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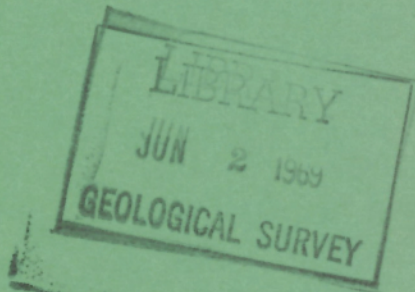
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BULLETIN 170

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**MIDDLE TRIASSIC (ANISIAN) AMMONOIDS FROM
NORTHEASTERN BRITISH COLUMBIA AND
ELLESMERE ISLAND**

F. H. McLearn

Price, \$3.00

**Ottawa,
Canada
1969**

MIDDLE TRIASSIC (ANISIAN) AMMONOIDS FROM
NORTHEASTERN BRITISH COLUMBIA AND
ELLESMERE ISLAND

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OF CANADA

BULLETIN 170

MIDDLE TRIASSIC (ANISIAN) AMMONOIDS
FROM NORTHEASTERN BRITISH COLUMBIA
AND ELLESMERE ISLAND

By
F. H. McLearn

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DEPARTMENT OF
ENERGY, MINES AND RESOURCES
CANADA

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PREFACE

The Triassic rocks of northeastern British Columbia contain an unusually rich variety of ammonoid faunas. The study of the successive ammonoid faunas provides the basis for the most accurate known method for dating Triassic rocks. The information derived from such studies is an essential prerequisite for stratigraphic and structural investigations, and for the preparation of geological maps.

This bulletin deals with most of the ammonoids of early Middle Triassic (Anisian) age from the Triassic rocks of British Columbia and with one species from Ellesmere Island. Many of the species were briefly described by F. H. McLearn in preliminary papers published between 1946 and 1951.

After his retirement in 1951, Dr. McLearn embarked on the preparation of a report in which the ammonoids were to be fully described and illustrated. He died in 1964, leaving a nearly complete manuscript fulfilling his objective. This bulletin has been prepared for publication from Dr. McLearn's manuscript by Dr. E. T. Tozer, who has also provided an explanatory introduction.

Y. O. FORTIER,
Director, Geological Survey of Canada.

OTTAWA, September 20, 1966

BULLETIN 170 — Mitteltriasische (anisische)
Ammoniten aus dem nordöstlichen Britisch-Ko-
lumbien und von Ellesmere-Land

Von F. H. McLearn.

Eine Beschreibung von 37 Arten anisischer Ammoni-
ten aus der Toad-Formation im nordöstlichen Britisch-
Kolumbien und einer Art aus der Blaa-Mountain-For-
mation auf Ellesmere-Land. Vier Arten — *Hollandites*
pelletieri, *Anagymnotoceras tozeri*, *Grambergia tetsaen-*
sis und *Lenotropites tardus* — werden als neu beschrie-
ben.

БЮЛЛЕТЕНЬ 170 — Среднетриассовые (ани-
зийские) аммонитиды северо-восточной ча-
сти Британской Колумбии и о. Элсмира

Ф. Г. МкЛёрн

Описываются 39 видов анизийских аммонид из тоуд-
ской свиты северо-восточной части Британской Колумбии
и один вид из свиты г. Блаа о. Элсмира. Четыре вида —
Hollandites pelletieri, *Anagymnotoceras tozeri*, *Gram-*
bergia tetsaensis и *Lenotropites tardus* — описаны как
новые.

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MIDDLE TRIASSIC (ANISIAN) AMMONOIDS FROM
NORTHEASTERN BRITISH COLUMBIA
AND ELLESMERE ISLAND

Abstract

Thirty-seven species of Anisian ammonoids are described from the Toad Formation of northeastern British Columbia, and one from the Blaa Mountain Formation of Ellesmere Island. Four species, *Hollandites pelletieri*, *Anagymnotoceras tozeri*, *Grambergia tetsaensis*, and *Lenotropites tardus*, are described as new.

Résumé

L'auteur décrit trente-sept espèces d'ammonoïdes de l'Anisien provenant de la formation de Toad du nord-est de la Colombie-Britannique, et une espèce provenant de la formation du mont Blaa dans l'île Ellesmere. Il y décrit également quatre espèces nouvelles: *Hollandites pelletieri*, *Anagymnotoceras tozeri*, *Grambergia tetsaensis* et *Lenotropites tardus*.

INTRODUCTION

by E. T. Tozer

F. H. McLearn died on October 7, 1964. His professional career, spanning the years 1913–1951, was with the Geological Survey of Canada. McLearn first studied the Anisian ammonoids of British Columbia in 1944 after the discovery of well-preserved specimens, in the summer of 1943, by E. D. Kindle, C. O. Hage, and M. Y. Williams. Stimulated by the discovery of this material, in the summer of 1944 McLearn, then aged 59, conducted field work in the Foothills of north-eastern British Columbia. He had previously spent many years working on the Triassic rocks and faunas of northeastern British Columbia but none of this work involved the study of Anisian strata. Travelling with pack horses, he examined exposures in the Halfway and Sikanni Chief River valleys in 1944. He also studied the outcrops in Tetsa River valley, which were exposed on the route of the newly completed Alaska Highway. In this work he was assisted by K. C. McTaggart. This season's work was not devoted exclusively to the study of the Anisian rocks and faunas for he also made an extensive study of the Ladinian and Upper Triassic formations. This was McLearn's last summer of field work in British Columbia and it was the only one during which he had an opportunity to study the Anisian rocks in the field.

McLearn's best collections were made from the Tetsa and Sikanni Chief River valleys. E. D. Kindle had collected some well-preserved material from Liard River in 1943. Another important collection was that of E. I. Wright, of Socony Vacuum Oil Company, from Chischa and Muskwa Rivers, made in 1944. Wright's collection was submitted to McLearn for identification. These collections provided the principal basis for a preliminary account of the Anisian fauna of northeastern British Columbia (McLearn, 1946a). Amplified and revised editions of this account were published later (McLearn, 1946b; 1948). Further notes, again in preliminary format, were published in 1951 and 1953 (McLearn, 1951, 1953a). The three earlier accounts (McLearn, 1946a, 1946b, 1948) included printed Appendices and Supplements with description of new species; they also included plates illustrating the ammonoids. The later publications (McLearn, 1951, 1953a) provide notes on the taxonomy of the ammonoids but do not include descriptions of new taxa.

The preliminary reports were issued promptly and in rapid succession, in response to requests from the petroleum industry for the provision of palaeontological reports that would be useful to geologists working in northeastern British Columbia. Under the circumstances the palaeontological descriptions were brief

and the number of illustrations provided was limited. It was always Dr. McLearn's intention that full descriptions and more numerous illustrations would be published eventually.

In 1951 McLearn retired from full time employment with the Geological Survey. In retirement he continued to work on Triassic ammonoids and embarked on the revision and amplification of his many preliminary papers. First he undertook the revision of the Upper Triassic ammonoids of the Pardonet Formation, which he completed (McLearn, 1960a), and then started on the Anisian faunas (McLearn, 1960b). For this work he had available the original collections described in the preliminary papers; he also started to study additional collections that had been made since 1944. These later collections include those made by P. K. Sutherland in 1948; by B. R. Pelletier in 1958 and 1959; and by the writer, from Ellesmere Island, in 1962. Many other collections were also available but McLearn had no opportunity to study them in detail.

At the time of his death Dr. McLearn left a manuscript including: (i) revised descriptions of the species described in the preliminary papers (McLearn, 1946a, 1946b, 1948); (ii) descriptions of four new species: one from his own collection of 1944, two from Pelletier's, and one from Ellesmere Island collected by the writer. This bulletin represents the major part of the manuscript. Some parts are clearly incomplete and are not being published.

Anagymnotoceras, a new ammonoid genus introduced in the manuscript, has already been described in a posthumous publication (McLearn, 1966).

With a few exceptions the taxonomic treatment of the fauna as presented in this bulletin is exactly as it was prepared by Dr. McLearn. Some departures from the text of the manuscript have been necessitated by the fact that a paper by Popov (1961), describing Anisian ammonoids from Siberia, was published after parts of McLearn's manuscript had been written. McLearn had received Popov's paper and had made some revisions to his manuscript to accommodate the nomenclature proposed by Popov. However, the parts of the manuscript dealing with a number of species assigned to '*Longobardites*' and '*Hungarites*' in the preliminary papers had not been revised to take Popov's nomenclature into account.

In the text that follows five species are assigned to *Grambergia*. This requires explanation. In the manuscript, McLearn provides a brief diagnosis for a new genus, in which he placed "*Longobardites*" *mctaggarti* McLearn, '*Hungarites*' *ovinus* McLearn, '*Hungarites*' *mackenzii* McLearn, '*Hungarites*' *nahwisi* McLearn, and also a new species, described below as *Grambergia tetsaensis* McLearn n. sp. McLearn's notes on the new genus were not complete and were apparently written before the publication of the genus *Grambergia*. They do not include the designation of a type species. As early as 1959 McLearn had considered the possibility of proposing a new genus to include these species (McLearn, 1960b). In the writer's opinion, at least some of the species listed above are referable to *Grambergia*. A decision was made to assign these species to *Grambergia* rather than to a new genus. The alternative would necessitate choosing a type species and probably result in the erection of an unnecessary taxon.

The assignment of a number of species to the genus *Lenotropites* Popov also requires explanation. In the manuscript, McLearn proposes a new genus to accommodate the ammonoids originally described as '*Hungarites* *caurus* McLearn, '*Hungarites* *boreas* McLearn, '*Hungarites* *dawsoni* McLearn, *Longobardites* *larvalis* McLearn, and also a new species described below as *Lenotropites* *tardus* McLearn n. sp. '*Hungarites* *boreas* and '*Hungarites* *dawsoni* are placed in synonymy with '*Hungarites* *caurus* and in this respect the manuscript is followed. McLearn selected the species described as *Lenotropites* *tardus* as type species of the new genus. McLearn's notes on the proposed new genus are evidently not complete. They include no descriptions of the suture line and make no explicit comparison with any other genus. It is the writer's opinion that the type species of the genus proposed by McLearn, and also '*Hungarites* *caurus*, are referable to *Lenotropites*, and accordingly they are assigned to Popov's genus. *Longobardites* *larvalis* is also placed in *Lenotropites* because McLearn clearly considered this species to be congeneric with *Lenotropites* *tardus* (McLearn, 1960b). However, *Longobardites* *larvalis* appears to occupy a transitional position between *Lenotropites* and *Longobardites* and a case can be made for excluding it from *Lenotropites* (Tozer, 1967, p. 24).

In the manuscript McLearn assigned "*Ceratites*" *hayesi* to *Epiczekanowskites* Popov 1961. It now appears that *Epiczekanowskites* is a junior subjective synonym of *Czekanowskites* Diener (Tozer, 1967, p. 25). The generic assignment of "*Ceratites*" *hayesi* has been changed accordingly.

The treatment of *Parapopanoceras* *tetsa* McLearn as now published follows the manuscript. McLearn places several species, previously recognized as distinct, in synonymy with *Parapopanoceras* *tetsa*. It should be noted, however, that he was not entirely satisfied with the new treatment, for in the margin of the manuscript there is a note suggesting that it might, after all, prove correct to retain *Parapopanoceras* *selwyni* and *Parapopanoceras* *obesum* as distinct species. Recent work has provided evidence that McLearn's original treatment, according to which several species were recognized, is at least partly correct. The writer's views on the taxonomy of these ammonoids are given later in this introduction.

McLearn's manuscript does not include description of the stratigraphy, nor any discussion of the age of the ammonoids. The preliminary reports include descriptions of the stratigraphy of the Toad Formation, but as most of this material has already been published in the Memoir on the "Geology of northeastern British Columbia" (McLearn and Kindle, 1950), it seems unnecessary to reproduce it in this bulletin. As regards the age of the ammonoids: when the preliminary reports were published McLearn was of the opinion that he was dealing with essentially one Anisian fauna, of late Anisian age (*see* McLearn and Kindle, 1950, pp. 41-42; McLearn, 1953b, p. 1219). At the time McLearn reached this conclusion he justly remarked that "Zoning of Anisian deposits is not yet satis-

factorily established" (McLearn, 1953b, p. 1219). Since then some progress has been made in the zonation of Anisian rocks, both in Nevada (Silberling, 1962) and in British Columbia (Tozer, 1967). In view of this recent work on the zonation of Anisian deposits it seems unnecessary to reproduce any part of McLearn's earlier discussion in the present bulletin. The reader interested in McLearn's original conclusions will find a concise summary in McLearn and Kindle (1950, pp. 41, 42).

Recent work in British Columbia has led to the recognition of four Anisian zones. Full details are given elsewhere (Tozer, 1967). The zones are as follows:

Upper Anisian	}	<i>Gymnotoceras chischa</i> Zone
		<i>Gymnotoceras deleeni</i> Zone
Middle Anisian	}	<i>Anagymnotoceras varium</i> Zone
Lower Anisian		<i>Lenotroprites caurus</i> Zone

The age of most of the ammonoids described by McLearn is now known (Tozer, 1967). The check list of the ammonoids, given below, summarizes these conclusions.

- Acrochordiceras* (*Paracrochordiceras*) *americanum* McLearn—Caurus Zone
Hollandites pelletieri McLearn n. sp.—Varium Zone
Hollandites humi McLearn—possibly Varium Zone
Hollandites mcconnelli McLearn—possibly Varium Zone
Hollandites spivaki McLearn—Varium Zone
Anagymnotoceras varium (McLearn)—Varium Zone
Anagymnotoceras tozeri McLearn n. sp.—Varium Zone of Ellesmere Island.
Anagymnotoceras moderatum (McLearn)—Varium Zone
Anagymnotoceras helle (McLearn)—Varium Zone
Anagymnotoceras wrighti (McLearn)—probably Varium Zone
Anagymnotoceras ino (McLearn)—Varium Zone
Anagymnotoceras columbianum (McLearn)—Varium Zone
Gymnotoceras deleeni (McLearn)—Deleeni Zone
Gymnotoceras deleeni var. *liardense* McLearn—Deleeni Zone
Gymnotoceras kindlei (McLearn)—zone uncertain
Gymnotoceras beachi McLearn—Deleeni Zone
Gymnotoceras sp. (p. 11)—probably Chischa Zone
Longobardites nevadanus Hyatt and Smith—This species, as interpreted by McLearn, occurs in the Caurus, Varium, and Deleeni zones. Study of these ammonoids, now underway by E. T. Tozer, shows that the *Longobardites* of these three zones are morphologically distinct and that their taxonomy requires revision. GSC No. 21716 (Pl. VI, figs. 7a, b) is from the Caurus Zone. It now appears probable that the specimens originally described as *Longobardites intornatus* McLearn (Pl. VI, figs. 4, 5) are from the Varium Zone, not from the Deleeni Zone, as previously suggested (Tozer, 1967, p. 72). The provenance of the holotype and paratype of *Longobardites canadensis* McLearn (Pl. VI, figs. 1, 2) remains uncertain but GSC No. 9581 (Pl. VI, figs. 3a, b) is almost certainly from the Deleeni Zone.

- Grambergia mctaggarti* (McLearn)—Caurus Zone
Grambergia tetsaensis McLearn n. sp.—Caurus Zone
Grambergia ovinus (McLearn)—Caurus Zone
Grambergia mackenzii (McLearn)—Caurus Zone
Grambergia nahwisi (McLearn)—Caurus Zone
Lenotropites tardus McLearn n. sp.—Caurus Zone
Lenotropites larvalis (McLearn)—Varium Zone
Lenotropites larvalis (McLearn)—Varium Zone. As mentioned above the writer considers that *Lenotropites larvalis* (McLearn) is more closely related to *Longobardites* than to *Lenotropites*.
Lenotropites caurus (McLearn)—Caurus Zone
Czekanowskites hayesi (McLearn)—Varium Zone
Arctohungarites bufonis (McLearn)—Caurus Zone
Parapopanoceras testa McLearn—In the broad interpretation given below this species occurs in the Caurus, Varium, and Deleeni Zones. Recent work, however, has shown that some of the morphologically distinct forms, originally segregated as distinct species by McLearn, are restricted to certain zones. Markedly excentrumbilicate specimens like the holotype (Pl. IX, figs. 3a, b) and the paratype of *Parapopanoceras normale* (Pl. IX, figs. 7a, b), with relatively numerous elements in the suture line (Fig. 24), characterize the Deleeni Zone. Specimens like the types of *Parapopanoceras selwyni* (Pl. IX, figs. 1, 2) and *Parapopanoceras obesum* (Pl. IX, figs. 9a, b), which are less excentrumbilicate and have fewer elements in the suture line, are restricted to the Varium Zone. The holotype of *Parapopanoceras normale* (Pl. IX, figs. 8a, b), another feebly excentrumbilicate specimen, is from the Caurus Zone. This specimen unfortunately does not show the suture line and there are no topotypes that might do so. The stratigraphic level of the holotype of *Parapopanoceras medium* is uncertain but is probably Caurus Zone or Varium Zone. The holotype (Pl. IX, figs. 4a, b) does not show the suture line but McLearn's collection includes a topotype that does (Fig. 24g). The paratype of *Parapopanoceras medium* (Pl. IX, fig. 5), which is probably from the Varium Zone, has a slightly different suture line (Fig. 24d) and may not be conspecific with the holotype. The stratigraphic position of *Parapopanoceras testa* var. *praematurum*, which does not show the suture line, is uncertain. There seems to be no doubt that the feebly excentrumbilicate specimens (types of *Parapopanoceras selwyni* and *P. obesum*, and holotypes of *P. normale* and *P. medium*) are specifically distinct from the holotype of *P. testa*. Justification for separation of *Parapopanoceras medium*, *P. obesum*, and *P. selwyni* from *P. testa* is also provided by differences in the suture lines (Fig. 24). A case may be made for assigning these feebly excentrumbilicate species, with relatively simple suture lines, to *Stenopopanoceras* Popov instead of *Parapopanoceras* Haug.
Parapinacoceras hagei (McLearn)—Varium Zone
Anagymnites via-alaska McLearn—Deleeni Zone
Anagymnites cf. *A. lamarcki* (Oppel)—Varium Zone
Anagymnites hollandi (McLearn)—Caurus Zone
Ussurites muskwa McLearn—Caurus Zone
Ussurites arthaberi var. *cameroni* McLearn—probably Varium and Deleeni Zones
Leiophyllites kindlei McLearn—Caurus Zone
Sturia sp. (p. 8)—Caurus Zone
Ptychites wrighti—probably Varium Zone or Caurus Zone

The ammonoids described by McLearn include most of the known species from the Varium and Deleeni Zones and the greater part of the fauna of the Caurus Zone. Additional ammonoids, as yet undescribed, are known from all four Anisian zones. Some indication of the composition of the undescribed fauna is provided by the faunal lists of Tozer (1967).

In accordance with the Rules of Zoological Nomenclature, species names explicitly given for E. D. Kindle and C. O. Hage have been spelled "*kindlei*" and "*hagei*".

The part of this bulletin headed "Description of Localities" was not prepared by Dr. McLearn. It has been compiled from data supplied by his field notebooks, the Geological Survey Catalogue of Fossil Localities, and published references (McLearn, 1946a, 1946b, 1948; Kindle, 1946; McLearn and Kindle, 1950).

The drawings of the suture lines (Figs. 2-31) have been prepared by the writer, using a Wild Binocular Microscope with an M2 drawing attachment. With four exceptions (GSC Nos. 21725, 22733, 22734, and 22735, Figs. 21 and 24), all drawings were prepared from specimens studied by McLearn.

DESCRIPTION OF LOCALITIES AND FAUNAL LISTS

Liard River Valley, British Columbia (Toad River Area 94N)

GSC loc. 10660. Toad Formation, south side Liard River, about 2 miles below the mouth of Toad River; collected by E. D. Kindle, 1943 (Kindle 1948, p. 38; McLearn and Kindle, 1950, p. 40). (= GSC loc. 42339, collection of E. T. Tozer, 1960).

Acrochordiceras (Paracrochordiceras) americanum McLearn (Pl. I, figs. 3a, b)
Longobardites nevadanus Hyatt and Smith (Pl. VI, figs. 7a, b)
Grambergia mctaggarti (McLearn) (Pl. VIII, figs. 8a, b)
Grambergia nahwisi (McLearn) (Pl. VII, figs. 8a, b)
Lenotropites caurus (McLearn) (Pl. VIII, figs. 4-6)
Arctohungarites bufonis (McLearn) (Pl. VIII, figs. 9-11)
Anagymnites hollandi (McLearn) (Pl. XII, figs. 1a, b)
Sturia sp. (Pl. XII, figs. 2a, b)

GSC loc. 10659. Toad Formation, north side of Liard River, 8 miles southwest of the mouth of Toad River, Toad River area, NTS 94N; collected by E. D. Kindle, 1943 (Kindle, 1948, p. 38; McLearn and Kindle, 1950, p. 40). (=GSC loc. 42406, collection of E. T. Tozer, 1960).

Longobardites nevadanus Hyatt and Smith
Czekanowskites hayesi (McLearn)
Parapopanoceras tetsa McLearn (Pl. IX, figs. 9a, b)
Parapinacoceras hagei (McLearn) (Pl. X, figs. 4a, b)
Anagymnites cf. *A. lamarcki* (Oppel) (Pl. XI, figs. 1a, b)

Tetsa River Valley, British Columbia (Tuchodi Lakes Area, 94K)

GSC loc. 10732. (Near locality 2, McLearn and Kindle, 1950, fig. 7) Toad Formation, in place, "Cameron Hill", east of Mile Post 378, Alaska Highway; collected by F. H. McLearn, 1944 (McLearn, 1948, p. 5).

Acrochordiceras (Paracrochordiceras) americanum McLearn (Pl. I, figs. 1, 2)
Grambergia tetsaensis n. sp. (Pl. VII, figs. 1-5)
Parapopanoceras tetsa McLearn (Pl. IX, figs. 8a, b)
Ussurites muskwa McLearn (Pl. XIII, figs. 1a, b)
Leiophyllites kindlei McLearn

GSC loc. 10698. (Near locality 2, McLearn and Kindle, 1950, fig. 7) Toad Formation, in place, "Cameron Hill", east of Mile Post 378, Alaska Highway; collected by F. H. McLearn, 1944 (McLearn, 1948, p. 5).

Anagymnotoceras ino (McLearn) (Pl. III, figs. 3a, b)
Czekanowskites hayesi (McLearn)

GSC loc. 10712. (Near locality 2, McLearn and Kindle, 1950, fig. 7) Toad Formation, in place, high on slope of "Cameron Hill", east of Mile Post 378, Alaska Highway; collected by F. H. McLearn, 1944 (McLearn, 1948, p. 5).

Parapopanoceras tetsa McLearn (Pl. IX, figs. 4a, b)

GSC loc. 10699. (Near locality 2, McLearn and Kindle, 1950, fig. 7) Toad Formation, in place, high on "Cameron Hill", east of Mile Post 378, Alaska Highway; collected by F. H. McLearn, 1944 (McLearn, 1948, p. 5).

Czekanowskites hayesi (McLearn)

Parapopanoceras tetsa McLearn

GSC loc. 10714. (Locality 3, McLearn and Kindle, 1950, fig. 7) Toad Formation, in place, at culvert, north side of Alaska Highway, at foot of "Cameron Hill"; collected by F. H. McLearn, 1944 (McLearn, 1948, p. 5).

Longobardites nevadanus Hyatt and Smith

Parapopanoceras sp.

GSC loc. 10696. (Locality 6, McLearn and Kindle, 1950, fig. 7) Toad Formation, in place, north side of Alaska Highway, west of Mile Post 375, Alaska Highway; collected by F. H. McLearn, 1944 (McLearn, 1948, p. 4).

Anagymnotoceras varium (McLearn) (Pl. III, figs. 7a-c)

Anagymnotoceras moderatum (McLearn) (Pl. III, fig. 6)

Anagymnotoceras helle (McLearn) (Pl. III, figs. 4a-c)

Anagymnotoceras columbianum (McLearn) (Pl. III, figs. 2a, b)

Longobardites nevadanus Hyatt and Smith

Lenotropites larvalis (McLearn) (Pl. VI, figs. 8a, b)

Parapopanoceras tetsa McLearn

GSC loc. 10693. Talus block derived from Toad Formation, west of Mile Post 375, Alaska Highway; collected by F. H. McLearn, 1944.

Gymnotoceras deleeni (McLearn)

Longobardites nevadanus Hyatt and Smith

Anagymnites via-alaska (McLearn) (Pl. XI)

GSC loc. 10694. Talus derived from Toad Formation, in ditch, north side of Alaska Highway, 450 feet west of Mile 376; collected by F. H. McLearn, 1944.

Longobardites nevadanus Hyatt and Smith (Pl. VI, figs. 3a, b)

Gymnotoceras deleeni (McLearn) (Pl. IV, figs. 1-5, 7)

Anagymnites via-alaska (McLearn) (Pl. XI, figs. 3a, b)

GSC loc. 14841. Toad Formation, Mile Post 377, Alaska Highway; collected by P. K. Sutherland, 1948.

Gymnotoceras deleeni (McLearn) (Pl. IV, figs. 6a, b)

GSC loc. 36446. Toad Formation, unnamed creek that flows into Tetsa River south of Mile Post 372, Alaska Highway; collected by B. R. Pelletier, 1958.

Lenotropites tardus n. sp. (Pl. VIII, figs. 1-3)

GSC loc. 10695. Talus derived from the Toad Formation, both sides of Alaska Highway, west of Mile Post 375, Alaska Highway; collected by F. H. McLearn, 1944.

Gymnotoceras deleeni (McLearn)

Longobardites nevadanus Hyatt and Smith (Pl. VI, figs. 1, 2, 4, 5)

Parapopanoceras tetsa McLearn (Pl. IX, figs. 3a, b)

GSC loc. 10697. Talus derived from the Toad Formation, "Cameron Hill", north side of Alaska Highway; collected by F. H. McLearn, 1944.

Anagymnotoceras helle (McLearn) (Pl. III, fig. 5)

GSC loc. 10706. Talus blocks, derived from Toad Formation, east of Mile Post 378, Alaska Highway; collected by F. H. McLearn, 1944.

Czekanowskites hayesi (McLearn) (Pl. I, figs. 6a-c)

Parapopanoceras tetsa McLearn (Pl. IX, figs. 2, 5)

Ussurites arthaberii var. *cameroni* McLearn (Pl. XIII, figs. 5a, b)

GSC loc. 10713. Talus from Toad Formation, near Mile Post 376, Alaska Highway; collected by F. H. McLearn, 1944.

Parapinacoceras hagei (McLearn) (Pl. X, figs. 3a, b)

GSC loc. 10730. Toad Formation, talus, east of Mile Post 378, Alaska Highway; collected by F. H. McLearn, 1944.

Parapopanoceras tetsa McLearn (Pl. IX, figs. 6a, b)

Chischa River, British Columbia (Fort Nelson 94J and Tuchodi Lakes 94 K Areas)

GSC loc. 10733. Toad Formation, south side of Chischa River, 6 miles above Muskwa River; collected by E. I. Wright, 1944.

Grambergia ovinus (McLearn) (Pl. VII, figs. 7a, b)

Ussurites muskwa McLearn (Pl. XIII, figs. 2a, b)

GSC loc. 10736. Toad Formation north side of Chischa River, 6 miles above Muskwa River; collected by E. I. Wright, 1944.

Grambergia mackenzii (McLearn) (Pl. VII, figs. 6a, b)

Lenotropites caurus (McLearn) (Pl. VIII, figs. 7a, b)

GSC loc. 10726. Toad Formation, south side of Chischa River, 5 miles above Muskwa River; collected by E. I. Wright, 1944.

Longobardites nevadanus Hyatt and Smith

Gymnotoceras deleeni var. *liardense* McLearn (Pl. V, figs. 3, 4)

GSC loc. 10727. Toad Formation, north side Chischa River, 8 miles above Muskwa River; collected by E. I. Wright, 1944.

Gymnotoceras beachi McLearn (Pl. V, figs. 1a-d)

GSC loc. 36657. Toad Formation, Chischa River, 9 miles south of Mile Post 372 on the Alaska Highway; collected by B. R. Pelletier, 1958.

Parapinacoceras hagei (McLearn) (Pl. X, figs. 2a, b)

Chlotapecta Creek, British Columbia (Tuchodi Lakes Area 94K)

GSC loc. 40109. Toad Formation, Chlotapecta Creek, 10 miles east of front range of Rocky Mountains, 300 feet from top of unit 1, section 7 (Pelletier, 1960, p. 26); collected by B. R. Pelletier, 1959.

Hollandites pelletieri n. sp. (Pl. II, figs. 3-7)

Hollandites cf. *H. pelletieri* n. sp. (Pl. II, figs. 2a, b)

GSC loc. 10735. (Position of locality uncertain) "Toad Formation", "Four Mile Creek" [=Chlotapecta Creek]; collected by E. I. Wright, 1944.

Gymnotoceras kindlei (McLearn) (Pl. V, figs. 2a, b)

Bat Creek (Trutch Area, 94G)

GSC loc. 16008. Toad Formation, in place, three-quarters mile up "Four Fall Creek" from Bat Creek; collected by P. K. Sutherland, 1948.

Czekanowskites haysi (McLearn) (Pl. I, figs. 8a-c)

West Side Mount Wooliever (= "Mount Hage"), Sikanni Chief River Valley, British Columbia (Trutch Area 94G)

Collections listed in descending stratigraphic order. All collections made by F. H. McLearn, 1944. (McLearn, 1948, p. 3; McLearn and Kindle, 1950, pp. 36-38.)

GSC loc. 10719. At locality 2 (McLearn and Kindle, 1950, fig. 6).

Daonella cf. *D. moussoni* Merian

Gymnotoceras sp. (Pl. V, figs. 6, 7)

GSC loc. 10722. At locality 1 (McLearn and Kindle, 1950, fig. 6).

Daonella cf. *D. moussoni* Merian

GSC loc. 10717. On "McTaggart Creek" (McLearn and Kindle, 1950, fig. 6).

Gymnotoceras deleeni (McLearn) (Pl. V, figs. 5a, b)

Longobardites nevadanus Hyatt and Smith

Parapopanoceras tetsa McLearn

GSC loc. 10731. Upper part of "McTaggart Creek" (McLearn and Kindle, 1950, fig. 6).

Ptychites wrighti McLearn (Pl. X, figs. 1a-c)

A collection made from a talus boulder, near GSC loc. 10717, is catalogued GSC loc. 10718, and provided *Hollandites humi* McLearn (Pl. II, figs. 1a-c).

Ellesmere Island (Greely Fiord West Area, 340B)

GSC loc. 51677. Blaa Mountain Formation, Lower Shale Member, 278 feet above the base five miles northwest from entrance to Hare Fiord (Tozer, 1965, p. 4); collected by E. T. Tozer, 1962

Anagymnotoceras tozeri n. sp. (Pl. V, figs. 8, 9)

SYSTEMATIC PALAEOLOGY

Family ACROCHORDICERATIDAE Arthaber

Genus *Acrochordiceras* Hyatt

Subgenus *Paracrochordiceras* Spath

Acrochordiceras (*Paracrochordiceras*) *americanum* McLearn

Plate I, figures 1-3

Acrochordiceras (*Paracrochordiceras*) *americanum* McLearn, 1946a, p. 16; 1946b, p. 3, pl. V, fig. 1; 1948, p. 25, pl. V, fig. 1.

Material. The holotype, GSC No. 6475, and the topotype, GSC No. 21696, are from the Toad Formation on "Cameron Hill", Tetsa River valley (GSC loc. 10732). The hypotype, GSC No. 21697, is from the Toad Formation, south side of Liard River, about 2 miles below the mouth of Toad River (GSC loc. 10660).

*Measurements.*¹ Holotype: 38; 34; 37; 43.

Description. The holotype is moderately evolute, with rather stout whorls, which are a little thicker than they are high, somewhat flattened flanks, gently arched wide venter, and rounded ventro-lateral shoulders. The single ribs are a little projected on the flanks, and straight, wide, and continuous across the venter. The topotype (Pl. I, figs. 2a, b) is the fragment of an outer whorl of a somewhat larger specimen. The specimen from Liard River (Pl. I, figs. 3a, b) is of about the same size as the topotype and is probably of this species. None of these specimens show suture lines.

Comparisons. This species appears to be close to the Timor species, *Acrochordiceras* (*Paracrochordiceras*) *anodosum* Welter, but has more ribs per half whorl.

Family BEYRICHITIDAE Spath

Genus *Hollandites* Diener

In the Anisian of northeastern British Columbia variably compressed shells without ventral keels, with long and short intercalated mostly single ribs, with mostly rare bifurcation (and that only near and within the middle of the flanks), are referred to this genus. No umbilical or ventro-lateral tubercles are found. In

¹Dimensions throughout this report are in the following order: diameter in mm, height of whorl as percentage of diameter, thickness as percentage of diameter, width of umbilicus as percentage of diameter. In some instances complete dimensions are not given but the order is retained.

some specimens there is a change to fewer and coarser ribs at maturity, and where the ribs divide, near or within the middle of the flanks, some thickening or elevation of the ribs takes place. However, the typical adult ornament registered by the Himalayan species, including passage, at maturity, to a stage of stout, nearly straight, single ribs, or to one of lateral tubercles on single ribs, as in the type species, is not attained.

No specimens from British Columbia record bifurcation on the umbilical shoulder from umbilical tubercles, as is found in some, but not all, Himalayan species. It does not, however, appear desirable to propose a new genus or sub-genus for the material from British Columbia. At best it would be a very finely drawn one. Only one species is represented by numerous specimens. Three others are based on single specimens. Their spread of variation is unknown and their status as species is not too well established.

Hollandites pelletieri n. sp.

Plate II, figures 3-7; Figure 2

Material. The holotype, GSC No. 21704, and the paratypes, GSC Nos. 21700, 21701, 21702, 21703, are from the Toad Formation of Chlotapecta Creek, 10 miles east of the front range of the Rocky Mountains (GSC loc. 40109).

Measurements. Paratype 21700: 21; 38; 28; 38. Paratype 21701: 24.5; 49; 26; 24. Paratype 21702: 27.5; 40; 29; 39. Paratype 21703: 52; 39; 25; 35. Holotype 21704: 61; 45; 26; 28.

Description. The very compressed, moderately involute holotype (P1. II, figs. 7a-c) has whorls that are much higher than they are thick, rather flattened

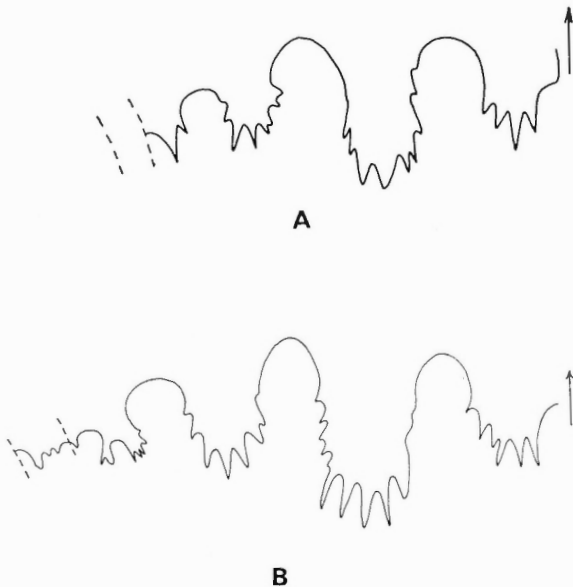


FIGURE 2

Suture lines of *Hollandites pelletieri* n. sp. (x3). A, of paratype, GSC No. 21703; B, of holotype, GSC No. 21704.

flanks, well-rounded ventro-lateral shoulders, a rather narrow convex venter, steeply sloping low umbilical wall, and an abruptly rounded and well-defined umbilical shoulder. It includes more than one half whorl of body chamber. The numerous slender ribs, about twenty-seven on the last half whorl, are a little convex on the flanks, projected at and near the ventro-lateral shoulder, and a little convex forward on the venter, where they are greatly reduced in strength. In the adapical part of the ultimate whorl most ribs are single but a few divide on the inner part of the flank. In the adoral part the ribs are mostly single but in places they branch on the ventro-lateral shoulders. Where the surface is well preserved fine flat costae or striae occur on both the ribs and the spaces between them. The suture line is illustrated by Figure 2b.

Paratype No. 21703 (Pl. II, figs. 3a, b) is more evolute than the holotype. It has, however, the similar compressed whorls, very gently convex somewhat flattened flanks, rounded ventro-lateral shoulder, and convex venter. The umbilical shoulder is abruptly rounded to less so. The strong, rather stout ribs number about twenty per half whorl. Some are single and others branch on the inner half of the flank, with or without slight elevation of the ribs at the point of branching. The suture line is illustrated by Figure 2a.

Paratype No. 21701 (Pl. II, figs. 5a, b), a small specimen, is very compressed, moderately involute, with somewhat flattened and convergent flanks, a rounded ventro-lateral shoulder, convex venter, vertical umbilical wall, and a rather well-defined umbilical shoulder. The ribs, about thirty-five to the half whorl, are mostly single, stiffly convex on the flanks, projected on the outer flanks, and a little reduced where they cross the venter; some are short but most are long.

Paratype No. 21700 (Pl. II, figs. 4a, b) is also a small specimen, but more evolute and less compressed than No. 21701. It is moderately evolute with whorls much higher than they are thick, almost flattened flanks, rounded ventro-lateral shoulder, convex venter, vertical umbilical wall, and rounded umbilical shoulder. The ribs are mostly single but a few branch on the inner flanks. They number about twenty to the half whorl, are stiffly curved on the flanks and projected forward on the ventro-lateral shoulder.

Paratype No. 21702 (Pl. II, figs. 6a-c) is another small specimen, a little more evolute than Nos. 21701 and 21700, and somewhat less compressed. At the adapical end of the ultimate whorl it is rounded and about as high as it is thick. The rather stout ribs are long and short or divide near or within the middle of the flanks. At the adoral end the whorl is more compressed, somewhat flattened on the flanks, with rounded ventro-lateral shoulder, low convex venter, and rounded but distinct umbilical shoulder. The ribs are long and short, intercalated, stiffly convex on the flanks, somewhat projected on the ventro-lateral shoulder, and a little convex forward on the venter where they are reduced in strength.

The extent of variation in this species is considerable, particularly in degree of involution, as registered by the width of the umbilicus, which ranges from about 25 to 37 per cent of the diameter; in degree of compression of whorl; and in number of ribs per half whorl (eighteen to about thirty). It does not appear possible

to establish any linkage between these characters. In a single specimen the spacing and size of ribs may vary from quadrant to quadrant, and not in any regular sequence. It may be noted that the ribs are mostly single, but on parts of some specimens some branching takes place near or within the middle of the flanks. True tubercles or well-defined bullae are absent. Some flattening or widening of the venter was noted in a few specimens. Most of the specimens are probably not mature.

Comparisons. There is some resemblance to a Himalayan species, *Hollandites ravana* (Diener), in general form, in the numerous falciform ribs, and in particular to those variants of that species in which the ribs divide on the inner flanks. The ribs of *Hollandites pelletieri* however do not bifurcate on the umbilical shoulder, and no small umbilical tubercles occur.

Hollandites cf. *H. pelletieri* n. sp.

Plate II, figures 2a, b

Material. The figured specimen, GSC No. 21772, is from the Toad Formation on Chlotapecta Creek, 10 miles east of the front range of the Rocky Mountains (GSC loc. 40109).

Description. This specimen is a mere fragment of a whorl of a large specimen, larger than any described as *Hollandites pelletieri* n. sp. The maximum height of the whorl is 27 mm. The whorl is stout and thick, but a little higher than thick. It bears stout nearly straight to somewhat convex ribs, projected on the ventro-lateral shoulder and greatly reduced on the venter. The four adoral ribs are single. The fourth from the aperture is thickened and elevated at the middle of the flank. A fifth rib divides near the middle of the flanks, with an appreciable elevation and thickening of the rib at the junction.

Comparisons. This specimen may represent an extreme variant of *Hollandites pelletieri*, or a closely related species, with stouter whorls and thicker ribs.

Hollandites humi McLearn

Plate II, figures 1 a-c; Figure 3

Hollandites? *humi* McLearn, 1946b, p. 3, pl. IV, fig. 1; 1948, p. 28, pl. IV, fig. 1.

Material. The holotype, GSC No. 9482 is from talus derived from the Toad Formation, on "McTaggart Creek", east of Mount Wooliever (GSC loc. 10718).

Measurements. Holotype: about 65; 38; 34; 32.

Description. The holotype, all phragmocone, is not complete and so the measurements are not exact. It is moderately involute, moderately compressed, with whorls only a little higher than they are thick, with gently convex flanks, rounded ventro-lateral shoulder, fairly broad venter, and a well-defined almost angular umbilical shoulder. Many of the fairly stout ribs, about seventeen to the

half whorl, are single; others branch on the inner flanks. They are stiffly curved on the inner and middle flanks and projected on the ventro-lateral shoulder. The venter is smooth. The lobes of the ceratitic suture line have small shallow denticulations extending high on the sides of the saddles (Fig. 3). ES is high and larger than S1. S2 is lower than S1 and there is a much smaller auxiliary saddle. L1 is longer than EL and L2 is much shorter than L1.

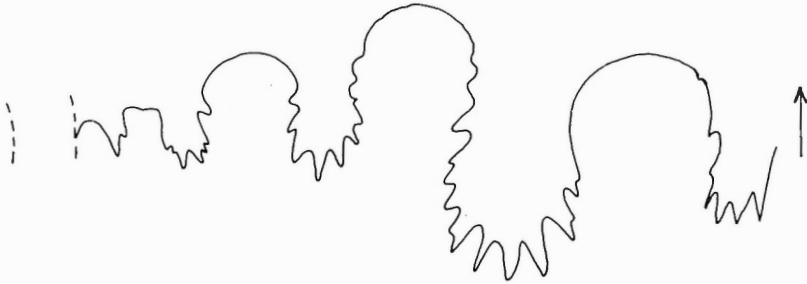


FIGURE 3. Suture line of *Hollandites humi* McLearn (x3). Holotype, GSC No. 9482.

Comparisons. This species resembles the more evolute variants of *Hollandites pelletieri* n. sp. The whorls, however, are more rounded and the compression of the whorls is not as great as in most typical specimens of that species, and the flanks are more rounded. The ribs are fewer and coarser. Unfortunately the spread of variation in this species is unknown and so its relation to *Hollandites pelletieri* cannot be satisfactorily determined.

Hollandites mcconnelli McLearn
Plate I, figures 10a, b; Figure 4

Hollandites? *mcconnelli* McLearn, 1946b, p. 3, pl IV, fig. 2; 1948, p. 27, pl V, fig. 2.

Material. The holotype, GSC No. 9481 is from talus derived from the Toad Formation, 300 yards west of Mile Post 375 on the Alaska Highway, Tetsa River valley (GSC loc. no. erased).

Measurements. Holotype: 49; 44; 28; 27

Description. The holotype is compressed, moderately involute. The ultimate whorl includes a little more than a quadrant of body chamber. The whorls are much higher than they are thick, have almost flattened flanks, well-rounded ventro-lateral shoulders, a rather narrowly rounded venter, and a well-defined abruptly rounded umbilical shoulder. The ribs are mostly single and are rather stiffly curved on the inner and middle flanks, and projected on the outer flanks, the ventro-lateral shoulder, and the margin of the venter. They number about nineteen to the half whorl. There is some branching near the middle of the flanks. In the adoral part of the ultimate whorl the ribs are a little wider and lower and more distantly spaced than in the adapical part. The venter is smooth. The suture line is illustrated by Figure 4.

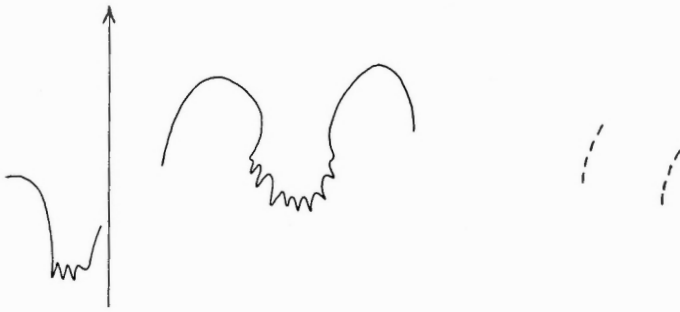


FIGURE 4

Suture lines of *Hollandites mcconnelli* McLearn (x3). Holotype, GSC No. 9481.

Comparisons. This species has lower, i.e. less elevated, ribs in the adoral part than in *Hollandites humi* McLearn. It has lower less elevated ribs than *Hollandites pelletieri* n. sp., and fewer ribs per half whorl than most specimens of that species.

Hollandites spivaki McLearn

Plate I, figures 11a, b; Figure 5

Hollandites? *spivaki* McLearn, 1946b, p. 3, pl. V, fig. 2; 1948, p. 28, pl. V, fig. 2.

Material. The holotype, GSC No. 9483, is from talus derived from the Toad Formation on "Cameron Hill", Tetsa River valley (GSC loc. no. erased).

Measurements. Holotype, at beginning of last quadrant: 49.5; 45; 36 (est.); 30.

Description. Only one side of the adoral part of the ultimate whorl is preserved and most of the adapical quadrant is missing. It is a compressed shell, moderately involute, with whorls higher than they are thick, gently convex converging flanks, very much rounded ventro-lateral shoulders, rather narrow rounded venter, and rounded but distinct umbilical shoulder. Some ribs are single, others divide on the inner part of the flanks. They are stiffly curved on the inner and middle flanks and rather strongly projected on the outer flanks, the ventro-lateral shoulder, and margin of the venter. The ribs are somewhat elevated at the point of branching. Suture line subammonitic with only small distant indentations on the saddles (Fig. 5).

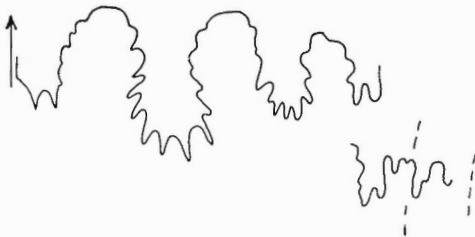


FIGURE 5

Suture lines of *Hollandites spivaki* McLearn (x3). Holotype, GSC No. 9483.

Comparisons. Compared with the holotype of *Hollandites humi* McLearn the shell is a little more involute and apparently much more compressed. The

flanks are more convergent and the venter narrower. There is more branching of ribs. Compared with *Hollandites mcconnelli* McLearn the shell is not as involute, the flanks are more convergent, the ribs are more elevated, and there is more branching of ribs. Compared with *Hollandites pelletieri* n. sp. the whorls are not so compressed, the flanks are more convergent, and there is more branching of ribs.

Genus *Anagymnotoceras* McLearn

Type species: *Gymnotoceras varium* McLearn

This genus includes *Beyrichitidae* without a ventral keel which pass through two stages of ornament in late ontogeny. In the earlier stage ("A") there are ribs that branch from umbilical bullae and also some intercalated ribs. The flanks are typically convergent at this stage. In the later adult stage ("B") the whorl is more compressed, with less convergent flanks. Stage "B" also shows loss of umbilical bullae, loss of branching of ribs, and the acquisition of ornament consisting of single ribs, which may or may not bear lateral tubercles or bullae. The diameter at which the change takes place is variable. Ventro-lateral tubercles are not developed.

The strong umbilical bullae distinguish *Anagymnotoceras* from *Hollandites*. The bullae of *Anagymnotoceras* are in great contrast with the small umbilical tubercles, from which the ribs branch in the typical *Hollandites* of the Himalayas. The species assigned to *Anagymnotoceras* are probably closer to the representatives of *Hollandites* from British Columbia than to the typical *Hollandites* from the Himalayas. However, branching of the ribs is much more common in species of *Anagymnotoceras* than in the *Hollandites* from British Columbia, among which, as already noted, branching of ribs is rare except in *Hollandites spivaki* McLearn. All specimens of *Anagymnotoceras* lack the ventral keel of *Gymnotoceras*.

Anagymnotoceras varium (McLearn)

Plate III, figures 7a-c; Figure 6

Gymnotoceras varium McLearn, 1948, p. 33, Supplement, p. 2, pl. XI, figs. 5, 6.

Anagymnotoceras varium (McLearn), McLearn, 1966, pl. I, figs. 11-13.

Material. The holotype GSC No. 9595 is from the Toad Formation, west of Mile Post 375, Alaska Highway, Tetsa River valley (GSC loc. 10696).

Measurements. Holotype: at 67; 42; - ; 31. Maximum diameter about 70.

Description. The adapical end of the penultimate whorl of the incomplete holotype is rounded and about as high as it is thick, with ribs but apparently no bullae. The middle part of the same whorl is about as thick as it is high, with rounded convergent flanks and a convex venter. Umbilical bullae are well defined and from each branches two to three slightly curved ribs which are a little projected as they approach the venter, the axis of which is smooth. At least one single rib is intercalated between the bullae. This is the ornament of Stage

"A". At the adoral end of the penultimate whorl the bullae disappear and the ribs are apparently single. The adapical end of the ultimate whorl becomes compressed and the ribs are mostly single and there are no umbilical bullae. A gap of unpreserved ultimate whorl follows. The adoral end of the ultimate whorl is well preserved only on one side. It is compressed and much higher than it is thick, the flanks are only gently convex, and are almost subparallel, the venter is fairly wide and of low convexity, the ventro-lateral shoulder is rounded, and the umbilical shoulder is angular. The coarse, almost straight ribs are single and distantly spaced. The two farthest from the aperture evidently carried large tubercles or bullae a little within the middle of the flanks, but they are broken off. The remaining three ribs are swollen near the middle of the flank. This illustrates stage "B" in ornament and is quite different from the ornament of stage "A" shown by the penultimate whorl. The suture line (Fig. 6) is ceratitic, but the indentations run up high on the sides of the saddles. ES is wider than S1. L1 is much larger than L2. The second auxiliary saddle is on the umbilical shoulder.

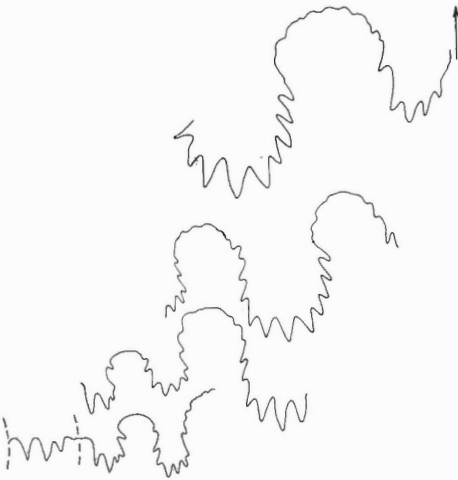


FIGURE 6

Suture lines of *Anagymnotoceras varium* (McLearn) (x3). Holotype, GSC No. 9595.

Comparisons. The adult, or "B" stage, with the stout, distant single ribs and bullate tubercles and swellings on the flanks is distinctive and recalls the adult ornament of some Himalayan species of *Hollandites*. However the ornament, the inner whorl (stage "A") differs from that of any typical Himalayan *Hollandites*.

Anagymnotoceras tozeri n. sp.

Plate V, figures 8, 9

Material. The holotype, GSC No. 21809, and paratype, GSC No. 21810, are from the Lower Shale Member of the Blaa Mountain Formation, five miles northwest of the entrance to Hare Fiord, northwest Ellesmere Island (GSC loc. 51677).

Measurements. Holotype: at 39; 42; 36; 33. Holotype: at 56; 41; 33; 39. Paratype: at 36; 43; - ; 32. Paratype: at 58; 44; 31+; 27.

Description. Part of the penultimate whorl may be seen on removal of the outer whorl of the incomplete holotype. The penultimate whorl is rounded and thicker than it is high with branched and single ribs that extend to the centre of the venter. At the adapical end of the ultimate whorl the shell is moderately involute and the whorl passes from being thicker than it is high to being a little higher than it is thick. The flanks are rounded and a little convergent. The venter and the umbilical shoulder are rounded. The stiffly curved ribs branch from prominent elevated umbilical bullae, and there are single intercalated ribs as well. All are a little projected as they approach the venter, the axis of which becomes smooth. The bullae decline and adorally disappear. At the adoral end of the ultimate whorl the shell is moderately involute, the whorl becomes increasingly compressed, and the umbilical shoulder is abruptly rounded and much better defined. On the flanks are stiffly curved to almost straight robust distantly spaced single ribs that decline as they approach the outer flanks. The adoral quadrant is the body chamber.

The paratype is preserved only on one side. At the adoral end of the penultimate whorl the shell is moderately involute, the flanks are rounded and convergent, and the venter and umbilical shoulder are rounded. From stout but not well-preserved umbilical bullae branch ribs that are stiffly curved on the flanks and a little projected where they approach the venter, which is smooth. In addition there are intercalated single ribs. What is preserved of the ultimate whorl includes a little more than a quadrant of body chamber. The whorl is quite compressed, being much higher than it is thick. The flanks are gently convex, the ventral shoulder is well rounded, the venter convex, and the umbilical shoulder abruptly rounded. Stout distantly spaced almost straight single ribs occur on the flanks and decline towards both the umbilical shoulder and the outer part of the flanks. The venter is smooth. Suture lines are not well preserved.

Comparisons. Resemblance to *Anagymnotoceras varium* (McLearn) is shown in the two stages of ornament and in the whorl shape. *Anagymnotoceras tozeri* lacks the lateral tubercles of *A. varium* and differs in general proportions. The stout single ribs at the adult (or "B") stage recall the adult ornament of some Himalayan species of *Hollandites moorei* Diener, for example, but as already mentioned, the inner whorls of *Anagymnotoceras* and *Hollandites* are different.

Anagymnotoceras moderatum (McLearn)

Plate III, figure 6

Gymnotoceras moderatum McLearn, 1948, p. 34, Supplement p. 3, pl. X, fig. 10.
Anagymnotoceras moderatum (McLearn), McLearn, 1966, pl. I, fig. 8.

Material. The holotype, GSC No. 9596, is from the Toad Formation, west of Mile Post 375, Alaska Highway, Tetsa River valley (GSC loc. 10696).

Measurements. Holotype: 39; 50; 18 (est.); 24.5.

Description. The very adapical end of the outer whorl of the holotype is not well preserved, but the whorl appears to be higher than it is thick, and the venter is possibly rounded. At this stage there are single ribs alternating with branched ribs. The junction of the branched ribs is marked by faint bullae. In the second and third quadrants the sides and venter are gently rounded and the rounded ventral shoulders are well defined. Ribs branch from three distinct, but not strong bullae and there are intercalated ribs between the bullae. The ribs are a little flexuous on the flanks and projected a little forward on the ventro-lateral shoulder. In the last quadrant the whorls are compressed with only gently convex almost flattened flanks and venter, and well-defined ventral shoulder. The ribs on this last quadrant are mainly single and are curved a little on the flanks and curved forward on the ventro-lateral shoulder. At this stage the ribs are apparently declining in strength and the umbilical bullae seem to have disappeared, although the umbilical shoulder and adjacent flanks are not well preserved. The venter is nearly smooth except for the fine growth lines. In the last quadrant the whorl has apparently passed from stage "A" to stage "B".

Comparisons. The ornament of stage "B" is attained at a smaller diameter than it is in *Anagyminotoceras varium* McLearn. Furthermore, the ribbing on the last quadrant of *Anagyminotoceras moderatum* is quite different from the coarse straight ribs of *A. varium*.

Anagyminotoceras helle (McLearn)

Plate III, figures 4a-c, 5; Figure 7

Gymnotoceras helle McLearn, 1948, p. 32, Supplement, p. 2, pl. X, fig. 7.

Anagyminotoceras helle (McLearn), McLearn, 1966, pl. I, figs. 3-5.

Material. The holotype GSC No. 9593, is from talus derived from the Toad Formation, "Cameron Hill", Tetsa River valley (GSC loc. 10697). The paratype, GSC No. 9592, is from the Toad Formation, west of Mile Post 375, Alaska Highway, Tetsa River valley (GSC loc. 10696).

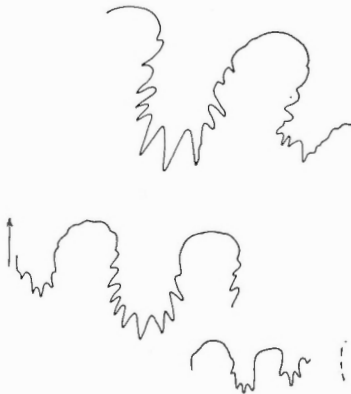


FIGURE 7

Suture lines of *Anagyminotoceras helle* (McLearn) (x3). Paratype, GSC No. 9592. Inner broken line indicates the position of the umbilical seam.

Measurements. Holotype, near anterior end: 44.5; 40; 28 (est); 35.

Description. On the outer whorl of the holotype only one flank and part of the venter is preserved. It is all phragmocone and the complete specimen must have been much larger. It is compressed, moderately evolute, with the ultimate whorl higher than it is thick, the flanks somewhat flattened and a little convergent, the ventro-lateral shoulder rounded, the venter gently rounded, and the umbilical shoulder almost angular. Mostly stiffly curved ribs divide from low not very prominent umbilical bullae, and there are in addition extra short intercalated ribs. The ribs are projected a little on the ventro-lateral shoulder. The venter is smooth. At the adapical end the whorl is a little more rounded, although higher than it is thick, and the ribs are much the same, but the umbilical bullae are at least faintly formed. The suture line of the holotype is ceratitic but small denticulations extend high up on the sides of ES and S1. ES is fairly wide and deep, L1 is very wide and long, S1 is of about the same size as ES, L2 is short and very much narrower than L1, S2 is much smaller than S1, and a very small auxiliary saddle is present on the umbilical shoulder.

The paratype (Pl. III, figs. 4a-c) is not as compressed as the holotype, the umbilical bullae are more elevated, or possibly only better preserved. The suture line is illustrated by Figure 7.

This species has the characteristic inner whorls of *Anagymnotoceras*. Comparison with other species of *Anagymnotoceras* is given in the description of *Anagymnotoceras wrighti*, etc.

Anagymnotoceras wrighti (McLearn)

Plate III, figures 1a, b; Figure 8

Gymnotoceras wrighti McLearn, 1946, p. 4, pl. V. fig. 4; 1948, p. 32, pl. V. fig. 4.

Anagymnotoceras wrighti (McLearn), McLearn, 1966, pl. I, figs. 1, 2.

Material. The holotype, GSC No. 9484, is from talus derived from the Toad Formation on "Cameron Hill", Tetsa River valley (GSC loc. 10702).

Measurements. Holotype, at middle of last quadrant: 54.5; 48; 40; 28.

Description. The holotype and only known specimen preserves about three quadrants of the ultimate whorl. There are about one and a half quadrants of body chamber. The whorls are higher than they are thick with nearly flat very convergent flanks, narrow round venter, well-rounded ventro-lateral shoulder, high umbilical wall, and rounded umbilical shoulder. The umbilical bullae are elevated and well defined and are close to the umbilical shoulder. From each bullae branch two to three stiffly curved ribs which are a little projected and thickened on the ventro-lateral shoulder. The venter is smooth. The suture line is subammonitic (Fig. 8). ES is large, rather high; S1 is not much smaller, but S2 is much smaller and there is a small auxiliary saddle on the umbilical wall. The saddles have only very small indentations. L1 is longer than EL and has small lobules. L2 is smaller and a first auxiliary lobe is very small. This specimen is in stage "A".

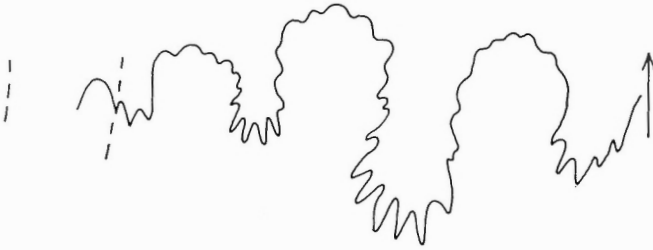


FIGURE 8

Suture line of *Anagymnotoceras wrighti* McLearn (x3). Holotype, GSC No. 9484.

Comparisons. The very convergent flanks, strong bullae, and narrow venter distinguish *Anagymnotoceras wrighti* from *Anagymnotoceras helle*.

Anagymnotoceras ino (McLearn)
Plate III, figures 3a, b

Gymnotoceras ino McLearn, 1948, p. 33, Supplement p. 2.
Anagymnotoceras ino (McLearn), McLearn, 1966, pl. I, figs. 9, 10.

Material. The holotype, GSC No. 9594, is from the Toad Formation of "Cameron Hill", Tetsa River valley (GSC loc. 10698).

Measurements. Holotype: 52; 41; 35 (est.); 31.

Description. About one half whorl of the body chamber of the holotype is preserved and it is crushed on one side. It is moderately involute, with nearly subquadrate whorls which are a little higher than they are thick, somewhat flattened flanks, rounded but distinct umbilical and ventro-lateral shoulders, and a fairly wide almost flat venter. From strong projecting bullate tubercles, near the umbilical shoulder, branch three fairly slender, slightly flexuous ribs that are projected forward a little on the ventro-lateral shoulder. The middle of the venter is smooth. The apparent loss of ribs at the adoral end may be the result of abrasion. The suture line is not preserved.

Comparisons. The flattened broad venter and less convergent flanks distinguish this species from *Anagymnotoceras wrighti* (McLearn).

Anagymnotoceras columbianum (McLearn)
Plate III, figures 2a, b

Gymnotoceras columbianum McLearn, 1946a, p. 17, Appendix II, p. 2, pl. III, fig. 7; 1948, p. 31, pl. III, fig. 7.
Anagymnotoceras columbianum (McLearn), McLearn, 1966, pl. I, figs. 6, 7.

Material. The holotype, GSC No. 6691, is from the Toad Formation, west of Mile Post 375, Alaska Highway, Tetsa River valley (GSC loc. 10696).

Measurements. Holotype: 46.5; 45; 47; 28.

Description. A little more than three quadrants of the ultimate whorl of the holotype is preserved and there is one half whorl of body chamber. It is a stout whorled moderately involute shell, with whorls about as thick as they are high, gently convex convergent flanks, well-rounded ventro-lateral shoulder, and rounded

venter. At the adapical end of the preserved part of the ultimate whorl are single radiating ribs. In the adoral part there are four prominent elevated umbilical tubercles, from each of which branch 2 to 3 slightly flexuous ribs, which are curved a little forward on the ventro-lateral shoulder. In addition there are two, in places three, ribs intercalated between the bullae. The axis of the venter is smooth.

Comparisons. A characteristic feature of this species is the number of ribs, both branching and single, in relation to the number of bullae. The number of ribs per bullae is greater than in the species of *Anagymnotoceras* described above. The single ribs intercalated between the bullae give a special pattern of ornament.

Genus *Gymnotoceras* Hyatt

Gymnotoceras deleeni (McLearn)

Plate IV, figures 1–7; Plate V, figures 5a, b; Figure 9

Beyrichites deleeni McLearn, 1946a, p. 16, Appendix II, p. 2, pl. I, fig. 5, pl. II, fig. 3; 1948, p. 26, pl. I, fig. 5, pl. II, fig. 3, pl. IX, fig. 2.

Beyrichites aff. *tenuis* Smith, McLearn, 1948, pp. 3, 26.

Material. The holotype, GSC No. 6479, is from talus derived from the Toad Formation, 450 feet west of Mile Post 376, Alaska Highway, Tetsa River valley (GSC loc. 10694). The paratype, GSC No. 6480, and hypotypes, GSC Nos. 21705, 21707, 21709, and 21710, are from the same collection. The hypotype, GSC No. 21708, is from the Toad Formation at Mile Post 377, Alaska Highway, Tetsa River valley (GSC loc. 14841). The hypotype, GSC No. 21706, is from the Toad Formation, "McTaggart Creek", east side of Mount Wooliever (GSC loc. 10717).

Measurements. Holotype: 38; 52.5; 37; 22. Paratype: 61; 55; 33; 16. Hypotype 21705: 34; 53; 29; 16. Hypotype 21706: 39; 55; 31; 18. Hypotype 21707: 44; 52; 30; 18. Hypotype 21708: 49; 52; 31; 12. Hypotype 21709: 51; 51; 33; 18.

Description. The holotype (Pl. IV, figs. 2a–c) is a comparatively small specimen. At the adapical end of the ultimate whorl the whorl is higher than it is thick, has somewhat flattened sides, rounded umbilical shoulder, distinct ventro-lateral shoulder, gently convex rather wide venter, and a keel. Near the umbilical shoulder are rather distantly spaced, short, stout, straight bullae which are detached and not continuous with any rib. Between the bullae are three to four intercalated well-defined ribs, a little convex on the flanks and well projected forward on the ventro-lateral shoulder where there are distantly spaced auriculoids. At the adoral end the shell is involute, the whorl is higher than it is thick, with fairly flattened converging flanks, well-defined ventro-lateral shoulder, and a convex venter, which is elevated along the centre. The bullae at this stage are continuous with the ribs and some ribs branch from them; other ribs are short and intercalated. They are convex on the flanks and well projected forward on the ventro-lateral shoulder.

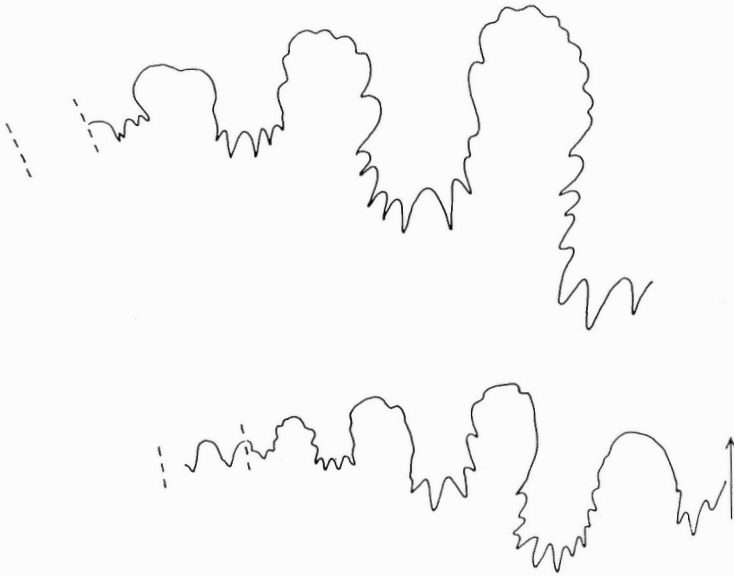


FIGURE 9. Suture lines of *Gymnotoceras deleeni* (McLearn) (x3). Upper figure of paratype, GSC No. 6480; Lower figure of hypotype, GSC No. 21707.

The paratype (Pl. IV, figs. 4a, b) is much larger than the holotype and has proceeded to a more mature stage. Only a small length of body chamber is preserved. At the adapical end of the ultimate whorl the whorl is higher than it is thick with somewhat flattened sides, rounded umbilical shoulder, well-defined ventro-lateral shoulder, low convex venter, and low keel. The bullae near the umbilical shoulder show a decline in strength. The ribs are convex on the flanks and well projected forward on the ventro-lateral shoulder. Some branch and some are single. Half a whorl from the aperture the ribs decline on the flanks but persist in strength on the ventro-lateral shoulder, an important character of this species at this stage of growth. The umbilical shoulder is well defined. At the adoral end the whorl is compressed and moderately involute. At this stage the flanks are more convex, the ventro-lateral shoulder is less well defined, and the venter is more rounded than at the adapical end of the same whorl. The keel has disappeared and no surface ornament exists except some low broad folds on the flanks. The suture line (Fig. 9) has high ES and S1, rather low S2, all with small indentations and a low wide auxiliary saddle. L1 is very long, longer than EL; L2 is long, but shorter than L1; the first auxiliary lobe is yet shorter; and the second auxiliary lobe is very small and on the umbilical shoulder.

Hypotype No. 21709 (Pl. IV, figs. 3a-c) is close to the paratype. It shows a similar stage in the decline of ribs. They remain strong only on the ventro-lateral shoulder and have somewhat the appearance of "clavi". At the adoral end the ribs and clavi are disappearing and the ventro-lateral shoulder is more rounded, but the umbilical shoulder is almost angular.

Hypotype No. 21710 (Pl. IV, fig. 7) shows that this species grew at least to a diameter of about 85 mm. The adoral end of the penultimate whorl resembles that of hypotype No. 21709 and the paratype, at the same stage of growth. The whorl is compressed with flattened flanks, abruptly rounded ventro-lateral shoulders, and a convex venter with low indistinct keel. The ribs on the flanks are low but are strong and curved forward on the ventro-lateral shoulder; this is the "clavate" stage of ornament. At the adapical end of the ultimate whorl the flanks are more convex, the ventro-lateral shoulder is more rounded, and so less defined. The ornament is lost except for low curved folds on the flanks. The adoral end is crushed but appears to have had broad folds on the flanks.

Hypotype No. 21707 (Pl. IV, figs. 5a, b) is a small specimen, all phragmone, recording pre-adult whorls. It is very compressed. At the adapical end of the ultimate whorl, the whorl is compressed with rounded ventro-lateral shoulder, elevated keel-like venter, and rounded umbilical shoulder. The ribs are of even size, convex on the inner flanks and projected forward on the umbilical shoulder. Adorally the ventral shoulder becomes much less defined, the keel disappears, the venter is rather narrowly rounded, and the umbilical shoulder is abruptly rounded. The ribs are much reduced in elevation, but a little less so at the ventro-lateral shoulder.

Hypotype No. 21708 (Pl. IV, figs. 6a, b) comprises at least a quadrant and possibly half a whorl of body chamber. At a diameter of about 50 mm it is compressed and involute. The adapical end of the ultimate whorl is much higher than it is thick, with somewhat flattened flanks that are rounded as they approach the somewhat angular venter, so that there is no definite ventro-lateral shoulder. The umbilical shoulder is abruptly rounded and almost angular. Evenly sized and spaced ribs are a little convex on the flanks and projected forward as they approach the venter. At the adoral end the flanks are a little convex and the venter narrowly rounded. The umbilical shoulder remains abruptly rounded and well defined. Adorally the ribs rapidly decline but persist longer on the outer part of the flanks.

Hypotype No. 21705 (Pl. IV, figs. 1a, b) is much smaller than No. 21708 and is moderately involute and compressed. The adapical part of the ultimate whorl, which is not completely preserved, is much higher than it is thick, somewhat flattened on the inner flanks but convex on the outer part, and passes into an almost angular venter. There is no well-defined ventro-lateral shoulder. Fine numerous ribs are a little convex on the flanks and curved forward as they approach the angular venter. At the adoral end the whorl is also compressed, flattened on the inner part and convex towards the venter, but without a well-defined shoulder. The venter is angular. The ribs have declined to low distant folds. Thus the ribs were declining at an early stage of growth.

Hypotype No. 21706 (Pl. V, figs. 5a, b) is only a little larger than No. 21705. Like Nos. 21708 and 21705 it is compressed, involute, rather flattened on the inner flanks and more convex towards the venter, with an ill-defined ventro-

lateral shoulder and an angular venter. At the adapical end are very faint ribs and at the adoral end the shell is almost smooth.

Variation. It is evident that this is a species with considerable spread in variation of characters. At one end stand shells like the holotype, the paratype, and hypotypes 21709 and 21710. In this typical group of variants the ontogeny follows a definite sequence: from a stage of more or less flattened whorls with a distinctive ventro-lateral shoulder, low nearly flat venter with keel, and well-defined ribs and umbilical bullae; to a stage of more rounded whorl, with reduction of bullae and weakening of ribs on the flanks, but brief retention of the ventro-lateral shoulder, forming "clavate-like" ornament there, and reduction or loss of the keel; to a stage with more rounded flanks and venter, a weak poorly defined ventro-lateral shoulder, absence of keel, and a smooth surface except for a few wide folds on the flanks.

This typical group of variants passes to more compressed shells with narrower venters, lacking bullae at any stage. There is however an early ontogenetic stage with well-defined ventro-lateral shoulders, ribs, and keel; this passes to a stage with more rounded venter and a less well-defined rather weak ventro-lateral shoulder. Hypotype No. 21707 is an example of this group of variants, and it is more or less intermediate between the typical group of variants and the variants represented by hypotypes 21708, 21705, and 21706 which stand at the other extreme of variation. The shells of this group of variants are compressed with narrow venters, and as they depart from the typical group they show reduction of ribs at earlier and earlier stages in the ontogeny, and the surface is smooth at earlier stages. Umbilical bullae are unknown at any stage. A conspicuous feature is a rather angular venter, but the shells are not true oxycones, however, as weak ventro-lateral shoulders are retained. In extreme variants the angular ventro-lateral shoulder and low venter and even the keel are unknown at any ontogenetic stage. This kind of venter persists to the adoral end of all the specimens. It is not impossible that this may pass a final mature stage of rounded venter as in the typical group of variants, but most specimens are too small to determine this and the adoral ends of large specimens are too crushed for observation. This group of variants almost forms a separate species. Variants like hypotype No. 21707, however, do seem to occupy an intermediate position. Their place within the species would be better established if the mature venter were better known.

Comparisons. The more typical forms close to the holotype and paratype differ from the strongly ribbed variants of *Gymnotoceras argentarius* Smith, as redefined by Silberling (1962). Thus the inner whorls have much better defined ventro-lateral shoulders, and the ribs are more flattened and decline at maturity. They moreover retain their strength longer on the outer part of the flanks. The more extreme variants with nearly smooth surface and narrow venter are close to the shells described as *Beyrichites tenuis* by Smith (1914). Silberling (1962) regards *Beyrichites tenuis* as a synonym of *Gymnotoceras argentarius*.

Gymnotoceras deleeni var. *liardense* McLearn

Plate V, figures 3, 4; Figure 10

Gymnotoceras liardense McLearn, 1946b, p. 4, pl. V, fig. 3; 1948, p. 30, pl. V, fig. 3.

Material. The holotype, GSC No. 9485, is from the Toad Formation, south side Chischa River, 5 miles above Muskwa River (GSC loc. 10726). The hypotype, GSC No. 21712, is from the same collection.

Measurements. Holotype, at about middle of last quadrant of phragmocone: 31.5; 50; 35; 25.

Description. The holotype consists of a well-preserved phragmocone to which adheres a mere fragment of a crushed body chamber. It is moderately involute and compressed with whorls much higher than they are thick, somewhat flattened flanks, well-defined umbilical shoulder and vertical umbilical wall, abruptly rounded ventro-lateral shoulder, and narrow gently convex venter elevated in the form of a low keel. Very short low ribs extend to rounded or somewhat bullate tubercles, from which branch, in threes or pairs, but mostly threes, rather slender sigmoidal ribs projected forward on the ventro-lateral shoulder. Rare intercalated ribs are also present. The crushed fragment of body chamber shows little more than a few distantly spaced ribs. It is not certain whether tubercles have disappeared at this stage. The suture line (Fig. 10) is subammonitic for small indentations extend very high on the saddles. ES and S1 are deep and of about the same width. S2 is more shallow, but is wide and is on the tubercle. In addition two very small auxiliary saddles extend to the umbilical shoulder. L1 and L2 are long, wide, and denticulate. An auxiliary lobe is wide, short, and contains two lobules or denticulations.

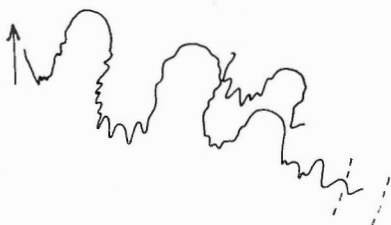


FIGURE 10

Suture lines of *Gymnotoceras deleeni* var. *liardense* (McLearn) (x3). Holotype, GSC No. 9485.

Hypotype No. 21712 (Pl. V, figs. 4a-b) is at a diameter of about 61 mm. Accurate measurements cannot be obtained as more than half the ultimate whorl, all body chamber, is crushed against the better preserved phragmocone. The adapical end of the ultimate whorl, which is phragmocone, is compressed, moderately involute, with whorls higher than they are thick, somewhat flattened and convergent flanks, rounded but distinct ventro-lateral shoulders, gently arched venter with keel, well-defined umbilical shoulder, and vertical umbilical wall. Just outside the umbilical shoulder are somewhat bullate ribs from which branch

curved ribs which are projected on the ventral shoulder. Intercalated ribs also occur. On the penultimate whorl the tubercles are more rounded. The ribs persist on to the adoral end of the ultimate whorl but are weak on the flanks and strong on the ventro-lateral shoulder.

Comparisons. Compared with typical specimens of *Gymnotoceras deleeni* McLearn, the tubercles are more rounded and less bullate, and the ribs persist to a later stage of growth.

Gymnotoceras kindlei (McLearn)

Plate V, figures 2a, b; Figure 11

Frechites kindli McLearn, 1946a, p. 18; 1946b, p. 4, pl. IV, fig. 4; 1948, p. 34, pl. IV, fig. 4.

Material. The holotype, GSC No. 6693 is from the Toad Formation of Chlotapecta Creek (= "Four Mile Creek") (GSC loc. 10735).

Measurements. Holotype: 51.5; 48; 37; 27.

Description. The holotype and only known specimen is compressed, and moderately involute. The specimen is entirely phragmocone so that the complete shell was much larger. Some of the adapical end of the ultimate whorl is not preserved. In the adapical part of the second quadrant of this whorl the section is somewhat quadrangular, although higher than it is thick. The flanks and venter are nearly flat, the ventro-lateral shoulder well defined, and the umbilical wall rounded. There is no keel. Bullate tubercles occur close to the umbilical shoulder and move a little towards the venter with the growth of the shell. Two ribs branch from each tubercle and there is one intercalated rib between the branched ribs. The laterally curved ribs are weak on the flanks and strong and projected on the ventro-lateral shoulder, where they form indistinct tubercles. Adorally the ultimate whorl is high and more compressed and the flanks, ventro-lateral shoulder, and venter are more rounded. The umbilical bullate tubercles decline and the ventro-lateral "tubercles" are even more indistinct. The subammonitic suture line (Fig. 11) has very small indentations on the saddles. ES and S1 are large, S2 much smaller and lower, and a small auxiliary saddle is close to the umbilical shoulder. L1 is longer than EL, L2 is shorter and narrower than L1, and an auxiliary lobe is small.

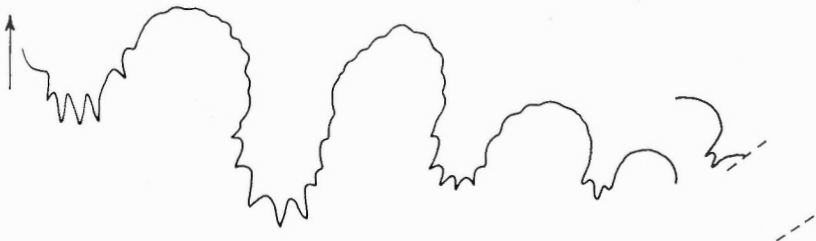


FIGURE 11. Suture lines of *Gymnotoceras kindlei* (McLearn) (x3). Holotype, GSC No. 6693.

Comparisons. Compared with variants of *Gymnotoceras nevadanus* (Smith) in the broad sense of Silberling (1962), particularly those variants that are close to the type of that species, the holotype of *Gymnotoceras kindlei* is more compressed and has weaker umbilical tubercles, which decline adorally.

Gymnotoceras beachi McLearn
Plate V, figures 1a-d; Figure 12

Gymnotoceras beachi McLearn, 1946a, p. 18; 1946b, p. 4, pl. V, fig. 5; 1948, p. 29, pl. V, fig. 5.

Material. The holotype, GSC No. 6692, is from the Toad Formation of Chischa River, 8 miles above Muskwa River (GSC loc. 10727).

Measurements. Holotype, at beginning of last quadrant of ultimate whorl: 38.5; 46; 36; 20.

Description. About one half whorl of body chamber is preserved. At the adoral end of the ultimate whorl the shell is moderately involute with an angular umbilical shoulder and a vertical umbilical wall. The flanks are very gently convex, nearly flat; the ventro-lateral shoulder is well rounded; the venter is broad and fairly convex and mounted by a low, distinct keel. From the ends of short, rather slender primary ribs two or three secondary slender ribs branch. The ribs are convex on the flanks and projected on the ventro-lateral shoulder and extend to the ventral keel. Intercalated ribs are also present. Small tubercles form at some points of branching. At its adapical end the ultimate whorl is only a little higher than it is thick, and has a rounded ventro-lateral shoulder, a wide convex venter, and a ventral keel. The umbilical shoulder is not defined. The lateral ornament differs from that at the adoral end. From sub-umbilical bullae, almost straight, short ribs extend to poorly defined tubercles situated near the ventro-lateral shoulder, beyond which rather irregular ribs are projected adorad and extend almost to the keel.

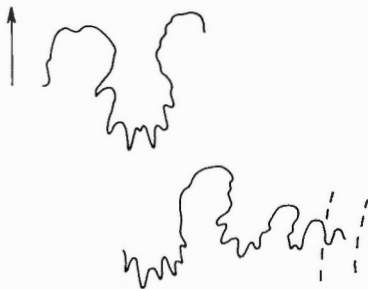


FIGURE 12

Suture lines of *Gymnotoceras beachi* McLearn (x3). Holotype, GSC No. 6692. Lower figure is reversed.

Comparisons. Compared with *Gymnotoceras deleeni* (McLearn) the ribs are more even, and extend unchanged to a more advanced stage of growth.

Family HUNGARITIDAE Waagen

Genus *Longobardites* Mojsisovics*Longobardites nevadanus* Hyatt and Smith

Plate VI, figures 1-7; Figure 13

Longobardites nevadanus Hyatt and Smith, 1905, p. 132, pl. XXV, figs. 13-18, pl. LVIII, figs. 16-20, pl. LXXV, figs. 6-9; Smith, 1914, p. 50, pl. VI, figs. 13-18, pl. VIII, figs. 16-20, pl. XI, figs. 6-9, pl. XXX, figs. 13-16; McLearn, 1951, p. 13.

Longobardites canadensis McLearn, 1946a, p. 14, Appendix II, p. 1, pl. III, figs. 1, 5, 6; 1948, p. 19, pl. III, figs. 1, 5, 6, pl. X, fig. 3.

Longobardites intornatus McLearn, 1946a, p. 15, Appendix II, p. 1, pl. I, fig. 1; 1948, p. 20, pl. I, fig. 1, pl. XI, figs. 7-10.

Material. Hypotype, GSC No. 6449 (=holotype of *Longobardites canadensis* McLearn), is from talus derived from the Toad Formation, west of Mile Post 375, Alaska Highway, Tetsa River valley (GSC loc. 10695). Hypotype, GSC No. 6450 (= paratype of *Longobardites canadensis* McLearn), is also from GSC loc. 10695. Hypotypes GSC Nos. 9581 and 21715 are from talus derived from the Toad Formation, 450 feet west of Mile Post 376, Alaska Highway, Tetsa River valley (GSC loc. 10694). Hypotype, GSC No. 6466 (=holotype of *Longobardites intornatus* McLearn), is from talus derived from the Toad Formation, west of Mile Post 375, Alaska Highway, Tetsa River valley (GSC loc. 10695). Hypotype, GSC No. 9582 (=“plesiotype” of *Longobardites intornatus* McLearn), is also from GSC loc. 10695. Hypotype GSC No. 21716 is from the Toad Formation, south side of Liard River, about 2 miles below the mouth of Toad River (GSC loc. 10660).

Measurements. GSC No. 6449: 37; 59; 24; 8. GSC No. 6466: 33.5; 56; 26; 17. at 23; 52; 30; 24. GSC No. 6450: 42; 60; 23; 3. GSC No. 21715: 62; 60; 21; 0. GSC No. 21716: 72; 61; 22; 0.

Description. Early in the study of this fauna specimens now referred to *Longobardites nevadanus* were assigned to two new species: one, *Longobardites canadensis* McLearn, with variably carinate finely costate to nearly smooth inner whorls; the other, *Longobardites intornatus* McLearn, with carinate-tuberculate or carinate-ribbed inner whorls. It was pointed out, however, that almost complete continuous variation occurs between the specimens of these two species, and that there was a close resemblance to *Longobardites nevadanus*. This view was reaffirmed in 1948 when it was noted that specimens of *Longobardites canadensis* with nearly smooth inner whorls are close to *Longobardites nevadanus* and might prove to be of that species, and that further studies might show that the specimens of *Longobardites canadensis* may prove to be varieties of *Longobardites nevadanus*. As known in 1948 and as described by Smith (1914), *Longobardites nevadanus* had only smooth inner whorls. At about this time, however, some new information called for a new conception of *Longobardites nevadanus*. A specimen collected at New Pass, Nevada, was received from the late Dr. J. B. Reeside, of the U.S. Geological Survey. It was accompanied by a label written by F. N.

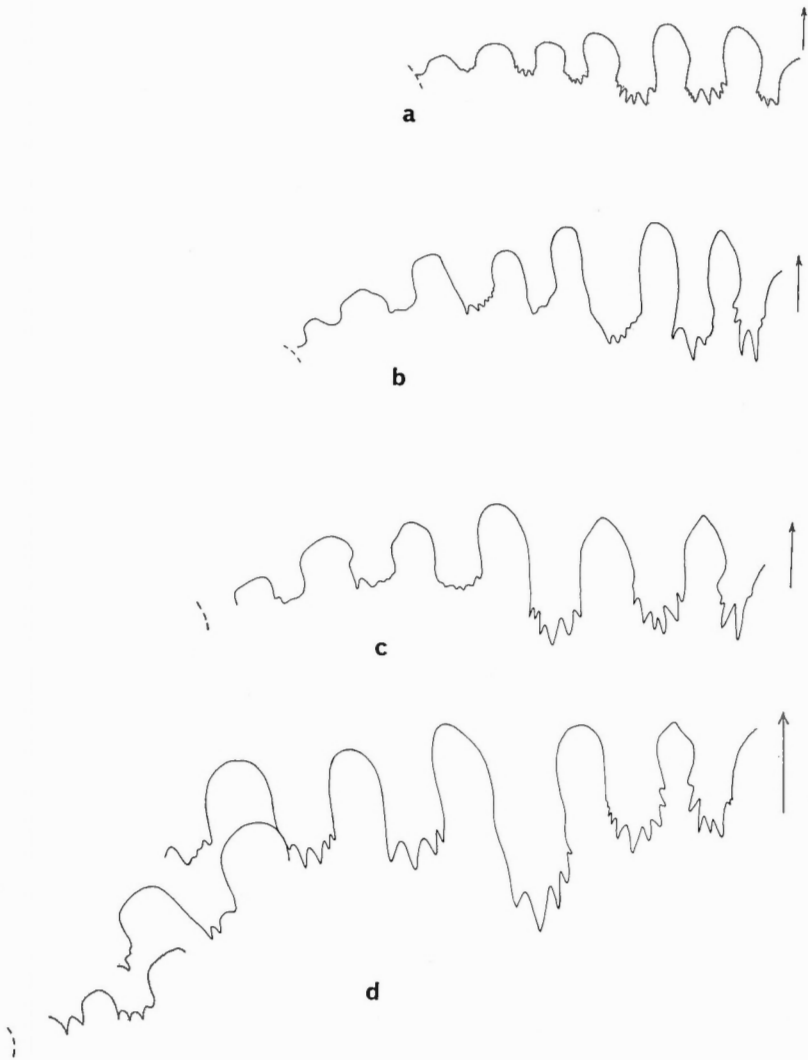


FIGURE 13. Suture lines of *Longobardites nevadanus* Hyatt and Smith.

- a. GSC No. 6466 (holotype of *Longobardites intornatus* McLearn);
- b. GSC No. 6449 (holotype of *Longobardites canadensis* McLearn). The lateral and auxiliary lobes are weathered;
- c. GSC No. 6450 (paratype of *Longobardites canadensis* McLearn);
- d. GSC No. 9581.

Johnston. On this label a resemblance of the specimen to *Dalmatites parvus* Smith was noted. The notes on the label further stated that preparation of the suture line of the type specimen of *Dalmatites parvus* revealed the presence of 10 external lobes, and that the specimens of "Dalmatites" from Nevada are probably the young of *Longobardites*. On a second label it was stated that F. N. Johnston considers the New Pass specimen to be the young of *Longobardites nevadanus*.

Examination of this New Pass specimen showed that it had inner whorls like those of *Longobardites intornatus*. Accordingly both *Longobardites intornatus* and *Longobardites canadensis* were placed in synonymy with *Longobardites nevadanus* (McLearn, 1951).

Hyatt and Smith (1905) called the adult suture line of *Longobardites* an adventitious one, but noted that at even as late a stage as early maturity there was no distinction of an adventitious and a lateral series. McLearn (1946a) questioned the validity of Hyatt and Smith's interpretation of the suture line of *Longobardites*. In describing the suture line of *Longobardites canadensis* it was stated "that the first (adventitious?) saddle is mostly narrower than the second" (McLearn, 1946a, p. 14). McLearn (1948, p. 17) described the *Longobardites* suture line. It was said to contain an S1 "in many specimens larger than ES. . . . ; L2 is as large as, and in some specimens larger than L1". It was also pointed out that this pattern of suture line formed during growth of the shell by changes in the relative size of the lobes, and of the saddles as well. At early stages ES is larger than S1, S1 is larger than S2, and L1 is larger than L2. With growth S1 and S2 increase in size so that S1 equals or exceeds ES in size and S2 is as large as S1; L2 increases in length and width to equal or exceed L1 in size. Spath (1951) called the suture line of *Longobardites* adventitious but noted the changes in proportions of the lobes and saddles during growth. McLearn (1951) used the term "pseudo-adventitious" for the suture line of *Longobardites nevadanus*.

Hypotype No. 21716 (Pl. VI, figs. 7a, b) is large, compressed, very involute, with an acute venter and an oxycone. Very little of the body chamber is preserved for most of the ultimate whorl is phragmocone. The surface is nearly smooth, having only lines and varices of growth, which are convex on the flanks and a little rursiradiate as they approach the venter. The suture line includes a high ventral saddle and wide EL, high and fairly slender ES, S1, and S2, all of which are narrowly rounded at the top. L2 is larger and longer than L1.

Hypotype No. 21715 (Pl. VI, figs. 6a, b) is a large specimen but all phragmocone. It has the oxyconic form and shell proportions of No. 21716. The surface is apparently smooth but not sufficiently well preserved to record lines of growth. The suture line has relatively low and stout saddles as compared with those of No. 21716. L2 is wider than L1. S1 is much wider than ES and the auxiliary saddles are relatively low and rounded at the top.

Hypotype No. 6450 (Pl. VI, figs. 2a, b; Fig. 13c), paratype of *Longobardites canadensis*, although just a medium-sized specimen and entirely phragmocone, illustrates very well the oxycone shape of this species, the very gently convex almost flat convergent sides, and the acute venter. The surface is too poorly preserved to record growth lines. It is too large a specimen to determine whether the inner whorls are smooth, costate, or tuberculate. The proportions and slenderness of the saddles are closer to those of No. 21716 than to those of No. 21715.

Hypotype No. 9581 (Pl. VI, figs. 3a, b; Fig. 13d) illustrates an extreme in slenderness of saddles and, with the saddles of No. 21715, records the range

of variation in the suture line of this species. Aside from this, no important variation occurs in the larger and more mature specimens of this species. It is in the inner whorls that the maximum variation in ornament and shape of shell is observed.

An early carinate-tuberculate stage of growth and a transition towards an almost smooth oxycone stage are recorded in the ultimate whorl of GSC No. 6466, the original holotype of *Longobardites intornatus* (Pl. VI, figs. 4a-c.). It is all phragmocone. The adapical part of the ultimate whorl is much thicker than it is high and has rounded sides, a rounded ventral shoulder, and a well-defined keel bordered by ventral furrows on either side. Distantly spaced tubercles occupy the inner part of the sides. Anteriorly the whorl rapidly becomes thinner and more compressed so that at the adoral end the whorl section is almost that of an oxycone, with moderately convex converging sides and sharpened venter, although there is some configuration of a keel remaining. The umbilical shoulder is almost angular at the adoral end. At this end the shell is moderately involute, the degree of involution increasing with growth, as recorded by the above measurements of this specimen. The tubercles disappear, are succeeded by short distant ribs on the inner sides, and finally decline at the adoral end to faint costae, which follow a falcoid line or direction. The suture line shows significant changes with growth. At the adapical end of the ultimate whorl the saddle in the EL is about half as high as ES, which is fairly high and narrows a little at the top. S1 is smaller than ES and S2 smaller than S1. L2 is smaller than L1. Anteriorly L2 becomes about as large as L1 so that the suture line is approaching that of a typical *Longobardites*.

Hypotype No. 9582 (Pl. VI, figs. 5a, b), the original "plesiotype" of *Longobardites intornatus* is a small specimen, 25 mm in diameter, entirely phragmocone. The adapical end of the ultimate whorl is compressed, being somewhat higher than it is thick, and has well-rounded sides, rounded ventro-lateral shoulders, and a well-defined keel bordered by ventral furrows. Stout radial ribs are present on the inner half of the sides. Anteriorly the whorl becomes more compressed and at the adoral end it is much higher than it is thick, and has gently convex converging sides and a sharp keel, set off by very shallow ventral furrows. The umbilical shoulder is well defined and narrowly rounded. At this stage the stout ribs have declined to low costae, least defined on the inner half of the whorl. The growth lines are falcate. At the adapical end, S1 and S2 of the suture line are progressively smaller than ES, the auxiliary saddles are small, and L1 is larger than L2. It has not therefore reached the stage of a *Longobardites* "pseudoadventitious" suture line. The suture line at the adoral end has not been prepared. Although this is a smaller specimen than No. 6466 it is more involute and in this character at a more advanced ontogenetic stage. It shows stout ribs rather than tubercles but the ornament of the innermost whorls of No. 8582 is not known.

Hypotype No. 6449, the original holotype of *Longobardites canadensis* (Pl. VI, figs. 1a-c), is larger than hypotypes 6466 and 9582 and smaller than 6450. It is entirely phragmocone. It is a very involute oxycone with gently convex sides,

sharp venter, very small umbilicus, and well-defined rounded umbilical shoulder. At the posterior end of the ultimate whorl are faint low costae. The remainder of the shell appears to be smooth; however, the surface is not preserved.

Genus *Grambergia* Popov¹

Grambergia mctaggarti (McLearn)

Plate VIII, figures 8a, b; Figure 14

Longobardites mctaggarti McLearn, 1946a, p. 16, Appendix II, p. 2, pl. II, fig. 5.

'Hungarites' mctaggarti McLearn, 1948, p. 21, pl. II, fig. 5, pl. X, figs. 1, 2.

Material. The holotype, GSC No. 6474, is from the Toad Formation, south side Liard River, 2 miles below the mouth of Toad River (GSC loc. 10660).

Description. The holotype includes less than one half of the ultimate whorl and is entirely phragmocone. Part of the penultimate whorl is also exposed. The ultimate whorl, at a diameter of at least 55 mm, is very involute, and compressed, with gently convex almost flat convergent flanks and an acute venter. The surface, which is poorly preserved, is smooth or nearly so. The ventral saddle on EL is high and wide. ES is high, L1 is longer than EL, S1 is higher and wider than ES, L2 is about as wide as L1, S2 is much smaller than S1. In addition there are about 5 auxiliary lobes and saddles.

The adoral part of the penultimate whorl is somewhat higher than it is thick, has convergent convex flanks and an acute venter, and is apparently smooth. The adapical part of this whorl is quite different. It is depressed, much thicker than it is high, and has a wide umbilicus; it is a depressed cadicone. It bears a well-defined ventral keel, bordered by two lateral furrows and two low lateral keels, all on the wide convex venter. On the flanks are short ribs ending in poorly defined ventro-lateral tubercles. On the venter they are low and continuous and extend forward, one from each tubercle. The shell passes from a keeled and ribbed cadicone to a smooth oxycone.

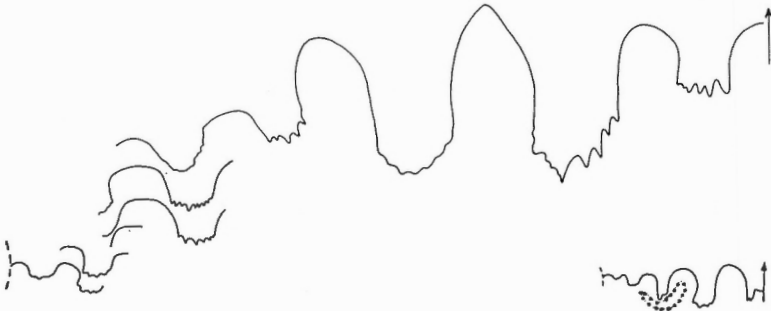


FIGURE 14. Suture lines of *Grambergia mctaggarti* (McLearn) (x3). Holotype, GSC No. 6474. Upper figure of outer whorl, lower figure of inner whorl.

¹See Introduction, p. 2.

Comparisons. Compared with the "intornatus variants" of *Longobardites nevadanus*, the inner whorls of this species have a cadicone form and not one, but three, ventral keels. The suture line (Fig. 14) is intermediate between the pseudoadventitious line of *Longobardites nevadanus* and a normal suture line. Distinguishing features are the very large S1 and the small S2.

Grambergia tetsaensis n. sp.

Plate VII, figures 1-5; Figure 15

Material. The holotype, GSC No. 21721, is from the Toad Formation on "Cameron Hill", Tetsa River valley (GSC loc. 10732). The paratypes, GSC Nos. 21717, 21718, 21719, and 21720, are also from GSC loc. 10732.

Measurements. Holotype: 44; 61; 25; 0. Paratype 21720: 40; 62; 22; 0. Paratype 21719: 32.5; 62; 28; 0. Paratype 21718: 13; 46; 31; 19. Paratype 21717: at 9; 51; 44; 28.

Description. The ultimate whorl of the holotype (Pl. VII, figs. 5a-c) comprises nearly three-quarters of a whorl of phragmocone and the remainder is body chamber. It is compressed and very involute. At the adapical end of the ultimate whorl the venter, although narrowly rounded, bears a small but definitely distinct keel. The flanks are smooth except for the presence of slightly falcate costae or striae. At the adoral end the keel has disappeared and the venter is the acute one of an oxycone. The surface bears faint costae or striae. The ceratitic suture line has a rather wide EL, wide rather low ventral saddle, a high ES and S1, a lower S2, L1 longer than EL, L2 about as wide as L1 but a little shorter, and apparently two small auxiliary saddles and lobes near the umbilical shoulder. The lobes are finely denticulate.

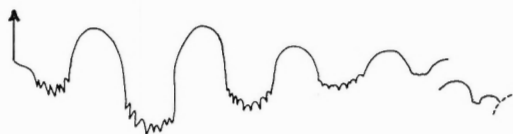


FIGURE 15

Suture lines of *Grambergia tetsaensis* n. sp. (x3). Holotype, GSC No. 21721.

Paratype No. 21720 (Pl. VII, figs. 1a-c), of which at least three-quarters of the ultimate whorl is phragmocone, is smaller than the holotype, is similarly compressed and similarly very involute. At the adapical end of the ultimate whorl the ventral keel is distinct although small, and there is some suggestion of a ventrolateral shoulder. Adorally the keel declines but is still faintly recognizable at the adoral end. The venter is progressing towards the acute form of an oxycone. Faint falcate costae and growth lines appear on the surface of the shell. The suture line is similar to that of the holotype.

Paratype No. 21719 (Pl. VII, figs. 4a, b) at a diameter of 30 mm is compressed and very involute. The ventral keel is well defined and a late enough stage is not attained for development of an acute venter. Faint low radial ribs or costae occur on the inner flanks.

Paratype No. 21717 (Pl. VII, figs. 2a, b) attains a diameter of about 11 mm. Compared with the later stages of growth recorded by the specimens already described, the adapical part is not so compressed, as the height of the whorl is only a little greater than its thickness; it is less involute, the venter is broadly rounded, it bears a distinct ventral keel, and there is a very broadly rounded ventro-lateral shoulder. The inner part of the flanks bears short radial ribs. The adoral end is crushed but is more compressed and the venter more acute.

Paratype No. 21718 (Pl. VII, figs. 3a, b) is a little larger than No. 21717. At the adapical end of the ultimate whorl the height of whorl is about equal to the thickness, the broadly arched venter bears a small keel, and the flanks have faint ribs dividing in pairs. At the adoral end, the whorls are more compressed but there is still some definition of a ventro-lateral shoulder, a rounded venter, and a small but definite ventral keel. Faint falcate ribs or costae persist to this stage.

From early to late whorls, the whorl segment passes from a rounded section about as high as it is thick, with a rounded broad venter, a keel, and faint ribs on the flanks, to a much more compressed and involute whorl section, with reduction or loss of ventro-lateral shoulder, an acute keel, and a more or less smooth surface, i.e., to a smooth oxycone.

Comparisons. Comparison with *Grambergia ovinus* (McLearn) is given below.

Grambergia ovinus (McLearn)
Plate VII, figures 7a, b; Figure 16

'*Hungarites*' *ovinus* McLearn, 1948, p. 24, Supplement, p. 2, pl. XII, figs. 1, 2.
'*Longobardites*' *ovinus* (McLearn), McLearn, 1951, p. 8.

Material. The holotype, GSC No. 9591, is from the Toad Formation, south side of Chischa River, 6 miles above Muskwa River (GSC loc. 10733).

Measurements. Holotype: 56; 57; 25; 7. 70; - ; - ; - .

Description. The holotype, a large but incomplete specimen, is entirely phragmocone and the entire specimen was of course much larger. It is a compressed, very involute, acute-ventered oxycone with an apparently smooth surface. A part of the antepenultimate whorl can be seen by breaking the specimen; it appears to be fairly stout and thick with a rounded venter and a small ventral keel. The suture line (Fig. 16) has fairly high saddles and long lobes.

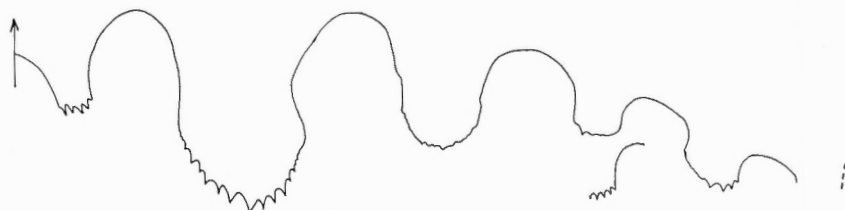


FIGURE 16. Suture lines of *Grambergia ovinus* (McLearn) (x3). Holotype, GSC No. 9591.

Comparisons. This species resembles *Grambergia tetsaensis* n. sp. in the long saddles and lobes and in the smooth adult surface. The inner whorls however, at an equivalent stage of growth, are not as compressed and the venter is not as sharp. These two species may be closely related however.

Grambergia mackenzii (McLearn)

Plate VII, figures 6a, b; Figure 17

'*Hungarites*' *mackenzii* McLearn, 1948, p. 22, Supplement, p. 1, pl. XII, fig. 3.

'*Longobardites*' *mackenzii* (McLearn), McLearn, 1951, p. 8.

Material. The holotype, GSC No. 9584, is from the Toad Formation, north side of Chischa River, 6 miles above Muskwa River (GSC loc. 10736).

Description. The holotype is incomplete, comprising less than one half of the ultimate whorl, mostly phragmocone, and a small part of the penultimate whorl. The ultimate whorl is that of an oxycone, compressed, with an acute venter, converging flanks, and a very small umbilicus. The flanks are smooth except for some faint costae. The penultimate whorl is much thicker than the ultimate and much less compressed, with a rounded ventro-lateral shoulder and a large umbilicus. It has a well defined although small keel. Fine ribs or costae are present on the flanks. The suture line (Fig. 17) has a wide EL and ventral saddle, and a wide finely denticulated L1, deeper than EL. The saddles are low, wide, and rounded at the top. S1 is smaller than ES and S2 smaller than S1.

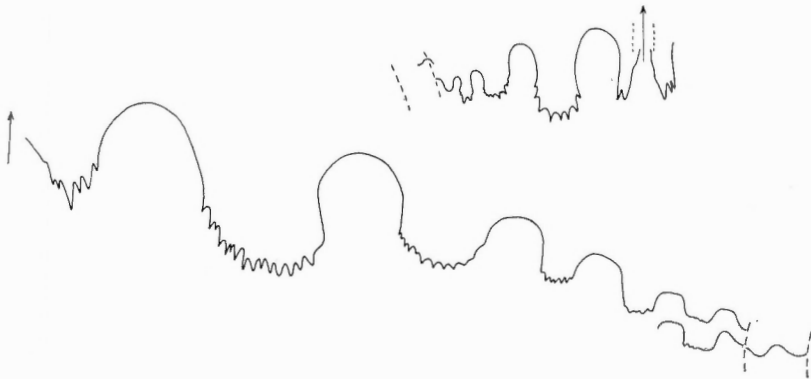


FIGURE 17. Suture lines of *Grambergia mackenzii* (McLearn) (x3). Holotype, GSC No. 9584. Upper figure of inner whorl, lower figure of outer whorl.

Comparisons. Compared with *Grambergia tetsaensis* n. sp. and *Grambergia ovinus* (McLearn), the saddles are lower, the lobes shorter, and the stage with thick whorls, rounded ventro-lateral shoulders, and ventral keel persists later in the ontogeny.

Grambergia nahwisi (McLearn)
Plate VII, figures 8a, b; Figure 18

'*Hungarites*' *nahwisi* McLearn, 1948, p. 24, Supplement, p. 2, pl. XII, figs. 4, 5.
'*Longobardites*' *nahwisi* (McLearn) McLearn, 1951, p. 8.

Material. The holotype, GSC No. 9590, is from the Toad Formation, south bank of Liard River, about 2 miles below the mouth of Toad River (GSC loc. 10660).

Measurements. Holotype: at 60; 57; 24; 5.

Description. (McLearn, 1948, p. 24).

Only the holotype is known, of which about one half whorl of living chamber is preserved.

The antepenultimate whorl, at a diameter of about 14 mm. is compressed, involute, with narrowly rounded venter and smooth surface.

The penultimate whorl is involute, compressed, sharp-ventered, and smooth.

The ultimate whorl, as preserved, is involute, compressed, sharp-ventered and almost smooth; the surface has fine sigmoidal lines of growth.

The saddles of the suture line are low and wide, the lobes are short and wide, very finely indented at their bases. L1 is larger than L2; ES is not much larger than S1, but S1 is larger than S2; about three auxiliary lobes and saddles are present.

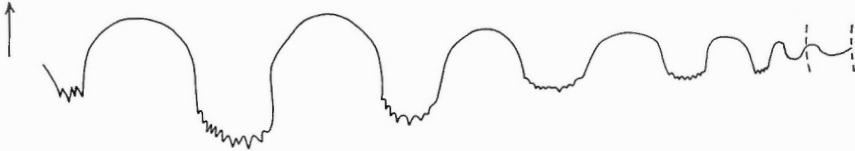


FIGURE 18. Suture line of *Grambergia nahwisi* (McLearn) (x3). Holotype, GSC No. 9590.

Comparisons. "The venter is sharper and the number of auxiliary lobes and saddles is larger than in *Hungarites involutus* var. *laevis* Kiparisova" (McLearn, 1948). The lobes are shorter, saddles lower, and inner whorls more compressed than those of *Grambergia mackenzii* (McLearn), *Grambergia ovinus* (McLearn), and *Grambergia tetsaensis* n. sp.

Genus *Lenotropites* Popov¹

Lenotropites tardus n. sp.

Plate VIII; figures 1-3; Figure 19

Material. The holotype, GSC No. 21723, and the paratypes, GSC Nos. 21722 and 21724, are from the Toad Formation, from a small tributary of Tetsa River from the south, joining Tetsa River south of Mile Post 372, Alaska Highway (GSC loc. 36446).

Measurements. Holotype: 32; 59; 36; 20. Paratype 21722: at 25; 52; 48; 28. Paratype 21724: 39; 53; 30; 16.

¹ See Introduction, p. 3.

Description. The ultimate whorl of the holotype (Pl. VIII, figs. 2a-c) is mostly body chamber. At the adapical end it is about as thick as it is high with rounded flanks, well-rounded ventro-lateral shoulders, wide venter, a well-defined keel, and shallow ventral furrows. Short coarse ribs and large tubercles occur on the flanks. At the adoral end the shell is moderately involute and the whorl is much higher than it is thick; the flanks are convergent and gently convex; the ventro-lateral shoulder is rounded; and the keel is much reduced. Low flat ribs are present on the inner flanks and die out on the outer flank. Growth lines are convex on the flanks and nearly radial on the ventro-lateral shoulders and venter. Thus the ultimate whorl passes from thick to compressed, the venter from wide to narrow, the flanks from more or less parallel to convergent, with reduction in strength of keel and ribs.

Paratype No. 21722 (Pl. VIII, figs. 1a, b) is about the same size as the holotype. The adoral quadrant of the ultimate whorl is body chamber and is crushed. The adapical end of the ultimate whorl is about as high as it is thick; the flanks, ventro-lateral shoulder, and venter are rounded. The ventral keel is distinct with shallow ventral furrows. Short stout ribs and tubercles are much as in the holotype. The adoral end appears to have been smooth but because of crushing the shape cannot be determined. The suture line is illustrated by Figure 19.

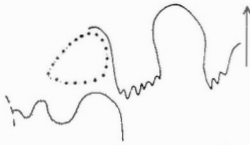


FIGURE 19

Suture line of *Lenotropites tardus* n. sp. (x3). Paratype, GSC No. 21722. The inner broken line is at or near the umbilical seam.

Paratype No. 21724 (Pl. VIII, figs. 3a, b) is a little larger than the holotype and paratype No. 21723. At the adapical end the ultimate whorl is a little higher than it is thick, and has gently convex flanks, rounded ventro-lateral shoulders, convex venter, a ventral keel, and irregular lateral ribs or folds, which are a little convex on the sides. At the adoral end the shell is moderately involute, the whorl is much higher than it is thick, and has convergent gently convex flanks, faint ventro-lateral shoulders, and a reduced keel. The flanks are nearly smooth with nothing more than faint irregular costae or fine folds.

In all specimens the ontogenetic trend is from thick stout whorls with lateral ribs or tubercles and well-defined keel, to a more compressed whorl with convergent flanks, with a weak keel, or with a rather acute venter, and to an almost smooth surface. There is considerable variation in the stoutness of the whorls and, in the ribbed stage, in the strength of ribbing and the presence of tubercles.

Comparisons. The specimens of this species resemble closely the inner whorls of "*Longobardites intornatus* McLearn" (= *Longobardites nevadanus*, Hyatt and Smith). The keeled, ribbed, or tuberculate stage is retained to a much later stage of growth in *Lenotropites tardus*. The members of the new species are in a sense

“larval” adults. All known specimens do not reach the stage of an oxycone but merely become more compressed and acute-ventered with growth.

Lenotropites larvalis (McLearn)¹

Plate VI, figures 8a, b; Figure 20

Longobardites larvalis McLearn, 1948, p. 20, Supplement, p. 1, pl. IX, figs. 3, 4; 1951, p. 9.

Material. The holotype, GSC No. 9583, is from the Toad Formation, west of Mile Post 375, Alaska Highway, Tetsa River valley (GSC loc. 10696).

Description. The holotype, and only known specimen, of which only one side and the venter is preserved, is small. It is mostly phragmocone and moderately evolute. The stout ultimate whorl, somewhat thicker than it is high, has rounded flanks, well-rounded ventro-lateral shoulders, and a wide venter, with a ventral keel bordered by well-defined furrows. On the flanks are large irregular fairly wide-spaced spines, bullae, and tubercles. A fine strigate ornament is also present. The ceratitic suture line has deep slender saddles and long lobes (Fig. 20).

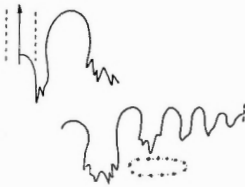


FIGURE 20.

Suture line of *Lenotropites larvalis* (McLearn) (x3). Holotype, GSC No. 9583. The inner broken line indicates the position of the umbilical seam.

Comparisons. At equivalent size this shell is more evolute than *Lenotropites tardus* n. sp., and the ornament on the flanks is more irregular and consists of bullae and spines rather than ribs. It probably does not record the adult stage, and whether with growth it passes to a more compressed shell with reduced ornament like *Lenotropites tardus* is not known.

Lenotropites caurus (McLearn)

Plate VIII, figures 4–7; Figure 21

'Hungarites' caurus McLearn, 1948, p. 22, Supplement, p. 1, pl. XI, figs. 1, 2.

'Longobardites' caurus (McLearn), McLearn, 1951, p. 9.

'Hungarites' boreas McLearn, 1948, p. 22, Supplement, p. 2, pl. XI, figs. 3, 4.

'Longobardites' boreas (McLearn), McLearn, 1951, p. 9.

'Hungarites' dawsoni McLearn, 1948, p. 23, Supplement, p. 2, pl. X, figs. 8, 9.

'Longobardites' dawsoni (McLearn), McLearn, 1951, p. 9.

Material. The holotype, GSC No. 9585, is from the Toad Formation, south side of Liard River, about 2 miles below the mouth of Toad River (GSC loc. 10660). The hypotype, GSC No. 9586 (=holotype of *'Hungarites' boreas* McLearn), is also from GSC loc. 10660. The hypotype, GSC No. 9587 (=holotype

¹Tozer (1967, p. 24) tentatively retains this species in *Longobardites* because the suture line, with three auxiliary lobes, is longer than that of *Lenotropites tardus* McLearn n. sp. and *Lenotropites caurus* (McLearn).

of *'Hungarites' dawsoni* McLearn), is from the Toad Formation, north side of Chischa River, 6 miles above Muskwa River (GSC loc. 10736).

Measurements. Holotype: 20.5; 49; 32; 25. Hypotype, GSC No. 9586: at beginning of last quadrant: 25.5; 49; 40; 25. Hypotype, GSC No. 9587: 48; 55; 33; 14.

Description. The holotype (Pl. VIII, figs. 4a, b), of which a little more than one half of the ultimate whorl is body chamber, is small, compressed, and moderately involute. The adapical part of the ultimate whorl is depressed, much thicker than it is high, with convex flanks, rounded umbilical and ventro-lateral shoulders, wide venter, well-defined ventral keel, and shallow ventral furrows. On the flanks are short, rather stout ribs, partly but not altogether of the same size. Adorally the whorl increases in proportional height and becomes compressed, with height much greater than thickness; the flanks become somewhat flattened; the ventro-lateral shoulders are well-defined, although rounded; the keel is retained, but is smaller; and the ribs become longer, more slender, and convex.

The ultimate whorl of the hypotype, No. 9586 (Pl. VIII, figs. 6a, b), comprises an adoral quadrant, all body chamber, and an adapical quadrant, all phragmacone. The adapical quadrant is about as thick as it is high, has convex flanks, well-rounded ventro-lateral shoulder, a well-defined ventral keel, and ventral furrows. On the flanks are stout nearly straight ribs. The adoral quadrant is more compressed, being much higher than it is thick; the flanks are only gently convex, the ventro-lateral shoulder is rounded; the ventral keel is small; the umbilical shoulder is rounded; and the ribs are weak, narrow and convex.

Hypotype No. 9587 (Pl. VIII, figs. 7a, b) is larger than the holotype and hypotype 9586. Parts of the second and third quadrants of the ultimate whorl are missing. The adapical end of the ultimate whorl is fairly stout, but somewhat higher than it is thick, has somewhat convex flanks, a well-rounded ventro-lateral shoulder, and a small ventral keel. On the inner half of the flanks are thick ribs that flatten and disappear towards the ventral keel. The adoral end of this whorl is more compressed, much higher than it is thick, involute with well-defined ventral shoulder, and convex but almost fastigate venter and faint keel. The ribs are declining and consist of low falcate ribs or folds. "The suture line is not fully known; it is simple and ceratitic. ES is larger than S1 and L1 is much larger than L2" (McLearn, 1948, p. 23) (*See Fig. 21*).

Variation. This species exhibits a wide range of variation. All specimens, however, pass from a stage of stout depressed whorls to a stage of compressed whorls with reduction of the keel and disappearance of the ventral furrows. The venter in one specimen approaches a fastigate form. In no known specimens however, is there a close approach to an oxycone. All specimens, at some stage, possess fairly long, lateral, single ribs, which decline in strength and increase in convexity towards the aperture. Particularly variable is the diameter at which compression of the whorl, loss of ventral furrows, and reduction of the keel begins.

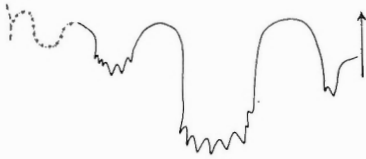


FIGURE 21

Suture lines of *Lenotropites caurus* (McLearn) (x3). Upper figure, GSC No. 9587, holotype of "*Hungarites*" *dawsoni* McLearn. The inner broken line indicates the position of the umbilical shoulder. Middle figure, holotype, GSC No. 9585. The inner broken line is at, or near the umbilical seam. Lower figure, topotype, GSC No. 21725. (GSC loc. 42339).



Comparisons. In *Groenlandites nielsenii* Kummel the shell passes to a stage with a trigonal section, rather than to a compressed whorl of *Lenotropites caurus*. Also the keel of *Groenlandites* is not conspicuous at any stage.

Genus *Czekanowskites* Diener¹

Czekanowskites hayesi (McLearn)

Plate I, figures 4–8; Figure 22

Ceratites? *hayesi* McLearn, 1946a, p. 18, Appendix II, p. 2, pl. I, fig. 2; 1948, p. 35, pl. I, fig. 2.

Ceratites? *hayesi* var. *angulatus* McLearn, 1946a, p. 19, Appendix II, p. 2; 1948, p. 35.

Ceratites? *hayesi* var. *pinguis* McLearn, 1946a, p. 19, Appendix II, p. 2; 1948, p. 35.

Material. The holotype, GSC No. 6478, is from talus derived from the Toad Formation, east of Mile Post 378, Alaska Highway, Tetsa River valley (GSC loc. no. erased). The hypotype, GSC No. 6476 (= holotype of *Ceratites?* *hayesi* var. *angulatus*), is from talus derived from the Toad Formation, on "Cameron Hill", Tetsa River valley (GSC loc. no. erased). The hypotype, GSC No. 6477 (= holotype of *Ceratites?* *hayesi* var. *pinguis*), is from talus derived from the Toad Formation on the north side of the Alaska Highway, east of Mile Post 378 (GSC loc. no. erased). The hypotype, GSC No. 21698, is from talus derived from the Toad Formation, north side of the Alaska Highway, east of Mile Post 378 (GSC loc. 10706). The hypotype, GSC No. 21699, is from the Toad Formation, three-quarters of a mile up "Four Fall Creek", a tributary of Bat Creek (GSC loc. 16008).

Measurements. Holotype: 27.5; 40; 35; 31. Hypotype, GSC No. 6476: 23; 43; 30; 28. Hypotype, GSC No. 21698: 24; 29; 33; 33. Hypotype, GSC No. 21699: 34; 44; 44; 26.

¹ See Introduction, p. 3.

Description. The holotype (Pl. I, figs. 7a–c) is somewhat compressed and moderately involute. The whorl at the adoral end is stout and nearly rectangular, a little higher than it is thick, and has flattened flanks, distinct narrowly rounded ventro-lateral shoulder, tabulate venter, and well-rounded umbilical shoulder. On the flanks are stout straight ribs, projected a little on the ventro-lateral shoulder. The wide ventral area is smooth except for the presence of a hair-like keel. At the adapical end of the ultimate whorl the flanks and venter are more rounded and the ventro-lateral shoulder less distinct. The ceratitic suture line (Fig. 22) comprises a large ES and also S1, and a small S2 is on the umbilical shoulder. L1 is large and L2 small.



FIGURE 22

Suture line of *Czekanowskites hayesi* (McLearn) (x3). Holotype, GSC No. 6478.

Hypotype No. 21699 (Pl. I, figs. 8a–c) is much larger than the holotype but resembles it, and has also attained a mature stage of growth, although not necessarily its maximum size. It is a moderately evolute shell with stout rectangular whorl at the adoral end, and with an angular ventro-lateral shoulder. Here stout radial ribs occur on the flanks and are curved forward a little on the ventro-lateral shoulder. At the adapical end of the ultimate whorl the venter and ventro-lateral shoulders are more rounded than at the adoral end. A faint thread-like keel occupies the centre of the venter at this stage.

Hypotype No. 6476 (Pl. I, figs. 5a, b) is a little smaller. At the adoral end the whorl is compressed and much higher than it is thick; the flanks are flattened; the ventro-lateral shoulders are angular; and the narrow venter is tabulate. A fine thin keel occupies the centre of the venter. The adapical end of the ultimate whorl is not so well preserved. At this stage, however, the venter is more rounded and the ventro-lateral shoulder not so well defined as at the adoral end.

The small hypotype, No. 6477 (Pl. I, figs. 4a, b), includes about one half whorl of body chamber. It has highly depressed whorls with the thickness much greater than the height, so that the nearly flat venter is very wide. The flanks are gently convex with short, stout, radial ribs, and the umbilical shoulder is rounded.

All shells, of whatever degree of compression, pass from a stage with a rounded venter and poorly defined ventro-lateral shoulders to one of well-defined ventro-lateral shoulders and tabulate flat venter.

Variation. This is a highly variable species, particularly in the degree of compression of the shell.

Comparisons. The specimens like the holotype resemble *Czekanowskites gastroplanus* Popov in form of shell and whorl section. *Czekanowskites hayesi* is smaller, however, and the tabulate venter appears at a smaller diameter.

Genus *Arctohungarites* Diener*Arctohungarites bufonis* (McLearn)

Plate VIII, figures 9–11; Figure 23

'*Hungarites*' *bufonis* McLearn, 1948, p. 24, Supplement, p. 2, pl. X, figs. 4–6.
 'Longobardites' *bufonis* (McLearn), McLearn, 1951, p. 8.

Material. The holotype, GSC No. 9588, is from the Toad Formation, south side of Liard River, about 2 miles below the mouth of Toad River (GSC loc. 10660). The paratype, GSC No. 9589, and the hypotype, GSC No. 21726, are also from GSC loc. 10660.

Measurements. Holotype: 44.5; 56; 27; 7.

Description. The holotype (Pl. VIII, figs. 11a, b) is one of the largest specimens in the collection. About three-quarters of the ultimate whorl is apparently body chamber. It is compressed and very involute. At the adapical end of the ultimate whorl the height is much greater than the thickness; the inner flanks are gently rounded; the outer flanks are rounded to form a poorly defined ventro-lateral shoulder. The convex venter bears a very low keel. The surface is covered with faint costae and striae and lines of growth. The adoral end of the ultimate whorl is similar to the adapical end, but the ventro-lateral shoulder is a little better defined, the venter is a little wider, and the keel is somewhat weaker. Low ribs, best defined on the inner flanks, striae, and lines of growth are a little convex on the flanks and radial or a little produced forward as they approach the venter.

The paratype (Pl. VIII, figs. 10a–c) is 30 mm in diameter and is entirely phragmocone. It is compressed and very involute, with a rather poorly defined rounded ventro-lateral shoulder, narrow convex venter, and a low small keel. In the adapical part of the ultimate whorl are short fairly faint ribs; on the adoral part are faint low ribs and furrows, best defined on the inner flanks, and lines of growth, a little convex on the flanks and produced forward on the outer flanks and shoulder. ES and S1 are high and slender, S2 is much smaller and there is a small auxiliary saddle near the umbilical shoulder. L1 is long and wide, finely denticulate at the base. L2 is wide but shorter than L1 and finely denticulate. The auxiliary lobe is rather wide, but shallow.

Hypotype No. 21726 (Pl. VIII, figs. 9a, b) is a small specimen about 10 mm in diameter. It is compressed, involute; the ventro-lateral shoulder is round and fairly distinct. At the adoral end the keel is small but distinct. It is almost smooth.

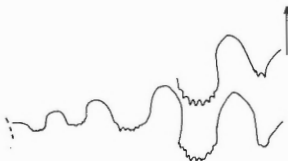


FIGURE 23

Suture line of *Arctohungarites bufonis* (McLearn) (x3). Paratype, GSC No. 9589.

Comparisons. The inner whorls resemble those of *Grambergia tetsaensis* but the venter of *Arctohungarites bufonis* is wider and, at maturity, instead of retaining a sharp venter, the venter widens and the ventro-lateral shoulder is retained. There is some resemblance to the shells described as *Hungarites involutus* var. *laevis* Kiparisova, from the mouth of the Olenek River in the Soviet Arctic. It has not been possible, however, to compare actual specimens. The saddles of the suture line are higher and more slender. *Arctohungarites bufonis* was at first compared with "*Dalmatites*" *parvus* Smith; it is quite different, however, at maturity and does not reach an oxycone form.

Family MEGAPHYLLITIDAE Mojsisovics

Genus *Parapopanoceras* Haug

Parapopanoceras tetsa McLearn¹

Plate IX, figures 1–8; Figure 24

Parapopanoceras tetsa McLearn, 1946a, p. 8, Appendix II, p. 1, pl. II, fig. 6; 1948, p. 9, pl. II, fig. 6, pl. IX, fig. 1.

Parapopanoceras tetsa var. *praematurum* McLearn, 1946a, p. 9, Appendix II, p. 1, pl. III, fig. 2.

Parapopanoceras praematurum McLearn, 1948, p. 11, Supplement, p. 1, pl. III, fig. 2, pl. VIII, fig. 4.

Parapopanoceras medium McLearn, 1948, p. 10, Supplement, p. 1, pl. VIII, figs. 1–3.

Parapopanoceras normale McLearn, 1948, p. 10, Supplement, p. 1, pl. VIII, figs. 7, 8; pl. IX, figs. 5, 6.

Parapopanoceras obesum McLearn, 1948, p. 10, Supplement, p. 1, pl. VIII, figs. 5, 6.

Parapopanoceras selwyni McLearn, 1948, p. 11, Supplement, p. 1, pl. IX, figs. 7–9.

Material. The holotype, GSC No. 6440, and the paratype of *Parapopanoceras normale* McLearn, GSC No. 9575, are from talus derived from the Toad Formation, west of Mile Post 375, Alaska Highway, Tetsa River valley (GSC loc. 10695). The holotype of *Parapopanoceras praematurum* McLearn, GSC No. 6441, is from talus derived from the Toad Formation, east of Mile Post 378, Alaska Highway, Tetsa River valley (GSC loc. 10730). The holotype of *Parapopanoceras medium* McLearn, GSC No. 9577, is from the Toad Formation of "Cameron Hill", east of Mile Post 378, Alaska Highway, Tetsa River valley (GSC loc. 10712). The paratype of *Parapopanoceras medium* McLearn, GSC No. 9578, is from talus derived from the Toad Formation, north side of Alaska Highway, east of Mile Post 378 (GSC loc. 10706). The holotype of *Parapopanoceras normale* McLearn, GSC No. 9574, is from the Toad Formation of "Cameron Hill", east of Mile Post 378, Alaska Highway (GSC loc. 10732). The holotype of *Parapopanoceras obesum* McLearn, GSC No. 9576, is from the Toad Formation, north side of Liard River, 8 miles southwest of the mouth of Toad River (GSC loc. 10659). The holotype of *Parapopanoceras selwyni* McLearn, GSC No. 9579, is from the Toad Formation, east of Mile Post 378, Alaska Highway (GSC loc. no. erased). The paratype of *Parapopanoceras selwyni* McLearn, GSC No. 9580, is from talus derived from the Toad Formation, north side of Alaska Highway, east of Mile Post 378 (GSC loc. 10706).

¹ See p. 3 for comments on the taxonomy of *Parapopanoceras* from British Columbia.

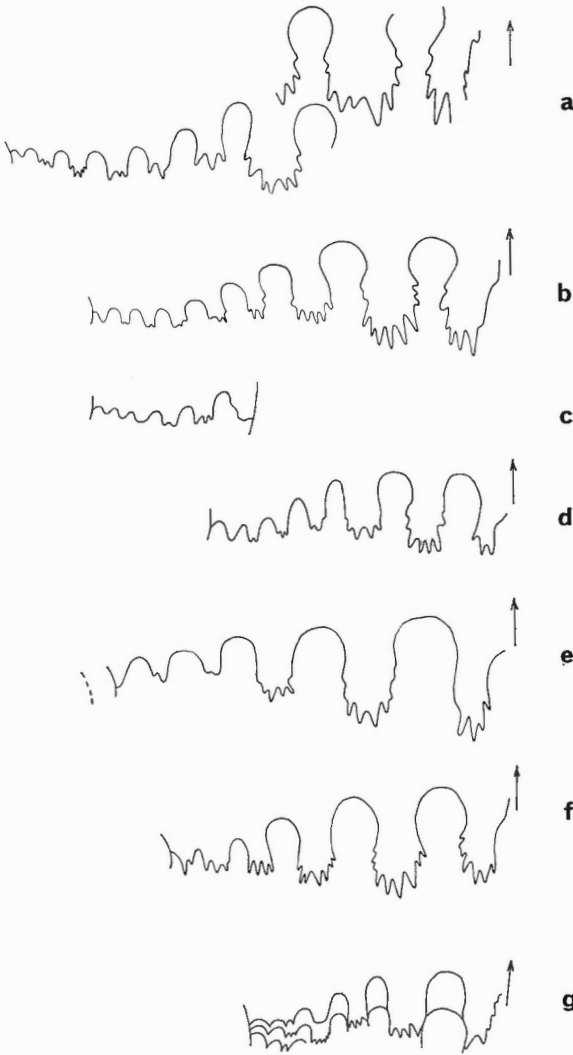


FIGURE 24

- Suture lines of *Parapopanoceras* (x3).
 a. GSC No. 9575, paratype of *Parapopanoceras normale* McLearn, third and fourth septa from body chamber.
 b. GSC No. 22733, topotype of *Parapopanoceras tetsa* McLearn, seventh septum from body chamber. (GSC loc. 10695) (Reversed)
 c. GSC No. 6440, holotype of *Parapopanoceras tetsa* McLearn, fourth septum from body chamber, exposed only between last umbilical seams.
 d. GSC No. 9578, paratype of *Parapopanoceras medium* McLearn, fourth septum from body chamber.
 e. GSC No. 9580, paratype of *Parapopanoceras selwyni* McLearn, last septum.
 f. GSC No. 22734, topotype of *Parapopanoceras obesum* McLearn, third septum from body chamber. (GSC loc. 42406) (Reversed)
 g. GSC No. 22735, topotype of *Parapopanoceras medium* McLearn, last septa (GSC loc. 10712).

Measurements. Holotype: 60; 35; 23; 28. GSC No. 6441: 31; 40; 24; 26. GSC No. 9577: 43; 38; 25; 30. GSC No. 9575: 58.5; 41; 26; 21. GSC No. 9576: 55; 30; 32; 43 (just behind anterior end). GSC No. 9579: 47.5; 44; 27; 21 (just behind anterior end).

Description. The holotype (Pl. IX figs. 3a, b) is mostly preserved as internal mould. The inner whorls are very involute. Umbilical enlargement begins in the adoral end of the penultimate whorl and continues to the adoral end of the specimen. The ultimate whorl is compressed and moderately involute with a nearly angular venter except near the adoral end, where it is broadly rounded. As the shell is mostly removed, details of the surface are unknown, but it must have been

nearly smooth. The body chamber is a little more than one whorl in length. The aperture is bordered by a furrow on the mould. This furrow follows a concave curve on the flanks and it is produced forward on the venter. This specimen is inferred to be a mature specimen with adult characters.

GSC No. 6441 ("*Parapopanoceras praematurum*") (Pl. IX, figs. 6a, b) is small. The inner whorls are very involute and umbilical enlargement begins at about the adoral part of the penultimate whorl. The ultimate whorl is much compressed and moderately involute, with an almost angular venter, which extends to the adoral end of the specimen. This specimen does not record a broadening of whorl at the adoral end as in the holotype, but the end is obviously broken off, which may explain the absence of this character. In this variant, umbilical enlargement and angulation of the venter begins at a much earlier diameter than in the holotype, which may explain its small size.

GSC No. 9577 ("*Parapopanoceras medium*") (Pl. IX, figs. 4a, b) is intermediate in size between Nos. 6441 and 9574, and the enlargement of the umbilicus and angulation of the venter take place at an intermediate diameter. Although crushed, it appears to have been compressed, with a very narrow and angular venter that broadens at the adoral end, so that this appears to have been an adult shell.

GSC No. 9578 ("*Parapopanoceras medium*") (Pl. IX, fig. 5) is similar to No. 9577 but smaller, probably because it is not complete, as the adoral end has been broken off. At least a quadrant of the ultimate whorl is phragmocone. In this adapical part of the whorl the venter is rounded. In the middle and adoral parts of the ultimate whorl the venter is angular. The specimen has not reached a size to record the broadened venter. The shell, where preserved, is nearly smooth and shows only fine low angular costae or striae. The suture line is illustrated. The numerous saddles are high, a little lobate, and entire, and decrease in size towards the umbilical shoulder. EL is wide with a relatively high median saddle; L1 is long, about as long as EL. The other lobes decrease in size and length toward the umbilical shoulder. All lobes are denticulate at and near the base.

GSC No. 9574 ("*Parapopanoceras normale*") (Pl. IX, figs. 8a, b) is larger than Nos. 9577 and 9578. The inner whorls are involute but umbilical enlargement begins in the adoral part, but not at the very end of the penultimate whorl. Only part of the ultimate whorl is preserved. It is compressed and moderately involute. The venter is angular except at the very adoral end of the ultimate whorl, where it is more rounded and wider.

GSC No. 9575 ("*Parapopanoceras normale*") (Pl. IX, figs. 7a, b) is a compressed neat specimen, incomplete at the adoral end. It is very compressed and moderately involute and the venter is almost acute. The suture line is similar to that of No. 9578 but the saddles are not quite so high and slender.

GSC No. 9576 ("*Parapopanoceras obesum*") (Pl. IX, figs. 9a, b) is a large specimen. The umbilical enlargement begins in the penultimate whorl. The ultimate whorl is moderately involute and has thick whorls, with a much narrowed to

angular venter, except at the anterior end where it widens and is becoming more rounded. It has much thicker whorls than most of the specimens and is less involute.

GSC No. 9579 ("*Parapopanoceras selwyni*") (Pl. IX, figs. 1a, b) is of medium size and the adoral end of the last whorl is absent. The inner whorls are very involute and umbilical enlargement begins at about the adoral end of the penultimate whorl. The ultimate whorl is compressed, and the umbilical shoulder is rather abruptly rounded. In the adapical part the venter is narrowly rounded and becomes more broadly rounded adorally.

GSC No. 9580 ("*Parapopanoceras selwyni*") (Pl. IX, figs. 2a, b) is about the same size as No. 9579. It, too, is imperfect at the adoral end. A rounded venter at the adapical end of the ultimate whorl passes to a more narrowly rounded venter adorally. The umbilical shoulder in the adapical part is abruptly rounded. The suture line resembles that of Nos. 9578 and 9575, but there are fewer saddles on the flanks, ES is larger, and the decrease in size from the venter to the umbilical shoulder is more rapid. GSC Nos. 9579 and 9580, originally described as *Parapopanoceras selwyni*, differ from all other variants in the less angular venter at any stage, in a tendency to a more distinct umbilical shoulder, and in dissimilarities of the suture line.

This is a very variable species, particularly in the diameter at which the umbilical expansion begins and in the degree of angulation of the venter. There is also variation in the degree of compression. In all complete specimens the venter widens at the adoral end and this widening apparently records the adult stage.

Comparisons. This species differs from *Parapopanoceras verneuili* (Mojsisovics) in that it has a more angular venter on the ultimate whorl and a greater length of whorl involved in umbilical expansion.

Family PINACOCERATIDAE Mojsisovics

Genus *Parapinacoceras* Diener

Parapinacoceras hagei (McLearn)

Plate X, figures 2-5; Figure 25

Gymnites hagi McLearn, 1946a, p. 13, Appendix II, p. 1, pl. I, fig. 4; 1948, p. 15, pl. I, fig. 4.
Parapinacoceras hagi (McLearn), McLearn, 1953a, p. 7.

Material. The holotype, GSC No. 6447, is from talus derived from the Toad Formation, west of Mile Post 375, Alaska Highway, Tetsa River valley (GSC loc. no. erased). The hypotype, GSC No. 21727, is from the Toad Formation, Chischa River, 9 miles south of Mile Post 372 on the Alaska Highway (GSC loc. 36657). The hypotype, GSC No. 21728, is from talus derived from the Toad

Formation, near Mile Post 376, Alaska Highway (GSC loc. 10713). The hypotype, GSC No. 21729, is from the Toad Formation, north side of Liard River, 8 miles southwest of the mouth of Toad River (GSC loc. 10659).

Measurements. Holotype: 40; 53; 17. GSC No. 21727: 57; 57; 18. GSC No. 21729: 95; 61; 11.

Description. The holotype (Pl. X, figs. 5a, b), entirely phragmocone, is relatively small, very compressed, very involute, with an acute venter. It is an oxycone. Very low flat slightly curved ribs extend a little more than half-way out on the flanks. Beyond this the ornament is finer, with low costae, projected forward as they approach the venter.

GSC No. 21727 (Pl. X, figs. 2a, b) is larger. It also is an oxycone and is entirely phragmocone. Low radial folds and striae extend across about the inner three-quarters of the flanks, beyond which faint low folds and growth lines, projected forward a little, are present.

GSC No. 21729 (Pl. X, figs. 4a, b) shows that this species grew to a fairly large size. It is an oxycone and entirely phragmocone. The ornament at this size is much reduced. Faint uneven costae are a little convex on the flanks and projected a little near the acute venter. The suture line of this specimen is quite deeply cut. ES is large, with deep denticulations. S1 is much narrower, S2 is yet smaller, and a row of auxiliary saddles is a little dependent in the inner part of the flank.

The suture line of GSC No. 21728 (Pl. X, fig. 3a; Fig. 25) contains an ES with a broad base and is deeply cut. S1 is much smaller, S2 is very small, and a long row of very small dependent auxiliary saddles is on the inner flanks.

The species name is given for C. O. Hage.

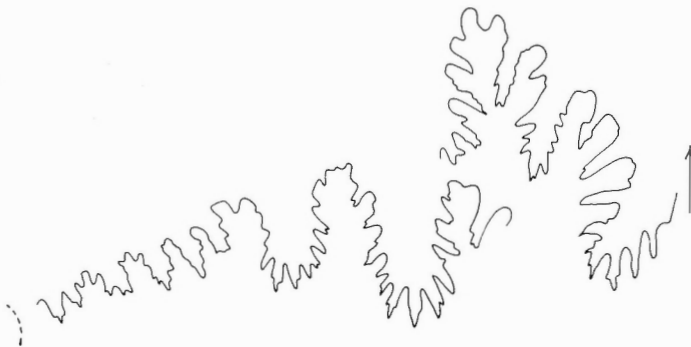


FIGURE 25

Suture lines of *Parapinaceras hagei* (McLearn) (x3). Hypotype, GSC No. 21728.

Comparisons. This species resembles a specimen figured by Salopek (1911) as a variety of *Gymnites subclausus* Hauer, but the suture line is not so complex. Also, *Gymnites subclausus* has a rounded not acute venter.

Genus *Anagymnites* Hyatt*Anagymnites via-alaska* McLearn

Plate XI, figures 2–3; Figure 26

Anagymnites involutus var. *via-alaska* McLearn, 1946a, p. 14; 1946b, p. 3, pl. VII, fig. 1.

Anagymnites via-alaska McLearn, McLearn, 1948, p. 16, pl. VII, fig. 1.

Material. The holotype, GSC No. 6446, is from talus derived from the Toad Formation, west of Mile Post 375, Alaska Highway, Tetsa River valley (GSC loc. 10693). The hypotype, GSC No. 21730, is from GSC loc. 10694.

Measurements. Holotype, at about middle of penultimate whorl: 56; 43; 21; 26.

Description. Parts of the inner whorls of the holotype are revealed when the specimen is taken apart. The penultimate whorl is compressed, moderately involute, and has an acute venter. The umbilical shoulder is rounded. The surface is apparently smooth, or nearly so, but is not well preserved. The suture line comprises a high, rather narrow ES and S1, a smaller S2, and a very small auxiliary saddle on the rounded umbilical shoulder. L1 is about as long as EL and L2 is shorter. Denticulations are moderately deep. The ultimate whorl, almost entirely body chamber, is crushed and is moderately involute. It appears to be very compressed and with an acute venter. The surface is not well preserved but is apparently covered with fairly fine varices and lines of growth.

GSC No. 21730 (Pl. XI, figs. 3a, b) is small and includes less than half the ultimate whorl. It corresponds to about the stage of the antepenultimate whorl of the holotype. It is compressed with flanks somewhat flattened on the inner part, convex and convergent on the outer part, and with an acute venter. The umbilical shoulder is rounded. The ammonitic suture line is moderately denticulated. EL is wide with a low ventral saddle; ES is wide; L1 is about as long as EL; S2 is a little smaller than S1; L2 is small. Auxiliary lobes and saddles are very small and dependent near and on the umbilical shoulder.

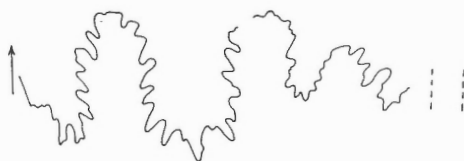


FIGURE 26

Suture line of *Anagymnites via-alaska* (McLearn) (x3). Holotype, GSC No. 6446.

Comparisons. Compared with *Anagymnites acutus* var. *involutus* Gugenberger the specimens of *Anagymnites via-alaska* are similarly involute, and very compressed, have a sharp venter, and a simple suture line with very small indentations. The saddles of the suture are wider, however, and the surface has small, irregular varices of growth.

Anagymnites cf. *A. lamarcki* (Oppel)

Plate XI, figures 1a, b; Figure 27

cf. *Ammonites lamarcki* Oppel, 1863, p. 274, pl. LXXV, fig. 3.

cf. *Gymnites lamarcki* Oppel, Diener, 1895, p. 58, pl. X, fig. 6.

Material. The figured specimen, GSC No. 21731, is from the Toad Formation, north side of Liard River, 8 miles southwest of the mouth of Toad River (GSC loc. 10659).

Description. The only specimen is entirely phragmocone and too incomplete for measurements. The rather stout ultimate whorl is higher than it is thick with convergent gently convex flanks, very narrowly rounded almost angular venter, and rounded umbilical shoulders. The surface is smooth or nearly so but is not well preserved. The stout penultimate whorl is about as thick as it is high with convergent convex sides and narrowly rounded almost angular venter and rounded umbilical shoulder; the surface appears to be smooth. ES and S1 are of about the same size, S2 is smaller, EL is longer than ES, and L2 is small. There is a dependent row of small auxiliary lobes and saddles.

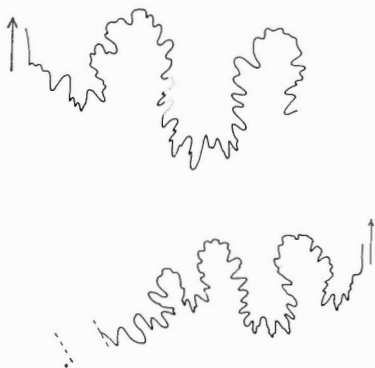


FIGURE 27

Suture lines of *Anagymnites* cf. *A. lamarcki* Oppel (x3). GSC No. 21731.

Comparisons. Compared with *Anagymnites lamarcki* (Oppel) this specimen is not so involute and there are no flat folds on the flanks. The venter may be a little more rounded and less acute.

Anagymnites hollandi (McLearn)

Plate XII, figures 1a, b

Gymnites hollandi McLearn, 1946a, p. 14; 1946b, p. 3, pl. VI, fig. 1; 1948, p. 16, pl. VI, fig. 1.

Material. The holotype, GSC No. 6448, is from the Toad Formation, south side Liard River, about 2 miles below the mouth of Toad River (GSC loc. 10660).

Measurements. Holotype, at adoral end of phragmocone: 200; 58; 20; 0.

Description. The ultimate whorl of the holotype and only known specimen comprises three quadrants of phragmocone and one of body chamber. Only one side of the body chamber is preserved. It is large, very involute, and compressed with a sharply rounded venter. The surface is smooth or nearly so. The ammonitic suture line is moderately denticulated. ES is of fair size, S1 more narrow, and S2 smaller. L1 is almost as long as EL, L2 is only a little smaller and there is a series of dependent small auxiliary lobes and saddles.

Comparisons. This species is more involute than any known species of *Anagymnites* and there are more auxiliary lobes and saddles.

Family USSURITIDAE Hyatt

Genus *Ussurites* Hyatt

Ussurites muskwa McLearn

Plate XIII, figures 1, 2; Figure 28

Ussurites muskwa McLearn, 1946a, p. 10, Appendix II, p. 1, pl. III, figs. 3, 4; 1948, p. 13, pl. III, figs. 3, 4.

Material. The holotype, GSC No. 6444, is from the Toad Formation on "Cameron Hill", Tetsa River valley (GSC loc. 10732). The hypotype, GSC No. 21733, is from the Toad Formation, Chischa River, 6 miles above Muskwa River (GSC loc. 10733).

Measurements. Holotype: 51; 40; 27; 37. GSC No. 21733: 90; 33; 24; 36.

Description. The holotype (Pl. XIII, figs. 1a, b) is of medium size, compressed, and moderately involute, with whorls much higher than they are thick, very gently convex almost flattened sides, rounded and not well-defined ventro-lateral shoulder, rounded venter, and well-rounded umbilical shoulder. The surface is covered with delicate striae or lirae, nearly straight and slightly prorsiradiate on the flanks, curved very little forward on the ventro-lateral shoulder, and almost straight across the venter. In addition narrow almost straight costae follow the striae, variably closely or more distantly spaced on the flanks and reduced on the venter.

The hypotype (Pl. XIII, figs. 2a, b) is larger than the holotype and is entirely phragmocone. Like the holotype it is compressed, moderately evolute with gently convex flanks, well-rounded not very distinct ventro-lateral shoulders, arched venter, and well-rounded umbilical shoulder. The surface ornament, as in the holotype, comprises the fine lirae and the variably spaced costae, more widely spaced at the adoral end of the ultimate whorl. EL is short but wide; ES is phylloid; L1 is tripartite, with a few coarse denticulations, much longer than EL; S1 is high and phylloid; L2 is smaller than L1; S2 is much smaller than S1. Very small lobes

and saddles are on the umbilical shoulder. The penultimate whorl is not so compressed and at the adapical end is depressed, being much thicker than it is high. There is some variation in the degree of compression; all specimens, however, are quite compressed. Variation also occurs in the number and spacing and to some extent fineness of the costae.

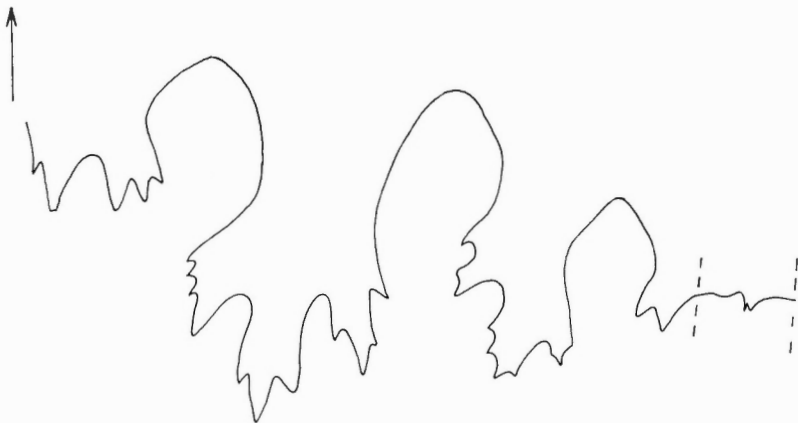


FIGURE 28. Suture line of *Ussurites muskwa* McLearn (x3). Hypotype, GSC No. 21733.

Comparisons. In compression of whorls the shells of this species are intermediate between *Ussurites hara* (Diener) and *Ussurites kingi* (Diener). The EL is shorter than in either and the venter narrower than in *Ussurites hara*. Compared with *Ussurites? decipiens* Spath the shell is not so compressed, the radial costae are more numerous and regularly spaced, the suture line is more compressed, EL is shorter, and L1 is definitely tripartite. Compared with *Ussurites yabei* (Diener) the costae are more narrow and subdued.

Ussurites arthaberi var. *cameroni* McLearn

Plate XIII, figures 3–5; Figure 29

Ussurites arthaberi var. *cameroni* McLearn, 1946a, p. 10, Appendix II, p. 1, pl. I, fig. 3, pl. II, fig. 1; 1948, p. 13, pl. I, fig. 3, pl. II, fig. 1.

Material. The holotype, GSC No. 6694, and the paratype, GSC No. 6445, are from talus derived from the Toad Formation, west of Mile Post 375, Alaska Highway, Testa River valley (GSC loc. nos. erased). The hypotype, GSC No. 21734, is from talus derived from the Toad Formation, north side of Alaska Highway, east of Mile 378 (GSC loc. 10706).

Measurements. Holotype, at adapical end of ultimate whorl: 37; 39; 39; 38. Paratype: 82.5; 37; -; 36. at 61.5; 39; 39; 36. GSC No. 21734: 56; 37; 32; 42.

Description. The holotype (Pl. XIII, figs. 3a, b) is incomplete. Of the ultimate whorl all that is preserved is a crushed adoral quadrant that is all body

chamber, and a better preserved adapical end of the same whorl that is all phragmocone. A part of the penultimate whorl is uncovered. The ultimate whorl at the adapical end is stout with height about equal to thickness, with a nearly rounded profile, and without any actually defined umbilical or ventro-lateral shoulders. It appears to be nearly smooth. ES is of fair size and phylloid, L1 wide and tripartite, S1 high, L2 smaller than L1, and S2 smaller than S1. Where the shell is preserved on the penultimate whorl the delicate lirate surface on it can be seen. The adoral end is too crushed to determine its form. The fine lirae can be seen on one patch of preserved shell.

The paratype (Pl. XIII, figs. 4a, b) is a large specimen with a diameter of about 85 mm. One side at the adoral end is missing. The ultimate whorl is stout, about as high as it is thick and the shell is moderately evolute. The surface ornament comprises the fine lirae and faint narrow irregular folds or fine ribs.

GSC No. 21734 (Pl. XIII, figs. 5a, b) is figured to show the suture line. The ultimate whorl is a little higher than it is thick, is rounded without ventro-lateral shoulders, and has a well-rounded umbilical shoulder. It is a little more evolute than the holotype and paratype and a little compressed. The surface ornament is poorly preserved. It comprises, however, faint lirae and small costae or faint irregular ribs.



FIGURE 29

Suture line of *Ussurites arthaberi* var. *cameroni* McLearn (x3). Holotype, GSC No. 6694.

Comparisons. This species or variety has stouter and less compressed whorls than *Ussurites muskwa* McLearn. Also, the ornament of costae or faint ribs appears to be more variable. The whorls are thicker than those of *Ussurites arthaberi* (Welter).

Genus *Leiophyllites* Diener

Leiophyllites kindlei McLearn

Plate I, figures 9a, b. Figure 30

Leiophyllites? *kindli* McLearn, 1946a, p. 10, Appendix II, p. 1, pl. II, fig. 4; 1948, p. 12, pl. II, fig. 4.

Material. The holotype, GSC No. 6443, is from the Toad Formation, south side of Liard River, about 2 miles below the mouth of Toad River (GSC loc. 10660).

Measurements. Holotype: 43.5; 34; 15; 41.

Description. The holotype, entirely phragmocone, is a very much compressed moderately evolute shell with somewhat flattened sides, rounded ventro-lateral shoulders, and a very narrow rounded venter. On the adapical quadrant of the ultimate whorl the umbilical wall is sloping and the umbilical shoulder is almost angular. On the internal mould the umbilical wall is concave. Growth lines are stiffly convex on the flanks, projected near the ventro-lateral shoulder and curved forward on the venter. EL is wide and short; ES is entire and club-shaped, i.e., with a long phylloid ending; L1 is denticulate and longer than EL; S1 is similar to ES, but higher; L2 is denticulate at the base and shorter than L1. A shallow denticulate lobe extends across the umbilical shoulder and wall.

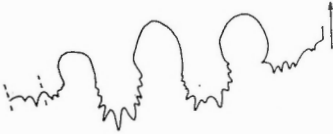


FIGURE 30

Suture line of *Leiophyllites kindlei* McLearn (x3). Holotype, GSC No. 6443.

Comparisons. Compared with *Leiophyllites middlemissi* (Diener) the shells of this species are more compressed, and the suture line is somewhat simpler with the saddles less club-shaped and phylloid.

Family PTYCHITIDAE Mojsisovics

Genus *Ptychites* Mojsisovics

Ptychites wrighti McLearn

Plate X, figures 1a–c, Figure 31

Ptychites wrighti McLearn, 1946a, p. 9; 1946b, p. 3, pl. IV, fig. 5; 1948, p. 12, pl. IV, fig. 5.

Material. The holotype, GSC No. 6442, is from the Toad Formation, far up “McTaggart Creek”, west slope of Mount Wooliever, Sikanni Chief River valley (GSC loc. 10731).

Measurements. Holotype: 60; 47; 66; 20.

Description. The holotype is a robust, moderately involute specimen with whorls higher than they are thick, converging convex flanks, rounded venter, deep umbilicus, and abruptly rounded umbilical shoulder. On the flanks are very low irregular ribs and growth lines, convex forward on the flanks and radial across the venter. The suture line (Fig. 31) is moderately denticulate; EL is short, ES small, L1 long, S1 large, L2 about as long as L1, S2 wide, but not as high as S1. A small auxiliary saddle is on the umbilical shoulder.

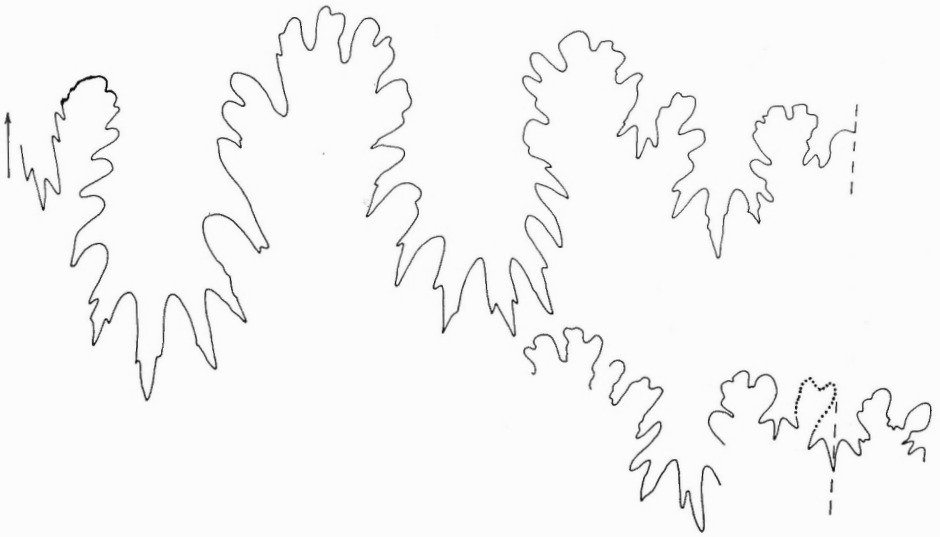


FIGURE 31. Suture lines of *Ptychites wrighti* McLearn (x3). Holotype, GSC No. 6442. The lower figure is reversed.

Comparisons. Compared with *Ptychites latifrons* Mojsisovics the ribs are more irregular and less prorsiradiate near the umbilical shoulder, the whorl is not as depressed, the umbilicus is a little larger. It differs in particular from typical *Ptychites* in not having radial almost straight ribs on the flanks, and in the proportionally small umbilicus.

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PLATES I-XIII

All figures, unless otherwise stated, are natural size
All specimens, unless otherwise stated, are from the
Toad Formation, northeastern British Columbia
X indicates the position of the last septum

PLATE I

Acrochordiceras (Paracrochordiceras) americanum McLearn (Page 12)

- Figures 1a, b. Side and anterior views, holotype, GSC No. 6475, Tetsa River valley, GSC loc. 10732.
- Figures 2a, b. Ventral and side views, topotype, GSC No. 21696, same locality as fig. 1.
- Figures 3a, b. Ventral and side views, hypotype, GSC No. 21697, Liard River, GSC loc. 10660.

Czekanowskites hayesi (McLearn) (Page 43)

- Figures 4a, b. Ventral and side views, GSC No. 6477, holotype of *Ceratites? hayesi* var. *pinguis*, Tetsa River valley.
- Figures 5a, b. Side and ventral views, GSC No. 6476, holotype of *Ceratites? hayesi* var. *angulata*, Tetsa River valley.
- Figures 6a-c. Side, anterior, and ventral views, hypotype, GSC No. 21698, Tetsa River valley, GSC loc. 10706.
- Figures 7a-c. Side, ventral, and anterior views, holotype, GSC No. 6478, Tetsa River valley.
- Figures 8a-c. Side, anterior, and ventral views, hypotype, GSC No. 21699, Bat Creek, GSC loc. 16008.

Leiophyllites kindlei McLearn (Page 55)

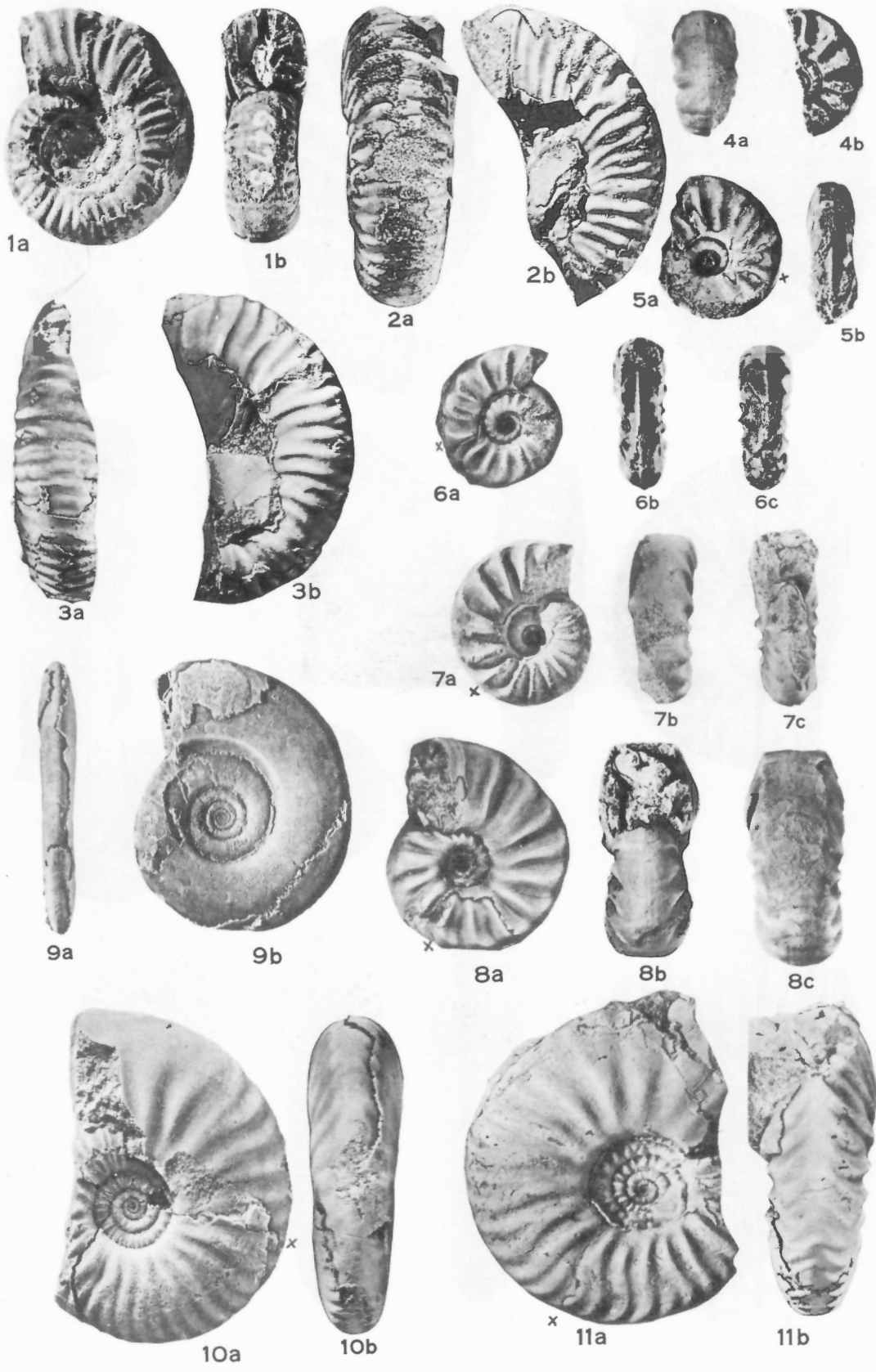
- Figures 9a, b. Ventral and side views, holotype, GSC No. 6443, Liard River, GSC loc. 10660.

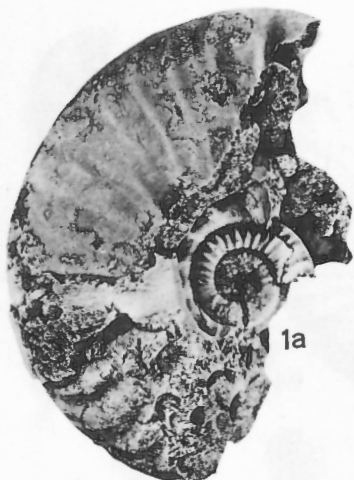
Hollandites mcconnelli McLearn (Page 16)

- Figures 10a, b. Side and ventral views, holotype, GSC No. 9481, Tetsa River valley.

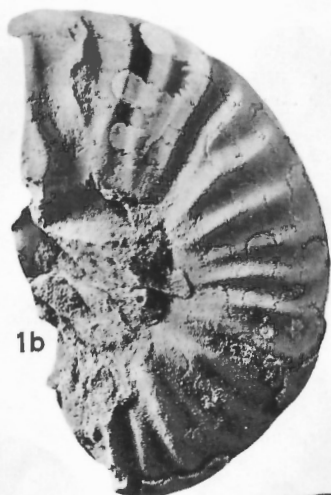
Hollandites spivaki McLearn (Page 17)

- Figures 11a, b. Side and ventral views, holotype, GSC No. 9483, Tetsa River valley.





1a



1b



1c



3a



3b



2a



2b



4a



4b



5a



5b



x

7a



7b



7c



6a



6b



6c

PLATE II

Hollandites humi McLearn (Page 15)

Figures 1a-c. Side views and ventral view, holotype, GSC No. 9482, east side Mount Wooliever, GSC loc. 10718.

Hollandites cf. *H. pelletieri* n. sp. (Page 15)

Figures 2a, b. Side and ventral views, GSC No. 21772, Chlotapecta Creek, GSC loc. 40109.

Hollandites pelletieri n. sp. (Page 13)

Figures 3a, b. Side and ventral views, paratype GSC No. 21703, Chlotapecta Creek, GSC loc. 40109.

Figures 4a, b. Ventral and side views, paratype, GSC No. 21700, same locality as fig. 3.

Figures 5a, b. Ventral and side views, paratype, GSC No. 21701, same locality as fig. 3.

Figures 6a, b, c. Side, anterior, and ventral views, paratype, GSC No. 21702, same locality as fig. 3.

Figures 7a-c. Side, ventral, and anterior views, holotype, GSC No. 21704, same locality as fig. 3.

PLATE III

Anagymnotoceras wrighti (McLearn) (Page 22)

Figures 1a, b. Ventral and side views, holotype, GSC No. 9484, Tetsa River valley, GSC loc. 10702.

Anagymnotoceras columbianum (McLearn) (Page 23)

Figures 2a, b. Ventral and side views, holotype, GSC No. 6691, Tetsa River valley, GSC loc. 10696.

Anagymnotoceras ino (McLearn) (Page 23)

Figures 3a, b. Ventral and side views, holotype, GSC No. 9594, Tetsa River valley, GSC loc. 10698.

Anagymnotoceras helle (McLearn) (Page 21)

Figures 4a-c. Ventral, side, and anterior views, paratype, GSC No. 9592, Tetsa River valley, GSC loc. 10696.

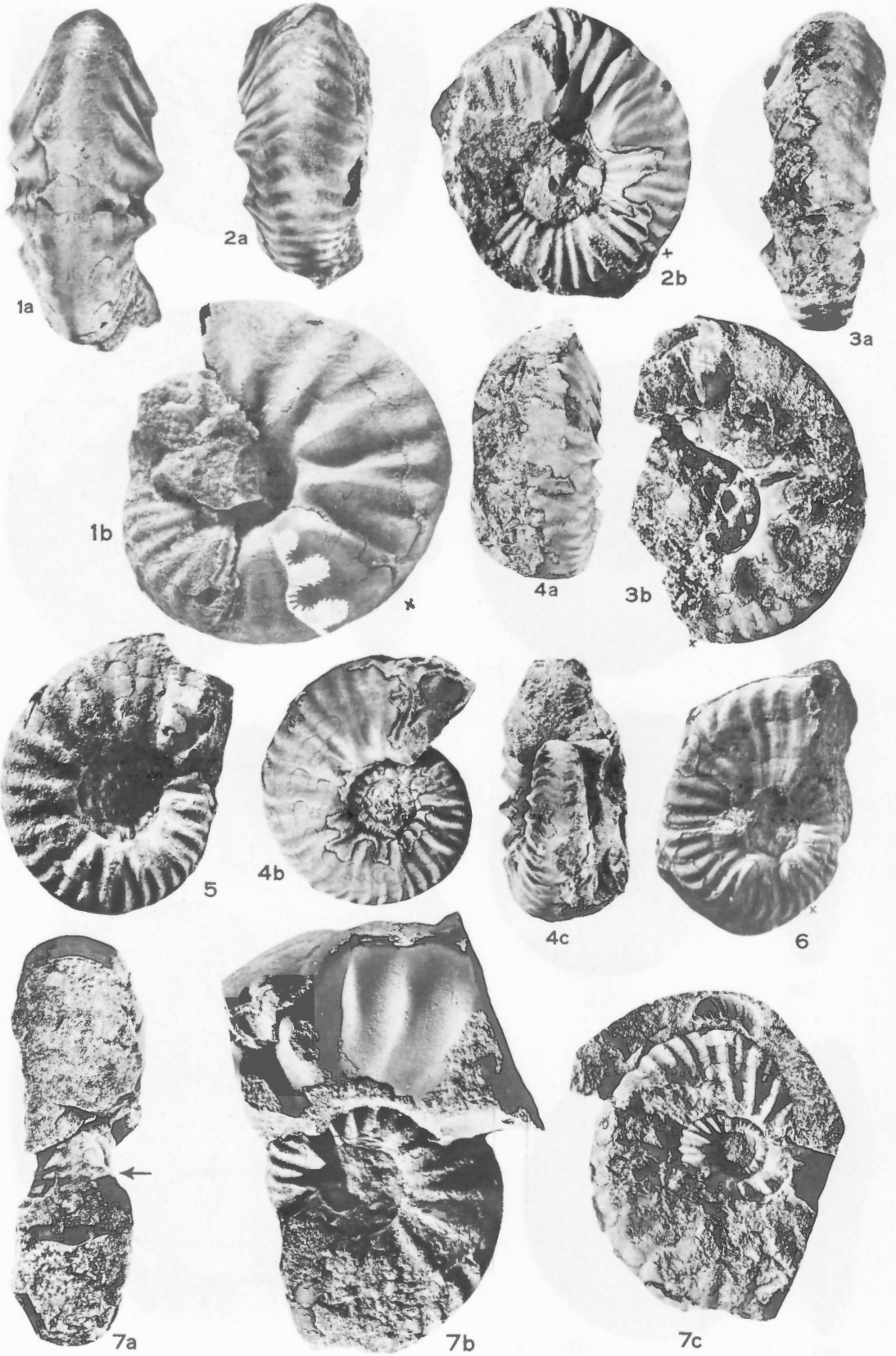
Figure 5. Side view, holotype, GSC No. 9593, Tetsa River valley, GSC loc. 10697.

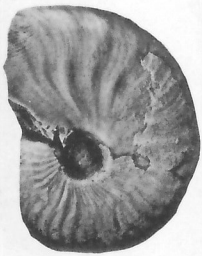
Anagymnotoceras moderatum (McLearn) (Page 20)

Figure 6. Side view, holotype, GSC No. 9596, Tetsa River valley, GSC loc. 10696.

Anagymnotoceras varium (McLearn) (Page 18)

Figures 7a-c. Ventral view and both sides of holotype, GSC No. 9595, Tetsa River valley, GSC loc. 10696. The arrow (7a) is directed at one of the umbilical bullae. Figures 7b and 7c have the same orientation.





1a



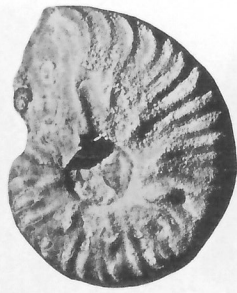
1b



3a



2a



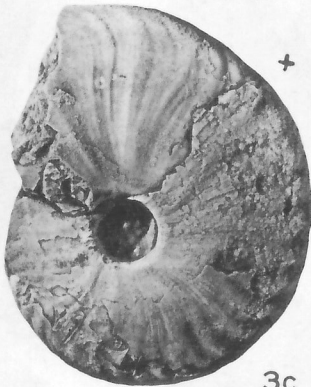
2b



2c



3b



3c



4a



4b



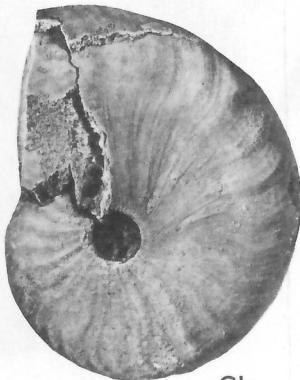
5a



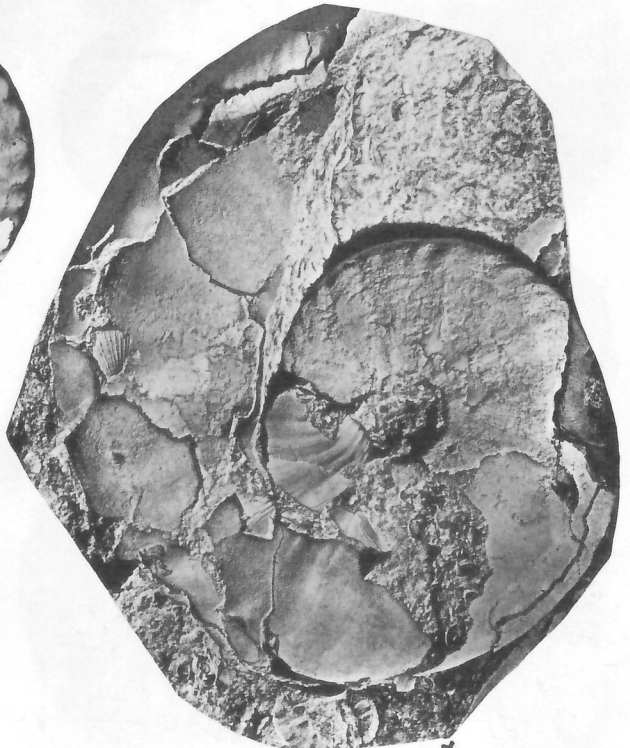
5b



6a



6b



7

+

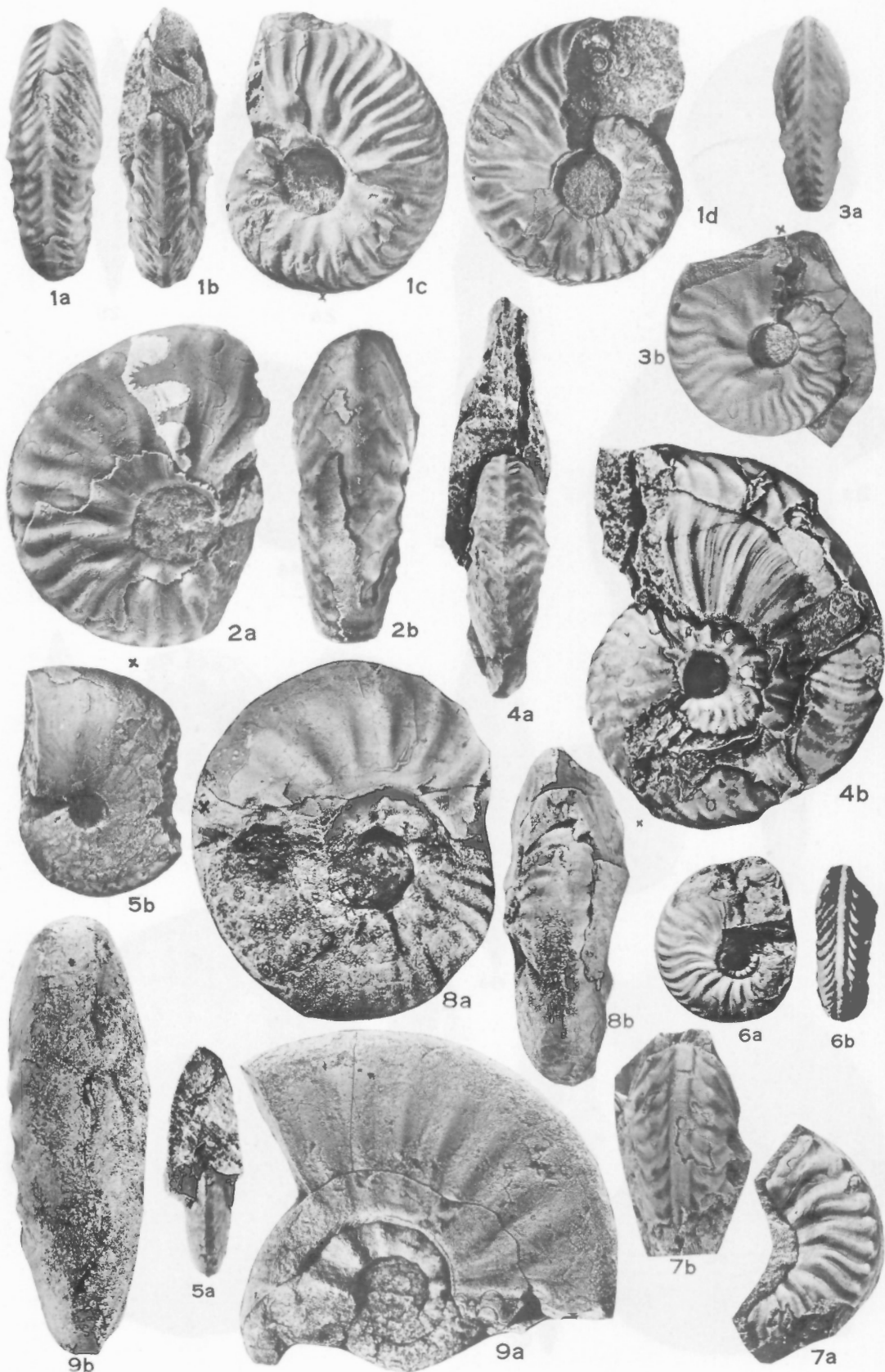
PLATE IV

Gymnotoceras deleeni (McLearn) (Page 24)

- Figures 1a, b. Side and ventral views, hypotype, GSC No. 21705, Tetsa River valley, GSC loc. 10694.
- Figures 2a-c. Anterior, side, and ventral views of phragmocone, holotype, GSC No. 6479, same locality as fig. 1.
- Figures 3a-c. Ventral, anterior, and side views, hypotype, GSC No. 21709, same locality as fig. 1.
- Figures 4a, b. Anterior and side views, paratype, GSC No. 6480, same locality as fig. 1.
- Figures 5a, b. Anterior and side views of phragmocone, hypotype, GSC No. 21707, same locality as fig. 1.
- Figures 6a, b. Anterior and side views, hypotype, GSC No. 21708, Tetsa River valley, GSC loc. 14841.
- Figure 7. Side view, hypotype, GSC No. 21710, same locality as fig. 1.

PLATE V

- Figures 1a-d. *Gymnotoceras beachi* McLearn (Page 30)
Ventral, anterior, and side views, holotype, GSC No. 6692, Chischa River, GSC loc. 10727.
- Figures 2a, b. *Gymnotoceras kindlei* (McLearn) (Page 29)
Side and ventral views, holotype, GSC No. 6693, Muskwa River area.
- Figures 3a, b. *Gymnotoceras deleeeni* var. *liardense* McLearn (Page 28)
Ventral and side views, holotype, GSC No. 9485, Chischa River, GSC loc. 10726.
- Figures 4a, b. Anterior and side views, hypotype, GSC No. 21712, same locality as figure 3.
- Figures 5a, b. *Gymnotoceras deleeeni* (McLearn) (Page 24)
Anterior and side views, hypotype, GSC No. 21706, east side Mount Wooliever, GSC loc. 10717.
- Figures 6a, b. *Gymnotoceras* sp. (Page 11)
Side and ventral views, GSC No. 21713, east side Mount Wooliever, GSC loc. 10719.
- Figures 7a, b. Side and ventral views, GSC No. 21714, same locality as figure 6.
- Figures 8a, b. *Anagymnotoceras tozeri* n. sp. (Page 19)
Side and anterior views, holotype, GSC No. 21809, Lower Shale Member, Blaa Mountain Formation, Ellesmere Island, GSC loc. 51677.
- Figures 9a, b. Side and ventral views, paratype, GSC No. 21810, same locality as figure 8.



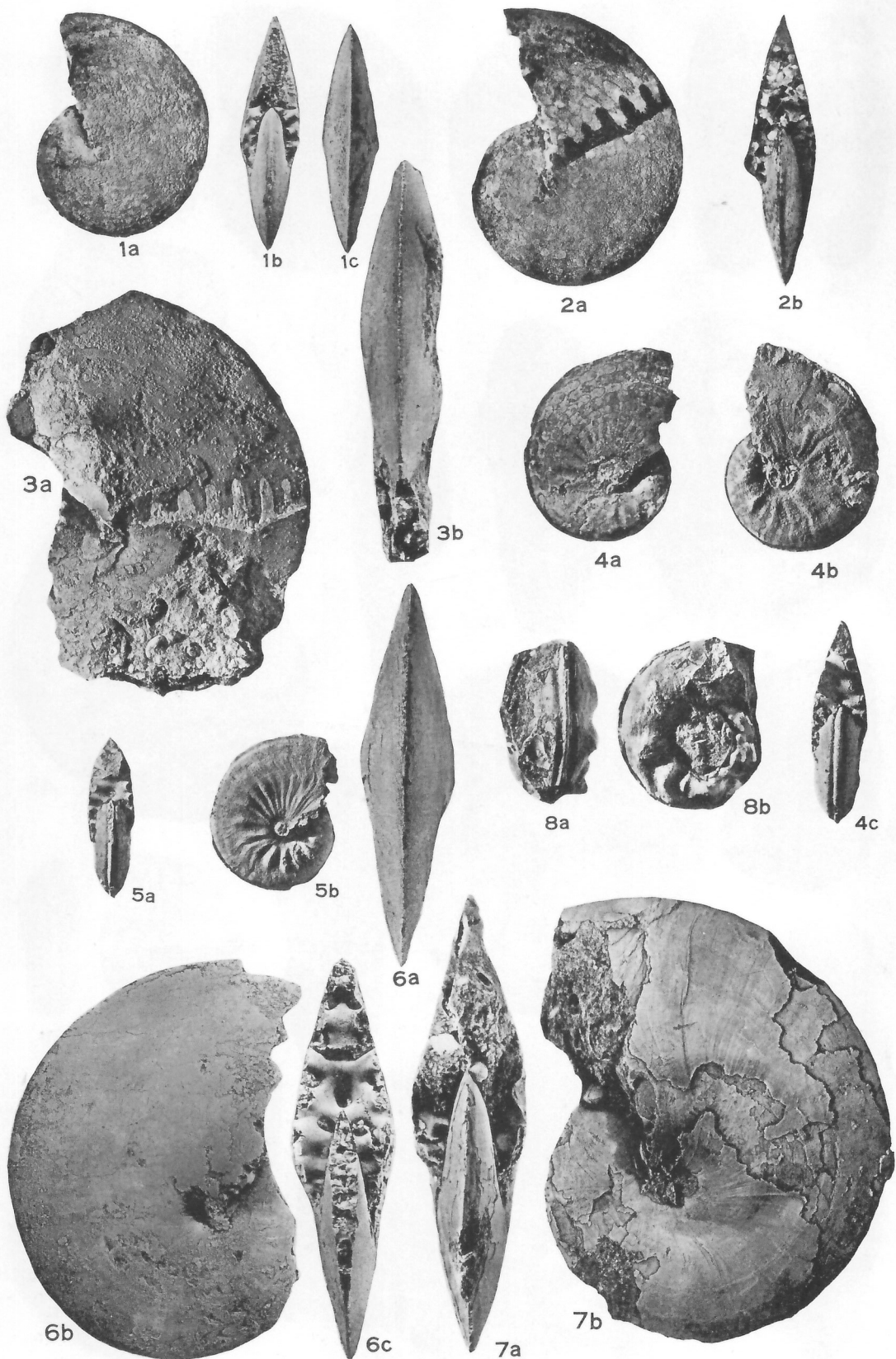


PLATE VI

Longobardites nevadanus Hyatt and Smith (Page 31)

- Figures 1a-c. Side, anterior, and ventral views, GSC No. 6449, holotype of *Longobardites canadensis* McLearn, Tetsa River valley, GSC loc. 10695.
- Figures 2a, b. Side and anterior views, GSC No. 6450, paratype of *Longobardites canadensis* McLearn, same locality as fig. 1.
- Figures 3a, b. Side and ventral views, GSC No. 9581, "plesiotype" of *Longobardites canadensis* McLearn, Tetsa River valley, GSC loc. 10694.
- Figures 4a-c. Side views and anterior view, GSC No. 6466, holotype of *Longobardites intornatus* McLearn, Tetsa River valley, same locality as fig. 1.
- Figures 5a, b. Anterior and side views, GSC No. 9582, "plesiotype" of *Longobardites intornatus* McLearn, Tetsa River valley, same locality as fig. 1.
- Figures 6a-c. Ventral, side, and anterior views, hypotype, GSC No. 21715, Tetsa River valley, GSC loc. 10694.
- Figures 7a, b. Anterior and side views, hypotype, GSC No. 21716, Liard River, GSC loc. 10660.

Lenotropites larvalis (McLearn) (Page 41)

- Figures 8a, b. Ventral and side views, holotype, GSC No. 9583, Tetsa River valley, GSC loc. 10696.

PLATE VII

Grambergia tetsaensis n. sp. (Page 36)

- Figures 1a-c. Anterior, ventral, and side views, paratype, GSC No. 21720, Tetsa River valley, GSC loc. 10732.
- Figures 2a-c. Side, anterior, and ventral views (x 3), paratype, GSC No. 21717, same locality as fig. 1. The anterior part of the outer whorl is crushed.
- Figures 3a, b. Ventral and side views (x 2), paratype, GSC No. 21718, same locality as fig. 1.
- Figures 4a, b. Anterior and side views, paratype, GSC No. 21719, same locality as fig. 1.
- Figures 5a-c. Side views and ventral view, holotype, GSC No. 21721, same locality as fig. 1.

Grambergia mackenzii (McLearn) (Page 38)

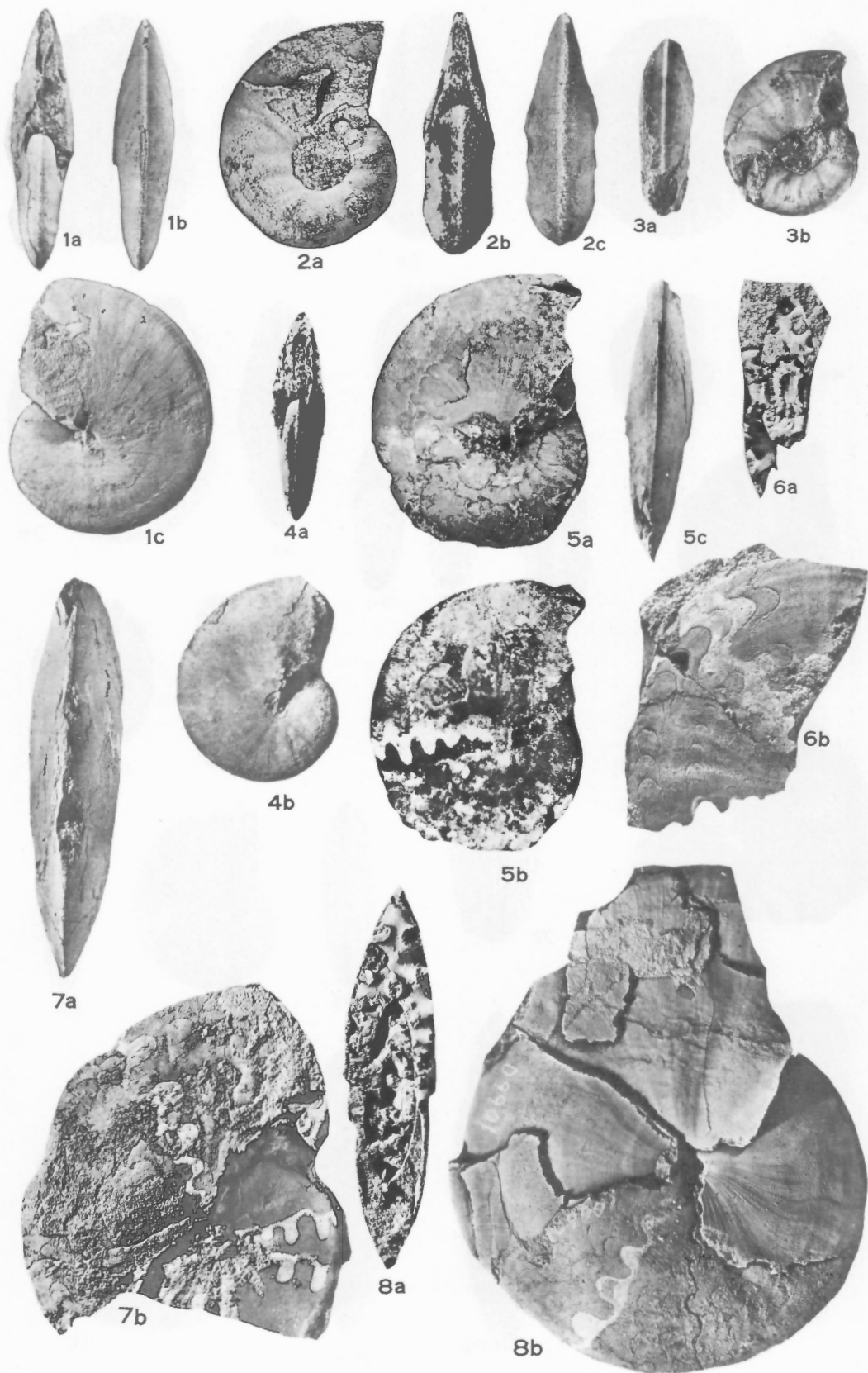
- Figures 6a, b. Section of inner whorls and side view, holotype, GSC No. 9584, Chischa River, GSC loc. 10736.

Grambergia ovinus (McLearn) (Page 37)

- Figures 7a, b. Ventral and side views, holotype, GSC No. 9591, Chischa River, GSC loc. 10733.

Grambergia nahwisi (McLearn) (Page 39)

- Figures 8a, b. Whorl section and side view, holotype, GSC No. 9590, Liard River, GSC loc. 10660.



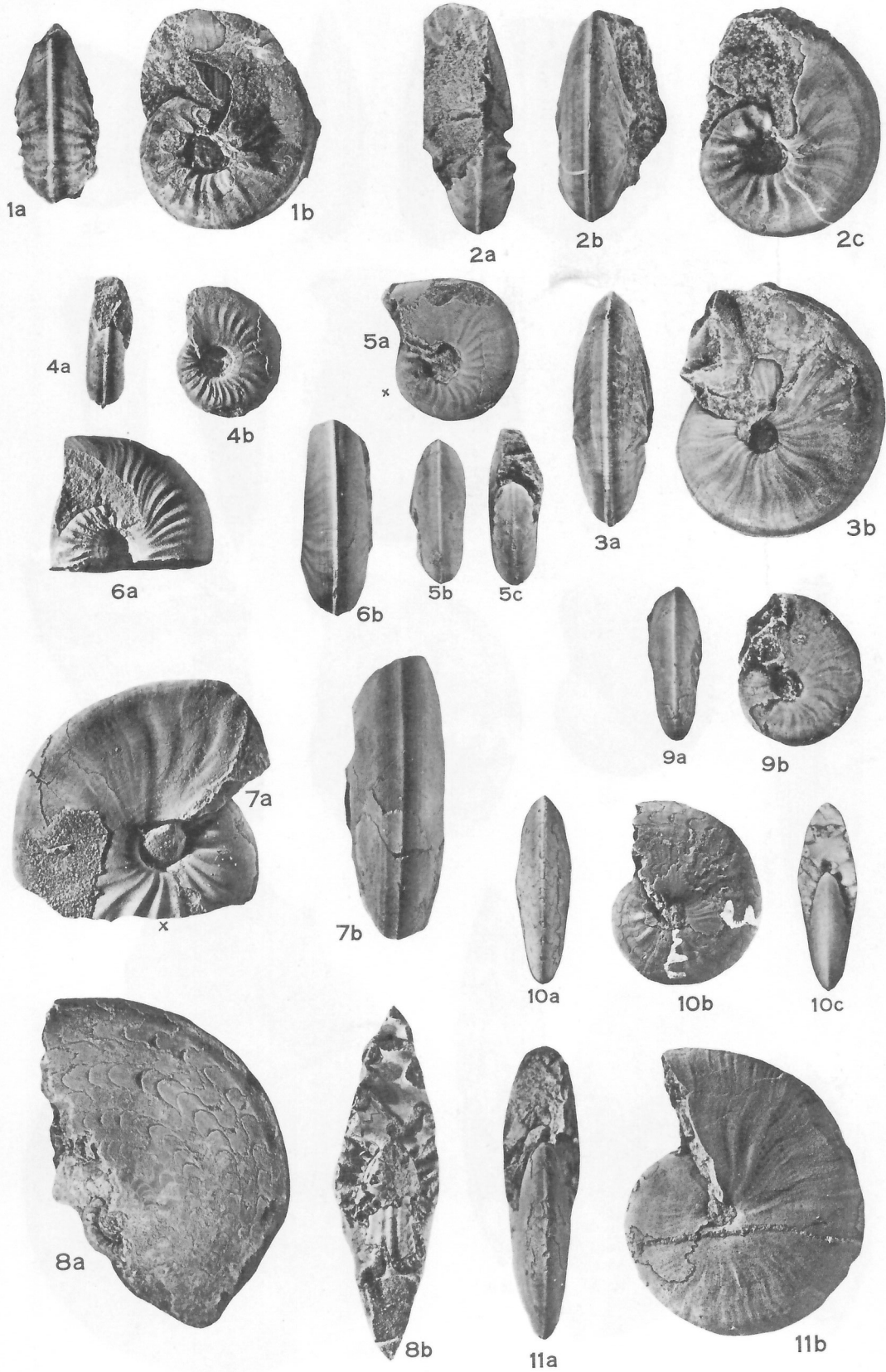


PLATE VIII

Lenotropites tardus n. s.p. (Page 39)

- Figures 1a, b. Ventral and side views, paratype, GSC No. 21722, tributary of Tetsa River, GSC loc. 36446.
- Figures 2a-c. Anterior, ventral, and side views, holotype, GSC No. 21723, same locality as fig. 1.
- Figures 3a, b. Ventral and side views, paratype, GSC No. 21724, same locality as fig. 1.

Lenotropites caurus (McLearn) (Page 41)

- Figures 4a, b. Anterior and side views, holotype, GSC No. 9585, Liard River, GSC loc. 10660.
- Figures 5a-c. Side, ventral, and anterior views, topotype, GSC No. 21725, Liard River, same locality as fig. 4, GSC loc. 42339.
- Figures 6a, b. Side and ventral views, GSC No. 9586, holotype of "*Hungarites*" *boreas* McLearn, same locality as fig. 4.
- Figures 7a, b. Side and ventral views, GSC No. 9587, holotype of "*Hungarites*" *dawsoni* McLearn, Chischa River, GSC loc. 10736.

Grambergia mctaggarti (McLearn) (Page 35)

- Figures 8a, b. Side view and whorl section, holotype, GSC No. 6474, Liard River, GSC loc. 10660.

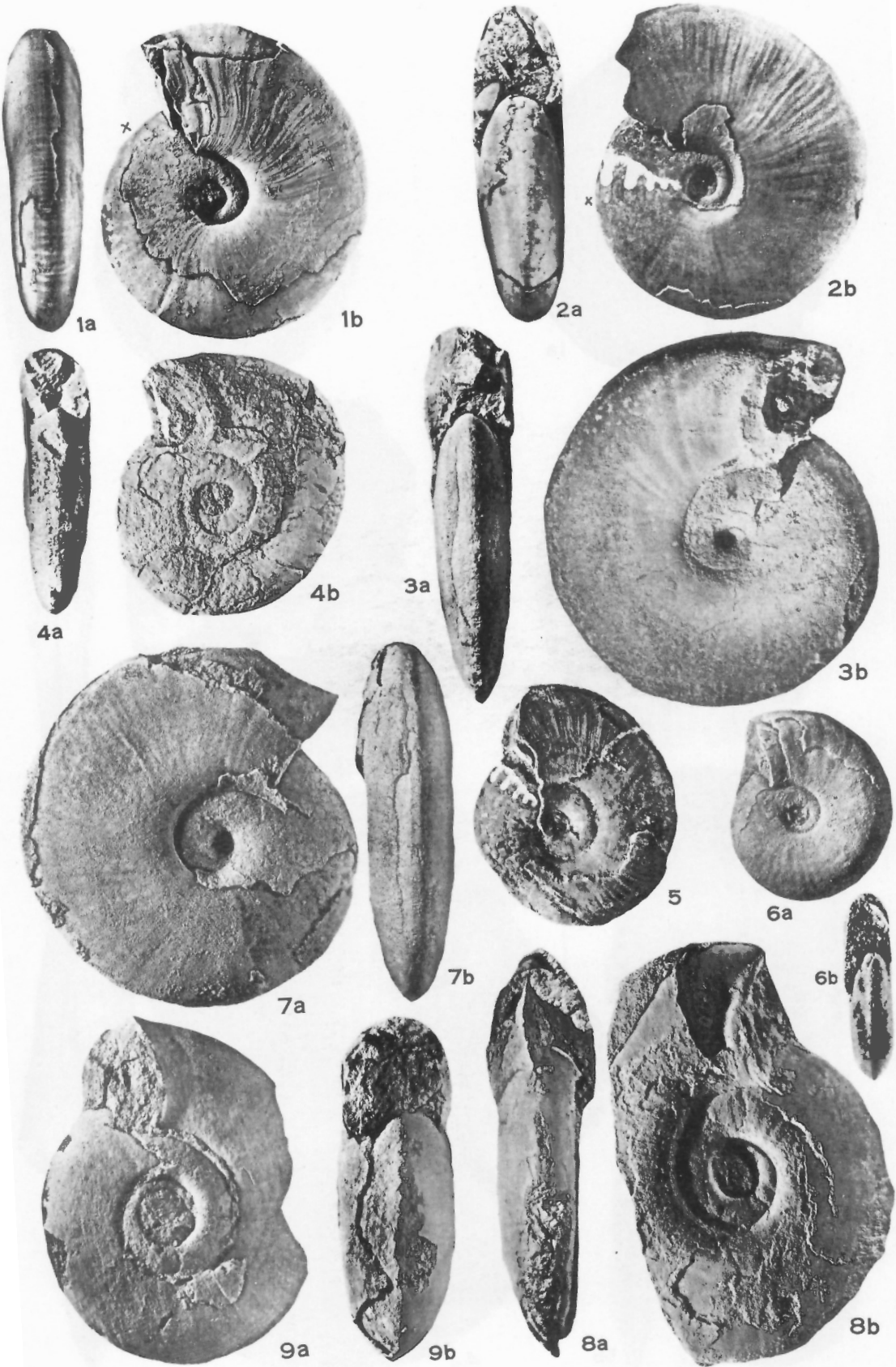
Arctohungarites bufonis (McLearn) (Page 45)

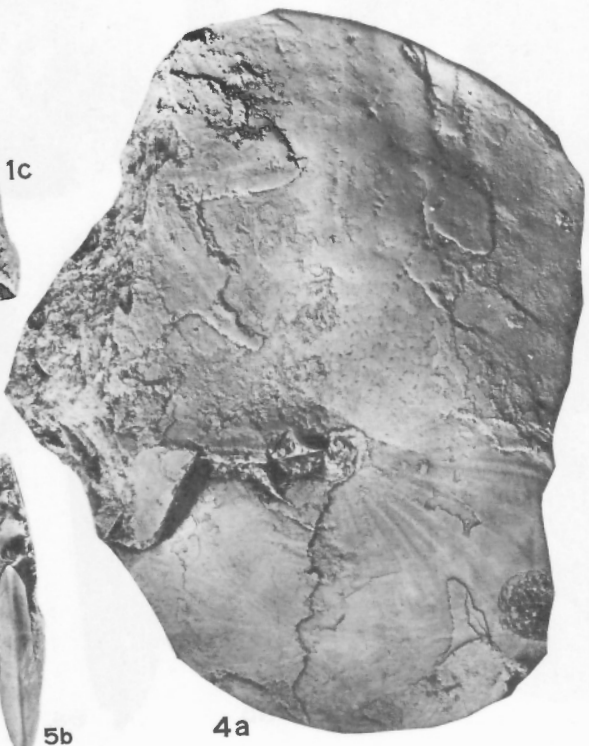
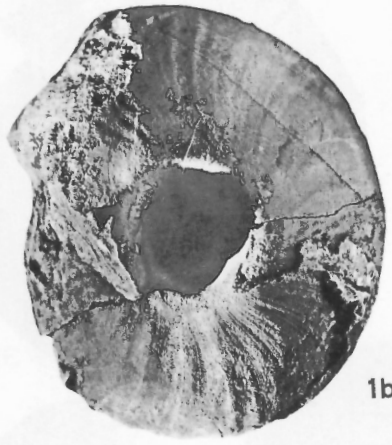
- Figures 9a, b. Ventral and side views (x 2), hypotype, GSC No. 21726. Liard River, GSC loc. 10660.
- Figures 10a, b, c. Ventral, side, and anterior views, paratype, GSC No. 9589, same locality as fig. 9.
- Figures 11a, b. Anterior and side views, holotype, GSC No. 9588, same locality as fig. 9.

PLATE IX

Parapopanoceras tetsa McLearn (Page 46)

- Figures 1a, b. Ventral and side views, GSC No. 9579, holotype of *Parapopanoceras selwyni* McLearn, Tetsa River valley.
- Figures 2a, b. Anterior and side views, GSC No. 9580, paratype of *Parapopanoceras selwyni* McLearn, Tetsa River valley, GSC loc. 10706.
- Figures 3a, b. Anterior and side views, holotype, GSC No. 6440, Tetsa River valley, GSC loc. 10695.
- Figures 4a, b. Anterior and side views, GSC No. 9577, holotype of *Parapopanoceras medium* McLearn, Tetsa River valley, GSC loc. 10712.
- Figure 5. Side view, GSC No. 9578, paratype of *Parapopanoceras medium* McLearn, Tetsa River valley, GSC loc. 10706.
- Figures 6a, b. Side and anterior views, GSC No. 6441, holotype of *Parapopanoceras praematurum* McLearn, Tetsa River valley, GSC loc. 10730.
- Figures 7a, b. Side and ventral views, GSC No. 9575, paratype of *Parapopanoceras normale* McLearn, Tetsa River valley, GSC loc. 10695.
- Figures 8a, b. Anterior and side views, GSC No. 9574, holotype of *Parapopanoceras normale* McLearn, Tetsa River valley, GSC loc. 10732.
- Figures 9a, b. Side and anterior views, GSC No. 9576, holotype of *Parapopanoceras obesum* McLearn, Liard River, GSC loc. 10659.





4a

4b

PLATE X

Ptychites wrighti McLearn (Page 56)

Figures 1a-c. Side views and ventral view, holotype, GSC No. 6442, east side Mount Wooliever, GSC loc. 10731.

Parapinacoceras hagei (McLearn) (Page 49)

Figures 2a, b. Side and anterior views, hypotype, GSC No. 21727, Chischa River, GSC loc. 36657.

Figures 3a, b. Side and anterior views, hypotype, GSC No. 21728, Tetsa River valley, GSC loc. 10713.

Figures 4a, b. Side and ventral views, hypotype, GSC No. 21729, Liard River, GSC loc. 10659.

Figures 5a, b. Side and anterior views, holotype, GSC No. 6447, Tetsa River valley.

PLATE XI

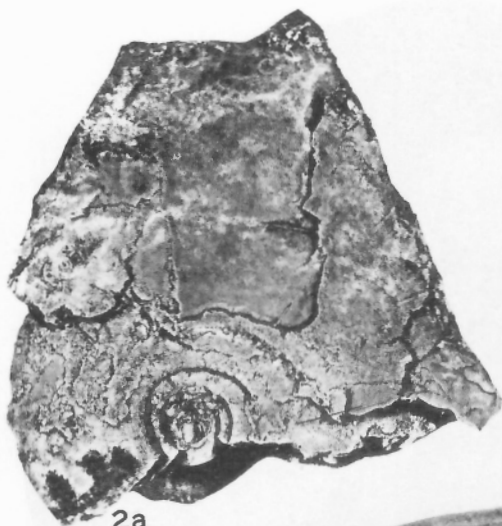
Anagymnites cf. *A. lamarcki* (Oppel) (Page 52)

Figures 1a, b. Side and ventral views, GSC No. 21731, Liard River, GSC loc. 10659.

Anagymnites via-alaska McLearn (Page 51)

Figures 2a-c. Side of inner whorls, whorl section, and side view, holotype, GSC No. 6446, Tetsa River valley, GSC loc. 10693.

Figures 3a, b. Ventral and side views, hypotype, GSC No. 21730, Tetsa River valley, GSC loc. 10694.



2a



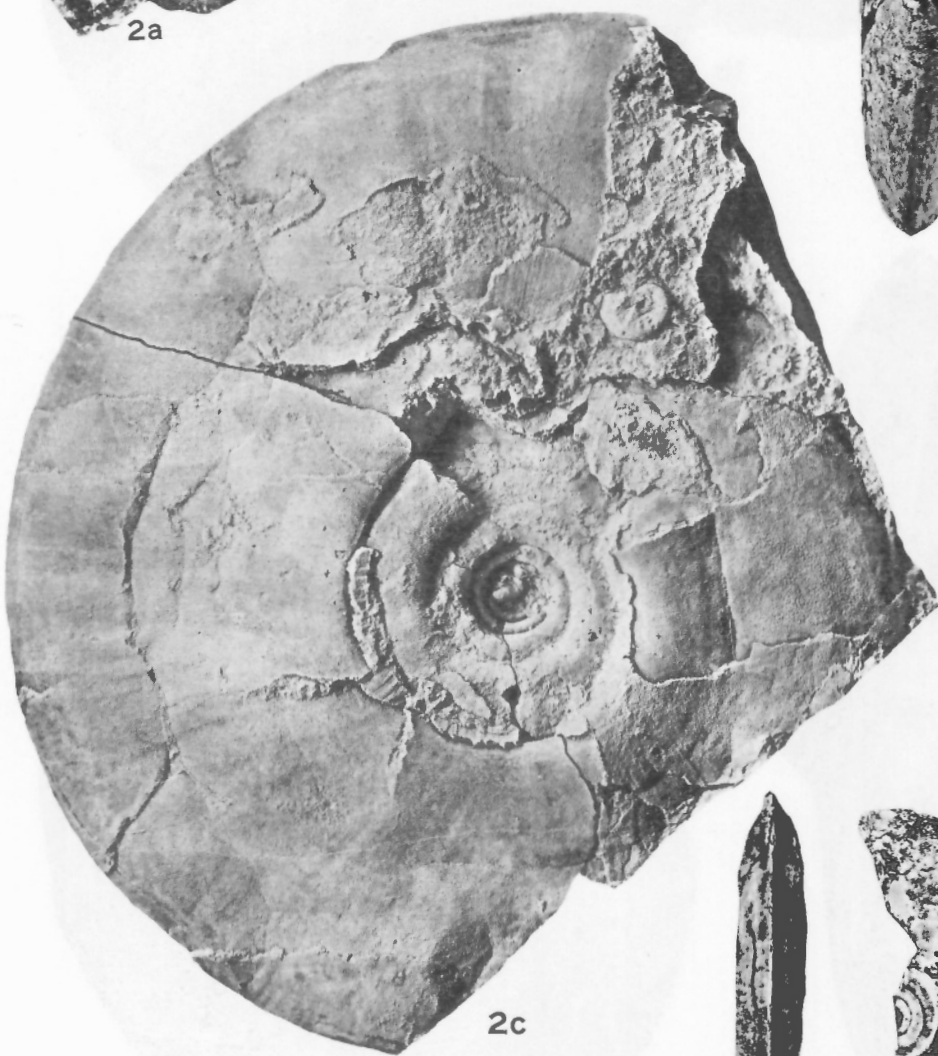
2b



1a



1b



2c



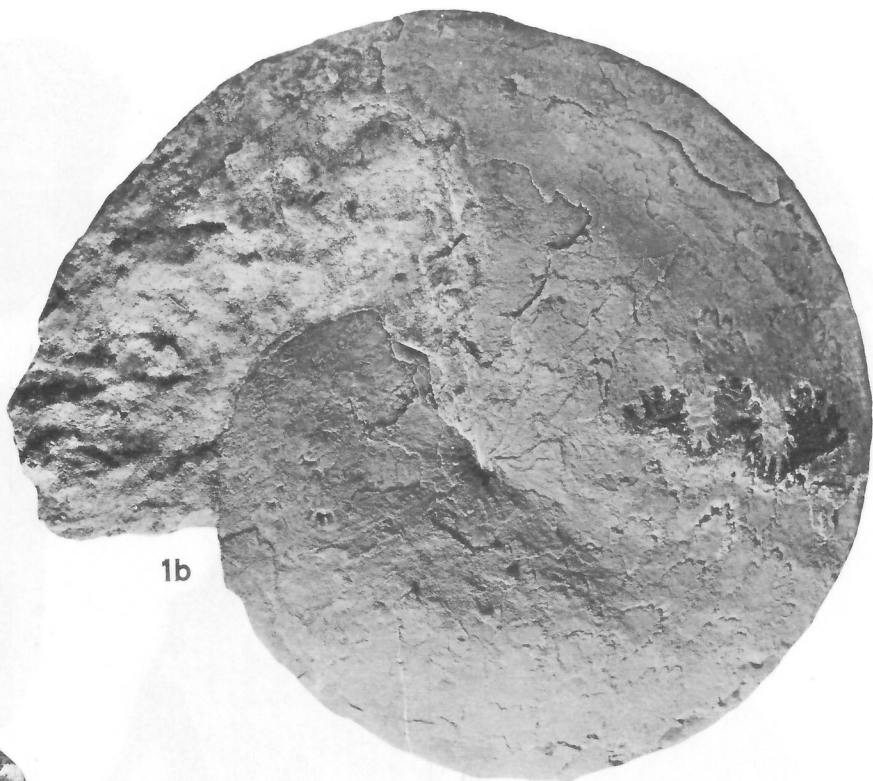
3a



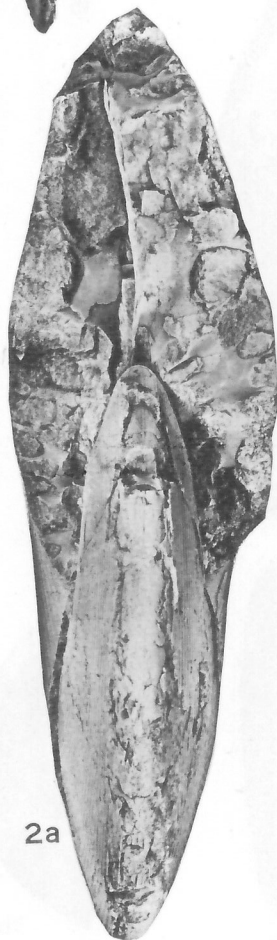
3b



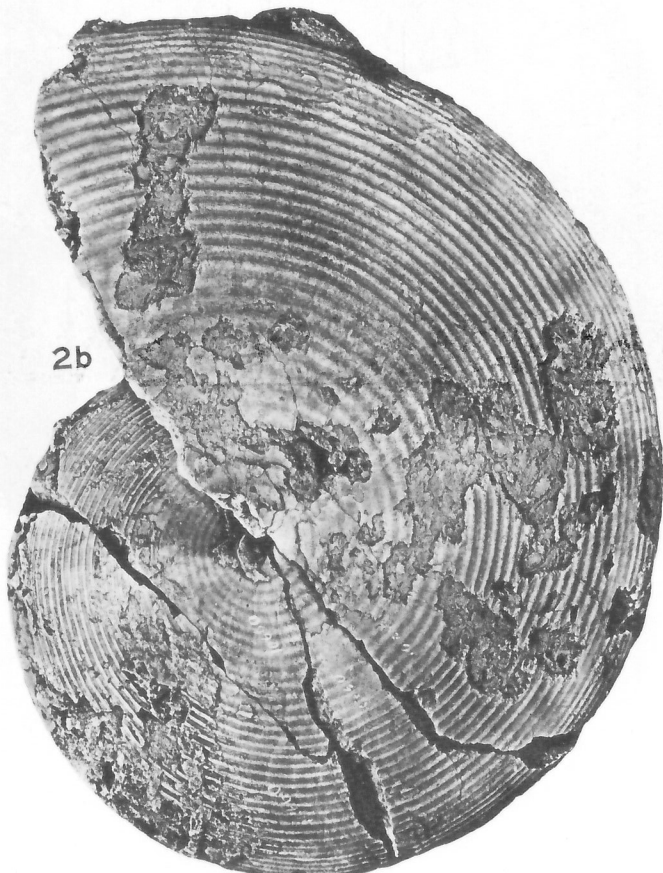
1a



1b



2a



2b

PLATE XII

Anagymnites hollandi (McLearn) (Page 52)

Figures 1a, b. Ventral and side views, holotype, GSC No. 6448, Liard River, GSC loc. 10660.

Sturia sp. (Page 8)

Figures 2a, b. Anterior and side views, GSC No. 21732, Liard River, GSC loc. 10660.

PLATE XIII

Ussurites muskwa McLearn (Page 53)

Figures 1a, b. Side and anterior views, holotype, GSC No. 6444, Tetsa River valley, GSC loc. 10732.

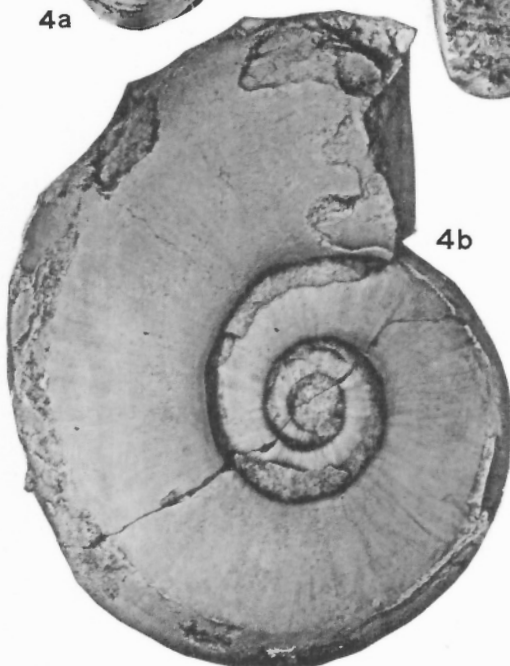
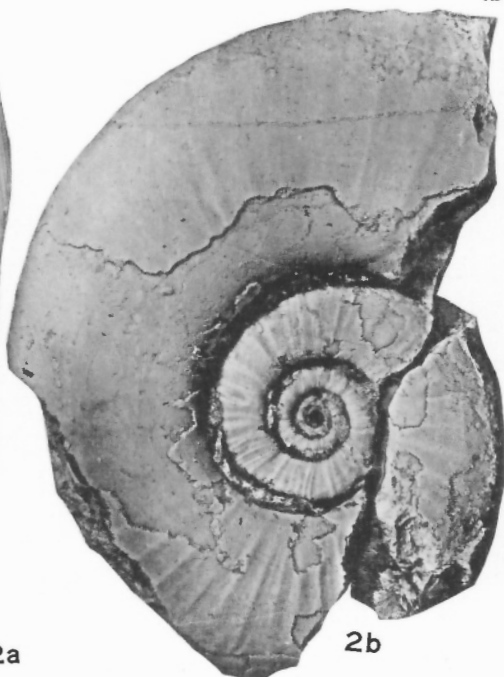
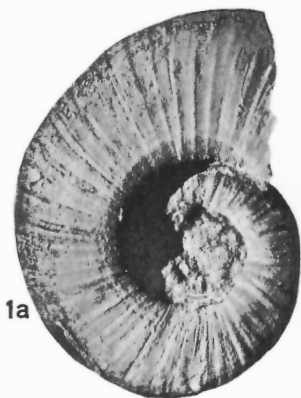
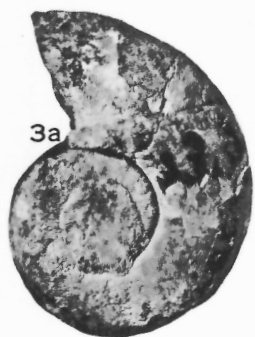
Figures 2a, b. Ventral and side views, hypotype, GSC No. 21733, Chischa River, GSC loc. 10733.

Ussurites arthaberi var. *cameroni* McLearn (Page 54)

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Figures 4a, b. Anterior and side views, paratype, GSC No. 6445, Tetsa River valley.

Figures 5a, b. Anterior and side views, hypotype, GSC No. 21734, Tetsa River valley, GSC loc. 10706.



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