Paratype GSC 32251.
2a, b. Paratype GSC 32252.
3a, b. Paratype GSC 32253.
4a, b. Holotype GSC 32250.
5a–c. Paratype GSC 32254, septa not visible.
All from Pardonet Formation, northwest of Mount McLearn, northeastern British Columbia (GSC loc. 68191).

Figures 6a–c. *Indojuvavites falcatus* n. sp. (Subzone 2) (Page 248)
Holotype GSC 32265. Pardonet Formation, 5 km southwest of Mount Stearns, northeastern British Columbia (GSC loc. 82452).

Figure 100. *Sutures. a,* ***Juvavites subangulatus*** *n. sp., GSC 32252 (Pl. 125, fig. 2) x2; b,* ***Indojuvavites falcatus*** *n. sp., GSC 32265 (Pl. 125, fig. 6) x2.*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x
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6c
x
4a
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6a
x
4b

PLATE 126

UPPER TRIASSIC
Lower Norian–Magnus Zone

Figures 1a–c. *Dimorphotoceras arctum* (McLearn) (Subzone 2) (Page 185)
Holotype GSC 8846. Pardonet Formation, Brown Hill, northeastern British Columbia (GSC loc. 9836).

Figures 2, 4. *Dimorphotoceras caurinum* (McLearn) (Subzone 2) (Page 185)
2a, b. Topotype GSC 28836.
4a, b. Topotype GSC 28834, specimen with body chamber.
Both from Pardonet Formation, Brown Hill, northeastern British Columbia (GSC loc. 9836).

Figures 3a, b. *Dimorphotoceras elegantulum* (McLearn) (Subzone 2) (Page 185)
Topotype GSC 28838. Pardonet Formation, Brown Hill, northeastern British Columbia (GSC loc. 9836).

Figures 5, 6. *Juvavites concretus* McLearn (Subzone 2) (Page 250)
5a, b. Hypotype GSC 32245.
6a–c. Hypotype GSC 32246.
Both from Pardonet Formation, talus block near Black Bear Ridge, northeastern British Columbia (GSC loc. 64636).

Figures 7, 8. *Juvavites gibbosus* n. sp. (Page 249)
7a–c. Paratype GSC 32255, outer whorl apparently mainly body chamber.
8a–c. Holotype GSC 32256.
Both from Pardonet Formation, northwest of Mount McLearn, northeastern British Columbia (GSC loc. 68191).

Figure 9. *Sirenotibetites*(?) sp. indet. (Page 42)
GSC 32365. Lewes River Group, Formation D, Maunoir Butte, Yukon (GSC loc. 23406).

Figures 10a, b. *Arietoceltites lewesensis* n. sp. (Page 226)
Holotype GSC 28912. Lewes River Group, Formation D, Maunoir Butte, Yukon (GSC loc. 23406).

Figures 11–15. *Indojuvavites* sp. indet. (Page 42)
11. GSC 32261 (GSC loc. 23406).
12. GSC 9629 (GSC loc. 10233).
13. GSC 32262 (GSC loc. 23406).
14. GSC 32264 (GSC loc. 23406).
15. GSC 32263 (GSC loc. 23406).
All are crushed and show no septa, all from Lewes River Group, Formation D, Maunoir Butte, Yukon.

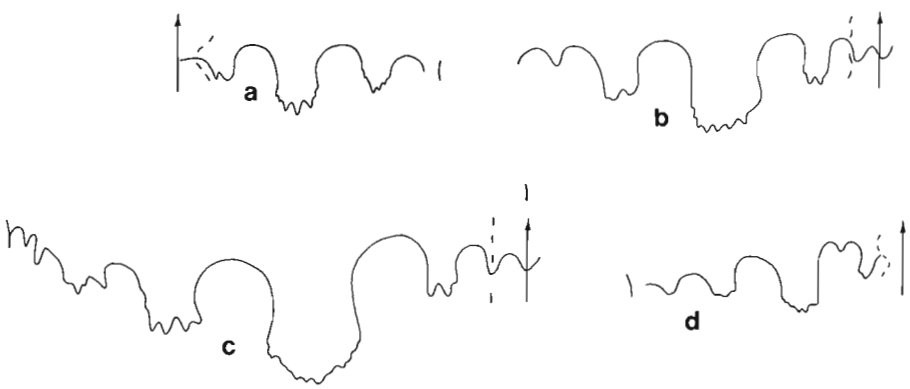

Figure 101. *Sutures. a–c.* ***Dimorphotoceras caurinum*** *(McLearn). a, GSC 28836 (Pl. 126, fig. 2) x4; b, GSC 12581 (McLearn, 1960a, Pl. 4, fig. 3) x4; c, GSC 28837* x4; d,* ***Dimorphotoceras elegantulum*** *(McLearn), GSC 28838 (Pl. 126, fig. 3) x4.*

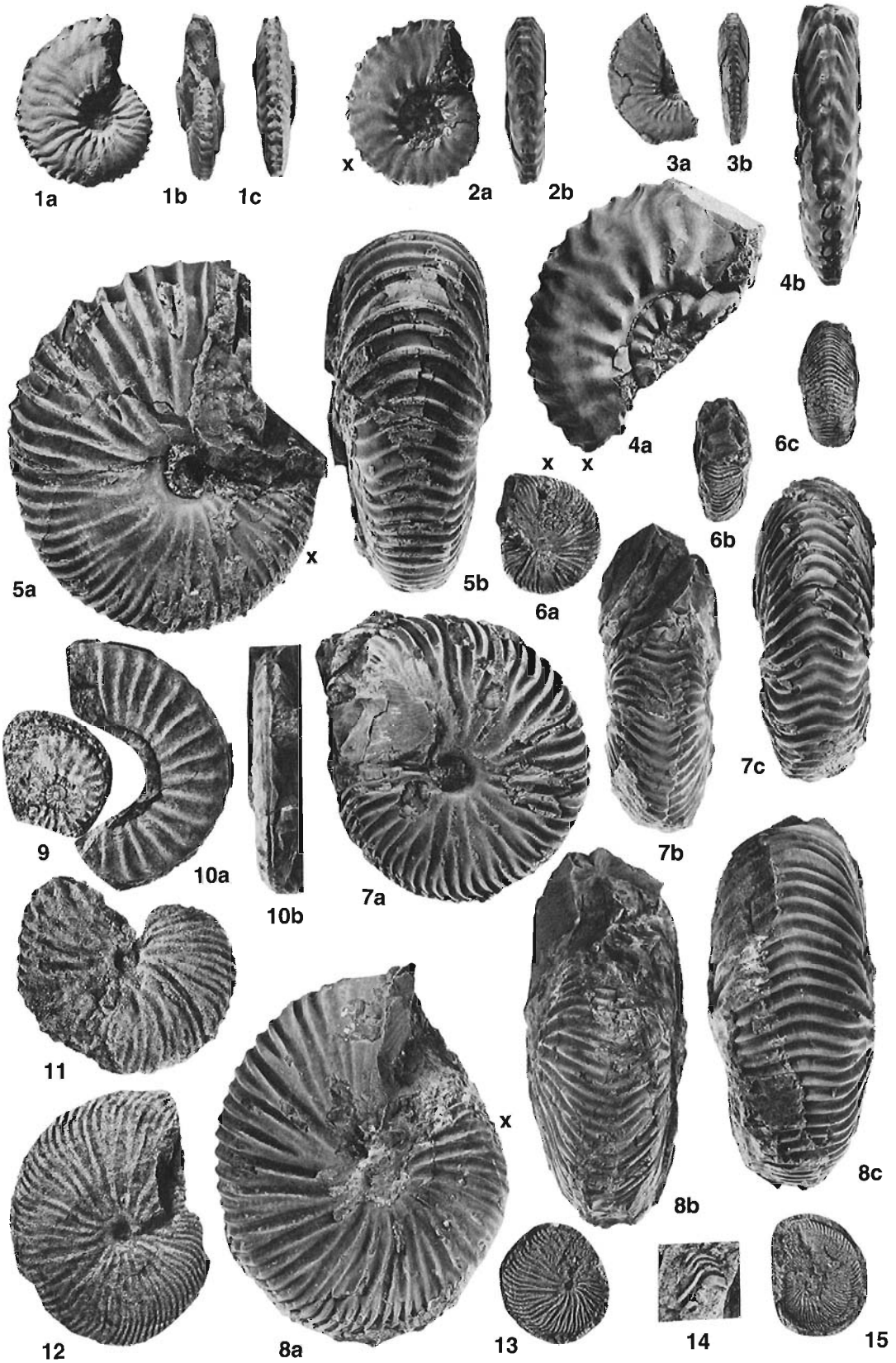
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PLATE 127

UPPER TRIASSIC
Lower Norian–Magnus Zone

Figures 1, 2. *Sirenotibetites cornutus* n. sp. (Subzone 2) (Page 187)
1a–c. Holotype GSC 28750, phragmocone.
2a–c. Paratype GSC 28751, septate fragment.
Both from Pardonet Formation, Crying Girl Prairie Creek, northeastern British Columbia (GSC loc. 83829).

Figures 3, 7, 8. *Indojuvavites brunneus* n. sp. (Subzone 1) (Page 247)
3a, b. Hypotype GSC 71019, phragmocone. Pardonet Formation, Crying Girl Prairie Creek, northeastern British Columbia (GSC loc. 97559).
7a, b. Hypotype GSC 35421, complete phragmocone with one eighth of a whorl of body chamber.
8a–c. Hypotype GSC 35420, body chamber three quarters of a whorl.
Figures 7, 8 from Pardonet Formation, hill northeast of Mount Stearns, northeastern British Columbia (GSC loc. 50028).

Figures 4, 5. *Indojuvavites laurieri* n. sp. (Subzone 1) (Page 247)
4a, b. Hypotype GSC 71020, partly body chamber(?). Pardonet Formation, Crying Girl Prairie Creek, northeastern British Columbia (GSC loc. 97560).
5a, b. Hypotype GSC 71021, partly body chamber(?). Pardonet Formation, Crying Girl Prairie Creek, northeastern British Columbia (GSC loc. 97558).

Figures 6a–c. *Juvavites levigatus* n. sp. (Subzone 2) (Page 251)
Holotype GSC 32249, body chamber three quarters of a whorl, specimen probably complete. Pardonet Formation, 5 km southwest of Mount Stearns, northeastern British Columbia (GSC loc. 82452).

Figure 102. *Suture.* ***Indojuvavites brunneus*** *n. sp., GSC 35421 (Pl. 127, fig. 7) x2.*

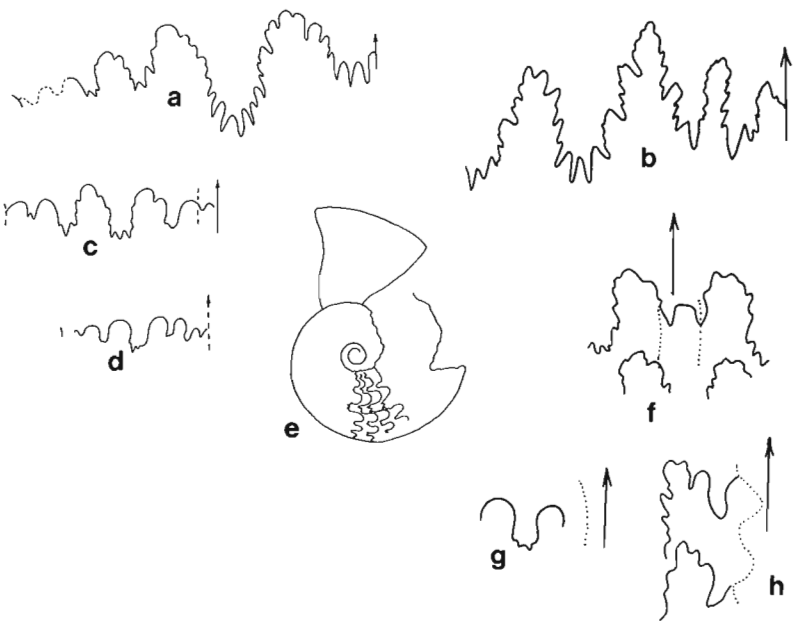

Figure 103. *Sutures. (Specimens are illustrated in Pl. 128.) a,* ***Drepanites rutherfordi*** *McLearn, GSC 28855* x2.7; b,* ***Oxytibetites welteri*** *n. sp., GSC 71018 (Pl. 128, fig. 1) x1; c,* ***Prodrepanites catenatus*** *n. sp., GSC 28845 (Pl. 128, fig. 7) x2.7; d, e.* ***Neotibetites minor*** *n. sp., GSC 28842 (Pl. 128, fig. 3), d x2.7, e x1.3; f,* ***Acanthodrepanites dieneri*** *n. sp., GSC 71033 (Pl. 128, fig. 8) x2; g, h.* ***Dimorphotoceras ursinum*** *n. sp., two sutures of GSC 72345 (Pl. 128, fig. 13) x2.*

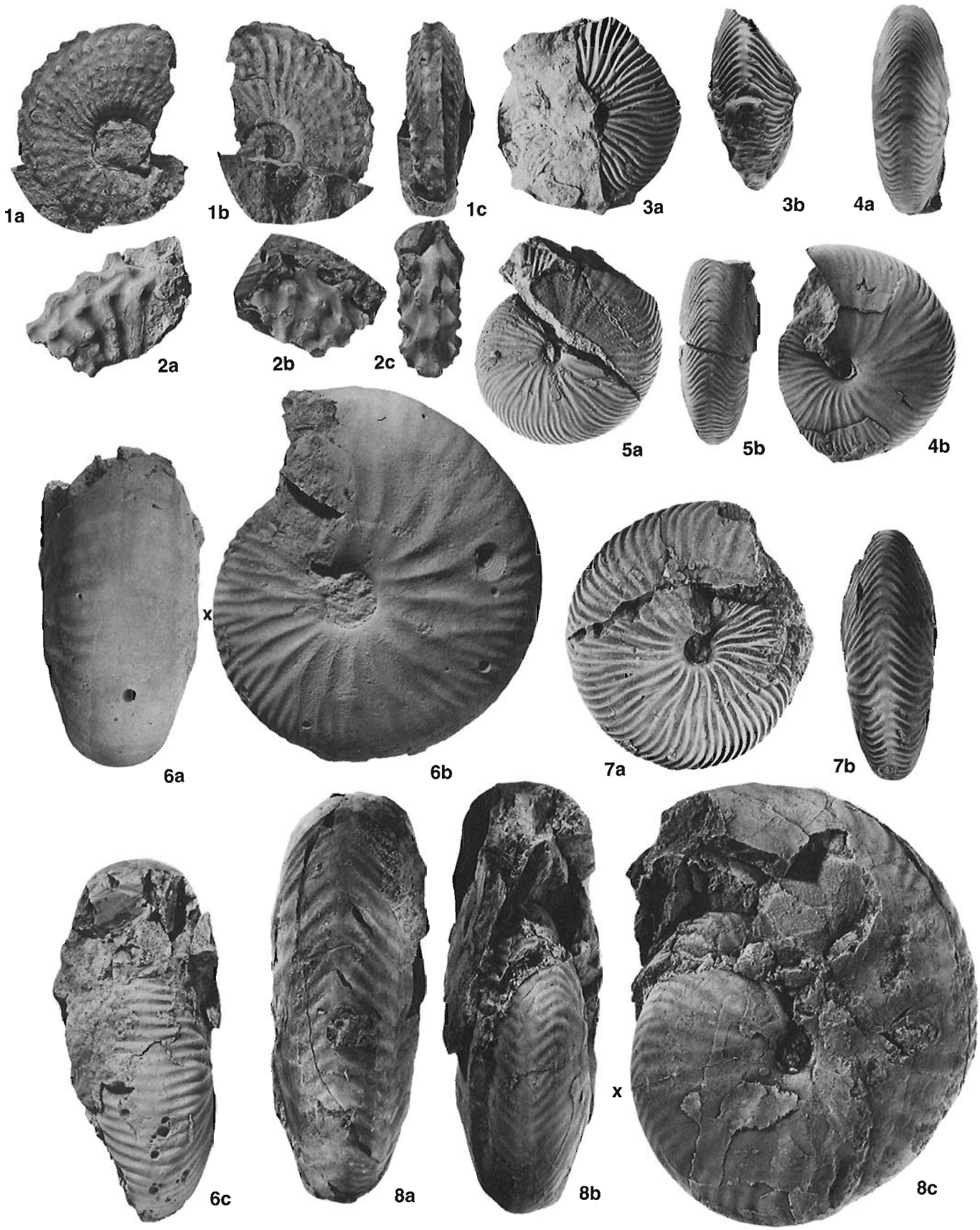
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PLATE 128

UPPER TRIASSIC
Lower Norian–Magnus Zone
Middle Norian–Rutherfordi Zone

Figures 1a–d. *Oxytibetites welteri* n. sp. (Magnus Subzone 1) (Page 184)
Holotype GSC 71018, 1a–c are of inner whorl enlarged about x3. Venter of outer whorl (GSC loc. 1d) is narrowly sulcate on internal mould. Pardonet Formation, Crying Girl Prairie Creek, northeastern British Columbia (GSC loc. 97558).

Figures 2a–e. *Hauerites astrictus* n. sp. (Rutherfordi Zone) (Page 192)
Holotype GSC 28856, 2a, b, show body chamber, 2c is part of venter of body chamber enlarged x2, 2d is phragmocone removed from the specimen, 2e is venter of phragmocone enlarged x2. Pardonet Formation, Crying Girl Prairie Creek, northeastern British Columbia (GSC loc. 46467).

Figure 3. *Neotibetites minor* n. sp. (Magnus Zone) (Page 187)
Holotype GSC 28842, phragmocone with half a whorl of crushed body chamber. Pardonet Formation, Crying Girl Prairie Creek, northeastern British Columbia (GSC loc. 83830).

Figures 4a, b. *Heraclites canadensis* n. sp. (Rutherfordi Zone) (Page 198)
Holotype GSC 71032. Pardonet Formation, Crying Girl Prairie Creek, northeastern British Columbia (GSC loc. 97580).

Figures 5, 6. *Drepanites rutherfordi* McLearn (Rutherfordi Zone) (Page 190)
5a–c. Hypotype GSC 28853, body chamber three quarters of a whorl. Pardonet Formation, Crying Girl Prairie Creek, northeastern British Columbia (GSC loc. 83836).
6. Hypotype GSC 28854, complete, uncrushed phragmocone and crushed body chamber. Pardonet Formation, Brown Hill, northeastern British Columbia (GSC loc. 9842).

Figures 7a, b. *Prodrepanites catenatus* n. sp. (Magnus Subzone 2) (Page 188)
Holotype GSC 28845, phragmocone. Pardonet Formation, Brown Hill, northeastern British Columbia (GSC loc. 9836).

Figures 8–10. *Acanthodrepanites dieneri* n. sp. (Rutherfordi Zone) (Page 191)
8a, b. Paratype GSC 71033 (GSC loc. 97532), about half a whorl appears to be body chamber.
9a–c. Paratype GSC 13489 (GSC loc. 9841), septa not visible.
10a, b. Holotype GSC 71034 (GSC loc. 97532), septa not visible.
All from Pardonet Formation, Brown Hill, northeastern British Columbia.

Figures 11, 12. *Cyrtopleurites hersiliae* Diener (Rutherfordi Zone) (Page 190)
11a–c. Hypotype GSC 28847, no septa visible. Pardonet Formation, headwaters east fork Carbon Creek, northeastern British Columbia (GSC loc. 83838).
12a, b. Hypotype GSC 28846, body chamber. Pardonet Formation, Crying Girl Prairie Creek, northeastern British Columbia (GSC loc. 46467).

Figures 13a–c. *Dimorphotoceras ursinum* n. sp. (Magnus Zone, Subzone 2) (Page 186)
Holotype GSC 72345. Pardonet Formation, Brown Hill, northeastern British Columbia (GSC loc. 9836).

Figures 14a, b. *Dimorphotoceras elegantulum* (McLearn) (Magnus Subzone 2) (Page 185)
Topotype GSC 28835. Pardonet Formation, Brown Hill, northeastern British Columbia (GSC loc. 9836).

Illustrations of suture lines (Fig. 103) face Plate 127.

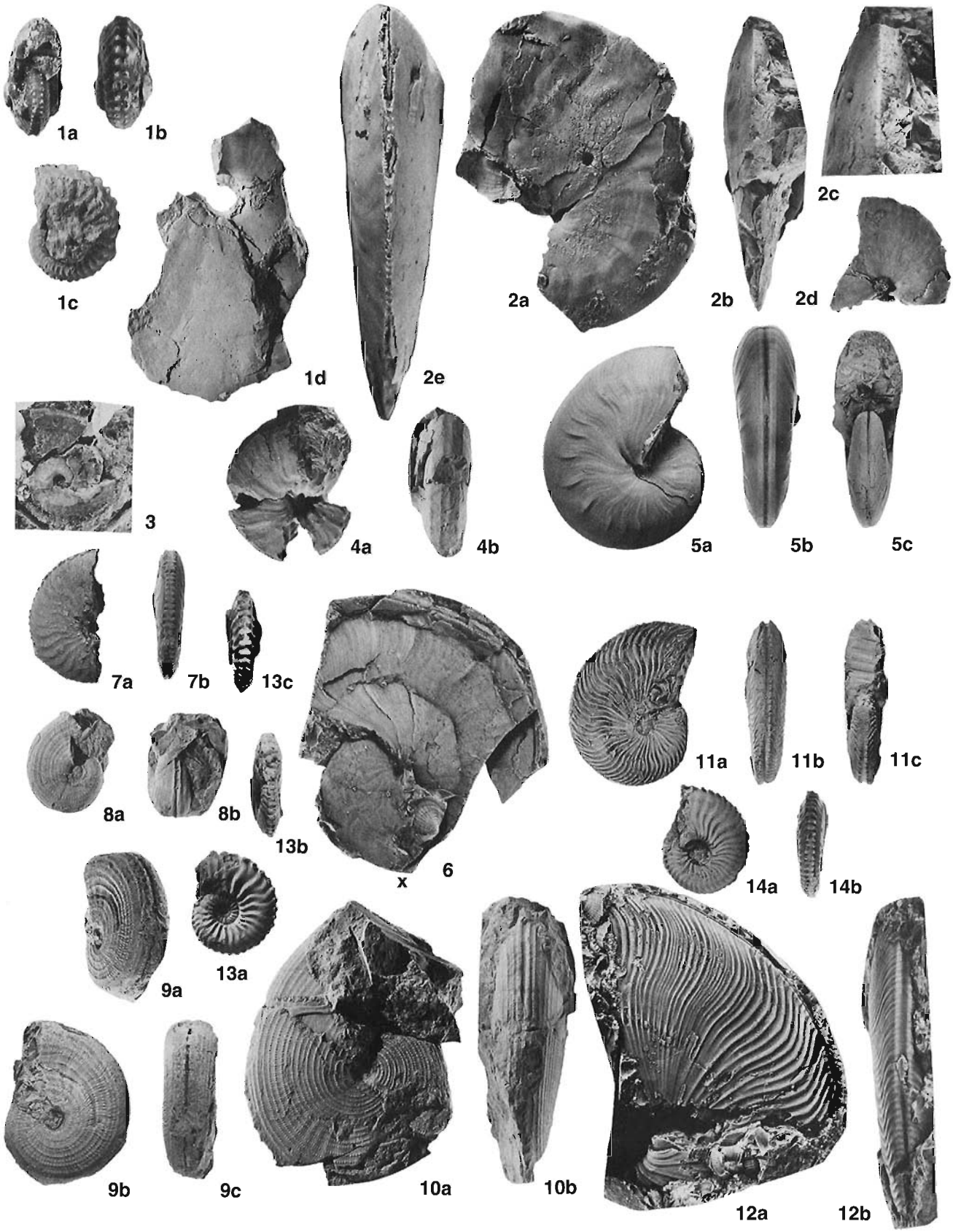
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PLATE 129

UPPER TRIASSIC
Middle Norian–Rutherfordi Zone

Figures 1–4. *Cyrtopleurites bicrenatus* (Hauer) (Page 189)
1a–c. Hypotype GSC 28850 (GSC loc. 83849), phragmocone.
2a, b. Hypotype GSC 28851 (GSC loc. 83849), complete phragmocone.
4a, b. Hypotype GSC 28852 (GSC loc. 83831), outer whorl partly body chamber.
Figures 1, 2, 4 from Pardonet Formation, Crying Girl Prairie Creek, northeastern British Columbia.
3a, b. Hypotype GSC 28849, body chamber. Pardonet Formation, Brown Hill, northeastern British Columbia (GSC loc. 9840).

Figures 5a, b. *Paragymnites symmetricus* (Mojsisovics) (Page 130)
Hypotype GSC 28392, phragmocone. Pardonet Formation, Brown Hill, northeastern British Columbia (GSC loc. 9841).

Figures 6–9. *Hauerites piceus* n. sp. (Page 191)
6a, b. Holotype GSC 28857 (GSC loc. 64663), specimen illustrated has been removed from a complete phragmocone 80 mm in diameter.
7a, b. Paratype GSC 28858 (GSC loc. 64663), phragmocone removed from specimen 110 mm in diameter.
8a–d. Paratype GSC 28859 (GSC loc. 9841), apparently a crushed phragmocone, but septa are not well preserved.
Figures 6–8 from Pardonet Formation, Brown Hill, northeastern British Columbia.
9a, b. Paratype GSC 28860. Pardonet Formation, Crying Girl Prairie Creek, northeastern British Columbia (GSC loc. 42537).

Figures 10a, b. *Didymites quenstedti* Mojsisovics (Page 251)
Hypotype GSC 14307, specimen with peristome, body chamber more than one whorl. Pardonet Formation, Crying Girl Prairie Creek, northeastern British Columbia (GSC loc. 42537).

Figures 11a, b. *Carinacanthites calypso* (Mojsisovics) (Page 189)
Hypotype GSC 28844, complete phragmocone. Pardonet Formation, Brown Hill, northeastern British Columbia (GSC loc. 64663).

Figures 12a–c. *Metaclionites taylori* n. sp. (Page 179)
Holotype GSC 28700. Pardonet Formation, south side Peace River valley near Carbon Creek (GSC loc. 83896).

Figures 13, 14. *Parisculites mundus* (McLearn) (Page 252)
13a–c. Topotype GSC 32114, body chamber one whorl, peristome preserved.
14a, b. Topotype GSC 32115, outer whorl, beyond break, is body chamber.
Both from Pardonet Formation, McLay Spur, northeastern British Columbia (GSC loc. 9146).

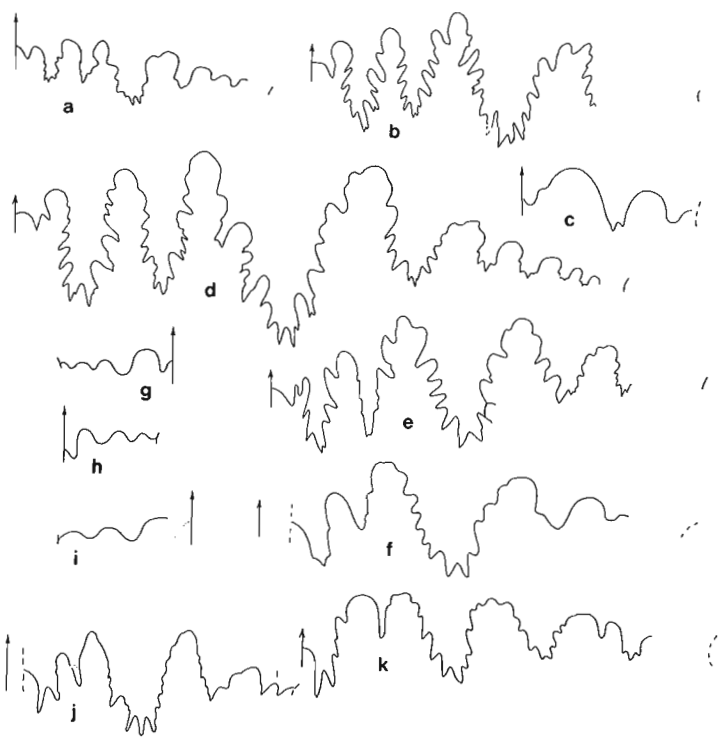

Figure 104. *Sutures.* a, ***Hauerites astrictus*** *n. sp., GSC 28856 (Pl. 128, fig. 2, preceding plate) x3. b, d–f.* ***Hauerites piceus*** *n. sp. b, GSC 28858 (Pl. 129, fig. 7) x1.5; d, GSC 13491 (McLearn, 1960a, Pl. 19, fig. 4) x1.5; e, f, two sutures of GSC 28857 (Pl. 129, fig. 6), e x1.5, f x6; c,* ***Metaclionites taylori*** *n. sp., GSC 28700 (Pl. 129, fig. 12) x3; g–i.* ***Parisculites mundus*** *(McLearn); g, GSC 9498 (McLearn, 1960a, Pl. 3, fig. 7) x3; h, GSC 9499 (McLearn, 1960a, Pl. 3, fig. 8) x3; i, GSC 32114 (Pl. 129, fig. 13) x3; j,* ***Cyrtopleurites bicrenatus*** *(Hauer), GSC 28851 (Pl. 129, fig. 2) x3; k,* ***Didymites quenstedti*** *Mojsisovics, GSC 14307 (Pl. 129, fig. 10) x3.*

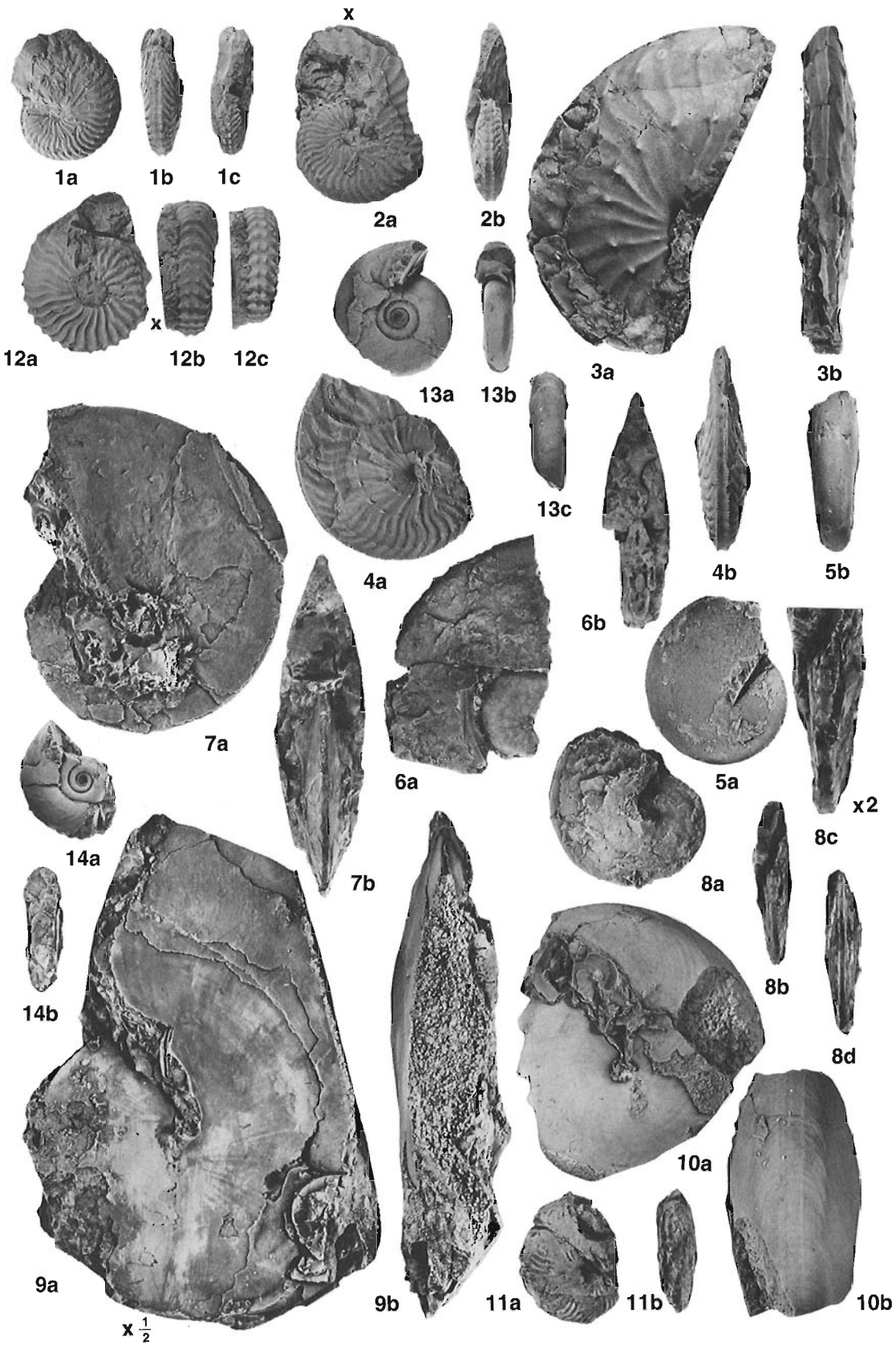
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PLATE 130

UPPER TRIASSIC
Middle Norian–Columbianus Zone

Figures 1, 2. *Phormedites juvavicus* Mojsisovics (Subzone 1) (Page 257)
1a–c. Hypotype GSC 32307.
2a–c. Hypotype GSC 32308.
Both from Pardonet Formation, Nevis Creek, northeastern British Columbia (GSC loc. 66027).

Figures 3a–c. *Alloclionites dieneri* n. sp. (Subzone 3?) (Page 181)
Hypotype GSC 28703, last half whorl is apparently body chamber. Pardonet Formation, loose block, Brown Hill, northeastern British Columbia (GSC loc. 9471).

Figures 4–6, 8. *Alloclionites welteri* n. sp. (Subzone 4) (Page 182)
4a, b. Paratype GSC 32362, complete with peristome. Pardonet Formation, near Blue Grave Creek, northeastern British Columbia (GSC loc. 47004).
5a, b. Paratype GSC 28705, spiral sculpture present, body chamber(?).
6. Holotype GSC 28704, body chamber.
Figures 5, 6 from Pardonet Formation, west side Pardonet Hill, northeastern British Columbia (GSC loc. 64634).
8a, b. Hypotype GSC 28707, body chamber. Pardonet Formation, west side of Pardonet Hill, northeastern British Columbia (GSC loc. 9768).

Figures 7a, b. *Alloclionites jeanneti* n. sp. (Subzone 3) (Page 182)
Holotype GSC 28701, no septa are visible. Pardonet Formation, Mount Stearns, northeastern British Columbia (GSC loc. 74776).

Figures 9a, b. *Brouwerites maclearni* n. sp. (Subzone 4) (Page 183)
Paratype GSC 28708, complete phragmocone with approximated septa. Pardonet Formation, west side Pardonet Hill, northeastern British Columbia (GSC loc. 9768).

Figures 10–13. *Brouwerites stotti* n. sp. (Subzone 4) (Page 183)
10a, b. Paratype GSC 28712, septa not visible.
11a, b. Paratype GSC 28711, beyond break specimen is body chamber.
12a, b. Paratype GSC 28713, body chamber more than half a whorl.
13a, b. Holotype GSC 28710.
All from Pardonet Formation, near Nevis Creek, northeastern British Columbia (GSC loc. 52233).

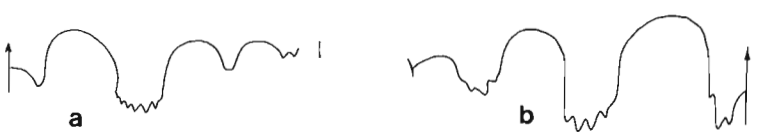

Figure 105. *Sutures. a,* ***Phormedites juvavicus*** *Mojsisovics, GSC 32308 (Pl. 130, fig. 2) x4; b,* ***Brouwerites maclearni*** *n. sp., GSC 28708 (Pl. 130, fig. 9) x4.*

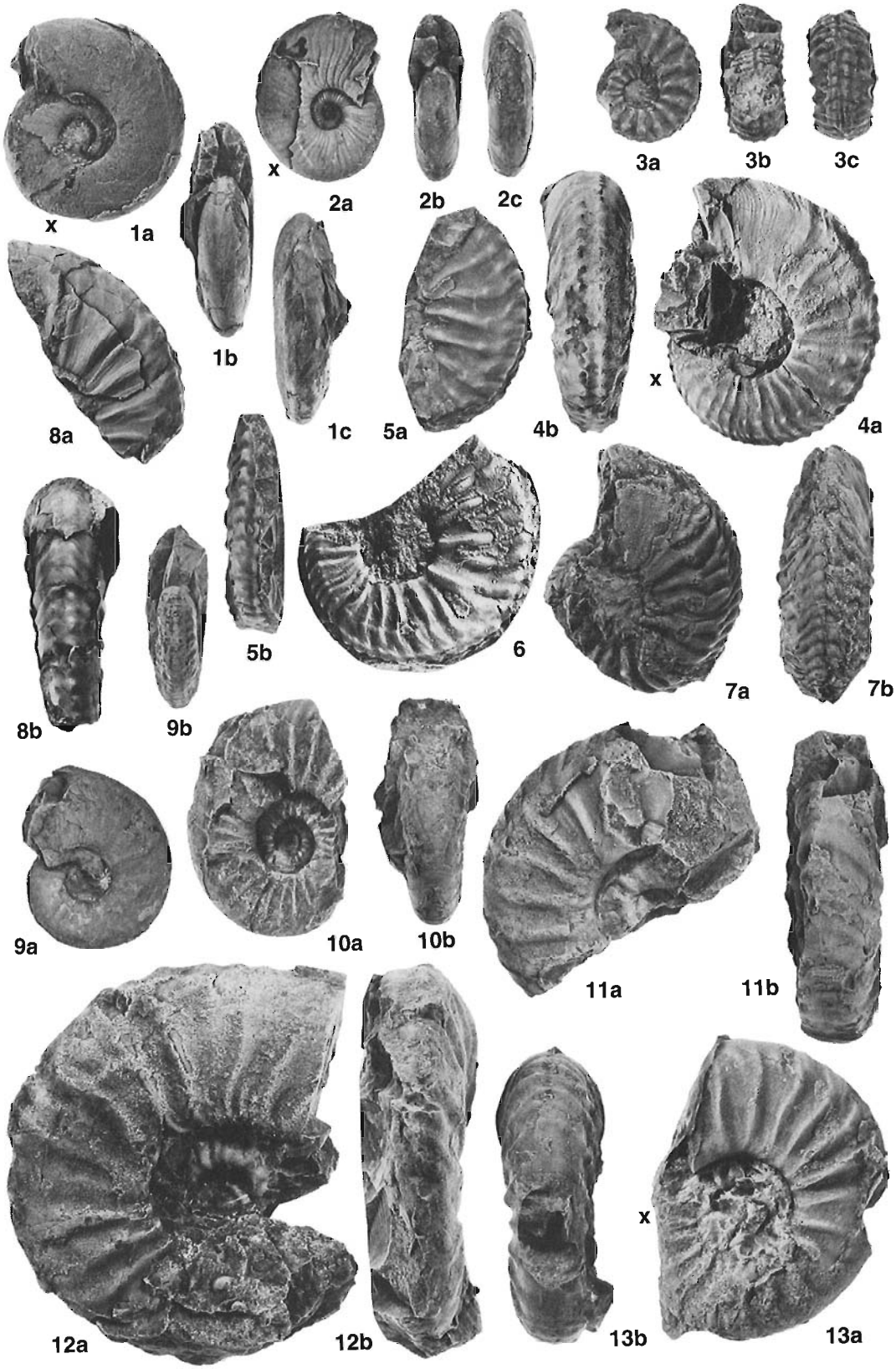
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PLATE 131

UPPER TRIASSIC
Middle Norian–Columbianus Zone

Figures 1, 2, 7. *Steinmannites* sp. indet. (Page 179)
1a, b. GSC 28716, phragmocone. Parson Bay Formation, Kyuquot area, Vancouver Island, British Columbia (GSC loc. 24351).
2a, b. GSC 28717, phragmocone. Pardonet Formation, near Black Bear Ridge, northeastern British Columbia (GSC loc. 64638).
7a, b. GSC 14308, phragmocone. Pardonet Formation, Mount Ludington, northeastern British Columbia (GSC loc. 46998) (Subzone 3).

Figures 3a–c. *Eosteinmannites ursensis* n. sp. (Subzone 3) (Page 181)
Holotype GSC 28718, phragmocone with remains of body chamber near umbilicus. Pardonet Formation, near Black Bear Ridge, northeastern British Columbia (GSC loc. 64638).

Figures 4a–c. *Eosteinmannites nitidus* n. sp. (Subzone 3) (Page 180)
Hypotype GSC 28729. Pardonet Formation, north of Besa River, northeastern British Columbia (GSC loc. 65935).

Figures 5, 6. *Steinmannites pacificus* n. sp. (Subzone 2?) (Page 179)
5a, b. Paratype GSC 28715.
6a–c. Holotype GSC 28714, phragmocone.
Both from Parson Bay Formation, Esperanza Inlet, Vancouver Island, British Columbia (GSC loc. 19275).

Figures 8, 9. *Alloclionites dieneri* n. sp. (Subzone 3) (Page 181)
8a, b. Holotype GSC 28702, at least half a whorl is body chamber.
9a–c. Paratype GSC 14310, phragmocone.
Both from Pardonet Formation, Mount Ludington, northeastern British Columbia (GSC loc. 46998).

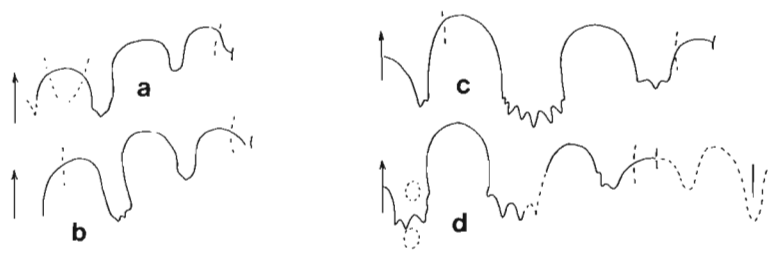

Figure 106. *Sutures. a, b.* ***Steinmannites pacificus*** *n. sp. a, GSC 28715 (Pl. 131, fig. 5) x2; b, GSC 28714 (Pl. 131,fig. 6) x2; c,* ***Steinmannites*** *sp. indet., GSC 14308 (Pl. 131, fig. 7) x2; d,* ***Alloclionites dieneri*** *n. sp., GSC 14310 (Pl. 131, fig. 9) x2.*

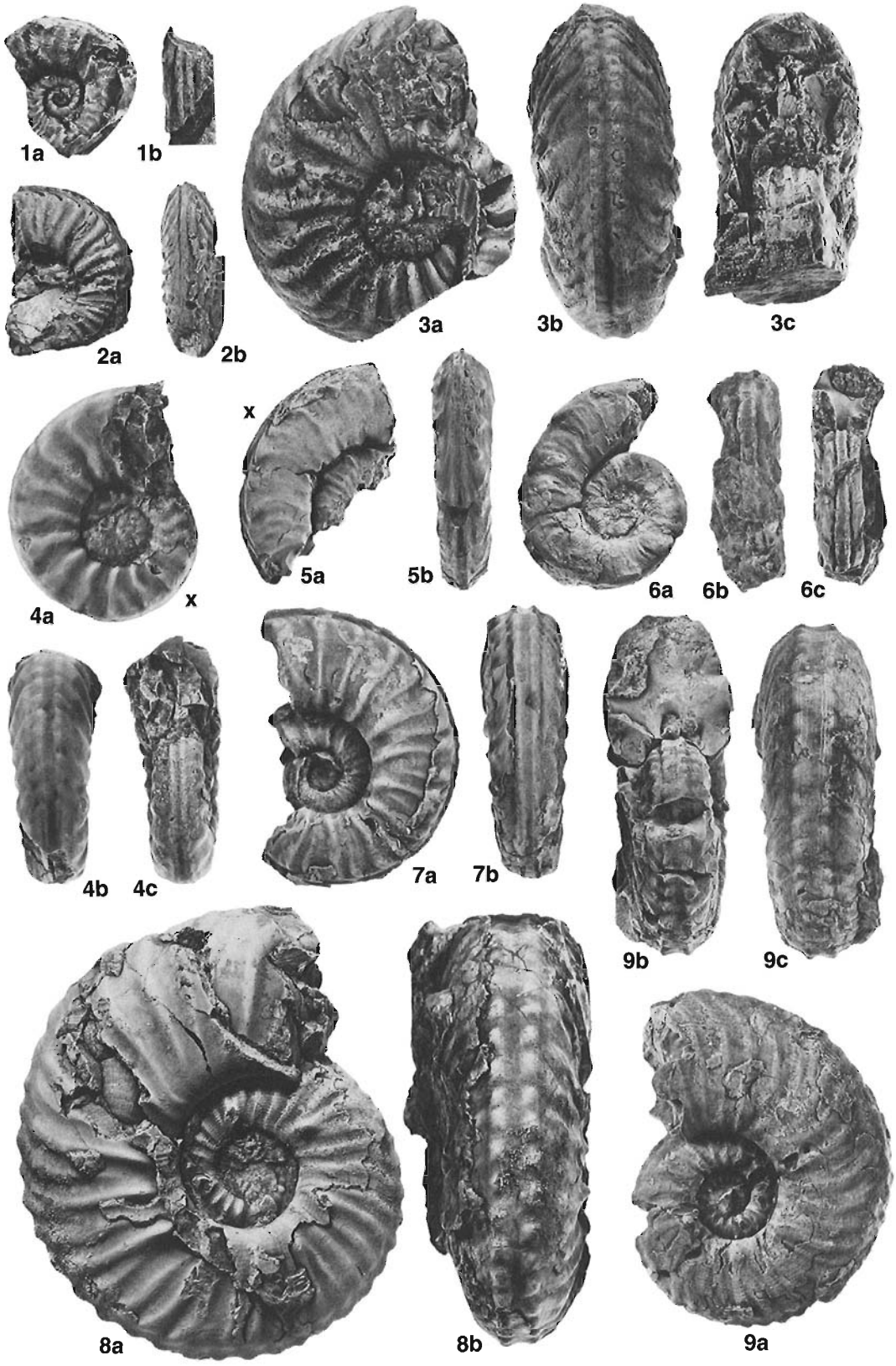
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PLATE 132

UPPER TRIASSIC
Middle Norian–Columbianus Zone

Figures 1–4. *Himavatites planiplicatus* n. sp. (Subzone 1) (Page 192)
1a, b. Paratype GSC 28865, no septa visible.
2a–c. Paratype GSC 28864, complete phragmocone.
3a, b. Holotype GSC 28866, apparently mainly or wholly body chamber.
4a, b. Paratype GSC 28863, body chamber.
All from Pardonet Formation, Crying Girl Prairie Creek, northeastern British Columbia (GSC loc. 83835).

Figures 5a, b. *Himavatites multiauritus* McLearn (Subzone 2) (Page 193)
Hypotype GSC 28867, phragmocone. Parson Bay Formation, Esperanza Inlet, Vancouver Island, British Columbia (GSC loc. 19678).

Figure 6. *Himavatites* sp. indet. (Subzone 2) (Page 193)
GSC 28862, body chamber probably about half a whorl. Pardonet Formation, Brown Hill, northeastern British Columbia (GSC loc. 9839).

Figure 7. *Mesohimavatites caponicus* n. sp. (Subzone 4) (Page 196)
Hypotype GSC 28881, body chamber(?). Pardonet Formation, west side of Pardonet Hill, northeastern British Columbia (GSC loc. 64634).

Figures 8a, b. *Neohimavatites burlingi* (McLearn) (Subzone 3) (Page 197)
Hypotype GSC 28882, no septa visible. Pardonet Formation, north of Besa River, northeastern British Columbia (GSC loc. 65935).

Figures 9, 10. *Neohimavatites canadensis* (McLearn) (Subzone 3) (Page 196)
9a–c. Hypotype GSC 28876, body chamber apparently about half a whorl. Pardonet Formation, 5 km southwest of Mount Stearns, northeastern British Columbia (GSC loc. 82455).
10a–c. Hypotype GSC 28877, complete, mature specimen. Pardonet Formation, Mount Ludington, northeastern British Columbia (GSC loc. 68305).

Figures 11, 12. *Episculites browni* (McLearn) (Subzone 2) (Page 253)
11a–c. Topotype GSC 32116 (GSC loc. 9744), complete with peristome, body chamber three quarters of a whorl.
12a, b. Topotype GSC 35412 (GSC loc. 9741), weakly ribbed variant complete with peristome, septa approximated, body chamber three quarters of a whorl.
Both from Pardonet Formation, near Black Bear Ridge, northeastern British Columbia.

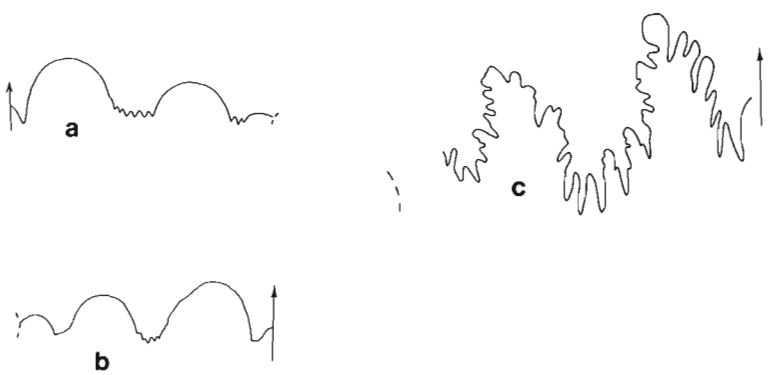

Figure 107. *Sutures. a, b.* ***Episculites browni*** *(McLearn). a, GSC 9513 (McLearn, 1960a, Pl. 18, fig. 3) x4; b, GSC 35412 (Pl. 132, fig. 12) x4; c,* ***Himavatites planiplicatus*** *n. sp., GSC 28864 (Pl. 132, fig. 2) x2.*

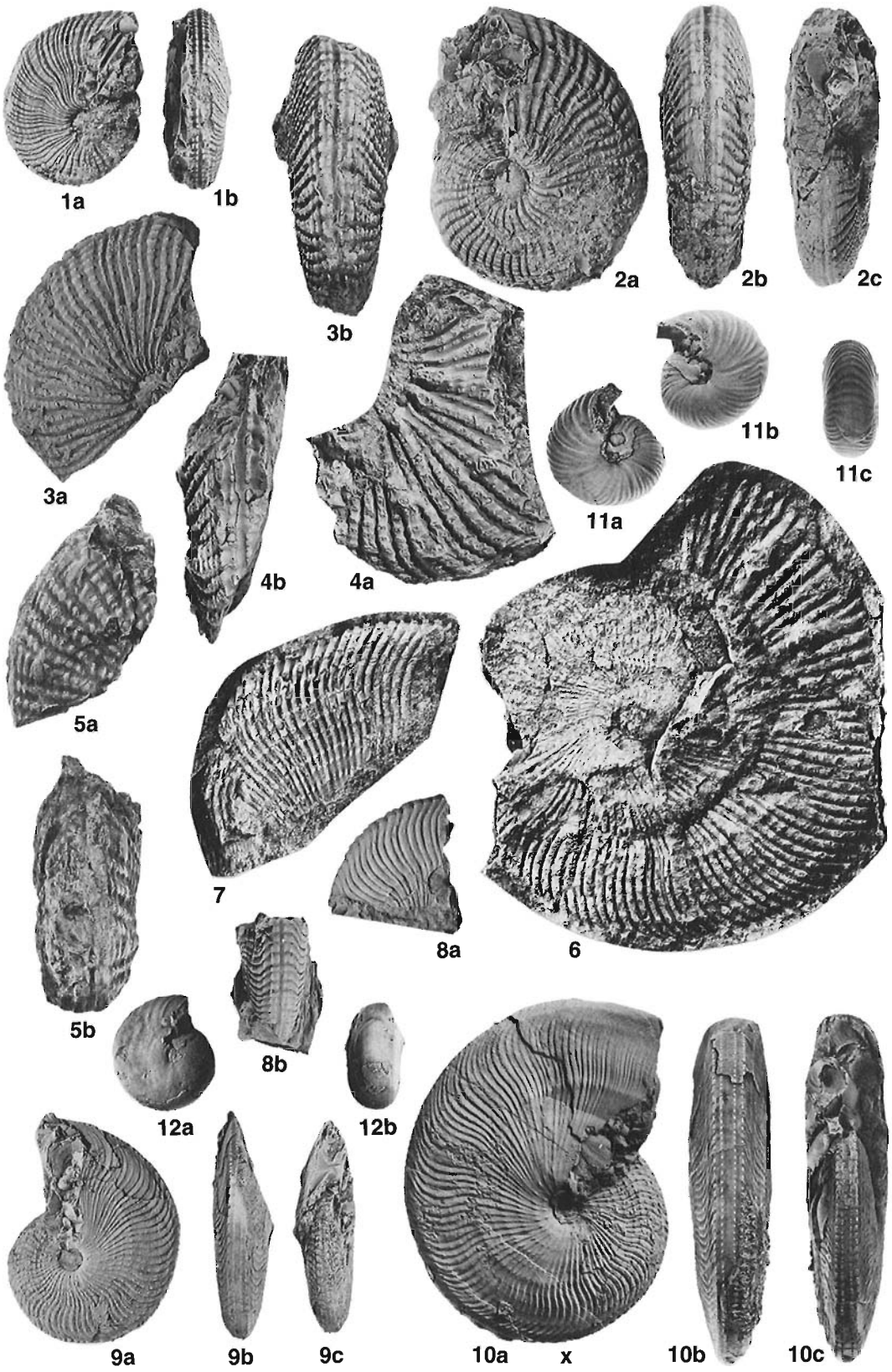
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PLATE 133

UPPER TRIASSIC
Middle Norian–Columbianus Zone

Figures 1–4, 9. *Mesohimavatites parvus* n. sp. (Subzone 2) (Page 194)
1a–c. Holotype GSC 28871 (GSC loc. 83834), body chamber at least one quarter whorl.
2a–c. Paratype GSC 28872 (GSC loc. 83834).
3a, b. Paratype GSC 28873, phragmocone (GSC loc. 83834).
4a, b. Paratype GSC 28874 (GSC loc. 83834), body chamber more than half a whorl.
9a, b. Paratype GSC 28875 (GSC loc. 46468).
All from Pardonet Formation, Crying Girl Prairie Creek, northeastern British Columbia.

Figures 5–8. *Mesohimavatites columbianus* (McLearn) (Subzone 2) (Page 195)
5a, b. Hypotype GSC 28870.
6a, b. Hypotype GSC 28869.
Figures 5, 6 from Pardonet Formation, Mount Stearns, northeastern British Columbia (GSC loc. 74775).
7. Topotype GSC 85781, probably body chamber.
8. Holotype GSC 9411, body chamber.
Figures 7, 8 from Pardonet Formation, west side Pardonet Hill, northeastern British Columbia (GSC loc. 9767).

Figures 10a, b. *Episculites teres* (McLearn) (Subzone 2) (Page 253)
Topotype GSC 35414, phragmocone. Pardonet Formation, near Black Bear Ridge, northeastern British Columbia (GSC loc. 9741).

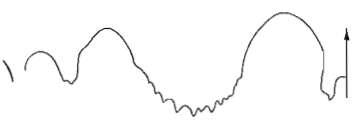

Figure 108. *Suture.* ***Episculites teres*** *(McLearn), GSC 35414 (Pl. 133, fig. 10) x4.*

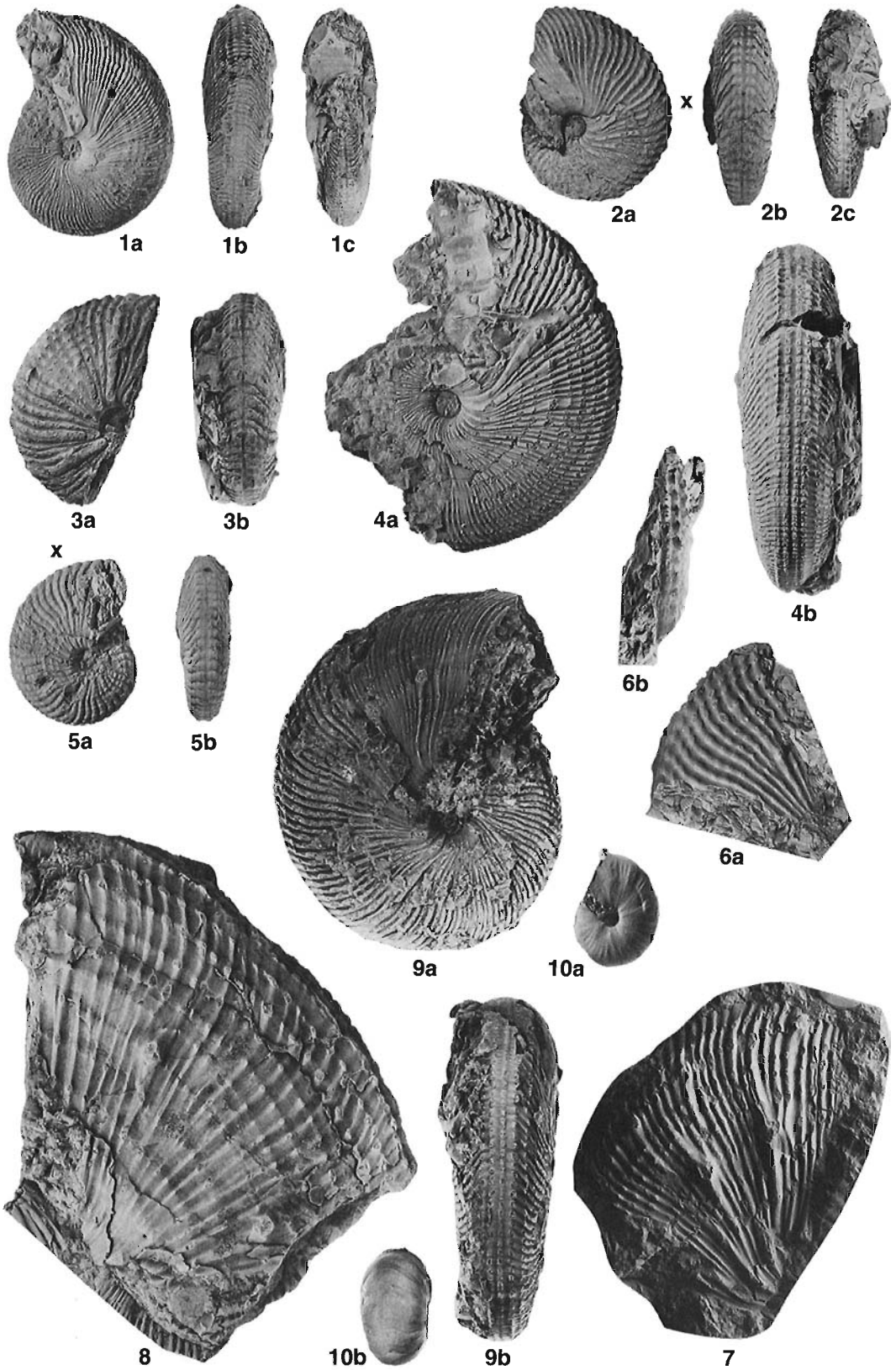
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PLATE 134

UPPER TRIASSIC
Middle Norian–Columbianus Zone

Figures 1a, b. *Neohimavatites burlingi* (McLearn) (Subzone 3) (Page 197)
Holotype GSC 9504, "Little parle–pas Rapids", Peace River at Pardonet Hill, northeastern British Columbia (GSC loc. 9784).

Figures 2, 12, 13. *Himavatites multiauritus* McLearn (Subzone 2) (Page 193)
2a, b. Holotype GSC 9503 (GSC loc. 9745), phragmocone.
12a, b. Topotype GSC 72191 (GSC loc. 98551).
13. Topotype GSC 72192 (GSC loc. 98867).
All from Pardonet Formation, near Black Bear Ridge, northeastern British Columbia.

Figures 3–5. *Himavatites apinnatus* n. sp. (Subzone 2) (Page 194)
3. Paratype GSC 71011, attached to specimen of *Parajuvavites canadensis*.
5. Paratype GSC 71012.
Figures 3, 5 from Pardonet Formation, Crying Girl Prairie Creek, northeastern British Columbia (GSC loc. 97557).
4a, b. Holotype GSC 71010. Pardonet Formation, near Black Bear Ridge, northeastern British Columbia (GSC loc. 98549).

Figure 6. *Mesohimavatites costatus* n. sp. (Subzone 2) (Page 195)
Holotype GSC 71009. Pardonet Formation, Crying Girl Prairie Creek, northeastern British Columbia (GSC loc. 97555).

Figures 7–10. *Mesohimavatites caponicus* n. sp. (Subzone 4) (Page 196)
7a, b. Hypotype GSC 71016, body chamber fragment. Pardonet Formation, west side Pardonet Hill, northeastern British Columbia (GSC loc. 9768).
8a, b. Paratype GSC 71014.
9. Paratype GSC 71015.
Figures 8, 9 show no septa. Both from Pardonet Formation, Sikanni Chief River below Chicken Creek, northeastern British Columbia (GSC loc. 10742).
10a, b. Holotype GSC 71013. Pardonet Formation, Sikanni Chief River, below Chicken Creek, northeastern British Columbia (GSC loc. 10741).

Figure 11. *Mesohimavatites columbianus* (McLearn) (Subzone 2) (Page 195)
Hypotype GSC 72190. Pardonet Formation, near Black Bear Ridge, British Columbia (GSC loc. 98552).

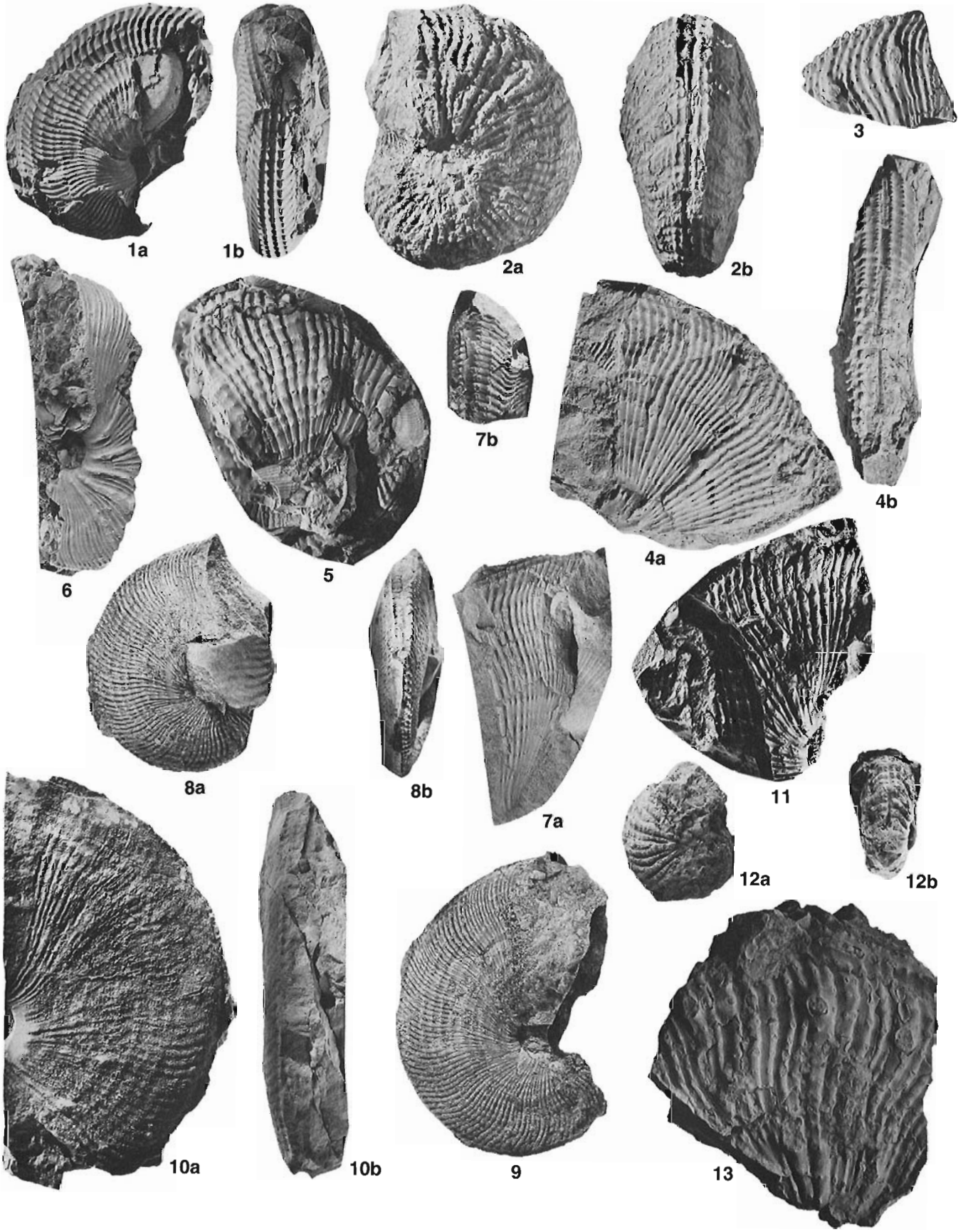
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PLATE 135

UPPER TRIASSIC
Middle Norian–Columbianus Zone

Figures 1–3. *Neohimavatites peregrinus* n. sp. (Subzone 3) (Page 197)
1. Holotype GSC 28878, body chamber. Pardonet Formation, Mount Stearns, northeastern British Columbia (GSC loc. 74777).
2a, b. Paratype GSC 28879. Pardonet Formation, Mount Ludington, northeastern British Columbia (GSC loc. 68301).
3a, b. Hypotype GSC 28880, crushed body chamber. Heiberg Formation, near Wolf Fiord, Axel Heiberg Island (GSC loc. 51643).

Figures 4a–c. *Parathisbites oineus* McLearn (Subzone 1) (Page 256)
Hypotype GSC 32309, probably complete specimen, with approximated septa. Pardonet Formation, Crying Girl Prairie Creek, northeastern British Columbia (GSC loc. 83835).

Figures 5a, b. *Helictites pacalis* n. sp. (Subzone 2) (Page 206)
Holotype GSC 28925, last quarter whorl is probably body chamber. Pardonet Formation, near Black Bear Ridge, northeastern British Columbia (GSC loc. 9729).

Figures 6, 7. *Pseudosirenites pardoneti* (McLearn) (Page 173)
6a–c. Hypotype GSC 28753, complete specimen. Pardonet Formation, Crying Girl Prairie Creek, northeastern British Columbia (GSC loc. 83835) (Subzone 1).
7a, b. Hypotype GSC 28752, phragmocone. Pardonet Formation, west side Pardonet Hill, northeastern British Columbia (GSC loc. 9781) (Subzone 2)

Figures 8–10. *Pseudosirenites falcatus* n. sp. (Subzone 4) (Page 174)
8. Holotype GSC 28754.
9. Paratype GSC 28755.
10. Paratype GSC 28756. None show septa.
All from Pardonet Formation, west side of Pardonet Hill, northeastern British Columbia (GSC loc. 64643).

Figures 11–13. *Leislingites politus* n. sp. (Subzone 3) (Page 208)
11a, b. Paratype GSC 28901. Pardonet Formation, Crying Girl Prairie Creek, northeastern British Columbia (GSC loc. 83848).
12a–c. Paratype GSC 28902.
13a–c. Paratype GSC 28903.
Figures 12, 13 from Pardonet Formation, 5 km southwest of Mount Stearns, northeastern British Columbia (GSC loc. 82455). None show septa clearly.

Figure 109. *Sutures. a,* ***Pseudosirenites pardoneti*** *(McLearn), GSC 28752 (Pl. 135, fig. 7) x2; b, c.* ***Parathisbites oineus*** *McLearn; b, GSC 32309 (Pl. 135, fig. 4) x4; c, GSC 32310* x4.*

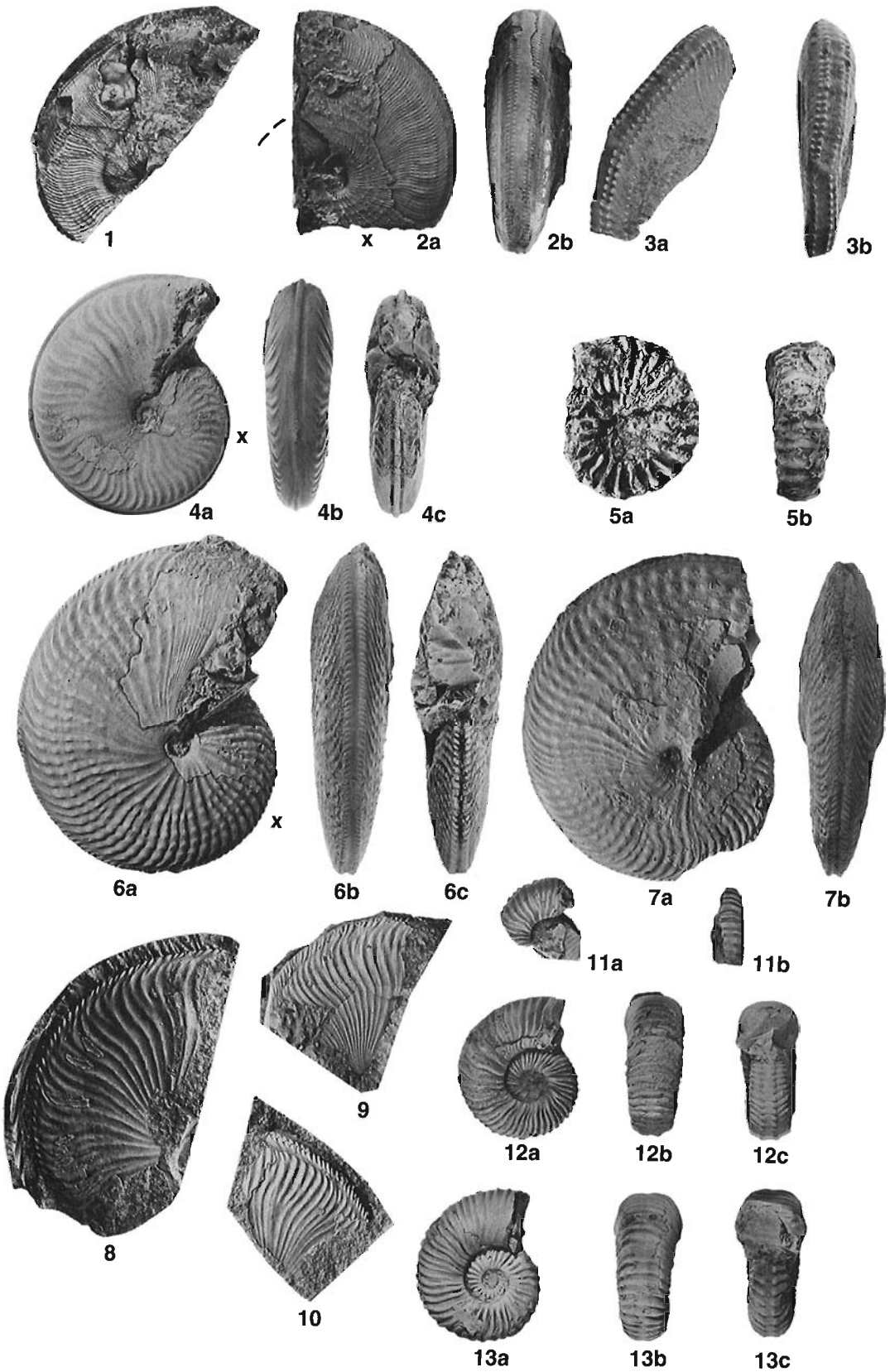
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PLATE 136

UPPER TRIASSIC
Middle Norian–Columbianus Zone

Figures 1a, b. *Pleurodistichites hindei* (Mojsisovics) (Page 201)
Hypotype GSC 28923. Parson Bay Formation, Kyuquot area, Vancouver Island, British Columbia (GSC loc. 21430).

Figures 2a, b. *Episculites wrighti* n. sp. (Subzone 3) (Page 255)
Paratype GSC 32121, whole of outer whorl is body chamber. Pardonet Formation, Mount Ludington, northeastern British Columbia (GSC loc. 46998).

Figures 3a, b. *Rhacophyllites debilis* (Hauer) (Subzone 2) (Page 271)
Hypotype GSC 14305, phragmocone. Parson Bay Formation, Esperanza Inlet, Vancouver Island, British Columbia (GSC loc. 19275).

Figures 4a–c. *Clydonites pacificus* n. sp. (Page 210)
Holotype GSC 28833, 4c is impression of dorsum. Parson Bay Formation, Kyuquot area, Vancouver Island, British Columbia (GSC loc. 20255)

Figures 5, 10. *Pseudosirenites bullatus* n. sp. (Subzone 3) (Page 173)
5a, b. Holotype GSC 28757 (GSC loc. 68301), outer whorl is partly body chamber.
10a–c. Paratype GSC 28758 (GSC loc. 68302), body chamber about half a whorl.
Both from Pardonet Formation, Mount Ludington, northeastern British Columbia.

Figures 6, 7, 11. *Distichites canadensis* McLearn (Subzone 2) (Page 200)
6. Hypotype GSC 28917, body chamber about half a whorl. Parson Bay Formation, Esperanza Inlet, Vancouver Island, British Columbia (GSC loc. 19709).
7a, b. Holotype GSC 8816 (GSC loc. 9741).
11a, b. Topotype GSC 28916 (GSC loc. 9744), body chamber about half a whorl.
Both from Pardonet Formation, near Black Bear Ridge, northeastern British Columbia.

Figures 8a–c. *Hypisculites minor* n. sp. (Subzone 2?) (Page 255)
Holotype GSC 32123, peristome is preserved at the venter. Pardonet Formation, Crying Girl Prairie Creek, northeastern British Columbia (GSC loc. 46468).

Figures 9a, b. *Hypisculites stelcki* (McLearn) (Subzone 1?) (Page 255)
Topotype GSC 32122. Pardonet Formation, Brown Hill, northeastern British Columbia (GSC loc. 9839).

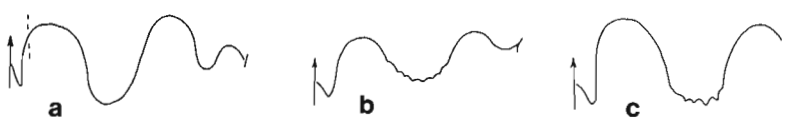

Figure 110. *Sutures. a,* ***Clydonites pacificus*** *n. sp. GSC 28833 (Pl. 136, fig. 4) x2; b,* ***Hypisculites minor*** *n. sp., GSC 32123 (Pl. 136, fig. 8) x4; c,* ***Hypisculites stelcki*** *(McLearn), GSC 32122 (Pl. 136, fig. 9) x4.*

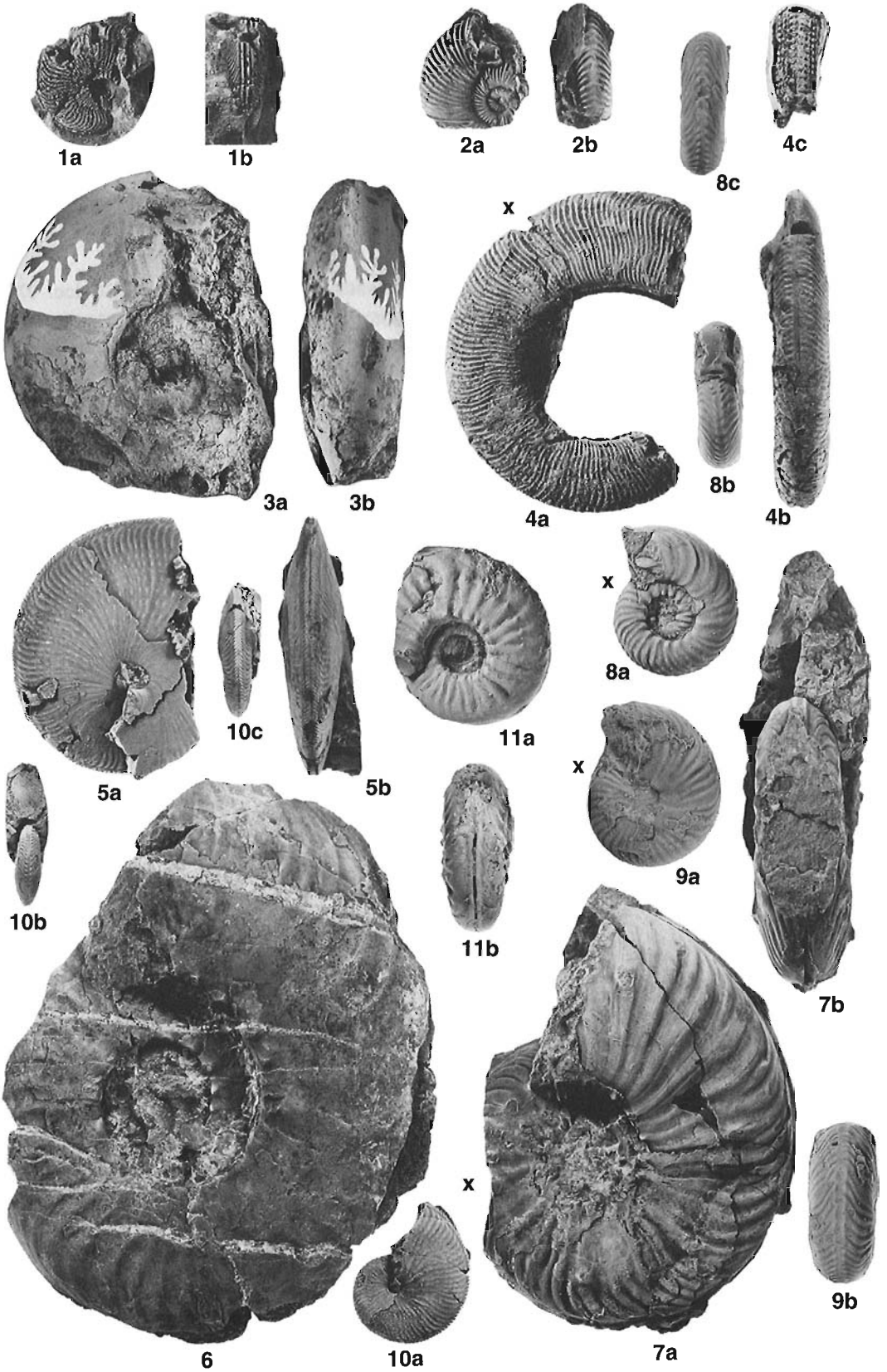
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PLATE 137

UPPER TRIASSIC
Middle Norian–Columbianus Zone

Figures 1, 2. *Pleurodistichites stotti* Tozer (Subzone 1) (Page 201)
1a–c. Holotype GSC 28921.
2a–c. Paratype GSC 28922, complete phragmocone.
Both from Pardonet Formation, near Nevis Creek, northeastern British Columbia (GSC loc. 66027).

Figures 3–5. *Leiodistichites ursidens* n. sp. (Subzone 2) (Page 201)
3a, b. Paratype GSC 28920, body chamber half a whorl.
4a, b. Paratype GSC 28919, phragmocone.
5a, b. Holotype GSC 12592, body chamber more than half a whorl.
All from Pardonet Formation, near Black Bear Ridge, northeastern British Columbia (GSC loc. 9744).

Figures 6a, b. *Helictites decorus* McLearn (Subzone 2) (Page 205)
Topotype GSC 28924. Pardonet Formation, near Black Bear Ridge, northeastern British Columbia (GSC loc. 9741).

Figures 7, 8. *Distichites gethingi* McLearn (Page 200)
7a, b. Hypotype GSC 28914, complete phragmocone. Pardonet Formation, Crying Girl Prairie Creek, northeastern British Columbia (GSC loc. 83835) (Subzone 1).
8a, b. Hypotype GSC 28915, width 8 mm, body chamber at least half a whorl. Pardonet Formation, near Black Bear Ridge, northeastern British Columbia (GSC loc. 9744) (Subzone 2).

Figures 9a, b. *Distichites columbianus* n. sp. (Subzone 1) (Page 199)
Holotype GSC 28918. Pardonet Formation, Crying Girl Prairie Creek, northeastern British Columbia (GSC loc. 83835).

Figure 111. *Sutures. a,* ***Helictites decorus*** *McLearn, GSC 28924 (Pl. 137, fig. 6) x4; b,* ***Pleurodistichites stotti*** *Tozer, GSC 28922 (Pl. 137, fig. 2) x4; c,* ***Leiodistichites ursidens*** *n. sp., GSC 28919 (Pl. 137, fig. 4) x4; d,* ***Distichites gethingi*** *McLearn, GSC 28913* x2.*

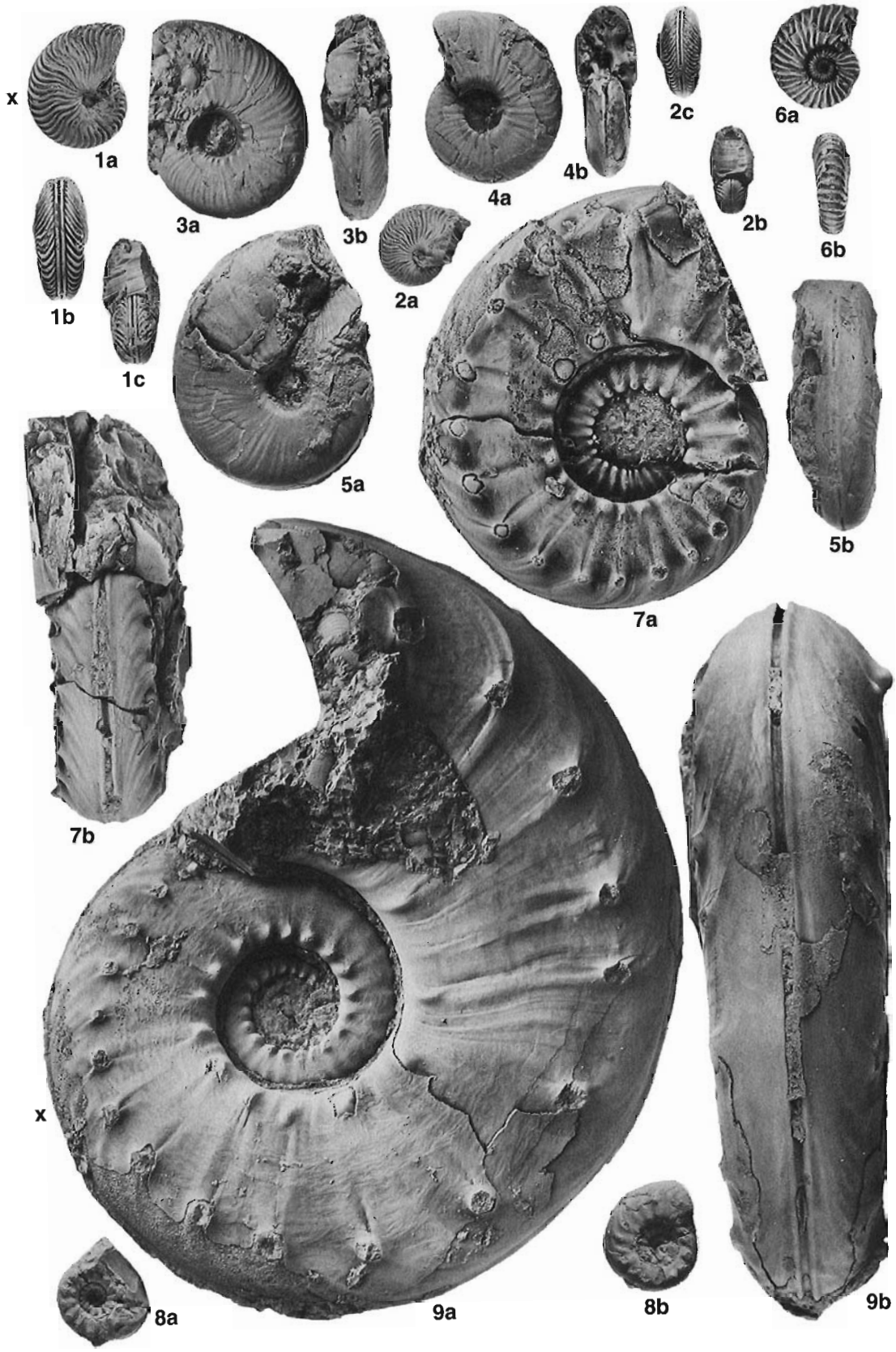
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PLATE 138

UPPER TRIASSIC
Middle Norian–Columbianus Zone

Figures 1–7. *Eothetidites lacrimosus* n. sp. (Subzone 1) (Page 203)

1a–c. Paratype GSC 28884.
2a–c. Paratype GSC 28885.
3a, b. Holotype GSC 28883.
4a, b. Paratype GSC 28886.
5a, b. Paratype GSC 28887.
6a–c. Paratype GSC 28888, 6c is dorsum.
7a–c. Paratype GSC 28889, specimen with approximated septa. Outer whorls, except on GSC 28889 (Fig. 7b) are mostly preserved as steinkern; inner whorls preserve the test. Subdued sculpture on mould of phragmocone and posterior part of body chamber (figs. 3a, 5a, b, 6a–c, 7a, c) indicates original presence of preseptal layer.
All from Pardonet Formation, Crying Girl Prairie Creek, northeastern British Columbia (GSC loc. 83835).

Figures 8a, b. *Parathetidites robustus* n. sp. (Subzone 1 or 2) (Page 204)

Holotype GSC 35312, septa not visible. Pardonet Formation, west side Pardonet Hill, northeastern British Columbia (GSC loc. 9632).

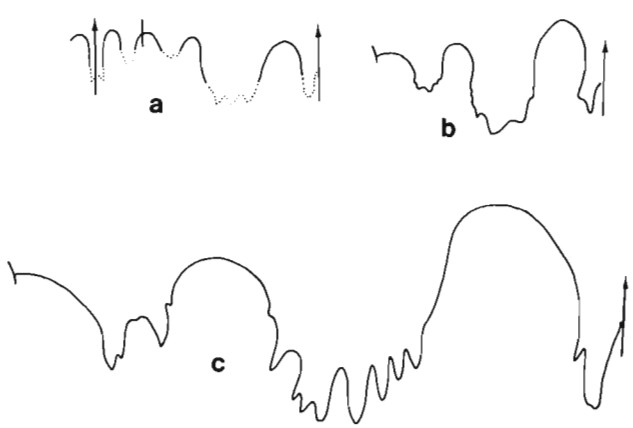

Figure 112. *Sutures.* ***Eothetidites lacrimosus*** *n. sp. a, GSC 28888 (Pl. 138, fig. 6) x2; b, GSC 28887 (Pl. 138, fig. 5) x2; c, GSC 28889 (Pl. 138, fig. 7) x2.*

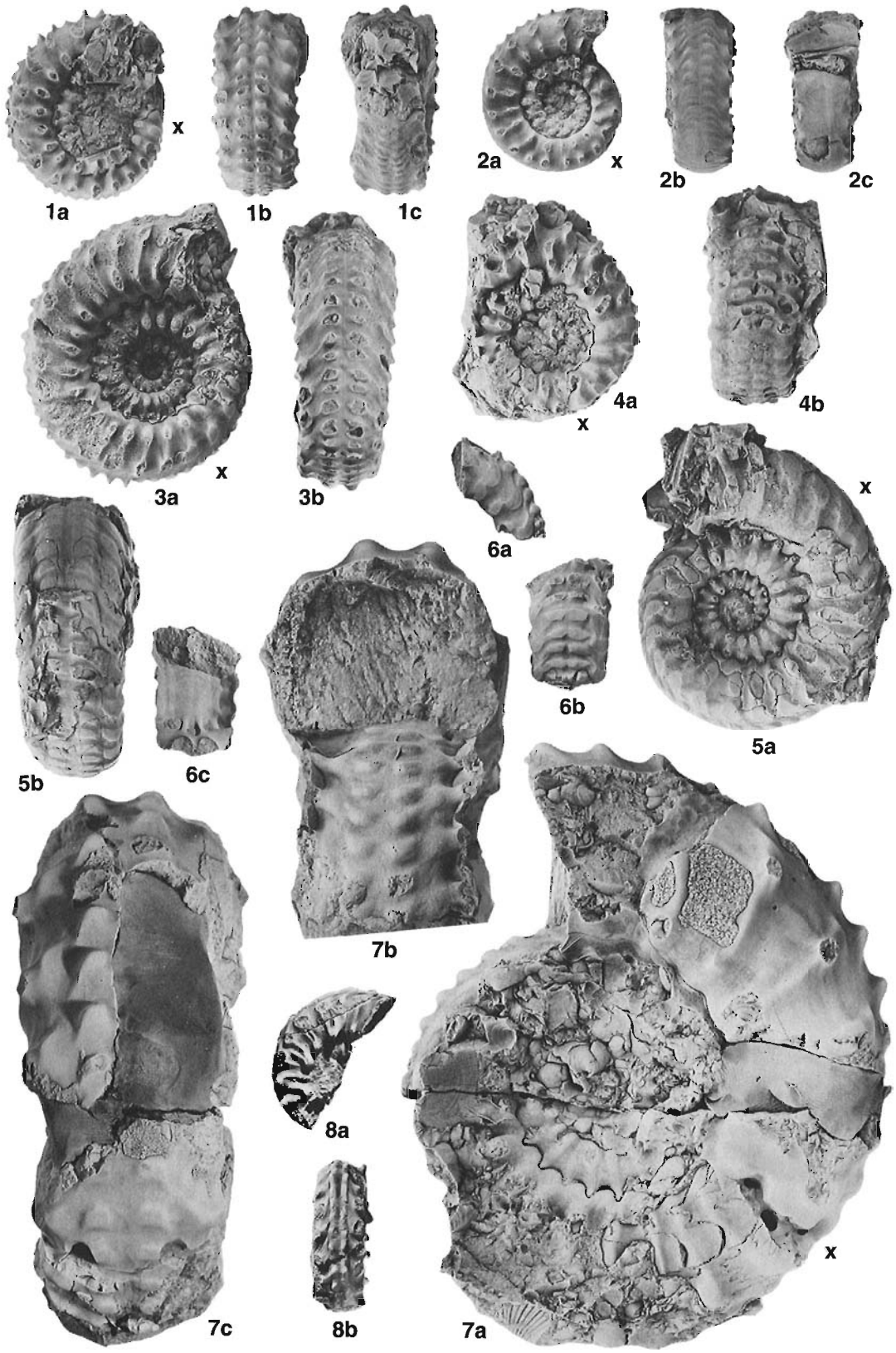
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PLATE 139

UPPER TRIASSIC
Middle Norian–Columbianus Zone

Figures 1–10. *Leislingites quadratus* n. sp. (Subzone 3) (Page 206)
1a–c. Hypotype GSC 28898.
2a, b. Hypotype GSC 28900, outer whorl, beyond break, is body chamber.
3a, b. Hypotype GSC 28899, body chamber about a quarter of a whorl.
Figures 1–3 from Pardonet Formation, Mount Stearns, northeastern British Columbia (GSC loc. 74777).
4a–c. Paratype GSC 28897 (GSC loc. 68303), septa not visible.
5a–c. Paratype GSC 28893 (GSC loc. 68301).
6a–c. Paratype GSC 28891 (GSC loc. 68302).
7a–c. Holotype GSC 28890 (GSC loc. 68302).
8a, b. Paratype GSC 28894 (GSC loc. 68301).
9a, b. Paratype GSC 28895 (GSC loc. 68301).
10a, b. Paratype GSC 28896 (GSC loc. 68301), body chamber.
Figures 4–10 from Pardonet Formation, Mount Ludington, northeastern British Columbia.

Figures 11, 19. *Parathetidites exquisitus* (McLearn) (Subzone 2) (Page 204)
11a, b. Topotype GSC 32359 (GSC loc. 9782) x2, septa not visible, peristome preserved.
19. Topotype GSC 33285 (GSC loc. 9781).
Both from Pardonet Formation, west side Pardonet Hill, northeastern British Columbia.

Figures 12–14. *Leislingites politus* n. sp. (Subzone 3) (Page 208)
12a–c. Holotype GSC 28904.
13a–c. Paratype GSC 28905.
14a–c. Paratype GSC 28906.
All from Pardonet Formation, Mount Ludington, northeastern British Columbia (GSC loc. 68302).

Figures 15a, b. *Pseudothetidites brysonis* (Diener) (Subzone 3) (Page 206)
Hypotype GSC 28908, phragmocone. Pardonet Formation, Mount Ludington, northeastern British Columbia (GSC loc. 68303).

Figures 16–18. *Leislingites vancouverensis* n. sp. (Probably Subzone 3) (Page 208)
16a, b. Holotype GSC 28909.
17a–c. Paratype GSC 28911, apparently body chamber with last septum.
18. Paratype GSC 28910.
All from Parson Bay Formation, Kyuquot area, Vancouver Island, British Columbia (GSC loc. 24352).

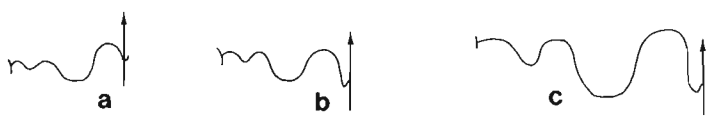

Figure 113. *Sutures. a,* ***Parathetidites exquisitus*** *(McLearn), GSC 9496 (McLearn, 1960a, Pl. 8, fig. 5) x4; b,* ***Leislingites quadratus*** *n. sp., GSC 28892* x4; c,* ***Leislingites politus*** *n. sp., GSC 28904 (Pl. 139, fig. 12) x4.*

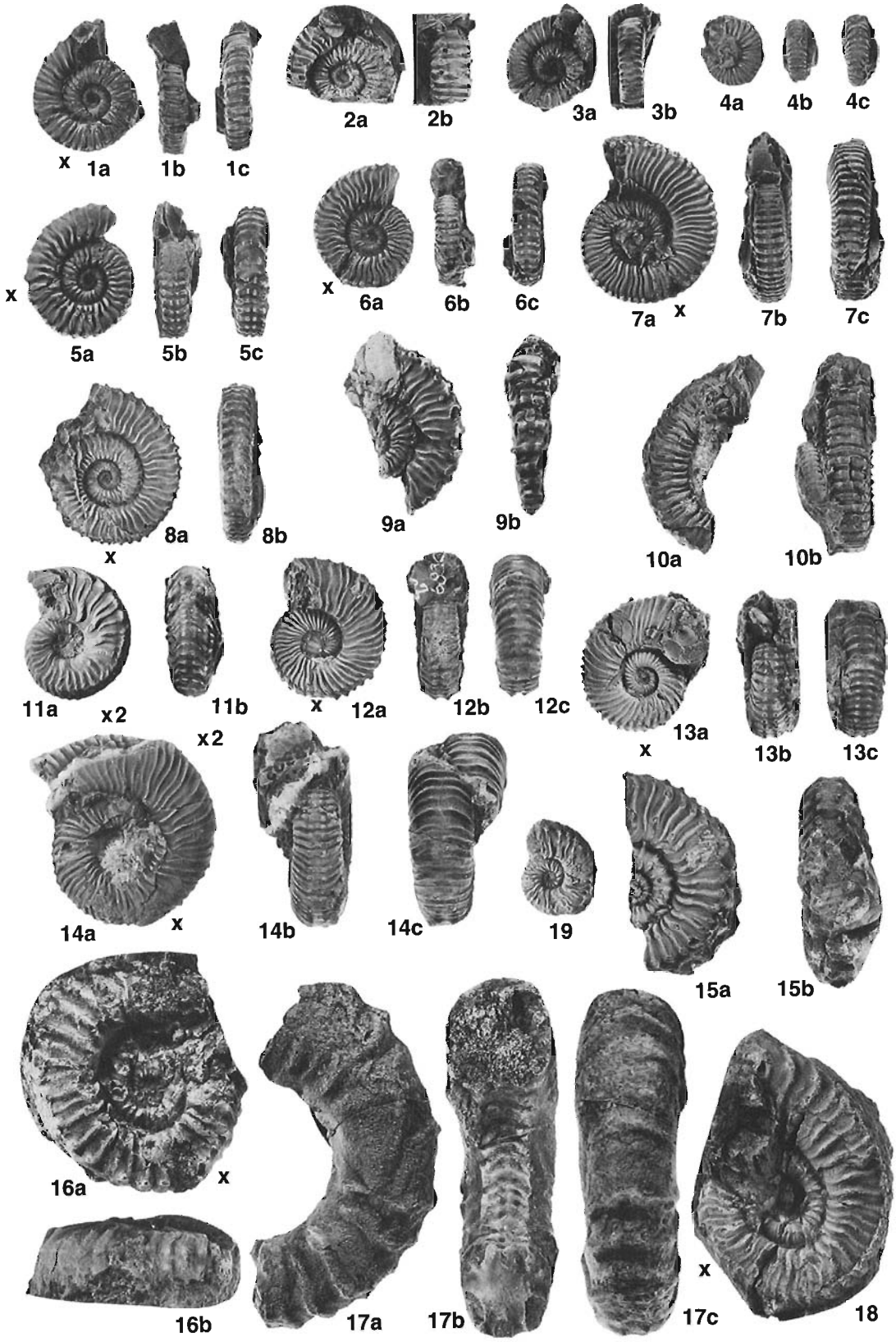
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PLATE 140

UPPER TRIASSIC
Middle Norian–Columbianus Zone

Figures 1–9. *Parajuvavites canadensis* n. sp. (Page 258)

1a, b. Paratype GSC 32273, peristome preserved.
2a–c. Paratype GSC 32272, peristome preserved.
3a, b. Paratype GSC 32274.
Figures 1–3 from Pardonet Formation, Mount Ludington, northeastern British Columbia (GSC loc. 68305) (Subzone 3).
4a, b. Holotype GSC 32266, peristome preserved.
6a, b. Paratype GSC 32270.
7a, b. Paratype GSC 32269, peristome preserved.
8a, b. Paratype GSC 32267.
9a, b. Paratype GSC 32268, peristome preserved.
Figures 4, 6–9 from Pardonet Formation, 5 km southwest of Mount Stearns, northeastern British Columbia (GSC loc. 82454). (Probably Subzone 2.)
5. GSC 32271. Pardonet Formation, Sikanni Chief River below Chicken Creek, northeastern British Columbia (GSC loc. 10739). (Probably Subzone 2.)

Figure 114. *Suture.* ***Parajuvavites canadensis*** *n. sp., GSC 32270 (Pl. 140, fig. 6) x2.*

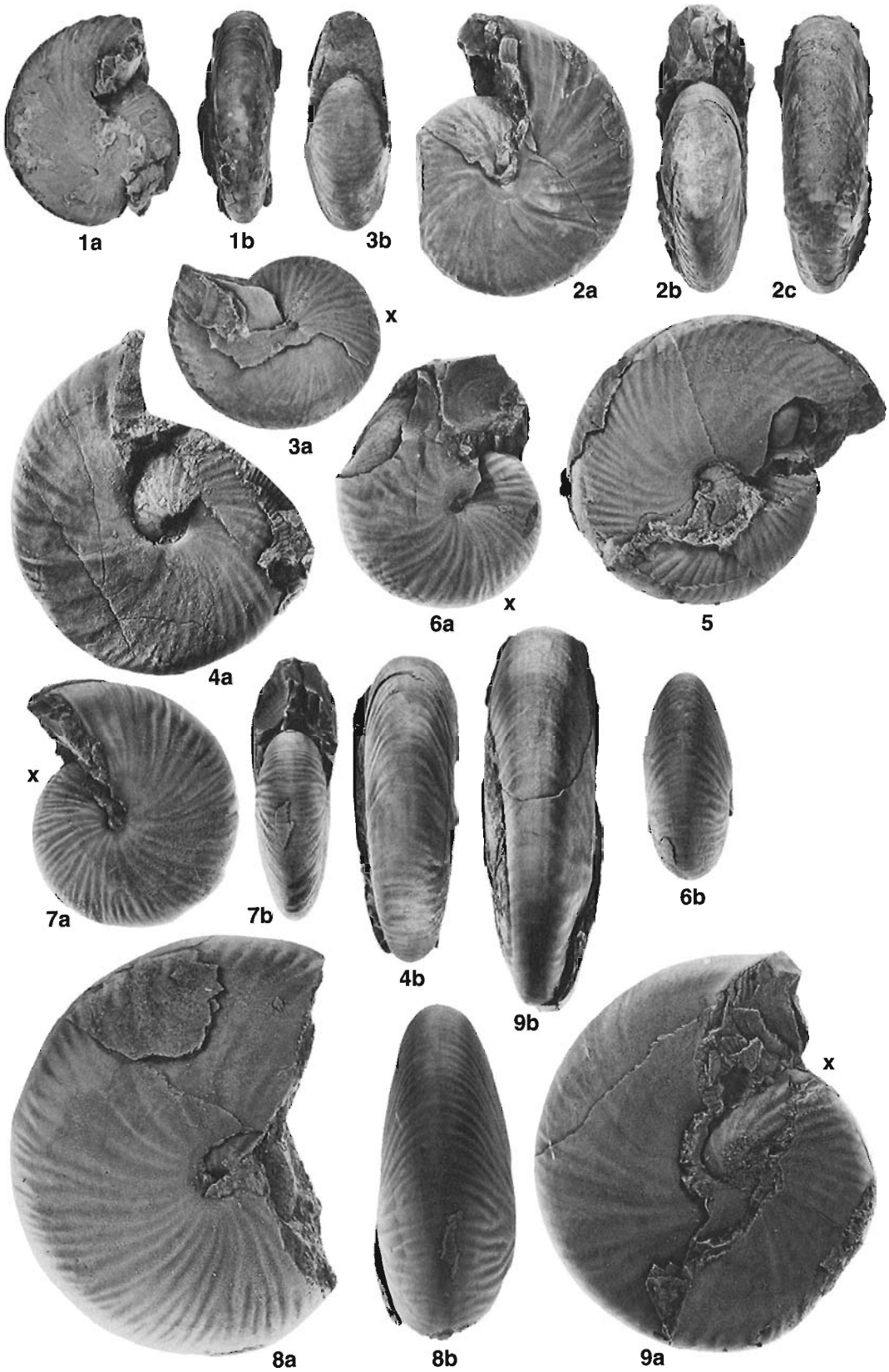
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PLATE 141

UPPER TRIASSIC
Middle Norian–Columbianus Zone

Figures 1–3. *Episculites teres* (McLearn) (Subzone 2) (Page 253)
1a–c. Hypotype GSC 32117 (GSC loc. 19275).
2a–c. Hypotype GSC 32119, (GSC loc. 19709) outer whorl, beyond break, is body chamber.
3a, b. Hypotype GSC 32118 (GSC loc. 19709), outer whorl is mainly or wholly body chamber.
All from Parson Bay Formation, Esperanza Inlet, Vancouver Island, British Columbia.

Figures 4a, b. *Episculites wrighti* n. sp. (Subzone 3) (Page 255)
Holotype GSC 32120, body chamber a little more than one whorl. Pardonet Formation, Mount Stearns, northeastern British Columbia (GSC loc. 74776).

Figure 5. *Sagenites* sp. indet. (Subzone 4) (Page 169)
GSC 28415. Pardonet Formation, west side Pardonet Hill, northeastern British Columbia (GSC loc. 64634).

Figures 6a–e. *Halorites* sp. indet. (Subzone 3) (Page 258)
GSC 32276, both sides of phragmocone, side and venter of body chamber. Pardonet Formation, Mount Ludington, northeastern British Columbia (GSC loc. 68301).

Figures 7, 8. *Parajuvavites canadensis* n. sp. (Probably Subzone 3) (Page 258)
7a, b. Paratype GSC 32275 (GSC loc. 24352).
8a, b. Paratype GSC 14306 (GSC loc. 21431).
Both from Parson Bay Formation, Kyuquot area, Vancouver Island, British Columbia.

Figures 9a, b. *Eothetidites pardoneti* n. sp. (Subzone 1 or 2) (Page 203)
Holotype GSC 12569, part of outer whorl is body chamber. Pardonet Formation, west side Pardonet Hill, northeastern British Columbia (GSC loc. 9781).

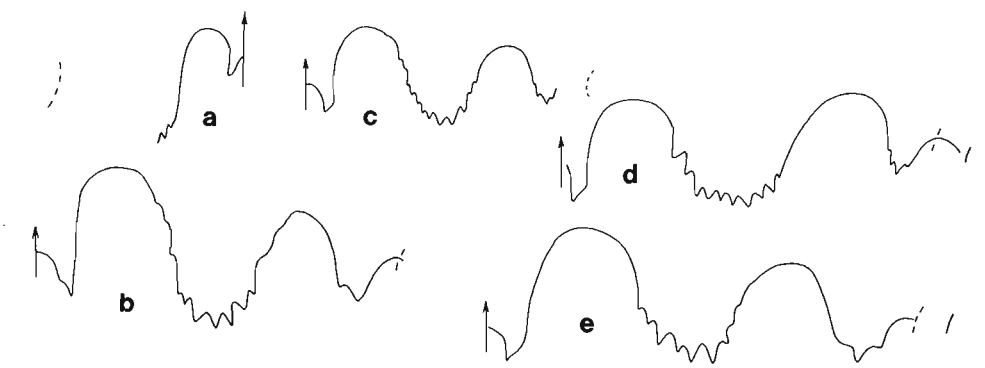
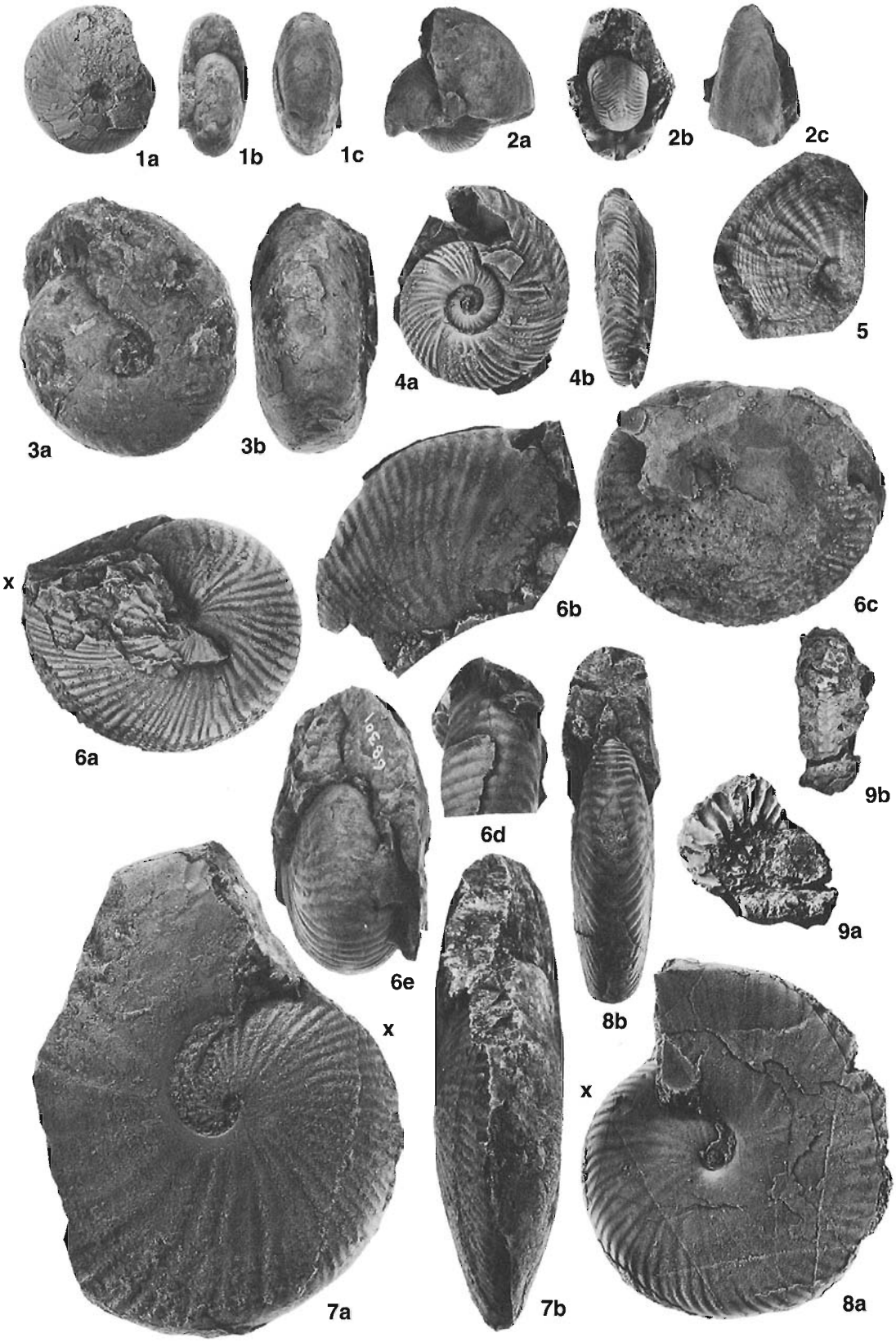


Figure 115. *Sutures. a,* ***Eothetidites pardoneti*** *n. sp., GSC 12569 (Pl. 141, fig. 9) x4; b–e.* ***Episculites teres*** *(McLearn). b, GSC 32117 (Pl. 141, fig. 1) x4; c, GSC 32119 (Pl. 141, fig. 2) x4; d, GSC 9494 (McLearn, 1960a, Pl. 18, fig. 5) x4; e, GSC 9493 (McLearn, 1960a, Pl. 18, fig. 6) x4.*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4b
5
6a
x
6b
6c
6d
6e
9a
9b
7a
x
7b
8b
x
8a

PLATE 142

UPPER TRIASSIC
Middle Norian–Columbianus Zone

Figures 1–3. *Idaoceras maclearni* n. sp. (Subzone 3) (Page 209)
1a, b. Paratype GSC 12567.
2a, b. Holotype GSC 12568.
3a–c. Paratype GSC 35365.
All from Pardonet Formation, talus block, Brown Hill, British Columbia (GSC loc. 9471).

Figures 4a–c. *Neodidymites tatzreiteri* n. sp. (Subzone 1) (Page 252)
Holotype GSC 72193, complete specimen. Pardonet Formation, Childerhose Cove, Williston Lake, British Columbia (GSC loc. 98885).

Figures 5a–c. *Leislingites semiviatus* n. sp. (Subzone 2) (Page 206)
Holotype GSC 71001. Pardonet Formation, Crying Girl Prairie Creek, British Columbia (GSC loc. 97557).

Figures 6a–d. *Helictites minor* n. sp. (Subzone 1) (Page 205)
Holotype GSC 72197. Pardonet Formation, west side of Pardonet Hill, British Columbia (GSC loc. 98518).

Figures 7a–d. *Parathisbites pardoneti* n. sp. (Subzone 1) (Page 257)
Holotype GSC 71004. Pardonet Formation, west side of Pardonet Hill, British Columbia (GSC loc. 98518).

Figures 8a–e. *Parathetidites laevis* n. sp. (Subzone 2) (Page 204)
Holotype GSC 72200. Pardonet Formation, near Black Bear Ridge, British Columbia (GSC loc. 98870).

Figures 9a–c. *Thetidites nudus* n. sp. (Subzone 3) (Page 209)
Holotype GSC 72198. Pardonet Formation, near Black Bear Ridge, British Columbia (GSC loc. 98909).

Figures 10, 11. *Episculites crassus* n. sp. (Subzone 3) (Page 254)
10a–c. Paratype GSC 71003.
11a–c. Holotype GSC 71002.
Both from Pardonet Formation, Crying Girl Prairie Creek, British Columbia (GSC loc. 97552).

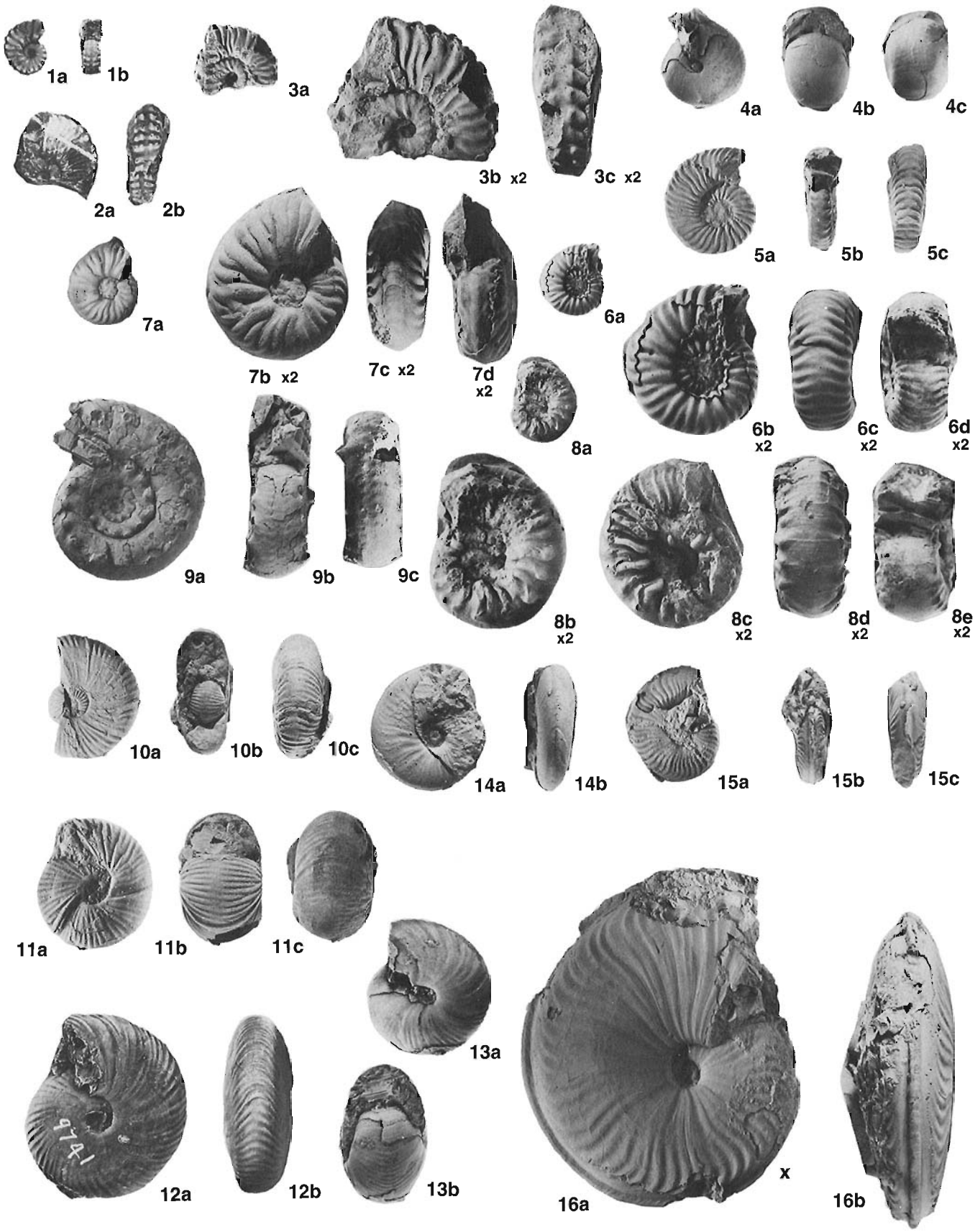
Figures 12, 13. *Episculites teres* (McLearn) (Subzone 2) (Page 253)
12a, b. Topotype GSC 12600 (GSC loc. 9741).
13a, b. Topotype GSC 35413 (GSC loc. 9745).
Both from Pardonet Formation, near Black Bear Ridge, British Columbia.

Figures 14a, b. *Phormedites transiens* n. sp. (Subzone 1) (Page 257)
Holotype GSC 71008. Pardonet Formation, Childerhose Cove, British Columbia (GSC loc. 98542).

Figures 15a–c. *Parathisbites obtusus* n. sp. (Subzone 1) (Page 256)
Holotype GSC 71007. Pardonet Formation, Childerhose Cove, British Columbia (GSC loc. 98542).

Figures 16a, b. *Parathisbites oineus* McLearn (Subzone 1) (Page 256)
Hypotype GSC 72199. Pardonet Formation, near Childerhose Cove, British Columbia (GSC loc. 98877).

Figure 116. *Sutures. a,* ***Episculites teres*** *(McLearn), GSC 12600 (Pl. 142, fig. 12) x4; b,* ***Neodidymites tatzreiteri*** *n. sp., GSC 72194* x5.*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3b x2
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16a
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16b

PLATE 143

UPPER TRIASSIC
Middle Norian–Columbianus Zone

Figures 1a–c. *Eosteinmannites nitidus* n. sp. (Subzone 3) (Page 180)
Holotype GSC 12570. Pardonet Formation, Sikanni Chief River, British Columbia (GSC loc. 10740).

Figures 2a, b. *Pleurodistichites* sp. indet. (Subzone 1) (Page 201)
GSC 72346. Pardonet Formation, west side of Pardonet Hill, British Columbia (GSC loc. 98518).

Figures 3a–c. *Eosteinmannites orientalis* n. sp. (Subzone 2) (Page 180)
Holotype GSC 71005. Pardonet Formation, near Black Bear Ridge, British Columbia (GSC loc. 98549).

Figures 4a, b. *Pseudosirenites pressus* (McLearn) (Subzone 2) (Page 173)
Holotype GSC 9501. Pardonet Formation, near Black Bear Ridge, British Columbia (GSC loc. 9745).

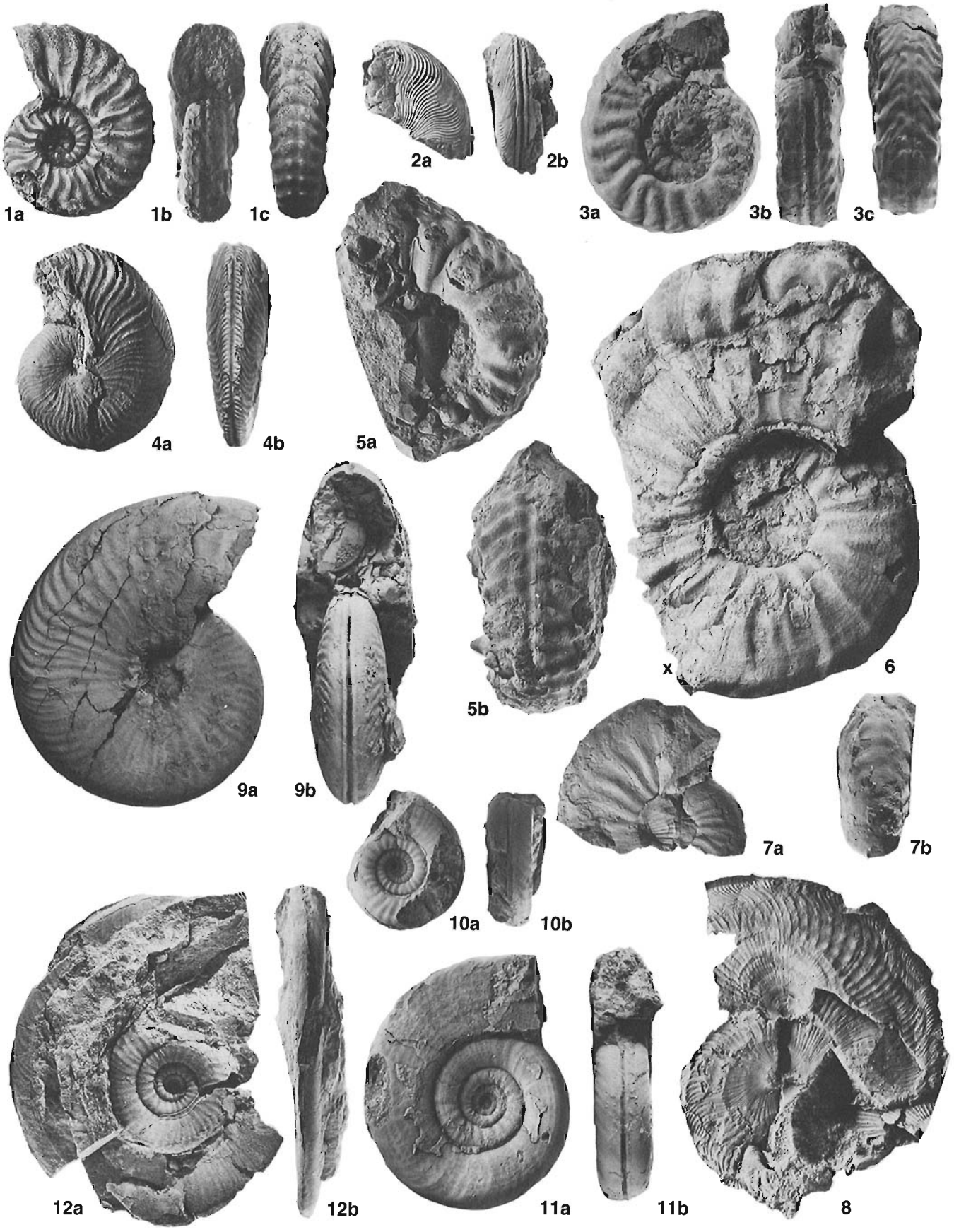
Figures 5a, b. *Alloclionites dieneri* n. sp. (Subzone 3) (Page 181)
Hypotype GSC 70997. Pardonet Formation, Crying Girl Prairie Creek, British Columbia (GSC loc. 97552).

Figures 6, 7. *Brouwerites maclearni* n. sp. (Subzone 4) (Page 183)
6. Holotype GSC 12573 (GSC loc. 9768).
7a, b. Topotype GSC 71017 (GSC loc. 64645).
Both from Pardonet Formation, west side Pardonet Hill, British Columbia.

Figure 8. *Pseudosirenites bullatus* n. sp. (Subzone 3) (Page 173)
Hypotype GSC 12566. Pardonet Formation, "Little parle–pas Rapids", Peace River at Pardonet Hill, British Columbia (GSC loc. 9784).

Figures 9a, b. *Leiodistichites beachi* n. sp. (Subzone 2) (Page 202)
Holotype GSC 72202, phragmocone. Pardonet Formation, near Black Bear Ridge, British Columbia (GSC loc. 98869).

Figures 10–12. *Ectolcites childerhosei* n. sp. (Subzone 1) (Page 199)
10a, b. Paratype GSC 72204.
11a, b. Holotype GSC 72205.
Figures 10, 11 from Pardonet Formation, Childerhose Cove, British Columbia (GSC loc. 98885).
12a, b. Paratype GSC 70998. Pardonet Formation, Brown Hill, British Columbia (GSC loc. 97528).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7b
10a
10b
12a
12b
11a
11b
8

PLATE 144

UPPER TRIASSIC
Upper Norian–Cordilleranus Zone

Figures 1–8. *Rhabdoceras suessi* Hauer (Page 264)
1. Hypotype GSC 32316.
2. Hypotype GSC 32315.
Figures 1, 2 from *"Rhacophyllites Beds"*, Pardonet Formation, Ne-parle-pas Rapids, Peace River, northeastern British Columbia (GSC loc. 64594) (Amoenum Zone).
3. Hypotype GSC 14263, ventral view.
4a–c. Hypotype GSC 14264, side (a), ventral (b) and dorsal (c) views.
Figures 3, 4 from Lewes River Group, Formation D, 5 km southeast of U.S. bend on Lewes River, Laberge area, Yukon (GSC loc. 23457).
5a–c. Hypotype GSC 32313 (GSC loc. 68300).
6a–d. Hypotype GSC 32311 (GSC loc. 68300).
7a–c. GSC 32314 (GSC loc. 68304).
8a–c. GSC 32312 (GSC loc. 68300). For Figures 5–7, a side view, b, ventral, c, dorsal view; 6d is sectional view.
Figures 5–8 from Pardonet Formation, Mount Ludington, northeastern British Columbia (Subzone 1).

Figures 9a–c. *Sagenites* sp. indet. (x2) (Subzone 1) (Page 136)
GSC 28417. Pardonet Formation, Mount Ludington, northeastern British Columbia (GSC loc. 68304).

Figures 10–12. *Peripleurites roemeri* Mojsisovics (Subzone 1) (Page 265)
10a, b. Hypotype GSC 32320.
11a, b. Hypotype GSC 32321.
Figures 10, 11 from Pardonet Formation, Mount Ludington, northeastern British Columbia (GSC loc. 68300).
12. Hypotype GSC 71036. Pardonet Formation, Pardonet Hill, northeastern British Columbia (GSC loc. 98530).

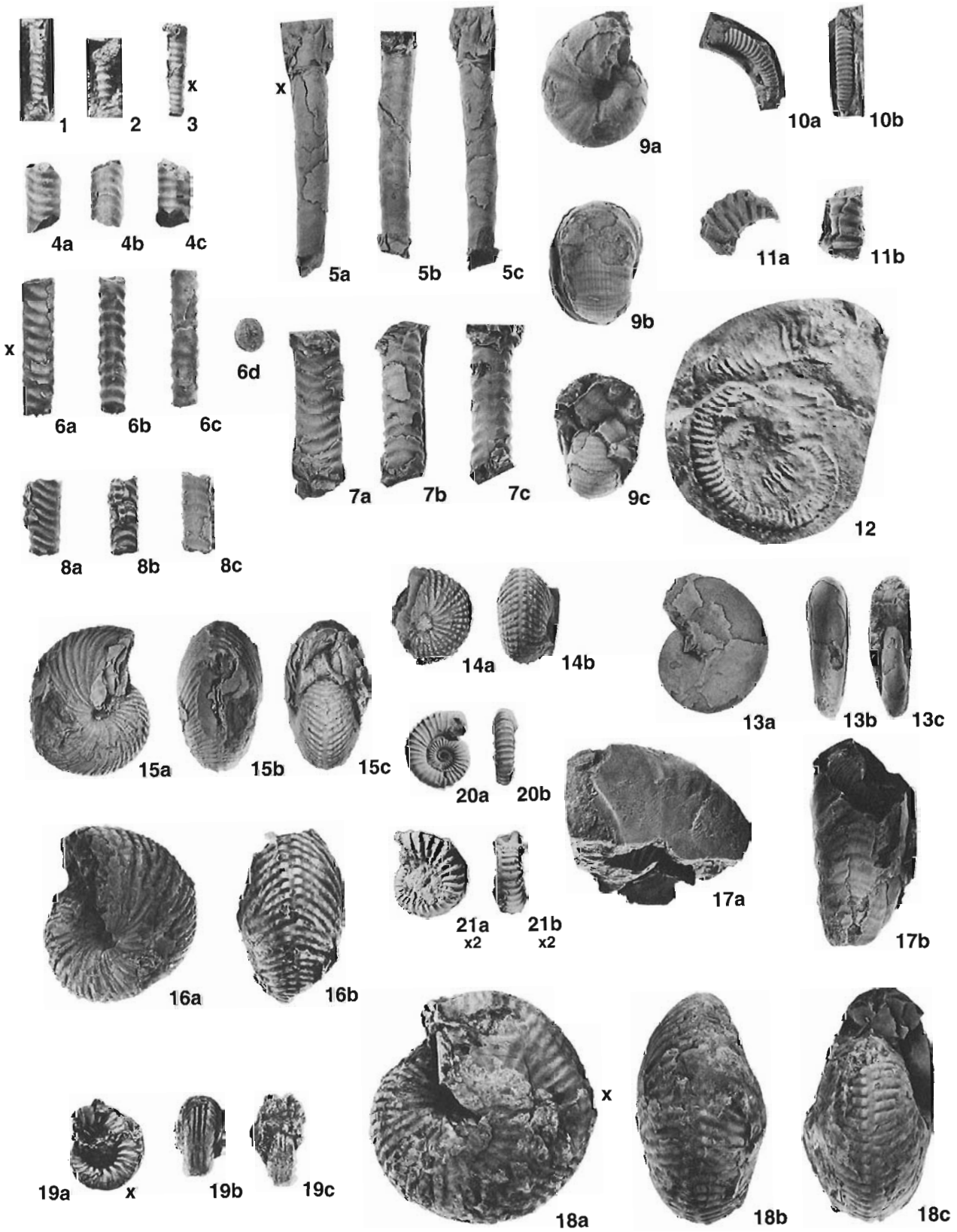
Figures 13a–c. *Paragymnites symmetricus* (Mojsisovics) (Subzone 1) (Page 130)
Hypotype GSC 28394. Pardonet Formation, Mount Ludington, northeastern British Columbia (GSC loc. 68304).

Figures 14–18. *Paraguembelites inflatus* n. sp. (Subzone 1) (Page 259)
14a, b. Paratype GSC 32291 (GSC loc. 68300), phragmocone.
15a–c. Paratype GSC 32288 (GSC loc. 68300), phragmocone.
16a, b. Paratype GSC 32289 (GSC loc. 68300), phragmocone.
17a, b. Paratype GSC 32286 (GSC loc. 68304), fragmentary body chamber with peristome, dorsum shows impression of tuberculate penult whorl.
18a–c. Holotype GSC 32290 (GSC loc. 68300).
All from Pardonet Formation, Mount Ludington, northeastern British Columbia.

Figures 19a–c. *Nannosteinmannites yukonensis* n. sp.m (Page 184)
Holotype GSC 28719. Otuk Formation, Nash Creek area, Yukon (GSC loc. 47134).

Figures 20, 21. *Ophiorhabdoceras canadense* n. sp. (Subzone 1) (Page 264)
20a, b. Paratype GSC 72327, half a whorl is body chamber.
21a, b. Holotype GSC 72328, x2, phragmocone.
Both from Pardonet Formation, Ducette Creek, northeastern British Columbia (GSC loc. 98558).

Figure 117. *Sutures. a,* ***Peripleurites roemeri*** *Mojsisovics, GSC 32320 (Pl. 144, fig. 10) x3; b,* ***Ophiorhabdoceras canadense*** *n. sp., GSC 72327 (Pl. 144, fig. 20) x4.5; c–g.* ***Rhabdoceras suessi*** *Hauer; c, GSC 14263 (Pl. 144, fig. 3) x3; d, GSC 32313 (Pl. 144, fig. 5) x3; e, GSC 32311 (Pl. 144, fig. 6), x3; f, GSC 32312 (Pl. 144, fig. 8) x3; g, GSC 32314 (Pl. 144, fig. 7) x3; h, i.* ***Paragymnites symmetricus*** *(Mojsisovics). h, GSC 28393* x1.5; i, GSC 28394 (Pl. 144, fig. 13) x1.5; j, k.* ***Paraguembelites inflatus*** *n. sp. j, GSC 32290 (Pl. 144, fig. 18) x3; k, GSC 32288 (Pl. 144, fig. 15) x3.*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17a
17b
16a
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21a
x2
21b
x2
19a
x
19b
19c
x
18a
18b
18c

PLATE 145

UPPER TRIASSIC
Upper Norian–Cordilleranus Zone

Figures 1a, b. *Gnomohalorites yukonensis* Tozer (Page 260)
Holotype GSC 14262, phragmocone. Lewes River Group, Formation D, 5 km southeast of U.S. bend on Lewes River, Laberge area, Yukon (GSC loc. 23457).

Figures 2a, b. *Gnomohalorites southeri* Tozer (Page 260)
Holotype GSC 32292. Sinwa Formation, Tulsequah area, British Columbia (GSC loc. 40429).

Figures 3, 4. *Gnomohalorites cordilleranus* Tozer (Subzone 1) (Page 260)
3a, b. Paratype GSC 32278, phragmocone.
4a–c. Holotype GSC 32277, phragmocone.
Both from Pardonet Formation, Mount Ludington, northeastern British Columbia (GSC loc. 68300).

Figure 5. *Sagenites* sp. indet. (Page 136)
GSC 28416, crushed specimen on slab with *Gnomohalorites, Rhabdoceras* and *Monotis*. Parson Bay Formation, probably from Malksope Inlet, Vancouver Island, British Columbia (GSC loc. 6897).

Figures 6a, b. *Rhacophyllites debilis* (Hauer) (Page 271)
GSC 32353, phragmocone. Lewes River Group, Formation D, 5 km southeast of U.S. bend on Lewes River, Laberge area, Yukon (GSC loc. 23457).

Figures 7–14. *Paraguembelites ludingtoni* Tozer (Subzone 1) (Page 259)
7a–c. Hypotype GSC 32287, phragmocone. Pardonet Formation, Mount Ludington, northeastern British Columbia (GSC loc. 68300).
8a–c. Paratype GSC 32284.
9a–c. Paratype GSC 32282.
10a–c. Paratype GSC 32283, phragmocone.
11a, b. Paratype GSC 32280.
12a–c. Holotype GSC 32279.
13a, b. Paratype GSC 32285, phragmocone.
14a–c. Paratype GSC 32281, complete specimen.
Figures 8–14 from Pardonet Formation, Mount Ludington, northeastern British Columbia (GSC loc. 68304).

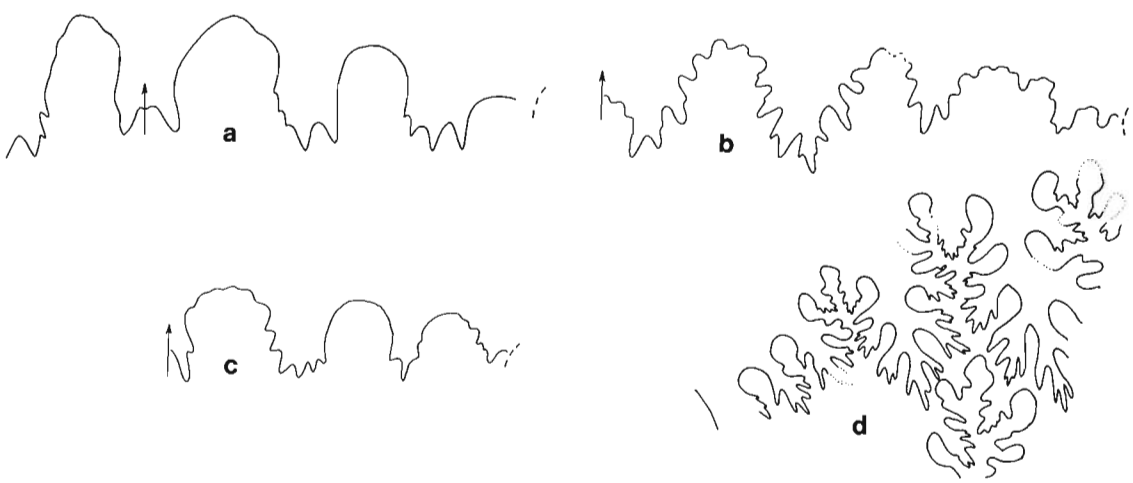
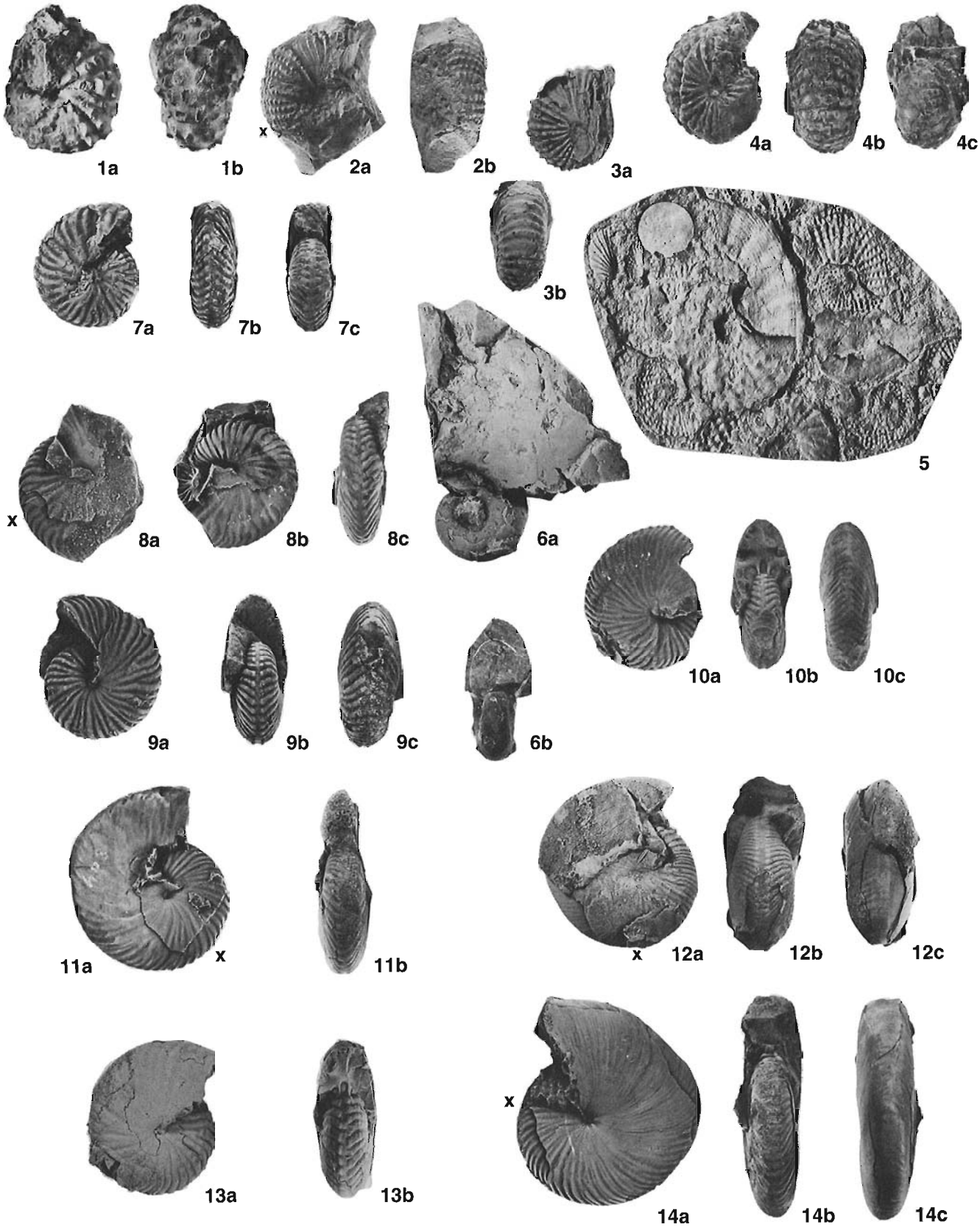


Figure 118. *Sutures. a,* ***Gnomohalorites yukonensis*** *Tozer, GSC 14262 (Pl. 145, fig. 1) x4; b,* ***Paraguembelites ludingtoni*** *Tozer, GSC 32285 (Pl. 145, fig. 13) x4; c,* ***Gnomohalorites cordilleranus*** *Tozer, GSC 32278 (Pl. 145, fig. 3) x4; d,* ***Rhacophyllites debilis*** *(Hauer), GSC 32353 (Pl. 145, fig. 6) x2.*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10c
9a
9b
9c
6b
11a
x
11b
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12a
12b
12c
13a
13b
x
14a
14b
14c

PLATE 146

UPPER TRIASSIC
Upper Norian–Cordilleranus Zone

Figures 1–7, 9–12. *Lissonites canadensis* Tozer (Subzone 2) (Page 262)
1a–g. Holotype GSC 28932 (GSC loc. 83818).
2a–c. Paratype GSC 28931 (GSC loc. 83818).
3a, b. Paratype GSC 28933 (GSC loc. 83818).
4a–c. Hypotype GSC 28934 (GSC loc. 83816).
5a–c. Paratype GSC 28930 (GSC loc. 83818).
6a–d. Paratype GSC 28929 (GSC loc. 83818).
7a, b. Hypotype GSC 28936 (GSC loc. 83817).
9a–c. Hypotype GSC 28938 (GSC loc. 83817).
10a, b. Hypotype GSC 28940 (GSC loc. 83817).
11a–c. Hypotype GSC 28939 (GSC loc. 83817).
12a–c. Hypotype GSC 28935 (GSC loc. 83817).
All from Pardonet Formation, Ducette Creek, northeastern British Columbia.

Figures 8a–d. *Lissonites pecki* n. sp. (Subzone 2) (Page 263)
Holotype GSC 28937. Pardonet Formation, Ducette Creek, northeastern British Columbia (GSC loc. 83817).

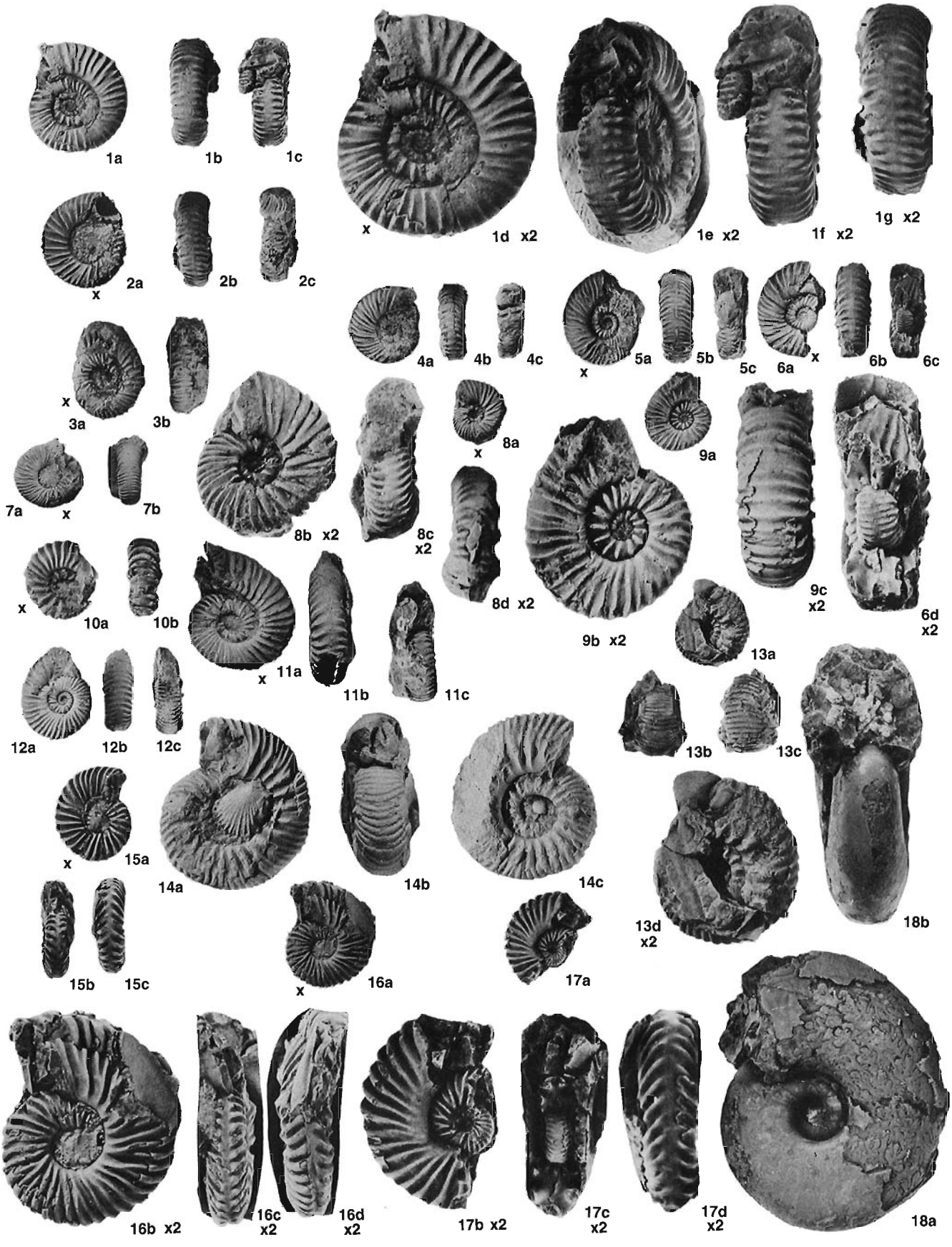
Figures 13a–d. *Metasibirites columbianus* Tozer (Subzone 1) (Page 261)
Holotype GSC 28927. Pardonet Formation, Mount Ludington, northeastern British Columbia (GSC loc. 68300).

Figures 14a–c. *Metasibirites speratus* n. sp. (Subzone 1) (Page 261)
Holotype GSC 71035, about a quarter of a whorl is body chamber. Pardonet Formation, Ducette Creek, northeastern British Columbia (GSC loc. 98559).

Figures 15–17. *Nassichukites dimidiatus* Tozer (Subzone 1) (Page 210)
15a–c. Hypotype GSC 28943 (GSC loc. 51207).
16a–d. Holotype GSC 28941 (GSC loc. 68300).
17a–d. Hypotype GSC 28942 (GSC loc. 51207).
All from Pardonet Formation, Mount Ludington, northeastern British Columbia.

Figures 18a, b. *Tragorhacoceras occultum* (Mojsisovics) (Subzone 1) (Page 272)
Hypotype GSC 32356, phragmocone. Pardonet Formation, Mount Ludington, northeastern British Columbia (GSC loc. 68300).

Figure 119. *Sutures. a,* ***Lissonites canadensis*** *Tozer, GSC 28933 (Pl. 146, fig. 3) x4; b,* ***Tragorhacoceras occultum*** *(Mojsisovics), GSC 32356 (Pl. 146, fig. 18) x2; c,* ***Nassichukites dimidiatus*** *Tozer, GSC 28941 (Pl. 146, fig. 16) x4; d,* ***Metasibirites columbianus*** *Tozer, GSC 28927 (Pl. 146, fig. 13) x4; e,* ***Metasibirites speratus*** *n. sp., GSC 71035 (Pl. 146, fig. 14) x3.*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17b x2
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17d x2
18a

PLATE 147

UPPER TRIASSIC
Upper Norian–Amoenum and Crickmayi zones

Figures 1–3. *Rhabdoceras suessi* Hauer (GSC loc. 1, 2, Amoenum Zone; 3, Crickmayi Zone) (Page 264)
1. Hypotype GSC 32318 (GSC loc. 56415), venter is to right of figure.
2a–c. Hypotype GSC 32319 (GSC loc. 56414), side (a), ventral (b), and dorsal (c) views.
Figures 1, 2 from Tyaughton Group, Tyaughton Creek valley, British Columbia.
3. Hypotype GSC 32317, venter is to right of figure. Sutton Formation, Cowichan Lake, Vancouver Island, British Columbia (GSC loc. 23370).

Figures 4a–c. *Tozeria yukonensis* n. sp. (Amoenum Zone) (Page 261)
Holotype GSC 28928, phragmocone. Lewes River Group, Whitehorse area, Yukon (GSC loc. 14860).

Figures 5a, b. *Megaphyllites* sp. indet. (Crickmayi Zone) (Page 91)
GSC 28275, phragmocone with remains of septa of succeeding whorl adhering; they indicate that phragmocone originally extended three quarters of a whorl beyond the preserved aperture. Sutton Formation, Cowichan Lake, Vancouver Island, British Columbia (GSC loc. 23374).

Figures 6a, b. *Rhacophyllites debilis* (Hauer) (Amoenum Zone) (Page 271)
Hypotype GSC 32355, phragmocone. Tyaughton Group, Tyaughton Creek valley, British Columbia (GSC loc. 13338).

Figures 7, 8. *Paracochloceras suessi* Mojsisovics (Amoenum Zone) (Page 266)
7. Hypotype GSC 32330, whorl fragment. Lewes River Group, Formation F, Lake Laberge, Yukon (GSC loc. 23429).
8a, b. Hypotype GSC 17016, Parson Bay Formation, Kyuquot area, Vancouver Island, British Columbia (GSC loc. 23072).

Figure 9. *Paracochloceras amoenum* Mojsisovics (Amoenum Zone) (Page 266)
Hypotype GSC 32328. Tyaughton Group, Tyaughton Creek valley, British Columbia (GSC loc. 56405).

Figure 10. *Paracochloceras canaliculatum* (Hauer) (Amoenum Zone) (Page 266)
Hypotype GSC 32329. Parson Bay Formation, Quatsino Sound, Vancouver Island, British Columbia (GSC loc. 24333).

Figures 11, 12. *Cycloceltites cowichanensis* n. sp. (Crickmayi Zone) (Page 264)
11a, b. Holotype GSC 17015, at least a quarter whorl is body chamber.
12a, b. Paratype GSC 28944.
Both from Sutton Formation, Cowichan Lake, Vancouver Island, British Columbia (GSC loc. 23372).

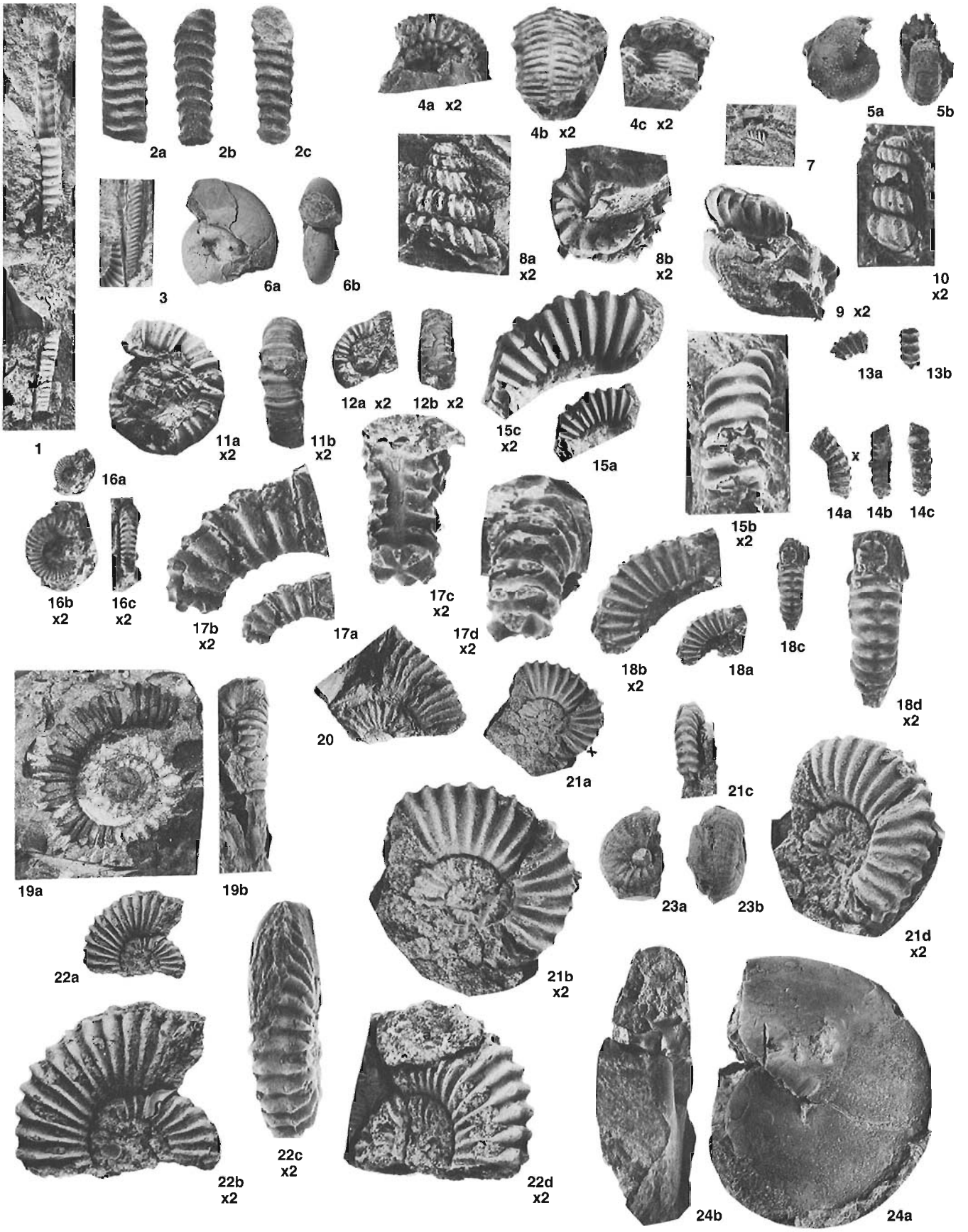
Figures 13–18. *Vandaites suttonensis* (Clapp and Shimer) (Crickmayi Zone) (Page 267)
13a, b. Holotype GSC 7813 (GSC loc. 13703), septate fragment.
14a–c. Topotype GSC 32324 (GSC loc. 23372).
15a–c. Topotype GSC 32323 (GSC loc. 23370), partly (wholly?) septate.
16a–c. Topotype GSC 32326 (GSC loc. 23379), partly (wholly?) septate.
17a–d. Topotype GSC 32325 (GSC loc. 23372), septate fragment.
18a–d. Topotype GSC 32322 (GSC loc. 23370), body chamber fragment.
All from Sutton Formation, Cowichan Lake, Vancouver Island, British Columbia.

Figures 19–22. *Choristoceras crickmayi* Tozer (Crickmayi Zone) (Page 267)
19a, b. Hypotype GSC 18913, a little more than one quarter whorl is body chamber. Tyaughton Group, east of Spruce Lake, Tyaughton Creek valley British Columbia (GSC loc. 62392).
20. Paratype GSC 34608 (GSC loc. 10095), no septa are visible.
21a–d. Paratype GSC 32327 (GSC loc. 10095).
22a–d. Holotype GSC 18912 (GSC loc. 56395), most of outer whorl is body chamber.
Figures 20–22 from Tyaughton Group, Tyaughton Creek, above Spruce Lake Creek, British Columbia.

Figures 23 a, b. *Sagenites* sp. indet. (Amoenum Zone) (Page 136)
GSC 28418, phragmocone. Parson Bay Formation, west coast of Vancouver Island, British Columbia (GSC loc. 82974).

Figures 24 a, b. *Placites polydactylus* (Mojsisovics) (Amoenum Zone) (Page 130)
GSC 28395, phragmocone. Tyaughton Group, Tyaughton Creek valley, British Columbia (GSC loc. 10141).

Illustrations of suture lines (Fig. 120) are facing Plate 148.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10 x2
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11b x2
12a x2
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17b x2
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17c x2
17d x2
18b x2
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18c
18d x2
20
21a
21c
19a
19b
21b x2
23a
23b
21d x2
22a
22b x2
22c x2
22d x2
24b
24a

PLATE 148

UPPER TRIASSIC
Upper Norian–Crickmayi Zone

All specimens from Sandilands Formation, Kennecott Point, Graham Island, Queen Charlotte Archipelago

Figures 1–10. *Choristoceras nobile* Mojsisovics (Page 268)
1. Hypotype GSC 85819.
2. Hypotype GSC 85820.
3. Hypotype GSC 85821.
4. Hypotype GSC 85822.
5. Hypotype GSC 85823.
6. Hypotype GSC 85824.
7. Hypotype GSC 85825.
8. Hypotype GSC 85826.
Figures 1–8 from GSC loc. C–156962.
9. Hypotype GSC 85827.
10. Hypotype GSC 85828.
Figures 9, 10 from GSC loc. C–157651.

Figures 11–16. *Choristoceras rhaeticum* (Guembel) (Page 268)
11. Hypotype GSC 85829.
12. Hypotype GSC 85830.
13. Hypotype GSC 85831.
14, 15. Hypotype GSC 85832.
Figures 11–15 from GSC loc. C–157686.
16. Hypotype GSC 85833 (GSC loc. C–156963).

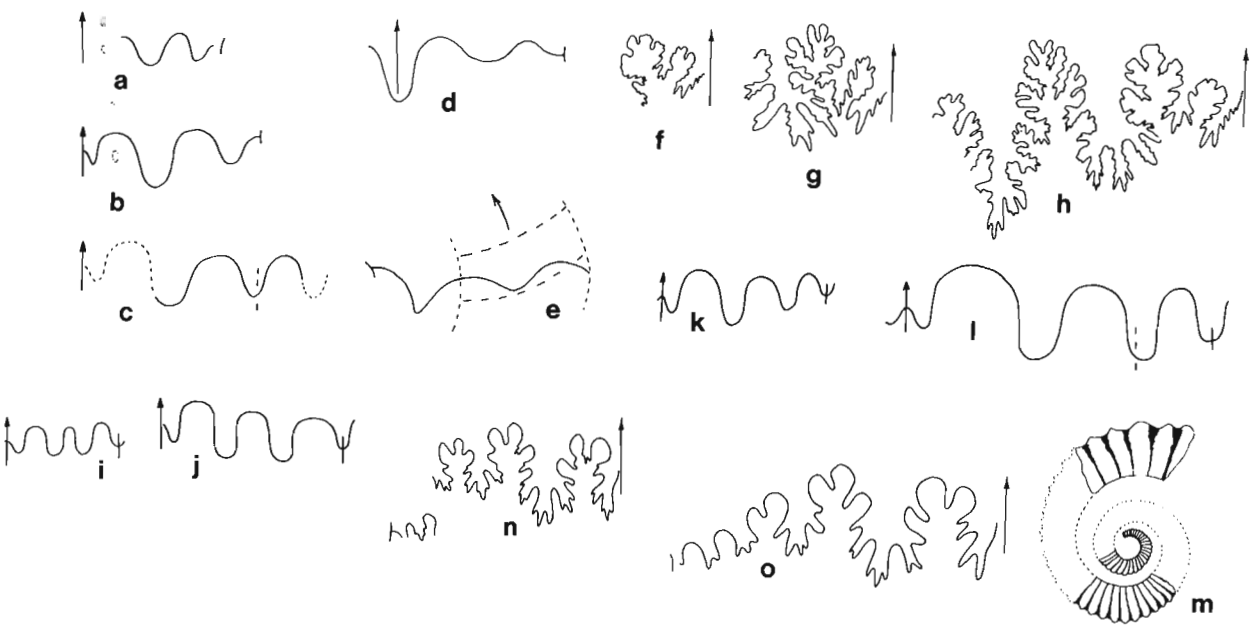

Figure 120. Sutures and restoration. (Specimens are illustrated on Plate 147.) a–c. ***Choristoceras crickmayi*** Tozer. a, GSC 18912 (Pl. 147, fig. 22) x4; b, GSC 32327 (Pl. 147, fig. 21) x4; c, GSC 18913 (Pl. 147, fig. 19) x4; d, ***Cycloceltites cowichanensis*** n. sp., GSC 28944 (Pl. 147, fig. 12) x8. e, ***Paracochloceras amoenum*** Mojsisovics, GSC 32328 (Pl. 147, fig. 9) x4; f–h. ***Placites polydactylus*** (Mojsisovics); f, GSC 28397* x2; g, GSC 28396* x2; h, GSC 28395 (Pl. 147, fig. 24) x2; i, j. ***Rhabdoceras suessi*** Hauer. i, GSC 32317 (Pl. 147, fig. 3) x4; j, GSC 32318 (Pl. 147, fig. 1) x4; k–m. ***Vandaites suttonensis*** (Clapp and Shimer). k, GSC 7813 (Pl. 147, fig. 13) x4; l, GSC 32325 (Pl. 147, fig. 17) x4; m, restoration x1 based on GSC 32322 (Pl. 147, fig. 18), GSC 32325 (Pl. 147, fig. 17), and GSC 32326 (Pl. 147, fig. 16); n, o. ***Rhacophyllites debilis*** (Hauer). n, GSC 32355 (Pl. 147, fig. 6) x4; o, GSC 32354* x4.

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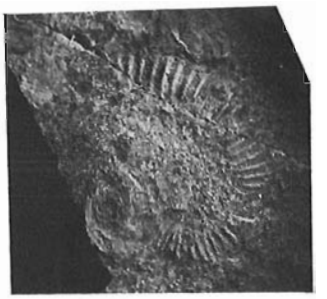

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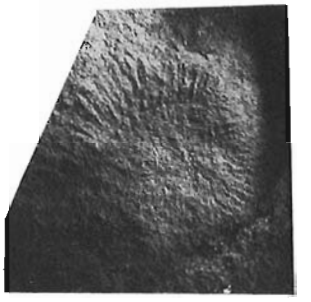

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FOSSIL INDEX

Numbers in **bold face** type are pages where taxa are defined. Numbers in *italics* are pages on which relevant textfigures appear.