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BRACHIOPODS OF THE ARISAIG GROUP (SILURIAN–LOWER DEVONIAN) OF NOVA SCOTIA

Charles W. Harper, Jr.

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PREFACE

Research in systematic paleontology is one of the means by which the Geological Survey of Canada provides data for the calibration of the geological time scale so necessary for the precise dating and correlation of the rocks that make up the geological framework of Canada.

The present report results from such a study. Within the Arisaig Group of northern Nova Scotia, the abundant brachiopods present a most valuable key to the solution of tectonic and sedimentation problems in rocks of Silurian age and younger. The importance of this and other such studies should become apparent with our increasing awareness of the economic potential of the Paleozoic basins of deposition within the Maritime Provinces of Canada.

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

OTTAWA, January 19, 1971

BULLETIN 215 — Brachiopoden der Arisaig-Gruppe (Silur — Unterdevon) in Neuschottland
Von C. W. Harper, Jr.

БЮЛЛЕТЕНЬ 215 — Брахиоподы Аризейгской группы (силур — нижний девон) Новой Шотландии
Ч. В. Харпер, Мл.

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BRACHIOPODS OF THE ARISAIG GROUP (SILURIAN–LOWER DEVONIAN) OF NOVA SCOTIA

Abstract

The Arisaig Group comprises a very fossiliferous, almost continuous sequence of strata of earliest Silurian to early Devonian age. The articulate brachiopod species of the Arisaig Group are described, identified generically, and compared with related species. Eighty-two species are recognized and assigned to forty-six genera. A new genus *Megumatrypa* and three new species *Megumatrypa glencoensis*, *Isorthis macadamensis*, and *Protochonetes stonehousensis* are defined.

The lowest formation in the Arisaig Group, the Beechhill Cove, is considered to be of early Llandovery age (as is the Glencoe Brook Formation in Pictou County, Nova Scotia). The three members of the overlying Ross Brook Formation are middle Llandovery (or high early Llandovery), late Llandovery (C_1-C_5), and late Llandovery (C_6) respectively. The overlying French River Formation is late Llandovery (C_6) or early Wenlock; the Doctor's Brook Formation overlying it is of Wenlock age. The succeeding McAdam Brook and Moydart Formations are Ludlow. The highest formation in the Group, the Stonehouse, is Pridoli to early Gedinnian in age.

Résumé

Le groupe d'Arisaig se compose d'une succession très fossilifère et presque continue de couches datant du tout début du Silurien au début du Dévonien. L'auteur décrit les espèces de brachiopodes articulés identifiés, en donne le genre et établit leur rapport avec d'autres espèces semblables. Il isole 82 espèces appartenant à 46 genres. Il donne également la description du nouveau genre *Megumatrypa* et de trois nouvelles espèces de brachiopodes: *Megumatrypa glencoensis*, *Isorthis macadamensis* et *Protochonetes stonehousensis*.

La formation de base du groupe d'Arisaig, la Beechhill Cove, appartiendrait au début du Llandovérien, tout comme la formation de Glencoe Brook, comté de Pictou (N.-É.). Les trois niveaux de la formation sus-jacente de Ross Brook appartiennent au Llandovérien moyen (ou à la fin du Llandovérien inférieur), au Llandovérien supérieur (C_1-C_5) et au Llandovérien supérieur (C_6) respectivement. La formation sus-jacente de French River date du Llandovérien supérieur (C_6) ou du début du Wenlockien; celle de Doctor's Brook qui la recouvre date du Wenlockien. Les formations suivantes, de McAdam Brook et de Moydart, datent du Ludlovien, et la formation supérieure du groupe, la Stonehouse, date du Pridoli au début du Gédinnien.

INTRODUCTION

The Arisaig Group (=Arisaig Series of McLearn, 1924; Maehl, 1961) comprises a very fossiliferous, unusually continuous marine sequence of limy mudstones, siltstones, and fine-grained sandstones, about 4,000 feet thick in the Arisaig area, of earliest Silurian (early Llandoverian) to early Devonian (Gedinnian) age. Brachiopods, are, by far, the most abundant megafossils in the Arisaig Group.

Hall (1860), Dawson (1880), and Ami (1895) described a few brachiopod species of the Arisaig Group. However the only published description of the brachiopod fauna as a whole is that by McLearn (1918, 1924), whose work on the brachiopods was pioneering in that he documented the occurrence in the Arisaig area of a number of Silurian forms. The present work is a revision of the articulate brachiopod section of McLearn's study of the fauna of the Arisaig Group. Many new species are described, and the taxonomy of the species described by McLearn is updated in accordance with recent advances in brachiopod taxonomy and inferred phylogeny.

This paper is based largely on about ten tons of fossiliferous blocks that were collected from the Arisaig Group in Antigonish and Pictou Counties by A. J. Boucot, Oregon State University, and others, during the summers of 1953, 1958–61, and in Pictou County by R. H. Maehl, Suffolk University, during the summers of 1957–59. In 1961 it became apparent that a monographic study of the brachiopods in the Arisaig Group, based on this collection, would be a useful supplement to McLearn's work, based on much smaller collections. It appeared desirable to undertake such a study at that time as recent advances had been made in the mapping of the Arisaig Group (Boucot *et al.*, *in press*; Maehl, 1961), and in the study of the fossils (Boucot, *in* Maehl, 1961; Ayrton *et al.*, 1969).

The present investigation was begun in the summer of 1961. W. S. McKerrow of Oxford University supplied additional collections from Arisaig in 1962–64. D. G. Kelley of the Geological Survey of Canada provided collections from the Arisaig Group of the Cobequid area in 1962–63 and 1968. The author has also studied collections of brachiopods from the Arisaig Group in the Geological Survey of Canada and in the Peabody Museum of Yale University. McLearn's 1924 memoir is based on the collection in the Peabody Museum.

A systematic study of the articulate brachiopod species of the Arisaig Group has been made. Its purpose was to identify and determine the taxonomic relationships of these species, and to correlate the units of the Arisaig Group on the basis of the known stratigraphic distribution of the groups to which these species belong.

Acknowledgments

I am deeply indebted to A. J. Boucot, who supervised the doctorate thesis at the California Institute of Technology upon which this paper is based. I am indebted to him, W. S. McKerrow, A. M. Ziegler of the University of Chicago, C. A. Hickox of Colby College, D. G. Kelley and D. G. Benson of the Geological Survey of Canada, R. H. Maehl, and J. Griffin formerly of the United States Geological Survey, each of whom provided numerous

large collections from the Arisaig Group. R. H. Maehl also generously provided extensive locality data and maps for Pictou County, and D. G. Kelley provided much locality data for the Cobequid Mountains. The following persons made detail maps of the Arisaig area while they were students at the Massachusetts Institute of Technology summer camp at Crystal Cliffs: V. Ablordeppey, A. Andrews, G. Badhroom, J. Beiers, D. Butler, R. Cohen, F. Collier, G. Erlanger, E. Essene, M. Field, V. Howard, S. Jacobs, E. Kendall, K. Kenyon, R. Koesoemadinata, H. Lahmen, H. McCarl, D. Naylor, P. Nelson, J. Powell, C. Reede, A. Regier, H. Sakrison, J. Saul, R. Saunders, W. Scanlon, J. Southard, D. Speidel, A. Stratton, and J. Werkeiser.

W. B. N. Berry of the University of California, Berkeley, identified graptolites from the Arisaig Group. R. K. Bambach of Yale University provided information on Twenhofel's 1909 fossil localities.

A. J. Boucot provided funds for fossil photography from his National Science Foundation Grant GP-2290, and laboratory facilities. Nelson Shupe of Tacoma Park, Maryland, did the photography.

A. J. Boucot and J. G. Johnson of Oregon State University read the manuscript and offered many useful suggestions.

Areas Studied

The areas of outcrop of the Arisaig Group (and correlative strata in southeastern Pictou County) are shown in Figure 1. Six are recognized: Arisaig, Cape George, and Lochaber in Antigonish County; northeast Pictou County; southeast Pictou County; and the Cobequid Mountains in Colchester and Cumberland Counties (numbers 1 to 4).

Previous Work

Many geologists have investigated the rocks of the Arisaig area and Pictou County since 1836 (McLearn, 1924, p. 3–7; Maehl, 1961, p. 12, 13; Boucot *et al.*, *in press*). Several early workers published species lists without including descriptions or illustrations of the fossils.

Hall (1860) described ten species of brachiopods from the Arisaig area. Two of these were inarticulates; the articulate brachiopod species described by Hall (the names in parentheses are used herein) are: *Chonetes tenuistriatus* (=*Protochonetes tenuistriatus*), *Chonetes novascoticus* (=*Protochonetes novascoticus*), *Rhynchonella saffordi* (=*Sphaerirhynchia saffordi*), *Spirifer rugaecosta* [=*Delthyris* (*Quadrifarius*) *rugaecosta*], *Spirifer subsulcatus* [=*Delthyris* (*Quadrifarius*) *rugaecosta*], *Trematospira acadiae* (=*Rhynchospirina acadiae*), *Rhynchospira sinuata* (=*Rhynchospirina sinuata*), and *Leptocoelia intermedia* (=*Eocoelia intermedia*). Dawson (1880) described two species: *Stricklandia billingsiana* (=*Meristina billingsiana*) and *Brachyprion gilpeni* (=*Shaleria gilpeni*). Ami (1895) described three inarticulates. McLearn (1918, 1924) described forty-nine species of articulate brachiopods including those listed above. Table I lists these, together with the generic and specific classification used in this paper.

TABLE I | *Brachiopod species described by McLearn (1918, 1924)*

The species described by McLearn are given in column A and the genus and species to which the holotype (or hypotypes) of each is assigned in this report is given in column B. (In some cases the holotype and one or more of the paratypes of one of McLearn's species belong to different species. The classifications given in column B refer only to the holotypes (or hypotypes) designated by McLearn.)

A	B
Dalmanella conservatrix	*Salopina conservatrix*
Dalmanella elegantula mut. *primitiva*	*Dalmanella* (?) *primitiva*
Dalmanella elegantula var. *submedia*	*Salopina submedia*
Dalmanella elegantula mut. *transversaria*	*Salopina submedia*
Dalmanella wisbyensis var. *nana*	*Visbyella nana*
Dalmanella lunata (Sowerby)	*Isorthis* (*Protocortezorthis*)*fornicatimcurvata*
Dalmanella orbicularis (Sowerby)	*Salopina submedia*
Idiorthis avita	indet. dalmanellid
Idiorthis matura	*Idiorthis matura*
Schizophorella arisaigensis	*Mendacella arisaigensis*
Leptaena rhomboidalis (Wilckens)	*Leptaena* cf. *L. depressa*
Rafinesquina beechhillensis	*Leptostrophia beechhillensis*
Brachyprion mertoni	*Mclearnites mertoni*
Brachyprion gilpeni (Dawson)	*Shaleria gilpeni*
Brachyprion (?) *honeymani*	*Shaleria honeymani*
Amphistrophia arisaigensis	*Shaleria honeymani*
Schuchertella pecten (Linnaeus)	indet. orthotetacid
Chonetes tenuistriatus (Hall)	*Protochonetes tenuistriatus*
Chonetes novascoticus Hall	*Protochonetes novascoticus*
Camarotoechia bimesiornata	"*C.*" *bimesiornata*
Camarotoechia nucula var. *planorugosa*	"*C.*" *planorugosa*
Camarotoechia nucula mut. *moydartensis*	"*C.*" *moydartensis*
Camarotoechia llandoveriana var. *rossonia*	"*C.*" *rossonia*
Camarotoechia glomerosa	"*C.*" *glomerosa*
(?) *Camarotoechia marklandensis*	"*C.*" *glomerosa*
Camarotoechia squamifera	"*C.*" *squamifera*
Pectorhyncha antiqua	*Sphaerirhynchia antiqua*
Pectorhyncha obtusiplicata (Hall)	*Sphaerirhynchia* sp.
Eatonioides westoni	"*C.*" *westoni*
Wilsonia wilsoni var. *saffordi* (Hall)	*Sphaerirhynchia saffordi*
Wilsonia wilsoni mut. *stonehousensis*	*Sphaerirhynchia saffordi*
Plagiorhyncha decemplicata (Sowerby)	*Plagiorhyncha* aff. *P. glassi*
Plagiorhyncha plastica	*Plagiorhyncha plastica*
Plagiorhyncha glassi (Davidson)	*Plagiorhyncha* aff. *P. glassi*
Atrypa reticularis (Linnaeus)	*Atrypa* cf. *A. gedinniana*
Delthyris crispa (Hisinger)	*Howellella moydartensis*
Delthyris crispa mut. *moydartensis*	*Howellella moydartensis*
Delthyris rugaecosta (Hall)	*Delthyris* (*Quadrifarius*) *rugaecosta*
Delthyris rugaecosta mut. *prima*	*Delthyris* (*Quadrifarius*) *rugaecosta*
Delthyris rugaecosta var. *subsulcata* (Hall)	*Delthyris* (*Quadrifarius*) *rugaecosta*

TABLE I (*conc.*) — *Brachiopod species described by McLearn (1918, 1924)*

A	B
Eospirifer stonehousensis	*Striispirifer stonehousensis*
Rhynchospira salteri var. *acadiae* (Hall)	*Rhynchospirina acadiae*
Rhynchospira sinuata (Hall)	*Rhynchospirina sinuata*
Whitfieldella (?) *crassa* var. *beechhillensis*	*Cryptothyrella beechhillensis*
Whitfieldella (?) *northumberlandensis*	*Hyattidina northumberlandensis*
Whitfieldella (?) *angustifrons* (McCoy)	*Cryptothyrella beechhillensis*
Meristina tumida (Dalman)	*Hyattidina northumberlandensis*
Meristina billingsi (Dawson)	*Meristina billingsiana*
Coelospira hemisphaerica (Sowerby)	*Eocoelia hemisphaerica*

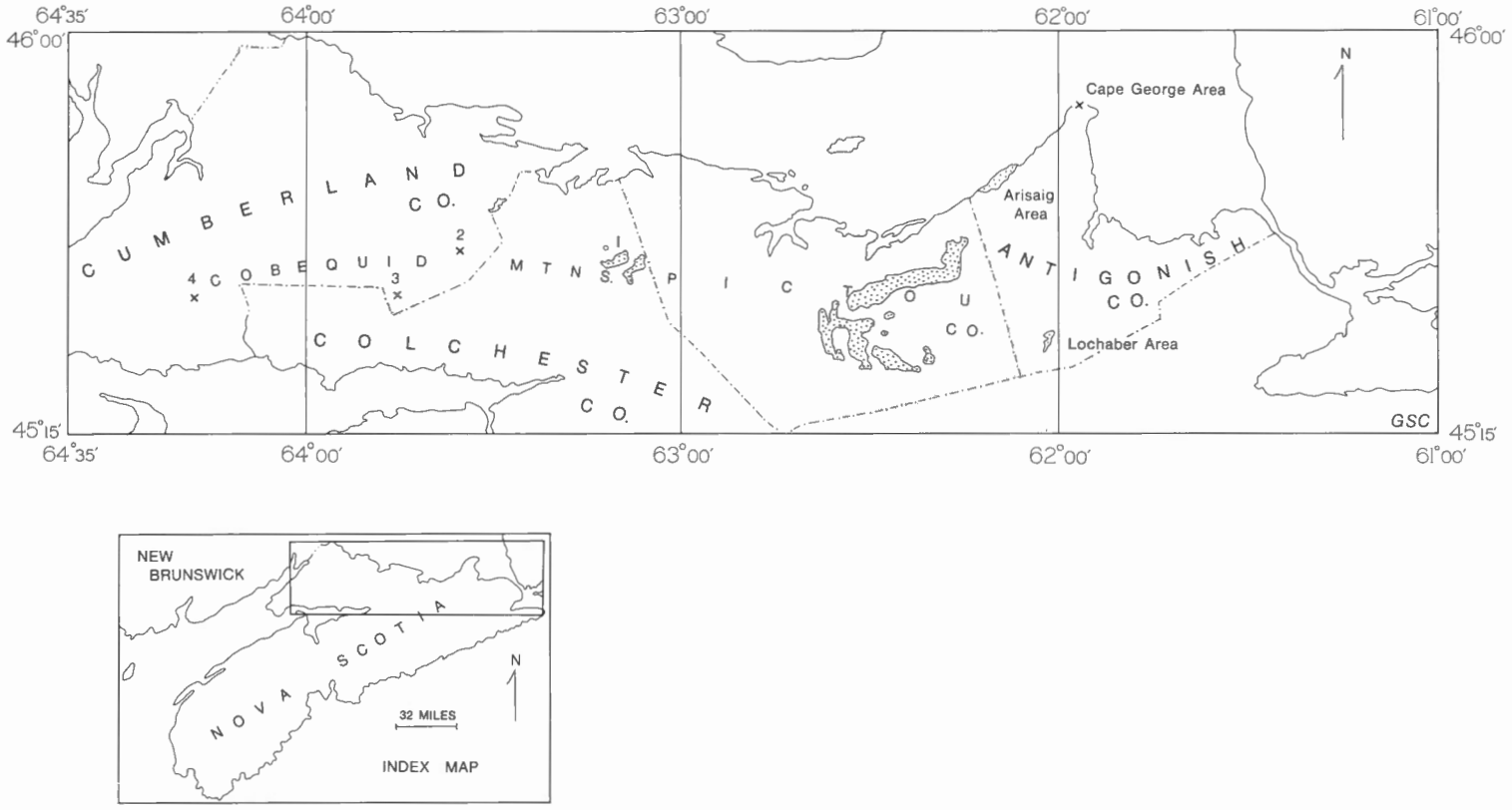


FIGURE 1. Map showing areas of outcrop of Arisaig Group (stippled or indicated by cross).

STRATIGRAPHY

Boucot *et al.* (*in press*) recognize the Arisaig Group (originally defined as the Arisaig Series by Williams (1914) in the Arisaig area) as comprising seven formations, three of which are divided into members. The reader is referred to that paper for a detailed discussion of the stratigraphy of the Arisaig Group, history of the stratigraphic nomenclature of the Arisaig Group, and detailed discussion of their stratigraphic nomenclature, which is followed herein. The formations recognized in the Arisaig area, northeast Pictou County, and the Cobequid Mountains, are in ascending order: Beechhill Cove, Ross Brook (three members), French River, Doctor's Brook, McAdam Brook (two members), Moydart (two members), and Stonehouse (Fig. 2). In the Lochaber area, beds correlative with the French River or Doctor's Brook, Moydart (lower member), and Stonehouse Formations have been found (Boucot *et al.*, *in press*). In the Cape George area, the Moydart and Stonehouse Formations occur (op. cit.) with strata lithologically distinct from the Arisaig Group but containing Arisaig fossils. These latter beds include the *Scolithus* (worm-tube) quartzite of Boucot *et al.* which contains fossils of Moydart and Stonehouse age, and the grey-blue siltstone which contains fossils of Stonehouse age.

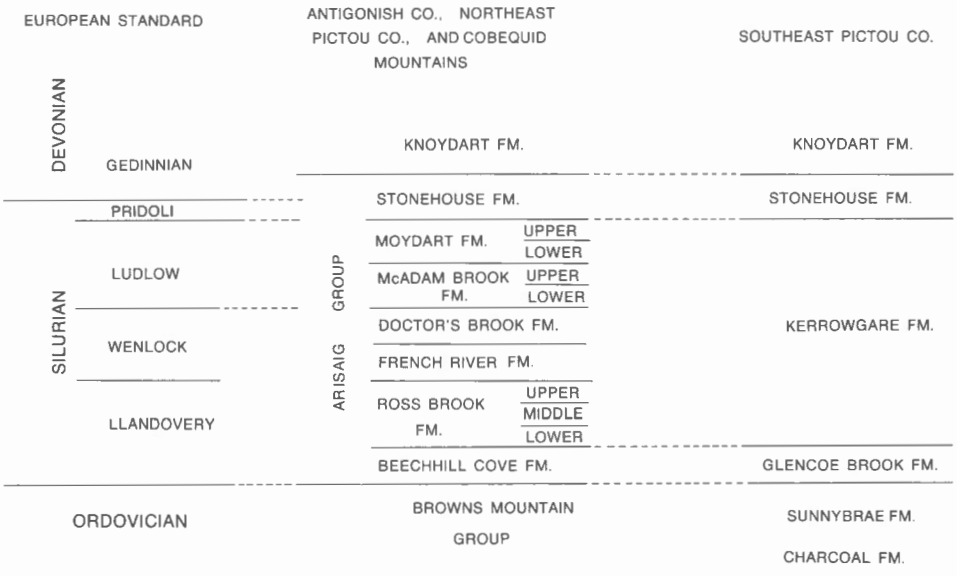


FIGURE 2. Correlation of Arisaig rocks.

Maehl (1961, p. 21, 22) points out that the older Paleozoic rocks in eastern Pictou County comprise two very distinct sequences. The stratigraphy in northeast Pictou County is almost identical to that in the Arisaig area, with the lower and upper members of the McAdam Formation of Maehl (1961) corresponding to the Doctor's Brook and McAdam Brook Formations respectively, the only significant difference being that the McAdam Brook Formation (=upper member of the McAdam Formation of Maehl, 1961) cannot be divided into two distinct members in northeast Pictou County as it can in the Arisaig area. In southeast Pictou County, a distinctly different succession is recognized by Maehl. The following stratigraphic units, correlative with the Arisaig Group in the Arisaig area, are recognized by Maehl there: Glencoe Brook Formation (correlative with Beechhill Cove Formation), Kerrowgare Formation (correlative with Ross Brook through Moydart Formations), and Stonehouse Formation (Fig. 2). The stratigraphic units as defined by Maehl are used in this report.

For this paper it is useful to outline the relations between the stratigraphic units used herein and the stratigraphic zones defined by McLearn (1924, p. 8–15). Boucot *et al.* (*in press*) consider McLearn's zone *a* of the Ross Brook Formation equivalent to the lower member of the Ross Brook Formation as used herein; McLearn's zones *b*, *c*, and part of *d* equivalent to the middle member of the Ross Brook Formation; part of McLearn's zone *d* and zone *e* equivalent to the upper member of the Ross Brook Formation; McLearn's McAdam Formation equivalent to the French River, Doctor's Brook, and McAdam Brook Formations, with McLearn's zone *a* equivalent to the French River Formation, zone *b* to the Doctor's Brook Formation, and zone *c* to the McAdam Brook Formation. They consider McLearn's zones *a* and *b* of the Moydart Formation as equivalent to their lower and upper members respectively. McLearn divided the Stonehouse Formation into four zones; these divisions are not recognized by Boucot *et al.* (*in press*) or in this study.

Articulate Brachiopod Fauna of the Arisaig Group

The stratigraphic ranges of articulate brachiopod species of the Arisaig Group and correlative strata are shown in Table II. Species that are rare and known from only a few localities are in parentheses; these species are not considered diagnostic of the formations or members in which they occur.

Age of Stratigraphic Units in the Arisaig Group

Beechhill Cove Formation

The Beechhill Cove Formation is considered to be of early Llandovery age (Ayrton *et al.*, 1969, p. 477, 478; Berry and Boucot, 1970), and occurs conformably beneath the lower member of the Ross Brook Formation which contains an early or middle Llandovery graptolite assemblage (*see below*). It contains the brachiopod *Leptostrophia beechhillensis* (McLearn, 1924) which belongs to a group of *Leptostrophia* with dental plates, i.e., *Leptostrophia* of the *L. mullochensis* Reed, 1917, type. *Leptostrophia* of this type are common and widespread in beds of early Llandovery age and are found in beds of late Llandovery age only in the Ross Brook Formation of Pictou County (and possibly in the late Llandovery of the Welsh Borderland; *see below*); they are not known to occur in beds of Ordovician age.

Other brachiopod elements do not serve to date the unit precisely. The common and widespread genera *Mendacella* and *Cryptothyrella* are restricted elsewhere in the world to beds of late Ordovician to late Llandovery (C_1–C_2) age. *Linoporella* is not known in beds of Ordovician age, although the Caradocian genus *Laticrura* Cooper, 1956, appears to be

closely related. *Isorthis* is not known in beds of Ordovician age. The differences between Llandovery *Isorthis* and Upper Ordovician and Llandovery *Dalmanella* are very subtle, however; until a comprehensive review of Upper Ordovician dalmanellids is made, it cannot be definitely established that *Isorthis* does not occur in the Ordovician.

Lower Llandovery brachiopod faunas are characterized by abundant *Leptostrophia* of the *L. mullochensis* type together with abundant *Mendacella* and *Cryptothyrella.* The Beechhill Cove Formation faunas resemble Lower Llandovery faunas elsewhere in this regard.

Ross Brook Formation

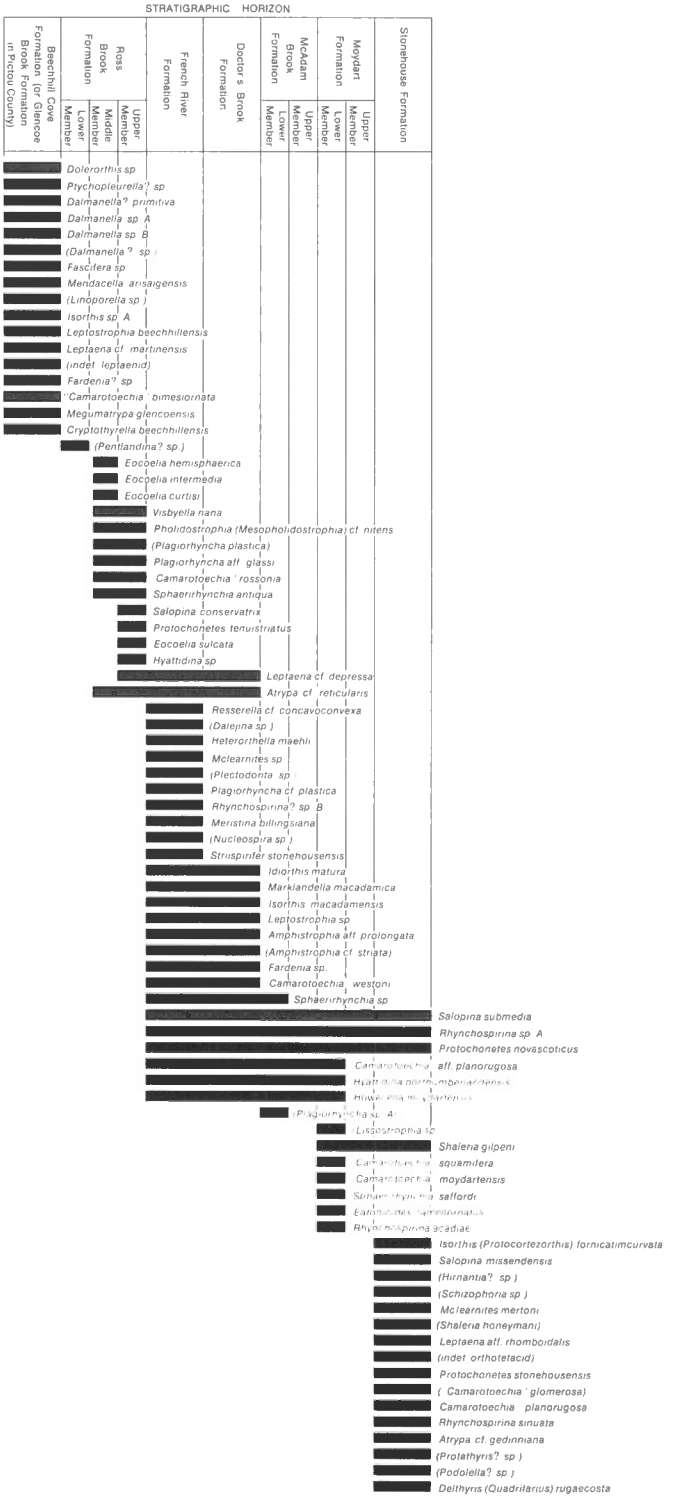
A graptolite assemblage collected from the lower 15 feet of the lower member of the Ross Brook Formation indicated a *Monograptus cyphus* or *Monograptus gregarius* zone age, i.e., an upper lower Llandovery and/or a middle Llandovery age (Ayrton *et al.*, 1969, p. 477; Berry and Boucot, 1970). Apart from the brachiopod *Pentlandina*? sp. which is not useful for dating, no other megafossils have been found in the lower member or lower part of the middle member of the Ross Brook Formation. The beds higher up in the middle member have yielded *Eocoelia hemisphaerica* (late Llandovery C_1–C_2 age), beds presumably still higher have yielded *Eocoelia intermedia* (late Llandovery C_3–C_4 age), and beds presumably still higher in the middle member have yielded *Eocoelia curtisi* (late Llandovery C_5 age) (Ziegler, 1966, p. 540). *Eocoelia* spp. exhibit a number of progressive evolutionary trends and are thus extremely useful for correlation (Ziegler, 1966, p. 523–529). Hence, the upper part of the middle member of the Ross Brook Formation spans late Llandovery C_1 through late Llandovery C_5 age. The upper member of the Ross Brook Formation contains *Eocoelia sulcata* (late Llandovery C_6 or early Wenlock age), and Ziegler (*pers. com.*) is of the opinion that the upper member specimens have ribs indicative of C_6 age (not as smooth as the Wenlock *E. sulcata*). Berry and Boucot (1970) report a graptolite assemblage including *Monograptus priodon*, *M. priodon* var. *clintonensis*, *M.* aff. *dextrorsus*, and *Retiolites* sp. from the upper member of the Ross Brook Formation; this assemblage indicates a late Llandovery age, thus agreeing with the more precise brachiopod correlation.

Brachiopods from the Ross Brook Formation, other than *Eocoelia*, do not serve to date the formation more precisely, but are consistent with the above correlations. *Salopina conservatrix* is known elsewhere only in the Hemse Group of Ludlow age on Gotland, and in the Wenlock Shale of the Welsh Borderland (Walmsley, Boucot, and Harper, 1969, p. 506). *Visbyella* is known from beds of late Llandovery to Ludlow age in Gotland, Britain, New Brunswick, and New South Wales (Walmsley *et al.*, 1968, p. 307). As *Leptostrophia* of the *L. mullochensis* type are known elsewhere only in beds of early Llandovery age (with the possible exception of *L. voraginis* Cocks, 1967, from the late Llandovery (C_1–C_2) of the Welsh borderland), this group appears to have survived longer at Arisaig. The other brachiopod species in the Ross Brook Formation belong to groups which are long ranging.

French River Formation

The French River Formation has yielded the graptolite *Monograptus* cf. *distans* which according to Berry (*pers. com.*) belongs to a group ranging from late Llandovery to early Wenlock age. The brachiopod species in the French River Formation belong to groups that are long ranging with the exception of *Heterorthella maehli*; *Heterorthella* occurs elsewhere in beds of Llandovery or Wenlock age (Harper, Boucot, and Walmsley, 1969, p. 80). The French River Formation occurs stratigraphically above the upper member of the Ross Brook Formation of late Llandovery C_6 age, and stratigraphically well below the McAdam Brook Formation, which contains early Ludlow graptolites. Hence, it is probably of Wenlock

TABLE II *Stratigraphic ranges, brachiopods, Arisaig Group*



age on the basis of its stratigraphic position (Berry and Boucot, 1970), although it could have a basal part of late Llandovery C_6 age.

Doctor's Brook Formation

The Doctor's Brook Formation contains numerous brachiopod species, all of which are long ranging. It lies stratigraphically above the French River Formation with graptolites that are not younger than early Wenlock age, and just below the McAdam Brook Formation, which contains early Ludlow graptolites at its base. Therefore it is probably of Wenlock age, although its upper part could conceivably be as young as early Ludlow.

McAdam Brook Formation

Berry (1967, p. 956–959) has identified three graptolite species from the lower member of the McAdam Brook Formation. Two, *Monograptus* cf. *varians* and *M.* sp. of the *M. chimaera* type, from the basal part of the member, indicate an early Ludlow age. The third species, *M. fritschi* cf. var. *linearis*, from a stratigraphically higher horizon in the lower member, indicates an early or middle Ludlow age (Berry and Boucot, 1970). Hence, the lower member is of early or early to middle Ludlow age. The upper member is stratigraphically below the upper member of the Moydart Formation, which contains Ludlow age fossils, and so is also of Ludlow age.

Moydart Formation

The lower member of the Moydart Formation is considered to be of Ludlow age because it is stratigraphically above the lower member of the McAdam Brook Formation, with early Ludlow graptolites, and contains *Hyattidina*, which is restricted elsewhere to beds of Silurian age.

The upper member of the Moydart Formation contains fish fragments of late Ludlow age (Dineley, 1963; Boucot *et al., in press*).

Stonehouse Formation

The Stonehouse Formation is considered to be of Pridoli to early Gedinnian age, as it contains the characteristic Pridoli to Gedinnian and younger elements *Isorthis* (*Protocortezorthis*) *fornicatimcurvata*, *Delthyris* (*Quadrifarius*), and *Schizophoria*, and lies stratigraphically and apparently conformably below the Knoydart Formation, from which Dineley (1962a, 1964, 1967) reports fish fragments of Downton to early Ditton age. The presence of questionable *Podollella* in the upper 50 feet of the Stonehouse Formation in Pictou County suggests an early Gedinnian age for that part of the formation. *I.* (*P.*) *fornicatimcurvata* and *Delthyris* (*Quadrifarius*) *rugaecosta* are abundant throughout the formation; *Schizophoria* sp. is known only from a few specimens from about the middle of the formation.

The upper part of the Stonehouse Formation contains an ostracod fauna that closely resembles the Beyrichian Kalk fauna of Europe (Copeland, 1960, 1964; Martinsson, 1967, p. 378, 379; Berdan *et al.*, 1969, p. 2167), with a succession of forms similar to the corresponding succession in Europe (Martinsson, *in* Berdan *et al.*, 1969, p. 2167). The Beyrichian Kalk fauna represents the youngest pre-Gedinnian ostracod fauna known and is of post-Ludlow age according to Martinsson (1967). Thus part of the upper portion of the Stonehouse Formation appears to be Pridoli (=post-Ludlow, pre-Gedinnian) age. Legault (1968, p. 5–8) reports *Spathognathodus eosteinhornensis* zone conodonts from the Stonehouse Formation, suggesting late Ludlow or Pridoli age for part of the formation.

The combined fossil evidence suggests a Pridoli (=post-Ludlow, pre-Gedinnian) to early Gedinnian age for the Stonehouse Formation.

Age of Non-Arisaig Group Rocks in the Cape George Area

Scolithus (Worm-tube) Quartzite

The *Scolithus* (worm-tube) quartzite (Boucot *et al., in press*) yielded fossils at three localities: USNM 10834 and 11246[1] yielded *Hyattidina northumberlandensis*, which indicates a Moydart age, and 11246 yielded the Moydart species *Sphaerirhynchia saffordi* and "*Camarotoechia*" *squamifera* as well; USNM 11214 yielded *Shaleria gilpeni* and *Isorthis* (*Protocortezorthis*) *fornicatimcurvata*, the latter indicating a Stonehouse age.

Grey-blue Siltstone

The grey-blue siltstone (Boucot *et al., in press*) yielded the Stonehouse species *Delthyris* (*Quadrifarius*) *rugaecosta* and *Isorthis* (*Protocortezorthis*) *fornicatimcurvata* at one locality (USNM 11322).

Age of Stratigraphic Units in Southeast Pictou County

Glencoe Brook Formation

The Glencoe Brook Formation contains *Dolerorthis* sp., *Mendacella arisaigensis*, *Leptostrophia beechhillensis*, and *Cryptothyrella beechhillensis*, which are restricted to the Beechhill Cove Formation in the Arisaig Group. The Glencoe Brook Formation is clearly the same age as the Beechhill Cove Formation, i.e., early Llandovery.

Kerrowgare Formation

The Kerrowgare Formation conformably overlies the Glencoe Brook Formation, and is overlain by the Stonehouse Formation of Pridoli to early Gedinnian age. Although the upper contact of the Kerrowgare Formation is not exposed, the strata of the formation appear to be conformable with those of the overlying Stonehouse Formation. Fossils were found in the Kerrowgare Formation in only four small areas: (*a*) near the mouth of Sam Cameron Brook, where *Visbyella nana* and *Plagiorhyncha* sp. aff. *P. glassi* were found at one locality (USNM 11228), indicating correlation with the middle or upper members of the Ross Brook Formation; *Eocoelia curtisi*? and *Visbyella nana*? were found at a second locality (USNM 11226), suggesting correlation with the middle member of the Ross Brook Formation; (*b*) a locality (USNM 10817) on the west branch of Blanchard Brook which yielded *Meristina billingsiana*, a species diagnostic of the French River Formation, and several other species that occur in that formation; (*c*) two localities about a mile east of Bridgeville (USNM 10820, 11218) which also yielded the diagnostic French River species *Meristina billingsiana*; and (*d*) three localities on Holmes Brook (USNM 10845, 10851, 10852). USNM 10851 yielded *Isorthis* cf. *macadamensis*, indicating a correlation with either the French River or the Doctor's Brook Formation; USNM 10852 yielded *Howellella moydartensis* and *Salopina submedia*, suggesting a post-Ross Brook, pre-Stonehouse age; USNM 10845 yielded *Salopina submedia* and *Protochonetes novascoticus*, suggesting a post-Ross Brook age.

Stonehouse Formation

The Stonehouse Formation in southeast Pictou County is regarded as equivalent to the Stonehouse Formation in the Arisaig area and northeast Pictou County. It is lithologically similar to the Stonehouse Formation in these areas and contains the same fossil species.

[1]USNM localities are shown in Figure 3, and listed in the locality register. Additional information for USNM and GSC localities is on open file with the Geological Survey of Canada, Ottawa, Ontario.

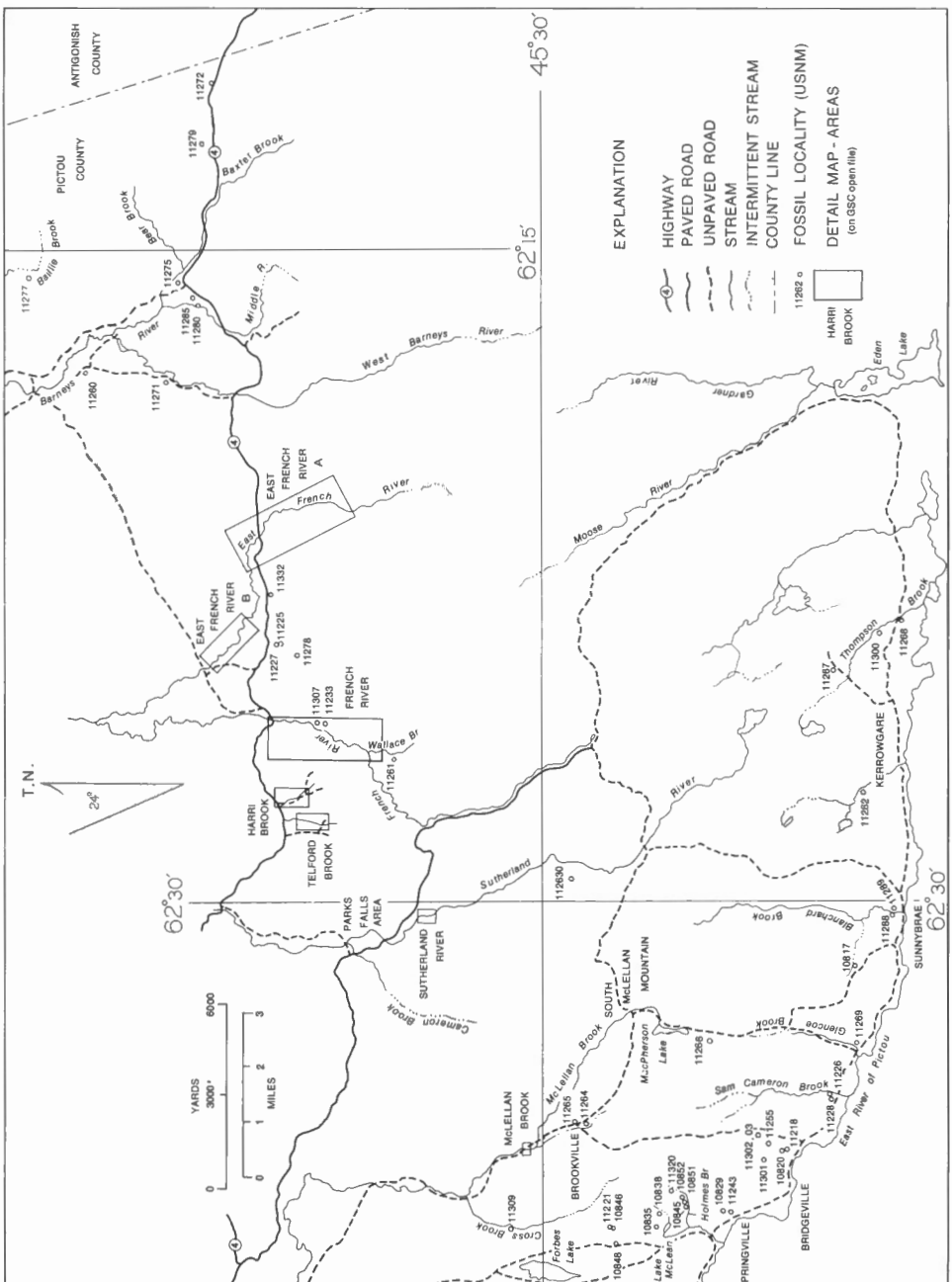


FIGURE 3. Fossil localities, eastern Pictou County, Nova Scotia.

SYSTEMATIC PALEONTOLOGY

Phylum **BRACHIOPODA**

Class ARTICULATA

Order ***ORTHIDA*** Schuchert and Cooper, 1932

Suborder ***ORTHIDINA*** Schuchert and Cooper, 1932

Superfamily ORTHACEA Woodward, 1852

[*nom. transl.* Walcott and Schuchert, 1908, p. 147 (*ex* Orthidae Woodward, 1852, p. 229)]

Family DOLERORTHIDAE Öpik, 1934

Subfamily DOLERORTHINAE Öpik, 1934

Genus ***Dolerorthis*** Schuchert and Cooper, 1931
(emended Williams, 1962)

Type species. *Orthis interplicata* Foerste, 1909a, p. 76, pl. 3, fig. 44.

Discussion. Schuchert and Cooper (1932, p. 88, 89) defined *Dolerorthis* to include only orthids in which the adult specimens are convexo-concave. Williams (1962, p. 113) emended the genus to include orthids which are similar to the type except that the adult specimens are biconvex. As now defined, the genus includes a great variety of species of Caradocian to Gedinnian age which are biconvex to convexo-concave, have an open delthyrium and notothyrium, short dental lamellae, cordate pedicle muscle field, flat triangular notothyrial platform, simple cardinal process and tabular brachiophores, and which lack accessory notothyrial ridges lateral to the cardinal process. Williams and Wright (1965, p. 316) state that *Dolerorthis* has variably developed notothyrial ridges; however, forms with notothyrial ridges are best assigned to *Schizoramma* Foerste (1912, p. 139; Boucot, 1960a, p. 294).

Dolerorthis sp.

Plate I, figures 1–5

Description

Exterior. Valves biconvex, pedicle valve more convex; semielliptical, 3/5 to 4/5 as long as wide, widest near long hinge line, cardinal angles rounded; brachial valve non-sulcate to weakly sulcate; interarea of pedicle valve flat, high apsacline, 1/4 to 1/5 as high as long; interarea of brachial valve flat, high anacline, about 1/6 as high as long; delthyrium and notothyrium open; anterior commissure crenulate and rectimarginate or slightly sulcate; costae fairly coarse, rectangular in cross-section, and increase by bifurcation or by insertion.

Interior of pedicle valve. Teeth supported by short, erect dental plates; muscle field cordate, extends anteriorly 1/3 to 1/4 the valve length; narrow, lanceolate adductor tracks open anteriorly; diductor impressions marked by curved ridges which mark the position of the muscle field at various growth stages; the impress of the costae may be confined to the periphery, or may extend posteriorly as far as the muscle field.

Interior of brachial valve. Short, tabular brachiophores supported by notothyrial platform; cardinal process a simple linear ridge; sockets slightly elevated above floor of valve; broad median ridge extends from the notothyrial platform to slightly less than half the valve length; muscle field usually obscure, when impressed, it consists of two pairs of oval adductors of about the same size; the impress of the costae is variable in extent as in the pedicle valve.

Comparison. Dolerorthis sp. was compared with type material, in the United States National Museum, of *Dolerorthis interplicata* Foerste, 1909a, from the Osgood Formation of late Llandovery (C_3–C_6) age of Indiana, the type species of *Dolerorthis* (Schuchert and Cooper, 1932, pl. 5, fig. 18). *D.* sp. is generically similar to the type species in its ornament and its brachial and pedicle interiors; however, owing to the poor state of preservation of the Arisaig specimens of *D.* sp., they cannot be identified specifically.

Occurrence. Beechhill Cove Formation (early Llandovery age), loc. USNM 10117, Arisaig area; loc. USNM 11257, Pictou County. Glencoe Brook Formation (early Llandovery age), locs. USNM 11262, 11267, Pictou County.

Material. 83 specimens.[1]

Subfamily GLYPTORTHINAE Schuchert and Cooper, 1931

Genus ***Ptychopleurella*** Schuchert and Cooper, 1931

Type species. *Orthis bouchardi* Davidson, 1847, p. 64, pl. 13, figs. 5–8.

Ptychopleurella? sp.

Plate I, figures 6, 7

Description

Exterior. Valves semielliptical, wider than long, pedicle valve subpyramidal, brachial valve fairly strongly convex with faint median sulcus; interarea of pedicle valve flat, apsacline, about 1/4 as high as long; delthyrium open; interarea of brachial valve not seen; valves marked by coarse angular costae which increase by bifurcation and insertion and by regularly spaced imbricating growth lamellae.

Interior of pedicle valve. Teeth supported by short divergent dental plates; muscle field short, circular in outline; surface marked by impress of external ornament.

Interior of brachial valve. Short brachiophores border prominent notothyrial platform; cardinal process narrow, simple; median ridge extends almost to midlength and separates adductor scars; periphery bears anterior crenulations.

Discussion. This orthid is known only from the external and internal impressions of the two valves. Both exhibit imbricating growth lamellae. Such lamellae are characteristic of glyptorthinids, of which five genera are known: *Glyptorthis* Foerste, 1914, *Eridorthis* Foerste, 1909b, *Lepidorthis* Wang, 1955, *Spinorthis* Wright, 1964, and *Ptychopleurella.* The specimens have a coarser ornament than *Glyptorthis*, and the subpyramidal pedicle valve differs from the relatively low pedicle valve of *Glyptorthis. Eridorthis* is characterized by a prominent sulcus in the brachial valve which reverts into a fold and by a corresponding fold in the pedicle valve; these are lacking in the two specimens. The specimens have a cardinal process which is not in *Lepidorthis*, and lack the suberect spines found in *Spinorthis. Ptychopleurella*? sp. resembles typical *Ptychopleurella* in having a subpyramidal pedicle valve and a relatively

[1] Counts of specimens given in this report do not include those in relatively small collections of Benson (1967, p. 17–20) and Kelley GSC numbered localities.

convex brachial valve which bears a sulcus, and in its cardinalia and muscle fields. However, Schuchert and Cooper (1932, p. 92) state that *Ptychopleurella* is characterized by a deep sulcus in the brachial valve bounded by two costellae considerably elevated above their fellows; this is lacking in *Ptychopleurella*? sp.

Ptychopleurella has not previously been recognized in beds of early Llandovery age. Ordovician *Ptychopleurella* have unbranched ribs; late Llandovery and younger *Ptychopleurella* have branching ribs. *Ptychopleurella*? sp. has branching ribs and thus resembles the other Silurian and Devonian species in this regard.

Occurrence. Beechhill Cove Formation (early Llandovery age), loc. USNM 10117, Arisaig area.

Material. Four specimens.

Suborder ***Dalmanellidina*** Johnson and Talent, 1967
[*nom.* "*correct.*" (*pro* Dalmanelloidea Johnson and Talent, 1967)]

Discussion. The punctate Orthida (=dalmanellids *sensu latu*) may be grouped into three categories, the first two of which form distinct, compact, and monophyletic groups: (1) the schizophoriids (Walmsley, Boucot, and Harper, 1969), (2) the rhipidomellids (Boucot, Johnson, and Walmsley, 1965; Boucot, Gauri, and Johnson, 1966; Harper, Boucot, and Walmsley, 1969), and (3) the Dalmanellidae plus all remaining punctate orthid groups. (The work of Kemežys (1968, p. 92) on the arrangement of primary costellae in punctate orthids supports the conclusion that the rhipidomellids, as defined in the above-cited references, constitute a monophyletic group.) This suggests a threefold classification of the punctate orthids into (1) a superfamily Enteletacea (to include the schizophoriids), (2) a superfamily Rhipidomellacea, and (3) a superfamily Dalmanellacea, all of these superfamilies being placed in a suborder Dalmanellidina. A related and equally workable scheme was proposed by Johnson and Talent (1967, p. 142, 143) following the lead of Alikhova (1960, p. 190–195). Alikhova assigned the punctate orthids to two superfamilies, the Enteletacea and the Rhipidomellacea, the latter including as two major groups the families Dalmanellidae and Rhipidomellidae. Johnson and Talent (1967, p. 142, 143) follow this scheme, substituting the name Dalmanellacea for Rhipidomellacea of Alikhova (ref. cit.) and assigning both the Dalmanellacea and the Enteletacea to a suborder Dalmanelloidea. The classification proposed by Johnson and Talent is followed here.

Superfamily DALMANELLACEA Schuchert, 1913
[*nom. transl.* Schuchert and Cooper, 1931 (*ex* Dalmanellinae Schuchert, 1913)]

Family DALMANELLIDAE Schuchert, 1913
[*nom. transl.* Schuchert and LeVene, 1929 (*ex* Dalmanellinae Schuchert, 1913)]

Genus ***Dalmanella*** Hall and Clarke, 1892

Type species. *Orthis testudinaria* Dalman, 1828, p. 115, pl. 2, figs. 4a–d.

Dalmanella? *primitiva* McLearn, 1924
Plate I, figures 8–17; Plate II, figure 1

1924. *Dalmanella elegantula* mut. *primitiva* McLearn, p. 53, pl. 3, fig. 7.

Description

Exterior. Pedicle valve strongly convex, somewhat carinate, brachial valve flat or gently convex with low sulcus; valves shield-shaped with greatest width near hinge line and rounded

cardinal angles; width varies from slightly greater than to slightly less than length; anterior commissure crenulate and slightly sulcate; interarea of pedicle valve apsacline, curved, about 1/8 as high as long; interarea of brachial valve flat, low, and anacline; delthyrium open, notothyrium partially filled by cardinal process; fine costellae increase by bifurcation and insertion.

Interior of pedicle valve. Stout teeth supported by short dental plates; muscle field rarely preserved, consists of oval diductor scars separated by a parallel-sided median adductor track; periphery bears anterior crenulations.

Interior of brachial valve. Brachiophores medially convergent at their bases and flare laterally at their distal ends; sockets floored by fulcral plates; cardinal process simple; muscle field extends to about midlength and is about as wide as long, consists of a posterior pair and a slightly larger anterior pair of adductors, and is divided by a broad, slightly tapering median ridge; curved ridges commonly extend from the brachiophores and bound the muscle field laterally at its posterior end; anterior crenulations deeply impressed along periphery of valve. One specimen shows faint ridges in one socket which may be crenulations.

Comparison. D.? primitiva resembles typical *Dalmanella* especially in having brachiophores which converge at their bases and fulcral plates. It differs in having a shield-shaped outline and a simple cardinal process in contrast to a semielliptical outline and double cardinal process.

D.? primitiva resembles *Resserella* Bancroft, 1928 in outline and in having a strongly convex pedicle valve, and may well have been ancestral to it. It differs, however, in lacking the characteristic resserellid ornament in the median part of the brachial valve, and in lacking well-defined crenulated teeth and sockets. *Resserella* has much stouter brachiophores than *D.? primitiva* and has a bilobed or trilobed cardinal process which is usually much broader than that in *D.? primitiva.*

Occurrence. Beechhill Cove Formation (early Llandovery age), locs. USNM 10116, 10929, Arisaig area.

Material. 166 specimens.

Dalmanella sp. A

Plate II, figures 2–11

Description

Exterior. Valves biconvex with pedicle valve more convex; outline subcircular to subelliptical; hinge line about 1/2 to 3/5 greatest width; cardinal angles rounded; interarea of pedicle valve apsacline, curved, about 1/5 as high as long; interarea of brachial valve flat, anacline, about 1/8 as high as long; notothyrium and delthyrium open; costellae coarse, increase by bifurcation and insertion; anterior commissure crenulate and rectimarginate.

Interior of pedicle valve. Teeth supported by short, widely spaced dental plates; muscle field oval in outline and slightly wider than long; diductor scars separated by broad adductor track; the impress of the costellae may be confined to the periphery of the valve or may extend inward to the muscle field.

Interior of brachial valve. Tabular brachiophores medially convergent on to the median ridge and supported by fulcral plates; cardinal process simple; prominent tapering median ridge extends from cardinalia to 1/2 to 3/4 the valve length; muscle field poorly impressed anteriorly; impress of costellae as in pedicle valve.

Comparison. D. sp. A and *D.? primitiva* differ as follows: *D.* sp. A has a subcircular to subelliptical outline; *D.? primitiva* is shield-shaped. *D.* sp. A has a more convex brachial valve, coarser ribs, a more prominent brachial valve median ridge, and a broader muscle field in the pedicle valve.

D. sp. A differs from *D. testudinaria* Dalman, 1828 in having a broader muscle field in the pedicle valve, coarser ribs, and a simple rather than a bilobed cardinal process.

Occurrence. Beechhill Cove Formation (early Llandovery age), loc. USNM 10115, Arisaig area.

Material. 53 specimens.

Dalmanella sp. B

Plate II, figures 13–18

Description

Exterior. Valves plano-convex or unequally biconvex with pedicle valve more convex; subelliptical in outline, wider than long, with hinge line about 2/3 greatest width and cardinal angles rounded; brachial valve gently sulcate or non-sulcate; anterior commissure crenulate, rectimarginate to gently sulcate; interarea of pedicle valve curved, apsacline, about 1/6 as high as long; interarea of brachial valve low, flat, and anacline; delthyrium open; notothyrium filled by cardinal process; moderately coarse costellae increase by bifurcation and insertion.

Interior of pedicle valve. Teeth supported by slightly curved dental lamellae; muscle field oval in outline, extends to about 1/3 valve length; impress of costellae extends posteriorly to muscle field.

Interior of brachial valve. Brachiophores short, stubby, medially convergent at their bases, supported by fulcral plates; cardinal process simple; median ridge extends to 1/2 to 2/3 the valve length; adductor scars poorly impressed; impress of costellae may be confined to periphery or may extend well posteriorly.

Comparison. D. sp. B differs from *D.? primitiva* in having stubby, nonflaring brachiophores, and a subelliptical rather than a shield-shaped outline; from *D.* sp. A in having a much flatter brachial valve, broader brachiophores, and a narrower muscle field in the pedicle valve; and from *D. testudinaria* Dalman, 1828 in having broader brachiophores, a flatter brachial valve, and a simple rather than a double cardinal process.

Occurrence. Glencoe Brook Formation (early Llandovery age), locs. USNM 11264, 11265, 11266, 11268, 11269, Pictou County.

Material. 162 specimens.

Dalmanella? sp.

Plate II, figure 12

A single finely costellate, strongly convex dalmanellid pedicle valve with an elongate muscle field that lacks a median ridge was found at loc. USNM 10115 in the Arisaig area in the Beechhill Cove Formation (early Llandovery age). It differs from *Dalmanella* sp. A, which occurs at the same locality, in having finer ornament and a much more elongate muscle field. The affinities of this specimen are not clear.

Genus *Visbyella* Walmsley, Boucot, Harper and Savage, 1968

Type species. *Orthis visbyensis* Lindström 1860, p. 366, pl. 12, fig. 8.

Visbyella nana (McLearn, 1924)

Plate III, figures 11–15; Plate IV, figure 1

1924. *Dalmanella wisbyensis* var. *nana* McLearn, p. 55, pl. 3, figs. 10–17.
1924. *Dalmanella conservatrix* McLearn, pl. 2, fig. 26.
1968. *Visbyella nana* Walmsley, Boucot, Harper, and Savage, p. 311–313, pl. 62, figs. 1–8.

Description

Exterior. Pedicle valve strongly convex; brachial valve sulcate, flat or only slightly convex in the posterior part and flat or gently concave along periphery; valves semielliptical to shield-shaped with obtuse cardinal angles; hinge line slightly shorter than greatest width, which is slightly posterior to midlength. Width varies from 3/4 length to equal to length; anterior commissure crenulate and sulcate; interarea of pedicle valve strongly curved, apsacline, 1/4 as high as long; interarea of brachial valve flat, erect to hypercline, and about 1/3 as high as interarea of pedicle valve; beak of pedicle valve strongly incurved but does not overhang brachial valve; delthyrium with apical 1/3 closed by apical plate; notothyrium and basal part of delthyrium filled by cardinal process; costellae fine, increase by bifurcation and insertion; median rib in brachial valve bifurcates in the typical resserellid pattern (Walmsley, 1965, p. 747) with median costella giving rise alternately to branches to the left and branches to the right, resulting in many specimens in a smooth triangular median area.

Interior of pedicle valve. Teeth large, crenulate, bear crural fossettes, supported by thick dental plates; muscle field cordate, extends 1/3 to 1/2 the valve length and is about 3/5 as wide as long; triangular diductor scars separated by broad adductor track of uniform width; low median thickening may extend anterior to adductor track; periphery marked by prominent anterior crenulations which may extend posteriorly as impress of costellae.

Interior of brachial valve. Brachiophores widely divergent at their bases, blunt, strongly curved posteriorly; sockets crenulate, floored by socket pads (Walmsley, 1965, p. 445–456) with a strongly convex inner surface; trilobed, posterodorsally directed, cardinal process widens distally; muscle field subtriangular, elongate, extends 2/3 valve length and is bounded laterally by low ridges; anterior adductors the smaller; high median ridge extends 7/8 valve length. Median ridge increases in height at the anterior end of the muscle field, and then tapers abruptly anteriorly; periphery with prominent anterior crenulations as in the pedicle valve.

Occurrence. Middle member Ross Brook Formation (late Llandovery (C_1–C_5) age), Twenhofel loc. 184b, loc. USNM 10124, Arisaig area; locs. USNM 11224, 11225, 11231, 11232, 11236, 11237, Pictou County; questionably at USNM 10121, Arisaig area. Upper member, Ross Brook Formation (late Llandovery (C_6) age), locs. USNM 10120, 10127, Arisaig area; locs. USNM 10833, 10856, 11227, 11229, 11230, 11233, 11234, 11235, Pictou County. Kerrowgare Formation (late Llandovery to Ludlow age), loc. USNM 11228, questionably at USNM 11226, Pictou County.

Material. 529 specimens (10 questionably assigned).

Genus *Resserella* Bancroft, 1928

Type species. *Orthis canalis* Sowerby, 1839, p. 630, pl. 13, fig. 12a.

Resserella cf. *R. concavoconvexa* (Twenhofel, 1928)

Plate IV, figures 2–9

1928. *Dalmanella concavoconvexa* Twenhofel, p. 179, pl. 16, figs. 1–3.

Description

Exterior. Pedicle valve strongly convex; brachial valve flat or concave, weakly sulcate or non-sulcate; valves shield-shaped with obtuse cardinal angles and hinge line about 3/4 the greatest width, which occurs at about midlength; interarea of pedicle valve curved, low anacline, about 1/5 as high as long; interarea of brachial valve flat, erect, about 1/10 as high as long; delthyrium open, notothyrium filled by cardinal process; anterior commissure crenulate, rectimarginate to gently sulcate; fine costellae increase by bifurcation and insertion; in both valves median costella bifurcates to give rise alternately to branches to the right and branches to the left which do not bifurcate. This pattern of branching is characteristic of the resserellids (Walmsley, 1965, p. 457).

Interior of pedicle valve. Stout teeth, faintly crenulate, bear crural fossettes, supported by short dental plates; muscle field oval, extends 2/5 valve length; diductor scars separated by broad adductor track; on some specimens faint tapering raised area extends anteriorly from adductor track; anterior crenulations deeply impressed around periphery, may extend inwards as impress of costellae.

Interior of brachial valve. Brachiophores widely divergent, curved posteriorly; sockets smooth or faintly crenulate, floored by socket pads; posteriorly directed cardinal process broad, bilobed; muscle field broad, extends anteriorly to about midlength, divided by broad median ridge, weakly impressed anteriorly; anterior crenulations as in pedicle valve.

Comparison. R. cf. *R. concavoconvexa* is identical in ornament and external form to *R. concavoconvexa* Twenhofel, 1928 from the Jupiter Formation of late Llandovery (C_3–C_6) age on Anticosti Island. The internal features of *R. concavoconvexa* are poorly known.

R. cf. *R. concavoconvexa* differs from *Visbyella nana* in having a bilobed posteriorly directed cardinal process and an erect interarea in the brachial valve, and in lacking an apical pseudodeltidium and a high median ridge in the brachial valve. *V. nana* has a trilobed, posterodorsally directed cardinal process, an erect to hypercline interarea in the brachial valve, an apical pseudodeltidium, and a very high median ridge in the brachial valve.

R. cf. *R. concavoconvexa* differs from *R. elegantula* Dalman, 1828 from the Mulde marl of Wenlock age on Gotland, Sweden, in having a flat or concave brachial valve and a very faint sulcus or no sulcus in the brachial valve.

Occurrence. French River Formation (late Llandovery (C_6) or early Wenlock age), loc. USNM 10155, Arisaig area; locs. USNM 10815, 10821, 11217, 11220, Pictou County; locs. USNM 10810, 10814, 10822, Cobequid Mountains. Kerrowgare Formation in beds correlative with the iron ore beds of the French River Formation, loc. USNM 10817, Pictou County.

Material. 147 specimens.

Subfamily ISORTHINAE Schuchert and Cooper, 1931

Genus *Isorthis* Kozlowski, 1929

Type species. *Dalmanella* (*Isorthis*) *szajnochai* Kozlowski, 1929, p. 75–79, pl. 2, figs. 24–41.

Discussion. Two subgenera are recognized herein: *Isorthis* (*Isorthis*) based on *I. szajnochai*, the type species of *Isorthis*, and *Isorthis* (*Protocortezorthis*) Johnson and Talent, 1967 based on *I. fornicatimcurvata* Fuchs, 1919. *Protocortezorthis* was defined as a genus by Johnson and Talent (1967, p. 154–160) but is here regarded as a subgenus as *I. fornicatimcurvata* closely resembles *I. szajnochai* in many of its internal characters. The principal differences lie in the muscle field of the pedicle valve; that of *I. szajnochai* is triangular in outline, and the pedicle valve of *I. szajnochai* is thickened at the anterior end of the muscle field; *I. fornicatimcurvata* has a muscle field in the pedicle valve with parallel or posteriorly convergent lateral margins, and shows no such thickening. Although *I. fornicatimcurvata* has a less convex brachial valve than *I. szajnochai*, this can hardly be regarded as a subgeneric character since, as pointed out by Walmsley (1965, p. 465), the many species assignable to *Isorthis* vary from almost plano-convex to subequally biconvex.

Of the three species of *Isorthis* recognized in the Arisaig rocks, *I. macadamensis* has a pedicle valve interior like that of *I. szajnochai* and so is assigned to *Isorthis* (*Isorthis*). *I. fornicatimcurvata* is assigned by definition to *Isorthis* (*Protocortezorthis*). The third species, *I.* sp. A, is most closely allied to *I.* (*Protocortezorthis*), but is not assigned to a subgenus pending a more complete investigation of all *Isorthis* species.

Isorthis sp. A

Plate IX, figures 14–17

Description

Exterior. Valves unequally biconvex, pedicle valve more convex; transversely subelliptical in outline with rounded cardinal margins; brachial valve sulcate; anterior commissure crenulate and sulcate; hinge line about 2/3 greatest width; interarea of pedicle valve curved, apsacline, about 1/5 as high as long; interarea of brachial valve low, flat, anacline; delthyrium and notothyrium open; valves multicostellate.

Interior of pedicle valve. Teeth supported by short dental plates; elongate parallel diductor scars extend anteriorly 1/3 to slightly less than 1/2 valve length and are separated by a faint broad median ridge; periphery marked by anterior crenulations.

Interior of brachial valve. Erect, slightly flaring brachiophores diverge at about a right angle to one another; cardinal process simple; sockets floored by socket pads; muscle field about as wide as long, extends somewhat anterior to midlength, and is divided by a narrow, tapering median ridge; periphery marked by anterior crenulations.

Comparison. Isorthis sp. A differs from the species of *Dalmanella* previously described in having brachiophores that are erect in contrast to those of *Dalmanella* that are medially convergent at their bases, and in having an incipient median ridge in the pedicle valve. It differs from *Dalmanella*? *primitiva*, which also occurs in the Beechhill Cove Formation, in having a subelliptical outline; *D.*? *primitiva* has a shield-shaped outline. It differs from *D.* sp. A from the Beechhill Cove Formation in having a much narrower muscle field in the pedicle valve and much finer costellae. It differs from *Dalmanella* sp. B from the Glencoe Brook Formation, equivalent in age to the Beechhill Cove Formation, in having finer ornament, a more convex brachial valve, a narrower muscle field in the pedicle valve, and brachiophores which are more divergent anteriorly.

Isorthis sp. A differs from *Fascifera* sp. from the Glencoe Brook Formation in having brachiophores which are more divergent anteriorly, socket pads in contrast to the fulcral plates of *Fascifera* sp., and a sulcus in the brachial valve. *Isorthis* sp. A has an incipient median ridge in the pedicle valve and this is lacking in *Fascifera* sp.

Occurrence. Beechhill Cove Formation (early Llandovery age), loc. USNM 10115, Arisaig area.

Material. 13 specimens.

Isorthis (*Isorthis*) Kozlowski, 1929

Isorthis (*Isorthis*) *macadamensis* n. sp.

Plate VII, figures 1–7

Description

Exterior. Valves unequally biconvex to plano-convex, pedicle valve more convex; subcircular to subelliptical in outline with rounded cardinal margins; as wide as to slightly wider than long; anterior commissure crenulate and rectimarginate to gently sulcate; brachial valve commonly with shallow median sulcus; hinge line about 2/3 the greatest width; interarea of pedicle valve curved, apsacline, about 1/4 as high as long; interarea of brachial valve anacline, flat, about 1/3 as high as pedicle interarea; delthyrium and notothyrium open; valves multicostellate.

Interior of pedicle valve. Teeth supported by short, thick, tabular dental plates with flattened anterior margins; teeth with deep crural fossettes; diductor field triangular in outline, deeply impressed, extends to midlength and is divided by a narrow median ridge; valve thickened at anterior end of muscle field; low ridges extend anteriorly from the dental plates to bound the diductor field; periphery with anterior crenulations which may bear a median groove; on some specimens a broad pallial mark extends anterolaterally from each diductor scar.

Interior of brachial valve. Brachiophores thick, tabular, diverge at about a right angle to one another, and may flare posterolaterally at their distal end; sockets curved, bounded by thick socket pads; cardinal process simple with short shaft and expanded myophore; muscle field slightly longer than wide, extends anteriorly 3/5 to 3/4 the valve length, and is divided by a broad, parallel-sided or slightly tapering median ridge and by transverse ridges; posterior pair of adductors smaller than anterior pair; periphery marked by anterior crenulations which may bear a median groove.

Comparison. I. macadamensis differs from *I.* sp. A in having a much more deeply impressed muscle field in the pedicle valve. Its muscle field is triangular in outline and divided by a narrow median ridge in contrast to that of *I.* sp. A, which is subelliptical and divided by a low broad median ridge. In *I. macadamensis*, but not *I.* sp. A, the pedicle valve is thickened at the anterior end of the muscle field. The teeth of *I. macadamensis* are thicker than those of *I.* sp. A and, unlike those of *I.* sp. A, they bear crural fossettes. The muscle field in the brachial valve of *I. macadamensis* is much more deeply impressed, and extends further anteriorly than that of *I.* sp. A.

Occurrence. French River Formation (late Llandovery (C_6) or early Wenlock age), locs. USNM 10135, 10136, 10138, 10142, 10148, 10912, 10927, Arisaig area; questionably at USNM 10150, Arisaig area; locs. USNM 10809, 10815, 10821, 11212, 11213, 11216, 11217, 11219, 11220, Pictou County; loc. USNM 10814, Cobequid Mountains. Doctor's Brook Forma-

tion (Wenlock age), loc. USNM 10909, Arisaig area. French River or Doctor's Brook Formation, loc. USNM 10818, Pictou County; loc. USNM 10813, Cobequid Mountains; loc. USNM 11183, Lochaber area. Kerrowgare Formation (late Llandovery to Ludlow age), loc. USNM 11218, Pictou County, questionably at loc. USNM 10851, Pictou County. *Material.* 3,042 specimens.

Type. Holotype, GSC No. 19250; paratypes, GSC Nos. 19244, 19245, 19248, 19249, 19251, 19253.

Isorthis (*Protocortezorthis*) Johnson and Talent, 1967

1967. *Protocortezorthis* Johnson and Talent, p. 154–160, pl. 21, figs. 1–22.

Type species. *Orthis fornicatimcurvata* Fuchs, 1919, p. 58–61, pl. 5, figs. 1–6, 10; pl. 6, fig. 1a.

Isorthis (*Protocortezorthis*) *fornicatimcurvata* (Fuchs, 1919)

Plate VII, figures 8–19

1919. *Orthis fornicatimcurvata* Fuchs, ref. cit.
1924. *Dalmanella lunata* (Sowerby), McLearn, p. 55, pl. 4, figs. 5, 6.
1924. *Dalmanella elegantula* var. *submedia* McLearn (*non Salopina submedia* (McLearn) as restricted herein), pl. 3, figs. 5, 6 only.
1960. *Isorthis fornicatimcurvata* (Fuchs), Boucot, p. 296–298, pl. 10, figs. 6, 7 (includes synonomy for species, p. 296, 297).
1967. *Protocortezorthis fornicatimcurvata* (Fuchs), Johnson and Talent, p. 157, pl. 21, figs. 14–22.

Description

Exterior. Valves biconvex with pedicle valve more convex; sub-semielliptical to sub-elliptical in outline; wider than long to as wide as long; cardinal angles rounded; hinge line about 2/3 the greatest width; brachial valve usually gently sulcate; anterior commissure crenulate and sulcate or rectimarginate; interarea of pedicle valve apsacline, gently curved, about 1/5 as high as long; interarea of brachial valve low, apsacline, flat; delthyrium and notothyrium open; valves multicostellate.

Interior of pedicle valve. Teeth bear crural fossettes; long dental plates extend anteriorly as low ridges to bound muscle field laterally; muscle field elongate, extends to about mid-length and is divided by median ridge anteriorly; diductor scars with parallel-sided or convergent lateral margins; adductor scars, when impressed, elongate oval in outline, enclosed by diductor scars, and confined to the medial 1/3 of the length of the muscle field; a pair of pallial marks may diverge anterolaterally from diductor scars at a low angle; low pedicle callist may be present; periphery marked by anterior crenulations; impress of costellae may extend posteriorly from anterior crenulations commonly as far as muscle field.

Interior of brachial valve. Brachiophores, erect slightly flaring blades, diverge at about a right angle to one another; sockets floored by socket pads; cardinal process consists of a narrow shaft and a simple, oval myophore except in a few large specimens which have a bilobed myophore; muscle field extends to midlength or slightly anterior to midlength, is longer than wide, bounded laterally by ridges which are usually disjunct, and is divided by a broad median ridge of uniform width; lateral margins of muscle field parallel to midline except at the anterior end of the muscle field where they converge medially; adductor scars commonly, but not always, divided into an anterior pair and a slightly smaller posterior pair; anterior crenulations and impress of costellae as in pedicle valve.

Comparison. I. fornicatimcurvata differs from *I.* sp. A in having a much more prominent median ridge in the pedicle valve, narrower and longer brachiophores, a shorter, narrower,

less circular, and more deeply impressed muscle field in the brachial valve, and a broader median ridge in the brachial valve.

I. fornicatimcurvata differs from *I. macadamensis* in having a less deeply impressed diductor field in the pedicle valve with parallel or posteriorly convergent lateral margins. In *I. macadamensis* the muscle field in the pedicle valve is triangular in outline. In *I. macadamensis* the pedicle valve is thickened at the anterior end of the muscle field; in *I. fornicatimcurvata* it is not. In the brachial valve the muscle field of *I. fornicatimcurvata* is narrower than that of *I. macadamensis*, does not extend as far anteriorly, and may or may not be distinctly quadripartite; that of *I. macadamensis* is distinctly quadripartite. *I. fornicatimcurvata* is more coarsely ribbed than *I. macadamensis*.

I. fornicatimcurvata differs from *I. orbicularis* Sowerby, 1839 from the Ludlovian of Great Britain, in having a more convex brachial valve, somewhat coarser ribs, and a muscle field in the brachial valve that is less circular in outline, extends further anteriorly, and is quadripartite or bipartite. The muscle field of *I. orbicularis* is quadripartite. In the pedicle valve of *I. fornicatimcurvata*, the lateral margins of the muscle field tend to be more convergent anteriorly than those in *I. orbicularis*.

Occurrence. Stonehouse Formation (Pridoli to early Gedinnian age), locs. USNM 10184–10190, 10193–10199, 10201–10206, 10208, 10210, 10211, 10910, 10922, 10928, Arisaig area; locs. USNM 10846, 11221, Pictou County; locs. USNM 10843, 11215, Cape George area; locs. USNM 10830, 11222, 11223, GSC 68836, 68837, 68842, 68846, 68847, 68850, Cobequid Mountains; loc. USNM 11186, Lochaber area. Beds of Stonehouse age in the *Scolithus* (worm-tube) quartzite, loc. USNM 11214, Cape George area. Questionable *I. fornicatimcurvata* occur in the lower member of the Moydart Formation (Ludlow age), loc. USNM 10827, Lochaber area.

Material. 2,099 specimens.

Family LINOPORELLIDAE Schuchert and Cooper, 1931

Genus ***Linoporella*** Schuchert and Cooper, 1931

Type species. *Orthis punctata* Verneuil, 1848, p. 343.

Linoporella sp.

Plate III, figures 6–9

Description

Exterior. Valves subequally biconvex; subelliptical in outline; slightly wider than long; hinge line shorter than greatest width; anterior commissure rectimarginate and weakly crenulate; interarea of pedicle valve low, apsacline, curved; interarea of brachial valve low, flat, and anacline; valves marked by fine costellae. No trace of coarse pits on the costellae such as those found in the type species, presumably owing to the relatively poor state of preservation of the Arisaig specimens.

Interior of pedicle valve. Teeth supported by parallel dental plates which bound muscle field laterally; muscle field longer than wide and confined to the posterior 1/3 of the valve; diductor scars divided by broad tapering adductor track; a low narrow ridge extends anteriorly from the muscle field to about 2/3 the valve length; periphery faintly marked by the impress of the costellae.

Interior of brachial valve. Linear cardinal process merges anteriorly with a prominent narrow median ridge which may terminate at midlength or may extend anteriorly as far as the margin; brachiophores erect and about parallel at their distal ends, they curve medially at their bases and converge to intersect the median ridge and form a cruralium; a faint ridge diverges anterolaterally from the cruralium on each side of the valve; periphery faintly marked by the impress of costellae as in the pedicle valve.

Discussion. Linoporella sp. is known from a small number of incomplete specimens and so may not be identified specifically. These specimens are similar to *Linoporella punctata* illustrated by Schuchert and Cooper (1932, pl. 18, figs. 13, 14, 17, 18, 24, 33).

Occurrence. Beechhill Cove Formation (early Llandovery age), locs. USNM 10115, 10117, Arisaig area; locs. USNM 11257, 11258, Pictou County.

Material. 14 specimens.

Family RHIPIDOMELLIDAE Schuchert, 1913
emended Boucot, Johnson, and Walmsley, 1965
emended Boucot, Gauri, and Johnson, 1966
emended Harper, Boucot, and Walmsley, 1969

Subfamily RHIPIDOMELLINAE Schuchert, 1913
emended Boucot, Johnson, and Walmsley, 1965

Genus *Mendacella* Cooper, 1930

Type species. *Orthis uberis* Billings, 1866, p. 42.

Mendacella arisaigensis (McLearn, 1924)

Plate IV, figures 10–17; Plate V, figures 1–8

1924. *Schizophorella arisaigensis* McLearn, p. 58, pl. 4, figs. 9–13.

Description

Exterior. Valves biconvex, brachial valve more convex; pedicle valve rarely weakly sulcate; valves 2/3 as long to as long as wide; circular to transversely elliptical in outline; hinge line about 1/3 the greatest width; anterior commissure crenulate and rectimarginate; interarea of pedicle valve low, slightly curved, apsacline; interarea of brachial valve low, planar, low anacline to orthocline; delthyrium and notothyrium open; valves multicostellate, costellae hollow, straight or very gently curved.

Interior of pedicle valve. Stout teeth supported by short, thick dental plates; pedicle callist prominent; muscle field deeply impressed, bounded laterally by ridges which extend anteriorly from dental plates; diductor scars very long and narrow, with parallel or anteriorly convergent, commonly scalloped, lateral margins anterior to delthyrial cavity; adductor scars confined to posterior half of muscle field. In juvenile specimens (Pl. IV, figs. 11, 12) the diductor scars do not enclose the adductor scars anteriorly; instead, they are separated by a broad, slightly raised area anterior to the adductor scars. In adult specimens (Pl. IV, figs. 13–17; Pl. V, figs. 1, 2) the diductor scars enclose the adductor scars and, anterior to the adductor scars, they are separated by a prominent median ridge. Anterior crenulations confined to periphery of valve.

Interior of brachial valve. Brachiophores stout, tear-shaped in outline, diverge laterally at about a 60 degree angle to one another; sockets rounded, may be floored by low socket pads; cardinal process broad, simple; muscle field slightly wider than long, extends to about midlength, divided medially by broad rounded ridge of uniform width; anterior pair of adductors somewhat larger than posterior pair; anterior crenulations confined to periphery; on a few specimens two pairs of pallial sinuses extend anterolaterally from the middle part of the muscle field.

Comparison. Mendacella arisaigensis differs from the type species, *M. uberis*, which is known from beds of Ashgill to Upper Llandovery (C_2) age on Anticosti Island, in having unequally biconvex valves with the brachial valve the more convex, a broader cardinal process, and a longer hinge line. *M. uberis* is subequally biconvex. In the pedicle valve of adult specimens of *M. arisaigensis*, the diductor scars enclose the adductor scars and are separated by a prominent median ridge anteriorly. In adult specimens of *M. uberis*, the diductor scars do not enclose the adductor scars, but are separated by a broad flat area anteriorly. (These differences may simply reflect differences in sample size as only a small sample of *M. uberis* was available for comparison.)

M. arisaigensis differs from *Mendacella mullochiensis* Davidson, 1871, from the Mulloch Hill Sandstone of early Llandovery age in the Girvan district of Scotland in lacking a prominent sulcus in the pedicle valve and a fold in the brachial valve.

M. arisaigensis is very similar to specimens of *M.* sp. in the collection of A. J. Boucot from beds of early Llandovery age in the Caparo Formation of the Mérida Andes (Boucot, Johnson, and Walmsley, 1965, pl. 45, figs. 21–28) and from Gaspé (Boucot, Johnson, and Walmsley, 1965, pl. 45, figs. 8–20; pl. 46, figs. 32–36). The Venezuelan species, especially, resembles *M. arisaigensis* in shape, outline, cardinalia, and brachial and pedicle valve muscle fields, and is, in all probability, conspecific with it.

McLearn (1924, p. 58) assigned *M. arisaigensis* to the orthid genus *Schizophorella*. *Schizophorella* is impunctate and has orthid cardinalia, whereas *M. arisaigensis* is punctate and has dalmanellid cardinalia.

Occurrence. Beechhill Cove Formation (early Llandovery age), locs. USNM 10114, 10115, 10117, 10930, Arisaig area; locs. USNM 11257, 11258, 11260, 11261, Pictou County. Glencoe Brook Formation (early Llandovery age), locs. USNM 11262, 11263, 11267, Pictou County.

Material. 1,199 specimens.

Genus ***Dalejina*** Havlíček, 1953

Type species. *Dalejina hanusi* Havlíček, 1953, p. 5, pl. 1, figs. 10–12; pl. 2, fig. 4.

Dalejina sp.

Plate V, figures 9, 10

Description

Exterior. Valves unequally biconvex, pedicle valve more convex; subelliptical in outline with hinge line about 1/3 the greatest width; slightly wider than long; anterior commissure crenulate and rectimarginate; interarea of pedicle valve low, apsacline; interarea of brachial valve low, anacline; delthyrium and notothyrium open.

Interior of pedicle valve. Stout teeth supported by short dental plates; muscle field broad, cordate, extends to about midlength; adductor scars confined to posterior half of muscle field, completely enclosed by diductor scars; anterior crenulations confined to periphery.

Interior of brachial valve. Brachiophores tear-shaped in outline, diverge laterally at about a 60 degree angle to one another; cardinal process simple, broad, oval in outline; muscle field about as wide as long, extends about to midlength, divided by broad, slightly tapering ridge; anterior pair of adductors larger than posterior pair; anterior crenulations confined to periphery.

Occurrence. French River Formation (late Llandovery (C_6) or early Wenlock age), locs. USNM 10148, 10158, Arisaig area; locs. USNM 10815, 11220, Pictou County; loc. USNM 10810, Cobequid Mountains.

Material. 19 specimens.

Subfamily HETERORTHINAE Schuchert and Cooper, 1931
emended Harper, Boucot, and Walmsley, 1969

Genus ***Heterorthella*** Harper, Boucot, and Walmsley, 1969

Type species. *Heterorthella maehli* Harper, Boucot, and Walmsley, 1969, p. 80, pl. 15, figs. 4–10, 12.

Heterorthella maehli Harper, Boucot, and Walmsley, 1969

Plate III, figures 16, 17; Plate VI, figures 10–18

Description

Exterior. Valves large, transversely subelliptical in outline with long hinge line and rounded cardinal angles, somewhat wider than long; anterior commissure crenulate and rectimarginate; pedicle valve gently convex, brachial valve flat to gently concave; interarea of pedicle valve slightly curved, apsacline, about 1/8 as high as long; interarea of brachial valve linear; delthyrium and notothyrium open; costellae in posterior part of valves strongly curved to intersect the posterior margin.

Interior of pedicle valve. Teeth supported by long, curved dental plates which bound the muscle field laterally; muscle field flabellate to suboval in outline, 3/4 as wide as long, and extends anteriorly about to midlength; elongate oval adductor scars confined to the medial 1/3 of the muscle field, not enclosed by diductor scars anteriorly; periphery marked by anterior crenulations which are rounded in cross-section; impress of costellae may extend posteriorly to muscle field.

Interior of brachial valve. Very long, erect, blade-like brachiophores diverge at a right angle to each other and bound the muscle field posterolaterally; brachiophores supported by secondary material deposited medial and anterior to them; cardinal process simple, blade-like, very high at its posterior end, tapering anteriorly; posterior margin of cardinal process straight and erect; sockets level with floor of valve; adductor scars faintly impressed, suboval in outline, extending to midlength, divided by low tapering myophragm; periphery marked by anterior crenulations which are rounded in cross-section; impress of costellae may extend posteriorly to muscle field.

Occurrence. French River Formation (late Llandovery (C_6) or early Wenlock age), locs. USNM 10140, 10149, Arisaig area; locs. USNM 10816, 10825, 10842, 10847, 11247, Pictou County.

Material. 135 specimens.

Subfamily PLATYORTHINAE Harper, Boucot, and Walmsley, 1969

Genus ***Marklandella*** Harper, Boucot, and Walmsley, 1969

Type species. *Marklandella giraldi* Harper, Boucot, and Walmsley, 1969, p. 83–84, pl. 17, figs. 1–10.

Marklandella macadamica Harper, Boucot, and Walmsley, 1969

Plate VI, figures 4–9

1969. *Marklandella macadamica* Harper, Boucot, and Walmsley, 1969, p. 84–86, pl. 17, figs. 11–15.

Description

Exterior. Valves plano-convex with pedicle valve gently convex; valves semielliptical in outline, slightly wider than long to as wide as long; hinge line 2/3 to 3/4 the greatest width; cardinal angles rounded; anterior commissure crenulate and rectimarginate; interarea of pedicle valve apsacline, about 1/6 as high as long, curved; interarea of brachial valve flat, anacline, about 1/10 as high as long; delthyrium and notothyrium open; valves multicostellate, costellae increase by bifurcation and insertion, costellae in posterolateral parts of valves curve to intersect the posterior margin.

Interior of pedicle valve. Teeth supported by long, thin, curved dental plates; muscle field elongate, oval in outline, extending to about midlength; adductor scars form a broad track which separates diductor scars; adductor track not enclosed by diductor scars anteriorly; internal surface marked by anterior crenulations along periphery which are rounded in cross-section; impress of costellae extends posteriorly to muscle field.

Interior of brachial valve. Brachiophores thick, blunt, erect, rarely slightly flaring, diverge anteriorly at a 60–90 degree angle to one another at their bases, and are subtriangular in lateral view; cardinal process consists of a shaft and a myophore which on well-preserved specimens is posteriorly directed, bilobed posteriorly, and tribolate or quadrilobate on its distal face. In some specimens that appear to have a simple cardinal process the interpretation is that these cardinal processes have been partially broken or abraded. Sockets rounded and floored by socket pads; muscle field somewhat longer than wide and extends to about midlength; elongate oval adductor scars divided by a broad, rounded myophragm of uniform width and bounded laterally by low ridges which extend anteriorly from the brachiophores; in some cases adductor scars are divided by transverse ridges into an anterior and a posterior pair of about equal width, internal surface marked by anterior crenulations around periphery which are rounded in cross-section; impress of costellae extends posteriorly as far as the muscle field.

Occurrence. French River Formation (late Llandovery (C_6) or early Wenlock age), loc. USNM 10860, Arisaig area. Doctor's Brook Formation (Wenlock age), locs. USNM 10164, 10909, Arisaig area. Either French River or Doctor's Brook Formation, locs. USNM 10841, 11211, Pictou County; loc. USNM 11183, Lochaber area.

Material. 67 specimens.

Subfamily PROSCHIZOPHORIINAE Boucot, Gauri, and Johnson, 1966

Genus ***Idiorthis*** McLearn, 1924

Type species. *Idiorthis matura* McLearn, 1924, p. 57, pl. 3, figs. 19–24; pl. 4, figs. 1–4; pl. 28, fig. 10.

Idiorthis matura McLearn, 1924

Plate V, figures 11–13; Plate VI, figures 1–3

1924. *Idiorthis matura* McLearn, ref. cit.
1932. *Idiorthis matura* McLearn, Schuchert and Cooper, p. 128, pl. 21, figs. 34–38.
1966. *Idiorthis matura* McLearn, Boucot, Gauri, and Johnson, p. 163–164, pl. 13, figs. 1–3.

Description

Exterior. Valves biconvex (not plano-convex as stated by Boucot, Gauri, and Johnson, 1966, p. 163), pedicle valve more convex; subelliptical in outline; slightly wider than long; hinge line 1/2 to 2/3 as long as greatest width; anterior commissure crenulate and rectimarginate to gently sulcate; brachial valve may be gently sulcate; interarea of pedicle valve apsacline, curved, about 1/6 as high as long; interarea of brachial valve flat, anacline, about 1/12 as high as long; delthyrium and notothyrium open; valves multicostellate.

Interior of pedicle valve. Teeth supported by stout, long, dental plates which extend anteriorly as ridges to bound the muscle field laterally; muscle field cordate, extends to about midlength and is slightly longer than wide; adductor scars separated by a broad, flat, parallel-sided diductor track. The muscle field is commonly marked by several curved ridges which parallel its anterior margin and mark its position at different stages of growth; anterior crenulations around periphery; impress of costellae may extend posteriorly as far as muscle field.

Interior of brachial valve. Brachiophores broad, divergent, lenticular in outline, and taper gently in height anteriorly; cardinal process broad, oval in outline, trilobed, merges anteriorly into a broad median ridge which divides the muscle field; muscle field broad, divided by strongly curved transverse ridges into an anterior pair and a smaller posterior pair of adductor scars; anterior crenulations rim periphery; impress of costellae may extend posteriorly as far as muscle field.

Occurrence. French River Formation (late Llandovery (C_6) or early Wenlock age), loc. USNM 10146, Arisaig area; questionably at loc. USNM 10822, Cobequid Mountains. Doctor's Brook Formation (Wenlock age), Twenhofel loc. 146a, locs. USNM 10164, 10909, questionably at USNM 10163, Arisaig area. Either French River or Doctor's Brook Formation, loc. USNM 11183, Lochaber area; questionably at loc. USNM 10841, Pictou County.

Material. 33 specimens.

Superfamily ENTELETACEA Waagen, 1884
[*nom. transl.* Alikhova, 1960 (*ex* Enteletinae Waagen, 1884)]

Family SCHIZOPHORIIDAE Schuchert and LeVene, 1929

Subfamily DRABOVIINAE Havlíček, 1950

Genus *Fascifera* Ulrich and Cooper, 1942

Type species. *Fascifera subcarinata* Ulrich and Cooper, 1942, p. 620, pl. 90, figs. 1–5.

Fascifera sp.

Plate II, figures 19–21; Plate III, figures 1–5, 10

Description

Exterior. Valves biconvex, pedicle valve somewhat more convex than brachial; subcircular to transversely subelliptical in outline with hinge line about 2/3 the greatest width and cardinal angles rounded; anterior commissure crenulate and rectimarginate; interarea of pedicle valve low, curved, apsacline; interarea of brachial valve low, flat, anacline; delthyrium and notothyrium open; valves multicostellate.

Interior of pedicle valve. Teeth supported by short dental plates; muscle field elongate, suboval to semioval in outline, commonly deeply impressed, extends anteriorly 1/3 to slightly less than 1/2 the valve length; adductor scars usually not impressed, rarely diductor scars separated by broad adductor track; periphery marked by anterior crenulations which may extend posteriorly to muscle field as impress of costellae.

Interior of brachial valve. Brachiophores thin, erect blades which may be parallel, or may diverge anterolaterally at less than a 30 degree angle to one another, supported by fulcral plates. On some specimens low ridges extend anteriorly from the brachiophore bases and converge medially; simple cardinal process consists of a shaft and expanded myophore; muscle field commonly not impressed but when present, it is about as wide as long, and extends anteriorly to about midlength and is divided by a broad median ridge; lateral margins of muscle field situated well lateral to brachiophores; periphery marked by anterior crenulations; impress of costellae may extend posteriorly to muscle field.

Comparison. Fascifera sp. differs from the type species *F. subcarinata* from the Porterfield and Wilderness stages (Caradocian age) of Tennessee, Virginia, and Georgia in lacking a sulcus and in having a muscle field in the pedicle valve which is commonly more elongate than that of *F. subcarinata.*

Occurrence. Glencoe Brook Formation (early Llandovery age), loc. USNM 11255, Pictou County.

Material. 498 specimens.

Genus *Salopina* Boucot, 1960

Type species. *Orthis lunata* Sowerby, 1839, p. 611, pl. 5, fig. 15, *non* fig. 16; pl. 3, fig. 12d.

Salopina conservatrix (McLearn, 1924)

Plate VIII, figures 20–22; Plate IX, figures 1–3

1924. *Dalmanella conservatrix* McLearn, p. 52, pl. 2, figs. 24, 25, *non* 26.
1969. *Salopina conservatrix* (McLearn), Walmsley, Boucot, and Harper, p. 505–506, pl. 77, figs. 15–22; pl. 78, figs. 1–11.

Description

Exterior. Valves unequally biconvex, pedicle valve more convex; transversely subelliptical to subcircular in outline with hinge line about 2/3 the greatest width which is slightly anterior to midlength; cardinal angles obtuse, somewhat rounded; brachial valve sulcate, anterior commissure crenulate and sulcate; interarea of pedicle valve low, curved, apsacline; interarea of brachial valve flat or gently curved, anacline, slightly lower than interarea of pedicle valve; delthyrium and notothyrium open; valves multicostellate with numerous "hollow costellae" which radiate with little curvature.

Interior of pedicle valve. Teeth supported by curved dental plates which bracket muscle field; muscle field slightly longer than wide, oval in outline, extends anteriorly 1/4 to 1/2 the valve length and is open anteriorly; diductor scars separated by broad adductor track; periphery marked by anterior crenulations which may extend posteriorly to muscle field as impress of costellae.

Interior of brachial valve. Brachiophores thin blades, erect to very slightly convergent dorsally, diverge anterolaterally at a 60 degree angle to one another; sockets floored by fulcral plates or socket pads; cardinal process simple; muscle field longer than wide, extends to about midlength and bounded laterally by disjunct ridges which terminate at their posterior end lateral to the anterior end of the brachiophores; a broad median ridge of uniform width divides the muscle field; anterior crenulations may extend posteriorly to muscle field as impress of costellae.

Occurrence. Upper member, Ross Brook Formation (late Llandovery (C_6) age), locs. USNM 10127, 10129, 10132, Arisaig area; locs. USNM 10823, 10824, 10832, 10833, Pictou County; locs. GSC 52807, 68849, Cobequid Mountains.

Material. 439 specimens.

Type specimens. McLearn designated a holotype GSC No. 6205 and two paratypes GSC Nos. 6206, 6207. Holotype and paratype No. 6206 belong to *S. conservatrix*. Paratype No. 6207 is *Visbyella nana*.

Salopina submedia (McLearn, 1924)

Plate VIII, figures 1–14, 24, 25

1924. *Dalmanella elegantula* var. *submedia* McLearn, p. 53, pl. 3, figs. 3, 4 (*non* 5, 6); pl. 4, fig. 8.
1924. *Dalmanella elegantula* mut. *transversaria* McLearn, p. 54, pl. 3, figs. 8, 9.
1960. *Salopina lunata* (Sowerby), Boucot, pl. 1, figs. 6–12.
1966. *Salopina submedia* (McLearn), Boucot, Johnson, Harper, and Walmsley, p. 15–17, pl. 3, figs. 26–28; pl. 4, figs. 1–14.
1969. *Salopina submedia* (McLearn), Walmsley, Boucot, and Harper, p. 504–505, pl. 75, figs. 8–12; pl. 76, figs. 1–26; pl. 77, figs. 1–3.

Description

Exterior. Plano-convex to biconvex with the pedicle valve more convex; subcircular to transversely subelliptical in outline with hinge line about 3/4 the greatest width and cardinal angles rounded; brachial valve faintly sulcate; anterior commissure crenulate and rectimarginate; interarea of pedicle valve curved, apsacline, about 1/6 as high as long; interarea of brachial valve anacline, planar, about 1/2 as high as pedicle interarea; valves multicostellate, costellae at posterior ends of valves strongly curved posteriorly to intersect the hinge.

Interior of pedicle valve. Teeth supported by short, curved, dental lamellae which bound the muscle field laterally; muscle field subelliptical to cordate in outline, usually elongate, and extends 1/3 to slightly less than 1/2 the valve length; diductor scars divided by broad adductor track which may be uniform in width or taper anteriorly; pallial marks extend anterolaterally from diductor scars on some specimens; periphery marked by anterior crenulations; impress of costellae present on smaller specimens, may extend posteriorly to muscle field.

Interior of brachial valve. Brachiophores relatively thick, tabular, erect blades diverging anterolaterally at a low angle to one another, sockets floored by fulcral plates or socket pads; cardinal process with elongate shaft and simple myophore; muscle field longer than wide, extends to about midlength, bounded laterally by ridges which are usually disjunct and which terminate at their posterior end lateral to the anterior end of the brachiophores; a broad median ridge of uniform width divides the muscle field; commonly two pair of adductor scars of about the same size are impressed; periphery marked by anterior crenulations which, on small specimens, may extend posteriorly to the muscle field as impress of costellae.

Comparison. S. submedia may be distinguished from *S. conservatrix* by its thicker brachiophores and by its muscle field in the pedicle valve which is usually more elongate. The costellae in the posterior parts of the valves of *S. submedia* are strongly curved posteriorly to intersect the hinge line at a high angle; the costellae of *S. conservatrix* are only gently curved and do not intersect the hinge line.

Occurrence. French River Formation (late Llandovery (C_6) or early Wenlock age), locs. USNM 10138, 10139, 10142, 10144, 10147, 10148, 10150, 10156, 10158, 10160, 10861, 10931, Arisaig area; USNM locs. 10809, 10816, 10825, 10842, 10847, 11212, 11217, 11247–11250, Pictou County; loc. USNM 10810, Cobequid Mountains. Doctor's Brook Formation (Wenlock age), Twenhofel loc. 136, locs. USNM 10164, 10165, 10909, Arisaig area. Either French River or Doctor's Brook Formation, locs. USNM 10841, 11211, Pictou County; loc. USNM 11183, Lochaber area. Lower member, McAdam Brook Formation (early Ludlow age), locs. USNM 10167–10169, Arisaig area. Upper member, McAdam Brook Formation (Ludlow age), loc. USNM 10170, Arisaig area. Lower member, Moydart Formation (Ludlow age), locs. USNM 10172, 10173, 10174, 10177, 10181, 10182, 10183, 10908, Arisaig area; locs. USNM 10853, 11238, Pictou County. Stonehouse Formation (Pridoli to early Gedinnian age), locs. USNM 10210, 10910, Arisaig area; loc. USNM 11243, Pictou County; loc. USNM 11215, Cape George area; locs. GSC 68836, 68839, 68842, 68845, Cobequid Mountains. Kerrowgare Formation (late Llandovery to Ludlow age), locs. USNM 10817, 10845, 10851, 10852, Pictou County. Beds of post-Ross Brook Formation age, loc. USNM 10840, Cobequid Mountains.

Specimens questionably assigned to *Salopina submedia* occur in the French River Formation, loc. USNM 10860, Arisaig area; loc. USNM 10815, Pictou County. Either French River or Doctor's Brook Formation, loc. USNM 10818, Pictou County. Lower member, Moydart Formation, locs. USNM 10828, 11241, 11242, 11243, Pictou County; loc.

USNM 10827, Lochaber area; beds of Moydart age in the *Scolithus* (worm-tube) quartzite, Cape George area, loc. USNM 11246. Stonehouse Formation, loc. USNM 10925, Arisaig area; loc. USNM 11320, Pictou County; locs. GSC 68838, USNM 10830, 11222, Cobequid Mountains.

Material. 3,207 specimens (35 questionably assigned).

Type specimens. McLearn designated a holotype GSC No. 6208 and three paratypes: Peabody Museum specimens Nos. 419, 420, and 428. Paratype No. 428 belongs to *S. submedia*; paratypes Nos. 419 and 420 belong to *Isorthis fornicatimcurvata.*

Salopina missendensis (Straw, 1933)
Plate VIII, figures 15–19, 23

1933. *Dalmanella missendensis* Straw, p. 116, pl. 9, figs. 8–10.
1969. *Salopina missendensis* (Straw), Walmsley, Boucot, and Harper, p. 509–510, pl. 77, figs. 4–14; pl. 79, figs. 3, 4.

Description

Exterior. Valves biconvex, pedicle valve the more convex; subcircular to transversely subelliptical in outline with rounded cardinal margins; hinge line 2/3 to 3/4 the greatest width; sulcus generally lacking in brachial valve, rarely very faintly developed; anterior commissure crenulate and rectimarginate; interarea of pedical valve slightly curved, apsacline, about 1/6 as high as long; interarea of brachial valve planar, low, anacline; delthyrium and notothyrium open; valves multicostellate, "hollow" costellae common, costellae radiate with little curvature.

Interior of pedicle valve. Teeth supported by curved dental plates which bound muscle field laterally; muscle field cordate, about as wide as long; adductor track, about 1/3 as wide as muscle field, separates diductor scars; impress of costellae extends posteriorly to muscle field.

Interior of brachial valve. Brachiophores thin erect blades which diverge at about a 30 degree angle to one another, supported by fulcral plates; cardinal process elongate oval, simple, or, rarely, bilobed; muscle field extends to midlength and is about as wide as long, divided by median ridge which commonly tapers posteriorly, and bounded laterally by raised margins which may be subparallel to the median ridge or diverge slightly and which terminate posteriorly lateral to the brachiophores; periphery marked by anterior crenulations which may extend posteriorly to muscle field as impress of costellae.

Comparison. S. missendensis differs from *S. conservatrix* in that it is generally nonsulcate, whereas the latter species has a well-developed sulcus.

S. missendensis differs from *S. submedia* in that it is generally nonsulcate and has only gently curved costellae in the posterolateral regions of the valves. The costellae in the posterolateral regions of *S. submedia* are strongly curved posteriorly to intersect the hinge. The muscle field in the pedicle valve of *S. submedia* is commonly more elongate than that of *S. missendensis.*

Occurrence. Stonehouse Formation (Pridoli to early Gedinnian age), locs. USNM 10187, 10191, 10192, 10201, 10202, 10203, 10205, 10206, 10210, 10211, 10212, 10922, 10926, Arisaig area; USNM locality 10835 in Pictou County.

Material. 303 specimens.

Genus *Hirnantia* Lamont, 1935

Type species. *Orthis sagittifera* M'Coy, 1851, p. 398.

Hirnantia? sp.

Plate IX, figures 4–9

Description

Exterior. Valves subequally convex, subcircular in outline; cardinal angles rounded; hinge line about half the greatest width; anterior commissure crenulate and rectimarginate; interarea of pedicle valve low, apsacline; interarea of brachial valve low, anacline; delthyrium and notothyrium open; valves multicostellate.

Interior of pedicle valve. Teeth supported by thin dental lamellae, muscle field oval in outline, slightly longer than wide, extends almost to midlength; adductor scars and individual diductor scars not impressed; impress of costellae extends posteriorly to muscle field.

Interior of brachial valve. Brachiophores thin, erect blades, diverge at about a right angle to one another, supported by fulcral plates; cardinal process narrow, apparently simple; narrow median ridge extends from cardinal process 1/3 to 1/2 the valve length; muscle field obscure; impress of costellae extends posteriorly to muscle field.

Discussion. This species has a relative convexity and cardinalia suggestive of the genera *Pionodema* Foerste, 1912, *Hirnantia* Lamont, 1935 and *Schizophoria* King, 1850. It differs from *Schizophoria* in lacking a median ridge in the pedicle valve and from *Pionodema* and *Hirnantia* in lacking a raised adductor track in the pedicle valve. From *Pionodema* it differs in having a much narrower median ridge and a poorly impressed muscle field in the brachial valve. *Pionodema* usually has convergent struts extending anteriorly from the brachiophore bases; these are lacking in the Arisaig species. The Arisaig species most closely resembles *Hirnantia* in the details of its interior and is here assigned questionably to that genus.

Occurrence. Stonehouse Formation (Pridoli to early Gedinnian age), locs. USNM 10835, 10848, GSC 45432, Pictou County.

Material. 61 specimens.

Subfamily SCHIZOPHORIINAE Schuchert and LeVene, 1929

Genus *Schizophoria* King, 1850

Type species. *Conchyliolithus Anomites resupinatus* Martin, 1809, pl. 49, figs. 13, 14.

Schizophoria sp.

Plate IX, figures 10–13

Description

Exterior of brachial valve. Valve subcircular in outline; moderately convex; hinge line about half as long as greatest width; cardinal angles obtuse; anterior commissure crenulate and rectimarginate; interarea flat, anacline, about 1/10 as high as long; notothyrium open; multicostellate with hollow costellae.

Interior of brachial valve. Brachiophores erect blades which diverge at about a 60 degree angle to each other and are supported by fulcral plates; low curved ridges commonly extend anteriorly from the brachiophores and bound the muscle field; cardinal process consists of

a narrow shaft and an expanded myophore which appears to be nonlobate; muscle field slightly longer than wide and extends anteriorly to about midlength; it is divided by a narrow median ridge and usually by a pair of transverse ridges which diverge from the midline at about a 45 degree angle; impress of costellae may extend posteriorly to muscle field.

Discussion. No pedicle valves were found. The material is not adequate for specific determination.

Occurrence. Stonehouse Formation (Pridoli to early Gedinnian age), locs. USNM 10187, 10188, Arisaig area.

Material. 24 specimens (all brachial valves).

Order ***Strophomenida*** Öpik, 1934

[*nom. transl.* Moore in Moore, Lalicker, and Fischer, 1952 (*ex* suborder Strophomenoidea Öpik, 1934)]

Suborder ***Strophomenidina*** Öpik, 1934

Superfamily STROPHOMENACEA King, 1846

[*nom. transl.* Schuchert, 1896 (*ex* Strophomenidae King, 1846)]

Family STROPHEODONTIDAE Caster, 1939

Subfamily LEPTOSTROPHIINAE Caster, 1939

[*nom. transl.* Williams, 1965 (*ex* Tribe Leptostrophiini Caster, 1939)]

Genus ***Leptostrophia*** Hall and Clarke, 1892, emended

Type species. *Stropheodonta magnifica* Hall, 1857, p. 54, 55 (by subsequent designation of Schuchert, 1897, p. 243).

Emended diagnosis. Plano-convex to gently concavo-convex stropheodontids with a triangular muscle field in the pedicle valve bounded laterally by ridges except in early species and with socket plates. Dental plates present or absent.

Discussion. Unequally parvicostellate leptostrophids which differ from contemporaneous and later *Leptostrophia* in having prominent dental plates are common and widespread in beds of early Llandovery age including one species, *Leptostrophia beechhillensis* McLearn, which occurs in beds from early Llandovery to late Llandovery (C_6) age in the Arisaig area. These have the essential characters of *Leptostrophia*: gently convex pedicle valve, flat or gently concave brachial valve, triangular muscle field in the pedicle valve, and socket plates; species included are: *Leptostrophia filosa* var. *mullochensis* Reed, 1917, p. 894–895, pl. 17, figs. 4–8; *Rafinesquina beechhillensis* McLearn, 1924, p. 60, pl. 4, fig. 15; *Eostropheodonta whittingtoni* Lamont, 1949, p. 9, pl. 2, fig. 6 (=*Eostropheodonta hirnantensis* mut. *delicatula* Lamont, 1949, p. 9, pl. 2, fig. 7; =*Eostropheodonta multiradiata* Lamont, 1949, p. 10, pl. 2, fig. 8; =*Stropheodonta* (*Eostropheodonta*) cf. *mullochensis* Williams, 1951, *non* Reed, 1917, p. 123–124, pl. 8, figs. 1–4); *Eostropheodonta* sp. Boucot and Johnson, 1964, p. 5, pl. 3, figs. 1–9; pl. 4, figs. 1–4; plus as yet undescribed species from beds of early Llandovery age in Norway, Quebec, and the Merida Andes, Venezuela, in the collections of A. J. Boucot. The described species listed above occur in beds of early Llandovery age in Britain, Sweden, and Nova Scotia, with the Nova Scotia species ranging up into beds of late Llandovery (C_6) age.

(The British species *Leptostrophia* (*Eostropheodonta*) *voraginis* Cocks, 1967, p. 253–256, pl. 38, Figs. 2–11, of late Llandovery (C_1–C_2) age appears to be related to this group.) All *Leptostrophia* spp. with dental plates will be placed in an, as yet, unnamed subgenus by A. J. Boucot, J. G. Johnson, and myself in a later study.

The *Leptostrophia* spp. with dental plates differ from *Eostropheodonta* Lamont, 1949 principally in ornament. *Eostropheodonta*, based on *Eostropheodonta hirnantensis* M'Coy, 1851, p. 395, from the Hirnant Limestone of early Llandovery age in the Bala district, Wales, is best restricted to include strophеodontids with fasciculate costellae, a few denticles on each side of the delthyrium, dental plates, a posteroventrally directed bilobed cardinal process, socket plates, and obscure muscle fields in both valves. So restricted, this genus includes only the type species and *Eostropheodonta siluriana* Davidson, 1871 from the Ashgill Shales of Yorkshire, England. The relationship of *Eostropheodonta* to *Leptostrophia* is not clear. Possibly they were derived separately from two distinct stocks of *Rafinesquina*.

Leptostrophia beechhillensis (McLearn, 1924)

Plate X, figures 1–6

1924. *Rafinesquina beechhillensis* McLearn, p. 60, pl. 4, fig. 15.

Description

Exterior. Pedicle valve very gently convex, brachial valve flat to gently concave; valves semielliptical in outline, alate, 2/3 as long as wide to as long as wide, widest at midlength; hinge line almost as long as greatest width; interarea of pedicle valve flat, apsacline, roughly 1/25 as high as long; interarea of brachial valve flat, high anacline to orthocline, lower than pedical valve interarea; apical pseudodeltidium not observed, prominent convex chilidium present; anterior commissure crenulate and rectimarginate; valves unequally parvicostellate.

Interior of pedicle valve. Short ridges each bearing a few denticles extend along hinge on each side of delthyrium; dental plates diverge anterolaterally from delthyrium at a 75–90 degree angle to each other; short, low, median ridge commonly present in delthyrial cavity; muscle field triangular, open anteriorly, sometimes obscure, extends anteriorly 1/3 to 1/2 valve length; elongate oval adductor scars situated in medial 1/3 of muscle field; posterolateral parts of valve commonly pustulose, periphery marked by impress of costellae.

Interior of brachial valve. Cardinal process bilobed, lobes having flat posteroventrally directed attachment faces and conjunct posteriorly; socket ridges straight, diverge at about a 120 degree angle to each other; low, broad, rounded median ridge extends a short distance anteriorly from cardinalia dividing poorly impressed, semielliptical, adductor scars; periphery marked by impress of costellae.

Occurrence. Beechhill Cove Formation (early Llandovery age), locs. USNM 10114, 10115, 10116, Arisaig area; locs. USNM 10819, 11258, 11260, 11272, 11276, Pictou County. Glencoe Brook Formation (early Llandovery age), locs. USNM 11255, 11262, 11263, 11264, 11265, 11269, 11301, Pictou County; questionably at USNM 11288, Pictou County. Upper member, Ross Brook Formation (late Llandovery (C_6) age), loc. USNM 11334, Pictou County; questionably at USNM 11305, Pictou County.

Material. 380 specimens (3 questionably assigned).

Leptostrophia sp.

Plate X, figures 7–11

Description

Exterior of pedicle valve. Valve gently convex; semielliptical in outline; about as wide as long; interarea flat, apsacline, about 1/20 as high as long; pseudodeltidium not observed; costellae fine, about uniform in width, increase by insertion.

Interior of pedicle valve. Short denticulate ridge on each side of delthyrium; ventral process narrow; muscle field triangular in outline, bounded laterally by ridges and bisected by a narrow median ridge, extends anteriorly slightly less than 1/2 the valve length and is open anteriorly; posterolateral portions of valve pustulose; periphery marked by impress of costellae.

Discussion. As no brachial valves of this species were found, it is not known whether it had socket plates as in *Leptostrophia* or lacked socket plates as in *Protoleptostrophia.* However, as *Protoleptostrophia* is not known in beds older than Siegenian (Becraft-Oriskany) age, the species, in all probability, had socket plates.

Leptostrophia sp. differs from *L. beechhillensis* in having uniformly costellate ornament and in lacking dental plates. *L. beechhillensis* has unequally parvicostellate ornament and dental plates.

Occurrence. French River Formation (late Llandovery (C_6) or early Wenlock age), locs. USNM 10150, 10155, 10158, Arisaig area; locs. USNM 10809, 10816, Pictou County. Doctor's Brook Formation (Wenlock age), locs. USNM 10164, 10909, Arisaig area.

Material. 24 specimens.

Subfamily AMPHISTROPHIINAE, new subfamily

Genus ***Amphistrophia*** Hall and Clarke, 1892

Type species. *Strophonella striata* Hall, 1843, p. 104, fig. 3.

Amphistrophia aff. *prolongata* (Foerste, 1903)

Plate XI, figures 1–7

1903. *Strophonella prolongata* Foerste, p. 110.
1909. *Strophonella prolongata* Foerste (1909a), p. 85, pl. 2, figs. 23a, b.
1949. *Strophonella prolongata* Foerste, Amsden (1949b), p. 51, pl. 5, figs. 8–10.
1951. *Strophonella prolongata* Foerste, Amsden, p. 79–80, pl. 18, figs. 52–57.

Description

Exterior. Pedicle valve initially gently convex, brachial valve initially flat or very gently concave, both valves becoming resupinate and sharply geniculate at a length of between 8 and 14 mm from the apex; valves semielliptical in outline, alate, widest at the hinge line; anterior commissure smooth or crenulate; interarea of pedicle valve apsacline, planar, about 1/20 as high as long; interarea of brachial valve linear; apical pseudodeltidium present, chilidium not observed. Costellae vary in weight from fine to relatively coarse (rare); on an individual specimen the costellae are relatively uniform in width, separated by interspaces of about the same width, and increase by insertion, with inserted costellae initially finer than primary ones, but becoming equal in width to primary costellae anteriorly.

Interior of pedicle valve. Hinge denticulate along 1/3 to 1/2 of its length; process pits low; ventral process low and hourglass-shaped; muscle field semielliptical in outline, extends anteriorly 1/2 to 4/5 the valve length, and varies from 2/3 as wide as long to as wide as long; muscle field bounded laterally by curved ridges which originate a short distance anterior to hinge line, and may terminate at or curve medially at the anterior margin of the muscle field to intersect at the midline and completely enclose the muscle field; diductor scars separated posteriorly by adductor scars and anteriorly by narrow median ridge; elongate, oval, adductor scars confined to posterior half of muscle field and completely enclosed by diductor scars lateral to muscle field; internal surface pustulose and commonly marked by impress of costellae.

Interior of brachial valve. Hinge denticulate along 1/3 to 1/2 of its length; cardinal process lobes disjunct, with posteroventrally directed attachment faces bearing a median groove; minute median ridge commonly present between cardinal process lobes; socket plates straight, diverge at about a 120 degree angle to each other; broad, tapering, median ridge extends from cardinalia to 1/3 to 1/2 the valve length and divides the muscle field; adductor scars semielliptical, commonly further divided into two subequal segments by subparallel or slightly divergent ridges; lateral to muscle field internal surface pustulose and commonly marked by impress of costellae.

Comparison. A. aff. *prolongata* resembles *A. prolongata* from the Brownsport Formation (Wenlock age) of Tennessee and the Henryhouse Formation (Ludlow age) of Oklahoma in having uniformly costellate ornament and in its outline and profile. It is larger than *A. prolongata* and differs from it in having costellae which vary (from specimen to specimen) from fine to coarse. The costellae of *A. prolongata* are consistently coarse.

It differs from *A. striata* Hall, 1843 from beds of Wenlock and Ludlow age in New York, Indiana, Tennessee, Kentucky, Wisconsin, and Ohio in having sharply geniculate anterior and lateral margins and uniformly costellate ornament. *A. striata* has margins which are only gently deflected ventrally and has unequally parvicostellate ornament.

A. aff. *prolongata* resembles *A. funiculata* M'Coy, 1846 from beds of Wenlock and Ludlow age in Britain and in Gotland, Sweden, in outline and profile. It differs from *A. funiculata* in having uniformly costellate ornament in contrast to the unequally parvicostellate ornament of *A. funiculata.*

Occurrence. French River Formation (late Llandovery (C_6) or early Wenlock age), locs. USNM 10145, 10150, Arisaig area; locs. USNM 10811, 11220, Pictou County; locs. USNM 10810, 10814, 10822, Cobequid Mountains. Doctor's Brook Formation (Wenlock age), loc. USNM 10164, Arisaig area. Either French River or Doctor's Brook Formation, locs. USNM 10812, 10841, 11211, Pictou County; loc. USNM 10813, Cobequid Mountains.

Material. 267 specimens.

Amphistrophia cf. *A. striata* (Hall, 1843)

Plate X, figures 12–17

1843. *Strophonella striata* Hall, p. 104, fig. 3.

Description

Exterior. Valves resupinate with anterior and lateral margins only gently deflected ventrally; semielliptical in outline; somewhat wider than long; alate; anterior commissure

crenulate and rectimarginate; pedicle interarea low, flat, apsacline; brachial interarea linear; pseudodeltidium and chilidial structures not evident on specimens studied; valves unequally parvicostellate.

Interior of pedicle valve. Hinge line denticulate; muscle field semielliptical in outline, open anteriorly, bounded by curved ridges which originate anterior to hinge line, extends anteriorly 1/3 to 1/2 the valve length and about as wide as long; ventral process and adductor scars not evident on specimens studied; internal surface marked by impress of costellae.

Interior of brachial valve. Cardinal process lobes disjunct, posteroventrally directed, oval in outline, and separated by a rounded groove which bears a minute median ridge; straight socket plates diverge anterolaterally at about a 120 degree angle to one another; semielliptical adductor scars separated by rounded myophragm which tapers anteriorly, extends anteriorly about 1/3 the valve width; internal surface marked by impress of costellae anterior and lateral to muscle field.

Comparison. A. cf. *A. striata* resembles *A. striata* in shape, ornament, cardinalia, and muscle fields. However, as the extent of the denticles along the hinge and the nature of the ventral process and adductor scars are not evident on the available pedicle valves, a positive assignment cannot be made. It differs from *A.* aff. *prolongata* and from *A. funiculata* in lacking a sharply geniculate margin. It further differs from *A.* aff. *prolongata* in having an unequally parvicostellate ornament in contrast to the uniformly costellate ornament of the latter.

Occurrence. French River Formation (late Llandovery (C_6) or early Wenlock age), locs. USNM 10815, 10821, Pictou County; questionably at loc. USNM 10809, Pictou County. Doctor's Brook Formation (Wenlock age), loc. USNM 10909, Arisaig area.

Material. 26 specimens.

Subfamily SHALERIINAE Williams, 1965 emended

Diagnosis. Gently concavo-convex or geniculate strophеodontids with long narrow parallel-sided diductor scars in the pedicle valve, and a narrow body cavity. Peripheral ridge lacking in brachial valve.

Genus assigned. Shaleria Caster, 1939.

Genera rejected. Telaeoshaleria Williams, 1950; *Hercostrophia* Williams, 1950; *Zophostrophia* Veevers, 1959.

Discussion. Williams (1965, p. 402–403) defined the subfamily Shaleriinae to include *Shaleria* Caster, 1939, *Telaeoshaleria* Williams, 1950, *Hercostrophia* Williams, 1950, and *Zophostrophia* Veevers, 1959. However, Harper, Johnson, and Boucot (1967, p. 425–428) demonstrated that *Telaeoshaleria* is a pholidostrophiid. *Hercostrophia* and *Zophostrophia* both have a triangular muscle field in the pedicle valve, a distinctive feature of leptostrophiids, and *Zophostrophia* has socket plates the medial portions of which are parallel to the cardinal process lobes, a feature characteristic of Devonian leptostrophiids. The lateral parts of the socket plates of *Zophostrophia* extend parallel to the hinge line as low ridges, as in the leptostrophiids *Sulcatostrophia* Stainbrook, 1945 and *Parastrophonella* Bublichenko, 1956. *Hercostrophia* and *Zophostrophia* are clearly Leptostrophiinids, not Shaleriinids.

Genus *Shaleria* Caster, 1939

Type species. *Strophomena gilpeni* Dawson, 1880, p. 341.

Shaleria gilpeni (Dawson, 1880)

Plate XII, figures 6, 7; Plate XIII, figures 1–7, 9

1880. *Strophomena gilpeni* Dawson, p. 341.
1924. *Brachyprion gilpeni* (Dawson), McLearn, p. 61, pl. 5, figs. 28, 29.
1953. *Shaleria gilpeni* (Dawson), Williams, pl. 12, figs. 9–13.

Description

Exterior. Valves gently concavo-convex; semielliptical in outline; alate; 1/2 as long to as long as wide; anterior commissure crenulate and rectimarginate; interarea of pedicle valve flat, apsacline, about 1/25 as high as long; interarea of brachial valve linear; hinge line denticulate along 1/2 of its length; apical pseudodeltidium and prominent convex chilidium present; some specimens unequally parvicostellate; others parvicostellate with inserted costellae very fine at their point of origin and increasing in width distally to reach the width of the lower order costellae between which they are inserted, so that the ornament in a small sector of the shells consists of relatively coarse costellae separated by interspaces of about the same width which may bear a single fine costella; on some specimens costellae are evenly curved laterally, on others they follow a somewhat irregular undulating pattern.

Interior of pedicle valve. Denticles present along hinge line from delthyrium to about 1/2 the distance to the cardinal angles; ventral process constricted in width at its midlength; muscle field consists of a pair of narrow elongate parallel-sided diductor tracks, which extend to midlength and may be parallel or very slightly divergent anteriorly, usually flanked laterally by a pair of narrower, shorter, accessory diductor tracks; both diductor tracks and accessory diductor tracks bounded laterally by ridges; diductor tracks divided by median ridge which may bifurcate at its anterior end; internal surface pustulose and marked by impress of the costellae peripheral to the muscle field.

Interior of brachial valve. Cardinal process lobes disjunct, posteroventrally directed to posteriorly directed, and commonly bear a groove on their attachment face; convex chilidium conjunct with cardinal process lobes; socket plates straight, diverge at about a 120 degree angle to each other; hinge line with denticles as in the pedicle valve; short, semielliptical adductor scars divided by a broad median ridge which tapers in width anteriorly and bounded laterally by prominent ridges which are wide at their posterior end and taper in width anteriorly. On small specimens the adductor scars are not always impressed, and the median ridge is not always present. Two pairs of low ridges occur anterior to the muscle field: a medial pair which may be parallel or may diverge as much as 30 degrees, and a lateral pair which may be only slightly divergent or may diverge as much as 30 degrees. The lateral pair of ridges commonly extend posteriorly to divide the adductor scars. In some cases, the lateral pair of ridges merge with the tapering muscle bounding ridges situated posterior to them. Internal surface pustulose and marked by impress of the costellae peripheral to the muscle field.

Comparison. Shaleria gilpeni differs from *Shaleria ornatella* Davidson, 1871 from the Ludlow of Wales and the Welsh borderland in having a uniformly costellate ornament with evenly curved growth lines, and in usually having a prominent pair of accessory diductor tracks in the pedicle valve. *Shaleria ornatella* has an unequally parvicostellate radial ornament crossed by 'zigzagging' growth lines, and either lacks accessory diductor tracks in the pedicle valve or has them only incipiently developed.

Shaleria rigida Koninck, 1876 from the lower Gedinnian of Germany and Belgium closely resembles *Shaleria ornatella* in its ornament and internal features. Boucot (1960a, p. 303) states that the ornament in *S. rigida* is more deeply impressed than that of *S. ornatella.*

Occurrence. Lower member, Moydart Formation (Ludlow age), locs. USNM 10174, 10182, 10183, Arisaig area. Stonehouse Formation (Pridoli to early Gedinne age), locs. USNM 10185, 10188, 10190–10195, 10199, 10201, 10203, 10204, 10210, 10211, 10212, 10214, 10928, Arisaig area; locs. USNM 10846, 11241, Pictou County; locs. USNM 10330, 11222, 11223, GSC 65913, 68847, 68850, Cobequid Mountains. Beds of Stonehouse age in the *Scolithus* (worm-tube) quartzite, loc. USNM 11214, Cape George area.

Material. 823 specimens.

Shaleria honeymani (McLearn, 1924)

Plate XIII, figures 8, 10

1924. *Brachyprion* (?) *honeymani* McLearn, p. 62, pl. 5, fig. 30.
1924. *Amphistrophia arisaigensis* McLearn, p. 63, pl. 5, fig. 31.

Discussion. Only three pedicle valves, all exteriors, of this species are known. *Amphistrophia arisaigensis* McLearn, 1924, based on a single brachial valve exterior shown on Plate XIII, figure 10, is concave outwards and, hence, does not belong to *Amphistrophia.* It closely resembles the holotype of *S. honeymani* in ornament and is here placed in synonomy with *S. honeymani.* No other brachial valves of *S. honeymani* are known.

Description. Valves concavo-convex with geniculate margins, wider than long, semielliptical in outline, alate. Ornament consists of widely spaced coarse costellae between which a single fine costella may be inserted and of 'zigzagging' growth lines. On one specimen, the holotype (Peabody Museum No. 433), a median ridge and closely spaced parallel muscle bounding ridges of the *Shaleria* type may be seen through the shell surface.

Comparison. S. honeymani differs from *S. gilpeni* in having a geniculate margin and an ornament of widely spaced costellae and 'zigzagging' growth lines. In *S. gilpeni* the pedicle valve is not geniculate, the costellae are more closely spaced, and the growth lines are evenly curved. *S. honeymani* resembles *S. ornatella* Davidson, 1871 from the Ludlow of Wales and the Welsh borderland in ornament.

Occurrence. The three specimens of *S. honeymani* in the Peabody Museum of Natural History are labeled as collected from the Stonehouse Formation, Arisaig, Twenhofel loc. 20a and from Cameron Brook, Pictou County, horizon not known. The single specimen (GSC No. 5422) described by McLearn as *Amphistrophia arisaigensis* and here assigned to *S. honeymani* is listed as coming from Arisaig, horizon not known but probably Stonehouse Formation.

Material. Four specimens.

Subfamily DOUVILLINAE Caster, 1939
[*nom. transl.* Williams, 1965 (*ex* Tribe Douvillinae Caster, 1939)]

Genus ***Mclearnites*** Caster, 1945

1939. *Mclearnia* Caster, p. 34, 35 (*non Mclearnia* Crickmay, 1930).
1945. *Mclearnites* Caster, p. 319 (in place of *McLearnia* preoccupied).
1950. *Douvillina* (*Mesodouvillina*), Williams, p. 281.
1953. *Douvillina* (*Mesodouvillina*), Williams, p. 44, 45, pl. 11, figs. 15–18; pl. 12, figs. 1, 2.

Type species. *Brachyprion mertoni* McLearn, 1924, p. 61, pl. 4, figs. 16–18; pl. 28, fig. 12.

Diagnosis. Gently to strongly concavo-convex, unequally parvicostellate to uniformly costellate douvillinids with a broad muscle field in the pedicle valve which is semielliptical in outline, bounded laterally by ridges, and open anteriorly. Brace plates lacking.

Discussion. Williams (1953, p. 46) placed *Mclearnites* in synonomy with *Shaleria* Caster, 1939. However, *Shaleria* has narrow, elongate, parallel-sided diductor tracks in the pedicle valve, and a median ridge in the pedicle valve which commonly bifurcates anteriorly. These characters differ markedly from the broad semielliptical muscle field and non-bifurcating median ridge of *Mclearnites*. Hence, *Mclearnites* and *Shaleria* are clearly distinct genera. They are considered to be unrelated at the subfamily level.

Mclearnites mertoni, the type species of *Mclearnites*, resembles *Stropheodonta* (*Brachyprion*) *subinterstrialis* var. *seretensis* Kozlowski, 1929, the type species of *Douvillina* (*Mesodouvillina*) Williams, 1950, in convexity and in the internal features of both valves. *Douvillina* (*Mesodouvillina*) is regarded as a junior subjective synonym of *Mclearnites* at the generic level. However, *Mesodouvillina* may be usefully retained as a subgenus of *Mclearnites*, *Mclearnites* (*Mesodouvillina*) differing from *Mclearnites* (*Mclearnites*) in having an unequally parvicostellate ornament in contrast to the uniformly costellate ornament characteristic of *M.* (*Mclearnites*).

Comparison. Mclearnites differs from Middle Devonian "*Douvillina*" in lacking brace plates. It differs from late Devonian *Douvillina* s.s. in lacking brace plates and in having a muscle field in the pedicle valve that is semielliptical in outline and open anteriorly. The muscle field in the pedicle valve of *Douvillina* is suboval in outline, bounded anteriorly by ridges and typically raised above the level of the floor of the valve.

Mclearnites sp.

Plate XI, figures 8, 9

Description

Exterior. Valves gently concavo-convex; semielliptical in outline; from 1/2 as long as wide to as long as wide; alate; anterior commissure crenulate and rectimarginate; interarea of pedicle valve low, apsacline; interarea of brachial valve linear; hinge line denticulate along 1/3 of its length; pseudodeltidium and chilidium not preserved in available specimens; valves parvicostellate, costellae commonly bent laterally in lateral parts of valves.

Interior of pedicle valve. Numerous denticles occur along the middle 1/3 of the hinge; muscle field semielliptical in outline, about as wide as long, extends anteriorly 1/4 to 1/3 the valve length, bounded laterally by curved ridges, commonly divided by a median ridge, and open anteriorly; valve marked by impress of costellae distal to the muscle field.

Interior of brachial valve. Only two fragments of the posterior end of the brachial valves were available for study. The cardinal process lobes are narrow and posteroventrally directed. There is a minute ridge between the cardinal process lobes. The socket plates are straight and widely divergent.

Occurrence. French River Formation (late Llandovery (C_6) or early Wenlock age), loc. USNM 10158, Arisaig area. Kerrowgare Formation in beds correlative to the French River Formation, loc. USNM 10817, Pictou County.

Material. 17 specimens.

Mclearnites mertoni (McLearn, 1924)

Plate XI, figures 10–13; Plate XII, figures 1–5

1924. *Brachyprion mertoni* McLearn, p. 61, pl. 4, figs. 16–18; pl. 28, fig. 12.

Description

Exterior. Valves plano-convex or gently to strongly concavo-convex; semielliptical in outline; alate; vary from slightly wider than long to about as wide as long; hinge line denticulate along 1/2 of its length; anterior commissure crenulate and rectimarginate; interarea of pedicle valve flat, apsacline, about 1/20 as high as long; interarea of brachial valve very low, flat, anacline; valves with pseudodeltidium and prominent convex chilidium bearing a median groove; valves parvicostellate, inserted costellae very narrow at their point of origin and increase in width distally to reach that of the primary costellae; costellae commonly bend abruptly laterally at their anterior ends.

Interior of pedicle valve. Denticles present along the hinge from delthyrium to about half the distance to the cardinal angles; ventral process narrow; muscle field semielliptical in outline, extends anteriorly 1/3 to slightly less than 1/2 the valve length, bounded laterally by curved ridges which originate slightly anterior to hinge line, divided by a low median ridge and open anteriorly; elongate oval adductor scars confined to the posterior half of the muscle field and completely enclosed by diductor scars; short, flat plates extend from the margins of the delthyrium at about a 150 degree angle to each other—these are in the position of dental plates in primitive stropheodontids but are shorter and more widely divergent; distal to the muscle field the internal surface is pustulose and marked by impress of the external ornament. The pustules are most prominent in the posterolateral parts of the valve.

Interior of brachial valve. Denticles as in pedicle valve; cardinal process lobes posteroventrally directed and bear a median groove; a minute ridge between the cardinal process lobes; socket plates diverge at about a 120 degree angle to one another; adductor scars semielliptical in outline, commonly separated by a low, tapering, median ridge, and bounded laterally by prominent subparallel ridges which taper in width anteriorly and may be straight or slightly convex outward; muscle field extends anteriorly about 1/3 the valve length and is longer than wide; internal surface pustulose and marked by impress of costellae distal to muscle field.

Comparison. M. mertoni differs from *M. newsomensis* Foerste, 1909a from the Waldron shale of Wenlock age in Tennessee in having tapering ridges in the brachial valve which bound the muscle field laterally and in having a uniformly costellate ornament. *M. newsomensis* lacks such ridges in the brachial valve and has unequally parvicostellate ornament.

M. mertoni differs from *Mclearnites subinterstrialis* Kozlowski, 1929 from the Borszczow Formation and Czortkow Formation, both of Gedinnian age, of Podolia, Western Russia, in ornament and in being, on the average, less strongly convex, and in having short plates in the pedicle valve which extend anterolaterally from the margins of the delthyrium. *M. subinterstrialis* has unequally parvicostellate ornament and lacks the above-mentioned plates. It closely resembles *M. subinterstrialis* in its cardinalia and muscle fields.

M. mertoni differs from *M.* sp. from the French River Formation in ornament and in having short plates in the pedicle valve which extend anterolaterally from the margins of the delthyrium. *M.* sp. has unequally parvicostellate ornament and lacks such plates.

Occurrence. Stonehouse Formation (Pridoli to early Gedinne age), locs. USNM 10184, 10185, 10187, Arisaig area; loc. USNM 11184, Lochaber area.

Material. 342 specimens.

Subfamily PHOLIDOSTROPHIINAE Stainbrook, 1943
emended Harper, Johnson, and Boucot, 1967

Pholidostrophia (*Mesopholidostrophia*) cf. *P.* (*M.*) *nitens* Williams, 1950

Plate XIII, figures 11–15; Plate XIV, figures 1, 2

1950. *Pholidostrophia* (*Mesopholidostrophia*) *nitens* Williams, p. 280, figs. 7–10.
1967. *Pholidostrophia* (*Mesopholidostrophia*) cf. *nitens* Williams, Harper *et al.*, p. 417, pl. 2, figs. 10a, b.

Description

Exterior. Valves smooth or very faintly parvicostellate; moderately concavo-convex, closely spaced, subelliptical in outline; 2/3 to 4/5 as long as wide; widest at hinge line or slightly anterior to hinge; interarea of pedicle valve planar, high apsacline to orthocline and about 1/10 as high as long; interarea of brachial valve planar, hypercline, about 1/2 as high as pedicle interarea; hinge line denticulate along 1/4 to 1/2 of its length; apical pseudodeltidium not observed; chilidium convex outward and extends upward into delthyrium.

Interior of pedicle valve. Denticles present along hinge from delthyrium to about 1/4 to 1/2 the distance to the cardinal angles; muscle field cordate, extends anteriorly 1/3 to 1/2 the length of the valve; diductor scars circular to oval in outline and occasionally divided anteriorly by a narrow ridge; adductor scars elongate oval in outline and confined to the posterior half of the muscle field; the internal surface distal to the muscle field is pustulose.

Interior of brachial valve. Denticles as in pedicle valve; cardinal process lobes posteroventrally directed; straight narrow socket plates diverge at about a 120 degree angle; muscle field consists of a medial pair of semielliptical adductors separated by a narrow median ridge and directed anteriorly, and a lateral pair of semielliptical adductors directed anterolaterally; the muscle field extends anteriorly 1/3 to 1/2 the valve length; the internal surface is pustulose distal to the muscle field.

Comparison. The Arisaig species *P.* (*M.*) cf. *nitens* closely resembles *P.* (*M.*) *nitens* from the Mulde Marl of Wenlock age in Gotland, Sweden, and may be conspecific with it. Shells of *P.* (*M.*) *nitens* commonly have a nacreous luster. It is reasonable to assume that the shell of some individuals of the Arisaig species *P.* (*M.*) cf. *nitens* also had a nacreous luster, but, as the specimens are casts and moulds of the original shells, this cannot be definitely established.

The Arisaig species differs from *P. nacrea* Hall, 1857, the type species of *P.* (*Pholidostrophia*) Hall and Clarke, 1892, in having socket plates, a convex chilidium, apical pseudodeltidium, and posteroventrally directed cardinal process lobes which lack a median groove. *P. nacrea* lacks socket plates, has a flat chilidium, complete pseudodeltidium, and posteriorly directed cardinal process lobes each of which bears a medial groove. *P. nacrea* has a breviseptum and brachial ridges anterior to the muscle field in the brachial valve, and these are lacking in the Arisaig species.

Occurrence. Middle member, Ross Brook Formation (late Llandovery (C_1–C_5) age), loc. USNM 11232, Pictou County. Upper member, Ross Brook Formation (late Llandovery (C_6) age), loc. USNM 10127, Arisaig area.

Material. 92 specimens.

Subfamily uncertain

Genus *Lissostrophia* Amsden, 1949

Type species. *Lissostrophia cooperi* Amsden, 1949a, p. 202.

Lissostrophia sp.

Plate XIV, figures 3a, b

External and internal moulds of a single specimen of a pedicle valve were found in the lower member, Moydart Formation (Ludlow age), loc. USNM 10182, Arisaig area.

Exterior of pedicle valve. Small, strongly convex, smooth, semielliptical in outline and widest at the straight hinge line.

Interior of pedicle valve. Muscle field semielliptical in outline and divided by a low myophragm; extends anteriorly a little less than 1/2 the valve length.

Family STROPHOMENIDAE King, 1846

Genus *Pentlandina* Lamont, 1949

Type species. *Strophomena* (*Pentlandina*) *parva* Lamont, 1949, p. 13, fig. 9 (*see also* Williams, 1951, p. 118, pl. VII, figs. 8–10).

Pentlandina? sp.

Plate XIV, figures 4, 5

A few poorly preserved specimens resembling *Pentlandina parva* were found in the lower member of the Ross Brook Formation. These are provisionally assigned to *Pentlandina* as the material is not adequate for positive identification.

Description

Exterior. Pedicle valve initially gently convex becoming gently resupinate; brachial valve initially flat becoming gently concave; valves semielliptical in outline, slightly wider than long and widest at the straight hinge line; pedicle interarea low, flat, and apsacline; brachial interarea not preserved on the available specimens; ornament unequally parvicostellate.

Interior of pedicle valve. Low pedicle callist present; flabellate pedicle muscle field confined to the posterior 1/4 of the valve and divided by a rounded myophragm.

Interior of brachial valve. Only one brachial interior was available. This was prepared by burning and scraping and, as the specimens of this species are preserved in a coarsely crystalline nodule, most of the details of the interior are obscure. The cardinal process consists of two narrow lobes which diverge at about a right angle. The brachiophores are linear and diverge at about a 150 degree angle.

Comparison. P.? sp. appears to differ from *P. parva* in lacking zigzag rugae.

Occurrence. Lower member, Ross Brook Formation (middle Llandovery or late early Llandovery age), loc. USNM 10118, Arisaig area.

Material. 11 specimens.

Family LEPTAENIDAE Hall and Clarke, 1892

Genus *Leptaena* Dalman, 1828

Type species. *Leptaena rugosa* Dalman, 1828, p. 137, pl. 1, fig. 1 (by subsequent designation of King, 1846, p. 28).

Leptaena cf. *martinensis* Cocks, 1968

Plate XIV, figures 7, 8

1968. *Leptaena martinensis* Cocks, p. 302–304, pl. 4, figs. 9–13; pl. 5, figs. 1–3.

Description

Exterior. Valves subquadrate to semielliptical in outline, about twice as wide as long, widest at the straight hinge line or slightly anterior to it, commonly alate; pedicle valve initially convex, brachial valve initially flat, both valves become sharply geniculate ventrally at a length between 7 and 20 mm; pedicle interarea flat, high apsacline; brachial interarea flat, high anacline; delthyrium not preserved on any of the available specimens; notothyrium filled by a chilidium which is strongly convex outward; valves marked by coarse rugae which are more or less evenly spaced at intervals that vary from 1/2 to 2 mm, and by costellae separated by interspaces of the same width.

Interior of pedicle valve. The one pedicle valve found has short dental plates which diverge at about a 120 degree angle to each other, and a very faintly impressed, oval muscle field bounded by faint ridges. Internal surface marked by impress of the costellae and rugae anterior and lateral to the muscle field.

Interior of brachial valve. Two fragmental brachial valve interiors were found. One specimen (1.8 cm long) has a bilobed cardinal process and triangular sockets which are open laterally and bounded anteriorly by straight socket ridges which diverge at a 120 degree angle to each other. Muscle field confined to posterior 1/4 of the valve, about 1/3 as long as wide, consists of two semioval adductor scars divided by a low rounded myophragm and flanked laterally by a second pair of semioval adductor scars; median ridge and a pair of lateral ridges parallel to it lie anterior to the muscle field; specimen geniculate; no peripheral ridge present in the interior. The other specimen (7 mm long) has a muscle field which is 4/5 as wide as long, extends 1/2 the valve length, and consists of a pair of elongate adductors which taper in width anteriorly; it is more deeply impressed than that of the first specimen; it is geniculate, with a peripheral ridge along the geniculate margin. These two specimens possibly belong to distinct species, but this cannot be demonstrated as additional specimens which show the interiors are not available.

Occurrence. Beechhill Cove Formation (early Llandovery age), locs. USNM 10116, 10117, Arisaig area; loc. USNM 10819, Pictou County.

Material. 10 specimens.

Leptaena cf. *L. depressa* (Sowerby, 1823)

Plate XIV, figures 9–16

1823. *Producta depressa* Sowerby, p. 86, pl. 459, fig. 3.
1924. *Leptaena rhomboidalis* (Wilckens),McLearn, p. 59 (*partim*), pl. 4, fig. 14.

Description

Exterior. Valves subquadrate to semielliptical in outline, alate, 1/2 to 3/5 as wide as long, becoming sharply geniculate dorsally at a length of 1.9 to 2.3 cm. Geniculate rim may reach a

length along the midline equal to that of the central disc, and may bear a narrow rounded median fold in the pedicle valve and a corresponding sulcus in the brachial valve; a broad rounded knob may be in the medial portion of the rim of the central disc in the pedicle valve. Interarea of pedicle valve planar, high apsacline, 1/12 to 1/20 as high as long; interarea of brachial valve flat, high anacline, and slightly lower than that of pedicle valve. Delthyrium trapezoidal in outline, pseudodeltidium not observed on any of the specimens studied. Prominent chilidium convex outward and bears a median groove. Valves marked by fine, uniform costellae which increase by bifurcation and insertion, and by relatively faint rugae. Ninety to one hundred and thirty costellae are present along the periphery at a length of 1 cm.

Interior of pedicle valve. Teeth stout, supported by short dental plates which diverge at about a 90 degree angle to each other. Small pedicle callist commonly present. Muscle field oval in outline with cordate anterior margin, 2/3 to 9/10 as wide as long, extends anteriorly 1/2 to 2/3 the valve length; adductor scars elongate oval in outline, confined to the median 1/2 to 2/3 of muscle field, and not enclosed by diductor scars; diductor scars commonly with scalloped margins, marked by numerous parallel ridges that extend anterolaterally at a low angle to the median line, and bounded laterally and anteriorly by ridges which extend anteriorly from the dental plates. Often there is a low platform between the diductor scars anterior to the adductor scars; this platform commonly has a low median ridge and may be raised as a knob at its posterior end. On some specimens a depression occupies the position of the platform. Internal surface, anterior and lateral to the muscle field, is pustulose and marked by impress of the rugae and costellae.

Interior of brachial valve. Cardinal process bilobed and conjunct with chilidium, the lobes are oval in outline with flat, longitudinally striated, posteroventrally directed attachment faces; minute median ridge commonly present between cardinal process lobes; sockets triangular in outline, laterally directed, and bounded anteriorly by straight socket ridges which diverge anterolaterally at a 120 degree angle to each other. Muscle field extends anteriorly 1/3 to 1/2 the length of the valve, varies from 3/4 as long to as long as wide, and is divided by a rounded myophragm which is very wide at its posterior end and decreases in width anteriorly; two pairs of oval adductors—one pair at the posterior end of the field and another pair situated anterior and medial to the first. A median ridge and a pair of lateral ridges are situated anterior to the muscle field; the lateral ridges diverge anterolaterally at about a 20 degree angle to the midline. A rounded peripheral ridge rims the valve along the geniculate margin. Lateral and anterior to the muscle field the internal surface is pustulose and is marked by the impress of the rugae and the costellae.

Comparison. L. cf. *L. depressa* resembles *L. depressa* in having relatively fine rugae and a prominent convex chilidium with a median groove, and in its cardinalia and muscle fields. Both species become geniculate at about the same stage of development. However, *L. depressa* has a small pseudodeltidium and an adjacent apical foramen, and in the specimens of *L.* cf. *L. depressa* studied the delthyrium appears to be open ventral to the chilidium. It is possible that a pseudodeltidium was present in these specimens but was not preserved.

Both *L.* cf. *L. depressa* and *L. depressa* differ from *L. rhomboidalis* (Wahlenberg, 1821) as described by Poulsen (1943, p. 18–21) in having much finer rugae. As pointed out by Spjeldnaes (1957, p. 172) it is not completely certain that the specimens described and figured by Poulsen are identical with *L. rhomboidalis* Wahlenberg.

Leptaena cf. *L. depressa* differs from *L.* cf. *martinensis* from the Beechhill Cove Formation in having finer rugae.

Occurrence. Upper member, Ross Brook Formation (late Llandovery (C_6) age), loc. USNM 10128, Arisaig area; loc. USNM 10823, Pictou County. French River Formation, (late Llandovery (C_6) or early Wenlock age), locs. USNM 10142, 10145, 10146, 10150, 10158, 10911, 10912, Arisaig area; locs. USNM 10811, 10816, 10820, 10821, 10825, 10826, GSC 46443, Pictou County; locs. USNM 10814, 10822, Cobequid Mountains. Doctor's Brook Formation (Wenlock age), locs. USNM 10164, 10909, Arisaig area. Either French River or Doctor's Brook Formation, loc. USNM 10812, Pictou County; loc. USNM 10813, Cobequid Mountains. Kerrowgare Formation, in beds correlative with the French River Formation, loc. USNM 10817, Pictou County.

Material. 748 specimens.

Leptaena aff. *L. rhomboidalis* (Wahlenberg, 1821)

Plate XIV, figures 17, 18; Plate XV, figure 1

1821. *Anomites rhomboidalis* Wahlenberg, p. 65.

Description

Exterior. Valves subquadrate in outline, alate, 1/2 to 2/3 as long as wide, widest at the straight hinge line, becoming sharply geniculate dorsally at a length of 0.8 to 1.4 cm. Interarea of pedicle valve flat, high apsacline, and about 1/10 as high as long; interarea of brachial valve flat, orthocline, and about 1/20 as high as long; apical pseudodeltidium and prominent convex chilidium. Valves marked by rounded costellae which increase by bifurcation and insertion, and by coarse, regularly spaced rugae.

Interior of pedicle valve. Stout teeth supported by short, widely divergent, dental plates. Muscle field circular in outline with cordate anterior margin, as wide as long or slightly wider than long, extends anteriorly to about 2/5 the valve length; diductor scars bounded laterally by curved ridges which are continuous with the dental plates; elongate oval adductor scars not enclosed by the diductors; small median pit may be present at the anterior end of the muscle field. Internal surface marked by impress of external ornament lateral and anterior to the muscle field.

Interior of brachial valve. Cardinal process bilobed and posteroventrally directed; straight socket ridges diverge at about a 100 degree angle to each other; muscle field, only faintly impressed, consists of semioval adductors divided by a low myophragm, extends to about 1/3 the valve length; linear median ridge and a pair of linear, slightly diverging lateral ridges anterior to the muscle field; internal surface marked by impress of the ornament as in the pedicle valve.

Comparison. L. aff. *L. rhomboidalis* resembles *L. rhomboidalis* illustrated by Poulsen (1943, text plate figs. 5c, 6b, 7a–d) in its external ornament, chilidium and pseudodeltidium; both species become geniculate at about the same size. However, as mentioned above, it is not completely clear whether Poulsen's specimens actually belong to *L. rhomboidalis.*

L. aff. *L. rhomboidalis* differs from *L.* cf. *L. depressa* described above in having much coarser rugae and in becoming geniculate at a smaller size.

Occurrence. Stonehouse Formation (Pridoli to early Gedinne age), locs. USNM 10184, 10185, Arisaig area.

Material. 65 specimens.

Indet. leptaenid

Plate XIV, figure 6

A few fragmental pedicle valves of a leptaenid other than *Leptaena* were found in the Beechhill Cove Formation. These cannot be identified generically. The pedicle interiors resemble somewhat those of *Cyphomena* (*Cyphomenoidea*) *wisgorensis* Lamont and Gilbert, 1945 and *Cyphomena* (*Laevicyphomena*) *feliciter* Cocks, 1968 (pl. 12, fig. 9; pl. 13, fig. 1).

Description

Exterior. Pedicle valve wider than long, alate, semielliptical in outline, widest at the straight hinge line, convex and geniculate; interarea of pedicle valve catacline. The three exteriors studied appear to lack radial ornament; however, their preservation is not adequate to establish definitely whether the specimens had radial ornament.

Interior of pedicle valve. Teeth stout and supported by short dental plates; muscle field consists of a pair of flabellate diductor scars divided by a broad myophragm.

Occurrence. Beechhill Cove Formation, loc. USNM 10117, Arisaig area.

Material. Four specimens.

Superfamily DAVIDSONIACEA King, 1850
[*nom. transl.* Williams, 1965 (*ex* Davidsoniinae King, 1850)]

Family SCHUCHERTELLIDAE Williams, 1953

Subfamily FARDENIINAE Williams, 1965

Discussion. Williams (1965, p. 407) assigned the subfamily Fardeniinae to the Family Meekellidae Stehli, 1954. The fardeniids, however, are closer morphologically to Devonian *Schuchertella* than they are to *Meekella* and its allies in the Carboniferous and Permian; further, they are impunctate as are Devonian *Schuchertella*, whereas meekellids are pseudopunctate. Thus, the Fardeniinae are here assigned to the Schuchertellidae.

Genus ***Fardenia*** Lamont, 1935

Type species. *Fardenia scotica* Lamont, 1935, p. 311, 312, pl. 7, figs. 1–7.

Fardenia? sp.

Plate XV, figures 2, 3, 5

A few specimens of an orthotetacid were found in the Beechhill Cove Formation and one was found in the Glencoe Brook Formation. These are assigned questionably to *Fardenia* as it is not clear from the available specimens whether the species has a chilidium as in *Coolinia* Lamont, 1949 (= *Chilidiopsis* Boucot, 1959) or discrete chilidial plates as in *Fardenia*. As *Coolinia* is not known in beds older than late Llandovery, and *Fardenia* is common in beds of lower Llandovery age, the Arisaig specimens are assigned questionably to *Fardenia*.

Description

Exterior. Valves gently biconvex, semielliptical in outline, widest slightly anterior to the straight hinge line, and about 2/3 as long as wide; cardinal angles obtuse; interarea of pedicle valve flat, apsacline, about 1/10 as high as long; interarea of brachial valve linear; delthyrium

trapezoidal with lateral margins that diverge at about a right angle; no pseudodeltidium or chilidium observed. Anterior commissure crenulate and rectimarginate. Valves bear straight rounded uniform costellae which increase by both bifurcation and insertion.

Interior of pedicle valve. Teeth supported by short dental plates which diverge at about a right angle to each other; muscle field triangular, extends anteriorly about 1/3 the valve length and bears faint radial grooves; periphery of the valve marked by coarse plications corresponding to the external ornament.

Interior of brachial valve. Cardinal process lobes posteriorly directed; socket ridges tabular, diverge at about a 150 degree angle to each other; faintly impressed semielliptical adductor scars separated by a broad flat myophragm and extend anteriorly about 1/3 the valve length; periphery of the valve is marked by coarse plications corresponding to the external ornament.

Occurrence. Beechhill Cove Formation (early Llandovery age), locs. USNM 10115, 10116, Arisaig area. Glencoe Brook Formation (early Llandovery age), loc. USNM 11262, Pictou County.

Material. Five specimens.

Fardenia sp.

Plate XV, figures 4, 6–12

Description

Exterior. Valves semielliptical in outline, up to 3 mm long, 3/5 to 9/10 as long as wide and widest at the hinge line or slightly anterior to it; anterior commissure crenulate and rectimarginate; pedicle valve initially gently convex becoming resupinate at a length of 1–1.5 cm, the ventrally deflected portion of the valve may be gently or strongly concave; brachial valve initially gently convex, almost flat, and may remain gently convex or become strongly convex; interarea of pedicle valve flat, high apsacline and 1/6 to 1/12 as high as long; delthyrium partially filled by an apical pseudodeltidium with a median groove; interarea of brachial valve flat, 1/20 to 1/25 as high as long, and high anacline; notothyrium with small discrete chilidial plates lateral to the cardinal process lobes; ornament consists of straight to slightly irregular, coarse, rather angular costae and growth lamellae. Costae increase by insertion, inserted costae are very fine at their point of origin and gradually increase in width distal to their point of origin until they attain the width of the primary costellae. At a given growth line coarse costellae are separated by angular interspaces of roughly the same width which may bear one or more higher order costellae.

Interior of pedicle valve. Teeth stout and supported by long dental plates which diverge anterolaterally from the margins of the delthyrial cavity at a 90 to 120 degree angle to each other; deltidium projects a short distance into the delthyrial cavity. Muscle field suboval in outline, 3/4 as wide as long, and extends anteriorly at about midlength; diductor scars may bear parallel, anterolaterally diverging ridges, and the lateral margins of the diductor scars may be scalloped between adjacent ridges; adductor scars elongate and elliptical in outline, completely enclosed by the diductors and confined to the median portion of the muscle field. Internal surface marked by the impress of the costellae, which may be confined to the periphery or may extend almost to the apex of the valve.

Interior of brachial valve. Cardinal process lobes triangular in outline, posteroventrally directed, and separated by a deep groove with a median ridge; the short chilidial plates, which may be fused at the apex on large specimens, flank the cardinal process; straight tabular

socket ridges extend anterolaterally from the cardinalia at a 90 degree angle to each other; sockets triangular in outline and open along their lateral margins; a broad rounded myophragm of uniform width extends anteriorly from the cardinalia to 1/3 to 1/2 the length of the valve; surface marked by impress of the external ornament as in the pedicle valve.

Comparison. Fardenia sp. closely resembles *Fardenia scotica* Lamont, 1935 from the Drummuck Group, Girvan, Scotland, of Ashgillian age in ornament and outline, and in its cardinalia and brachial valve muscle field. It differs from *Fardenia scotica* in having adult specimens which are much larger than those of *F. scotica* (specimens of *F.* sp. studied by the author were up to 3 cm long, specimens of *F. scotica* studied were up to 1.2 cm long). *Fardenia* sp. is initially convex and becomes resupinate at a length of 1 to 1.5 cm; the pedicle valve of *F. scotica* is convex and may have flattened margins but is not resupinate. However, as all of the specimens of *F. scotica* studied by the author were less than 1.2 cm long, and the pedicle valve of *F.* sp. usually did not become resupinate until it attained greater length, the presence or absence of resupinate pedicle valves may not be used to distinguish between the species. The pedicle muscle field of the specimens of *F.* sp. studied appear to be more deeply impressed than those of *F. scotica* studied. This difference is quite possibly not significant as the specimens of *F.* sp. pedicle valves were in all cases larger than the valve of the largest specimen of *F. scotica.*

F. sp. differs from *Fardenia geoffreyi* Williams, 1951, from the Gasworks Mudstone of early Llandovery age at Haverfordwest in Wales in having a relatively uniform costellate ornament in contrast to the parvicostellate ornament of the latter species.

The Arisaig specimens of *Fardenia* sp. closely resemble specimens of a species of *Fardenia* in the collections of the United States National Museum from the middle Clinton limestones (possibly Reynales Limestone) of late Llandovery (C_3–C_6) or low Wenlock near Pultneyville, 10 miles northeast of Rochester, New York, collected by T. Amsden of the Oklahoma Geological Survey. The Arisaig species and the New York species are identical externally and in the details of their muscle fields and cardinalia, and both have an apical pseudodeltidium and discrete chilidial plates. However, the New York species has a faint peripheral ridge in the pedicle valve that is lacking in the Arisaig species. The New York species does not have a groove in its pseudodeltidium as does the Arisaig species.

Fardenia, which is common in beds of late Ordovician and lower Llandovery age, has not been previously recognized in beds of post-lower Llandovery age. The common orthotetacid in Silurian beds younger than lower Llandovery is *Coolinia* Lamont, 1949 (= *Chilidiopsis* Boucot, 1959) although species of the "*Schellweinella*" type also occur (*see* Boucot, 1959, p. 25–27).

Occurrence. French River Formation (late Llandovery (C_6) or early Wenlock age), locs. USNM 10150, 10155, 10912, Arisaig area; locs. USNM 10809, 10811, 10815, Pictou County; locs. USNM 10810, 10814, Cobequid Mountains. Doctor's Brook Formation (Wenlock age), locs. USNM 10161, Arisaig area. Either French River or Doctor's Brook Formation, locs. USNM 10812, 10818, GSC 50912, Pictou County; loc. USNM 10813, Cobequid Mountains. Kerrowgare Formation, loc. USNM 10817, Pictou County, in beds correlative with the French River Formation.

Unidentified orthotetacids possibly belonging to *Fardenia* sp. have been found in the French River Formation, locs. USNM 10917, 10938, Arisaig area; in beds questionably assigned to the French River Formation, loc. USNM 10921, Arisaig area. Doctor's Brook

Formation, locs. USNM 10913, 10914, 10915, 10916, 10918, 10919, Arisaig area; lower member, Moydart Formation (Ludlow age), loc. USNM 10174, Arisaig area.

Material. 257 specimens (20 questionably assigned).

Indet. orthotetacid

Plate XV, figures 13–15

1924. *Schuchertella pecten* (Linnaeus), McLearn (?), p. 63, 64, pl. V, fig. 32.

A single slab (GSC No. 5423) contains several specimens of an unidentifiable orthotetacid listed as coming from the Stonehouse Formation, shore section, Arisaig.

Exterior. Valves resupinate, semielliptical in outline, somewhat wider than long, and widest at the straight hinge line; ornament consists of straight costellae which increase by insertion.

Interior. Not known.

Superfamily PLECTAMBONITACEA Jones, 1928
Family PLECTAMBONITIDAE Jones, 1928
Genus ***Plectodonta*** Kozlowski, 1929

Type species. *Plectodonta mariae* Kozlowski, 1929, pp. 114–117, pl. 3, figs. 30–32.

Plectodonta sp.

Plate XVI, figures 1, 2

Description

Exterior. Valves concavo-convex, semielliptical in outline, wider than long, and widest at the straight hinge line; interarea of pedicle valve flat, roughly 1/10 as high as long and marked by grooves corresponding to the trace of the denticles which occur along the hinge line; pseudodeltidium not preserved on any of the specimens studied; interarea of brachial valve low; notothyrium filled by the large cardinal process and a pair of large chilidial plates lateral to the cardinal process; valves marked by fine costellae which are separated by interspaces of about the same width and increase in number by insertion. Some specimens are unequally parvicostellate, others have costellae of uniform size.

Interior of pedicle valve. Teeth small, rounded; small rounded denticles occur along the middle half of the hinge line lateral to the teeth and decrease in size laterally; curved ridges extend anteriorly from the delthyrial cavity to about 1/2 the valve length and bound the muscle field; a medial ridge extends from the delthyrial cavity to about 1/2 the valve length and bifurcates anteriorly so as to divide the muscle field and partially enclose the diductors anteriorly; muscle field extends to about 1/3 the valve length; elongate oval adductor scars confined to the posterior half of the muscle field and completely enclosed by the broad oval diductor scars. A pair of linear pallial tracks extend anteriorly from the muscle field parallel to the median line to about 2/3 the valve length, and are bounded by the lateral ridges and the branches of the median ridge. Periphery of valve marked by radial ridges.

Interior of brachial valve. Simple cardinal process flanked laterally by prominent chilidial plates, cardinal process and chilidial plates extend outward from the notothyrium and are posterodorsally directed; a deep pit occurs anterior and adjacent to the cardinal process and chilidial plates; rounded sockets occur lateral to the chilidial plates and are bounded anteriorly by short low socket plates which extend parallel to the hinge line; muscle field extends ante-

riorly to about 2/3 the valve length, about as wide as long; divided by two pair of brachial septa and a low median ridge, and bounded laterally by a third pair of brachial septa; the medial pair of brachial septa curve laterally outward from their bases; they are highest at their posterior end and taper anteriorly. A somewhat lower pair of brachial septa occur a short distance lateral to the medial pair; they curve slightly medially from their bases, are highest at their anterior end and taper anteriorly. The bases of the medial pair and of the second pair of brachial septa diverge slightly anteriorly. The brachial septa which bound the muscle field are lower than the medial two pairs, straight, and converge anteriorly at a low angle. Internal surface pustulose and marked by impress of the costellae along the periphery.

Occurrence. French River Formation (late Llandovery (C_6) or early Wenlock age), loc. USNM 10810, Cobequid Mountains.

Material. 10 specimens.

Suborder ***Chonetidina*** Muir-Wood, 1955
[*nom. correct.* Muir-Wood, 1965 (*pro* Chonetoidea Muir-Wood, 1955)]

Superfamily CHONETACEA Bronn, 1862
[*nom. transl.* Shrock and Twenhofel, 1953 (*ex* Chonetidae Bronn, 1862)]

Family CHONETIDAE Bronn, 1862

Subfamily CHONETINAE Bronn, 1862

Genus ***Protochonetes*** Muir-Wood, 1962
emended Boucot and Harper, 1968, p. 148, 149

Type species. *Protochonetes ludloviensis* Muir-Wood, 1962, p. 51, pl. 3, figs. 1–5.

Diagnosis. Transverse, gently to moderately concavo-convex chonetids, with a radial ornament of costellae that increase by insertion or bifurcation, with or without a median, enlarged costellae, with spines that extend posterolaterally outward from the interarea, with a median septum in the pedicle valve that may or may not bifurcate posteriorly, with a cardinal process that is bilobed at its base and may be bilobed or quadrilobate on its distal face, and with a median septum and a pair of anderidia (term defined by Sadlick, 1965, p. 157–159; =lateral septa of Muir-Wood, 1962, p. 21) in the brachial valve.

Discussion. The chonetid species of the Arisaig Group are assigned to *Protochonetes* rather than to *Strophochonetes* on the basis of the angle of emergence of the spines. The spines in *Protochonetes* extend posterolaterally from the margin of the interarea whereas those in *Strophochonetes* extend posteriorly at a right angle to the margin of the interarea (Boucot and Harper, 1968, p. 149).

Protochonetes tenuistriatus (Hall, 1860)

Plate XVI, figures 5–9

1860. *Chonetes tenuistriata* Hall, p. 145, fig. 3.
1924. *Chonetes tenuistriatus* (Hall), McLearn, p. 64, pl. V, figs. 33, 34.

Description

Exterior. Valves small (up to 1 cm wide), relatively strongly concavo-convex, transversely semielliptical in outline with the cardinal angles slightly rounded, 3/5 to 4/5 as wide as long,

and widest at the hinge line or between the hinge line and midlength; posterolateral margins may be slightly flattened; anterior commissure crenulate and rectimarginate; interarea of pedicle valve planar, high apsacline, about 1/20 as high as long; interarea of brachial valve linear; pseudodeltidium not observed on specimens studied; small chilidial plates present; valves marked by fine rounded, slightly undulating, costellae which increase by insertion and occasionally by bifurcation; sixty to eighty costellae cross a growth line 5 mm from the apex at the midline; spines rarely preserved. When present, the spines diverge posterolaterally from the pedicle interarea at a high angle to the interarea.

Interior of pedicle valve. Teeth small, rounded; median ridge extends 1/4 to 1/2 the length of the valve and tapers in height anteriorly; muscle field is triangular to semioval in outline and extends anteriorly 1/4 to 1/2 the length of the valve; lateral margins of the muscle field diverge at about a 100 degree angle to each other; adductor scars elongate oval in outline and confined to the posterior 1/2 of the muscle field; interior pustulose and marked by impress of the costellae.

Interior of brachial valve. Cardinal process bilobed, directed posteriorly and bordered laterally on each side by short chilidial plates; sockets rounded at their base and diverge anterolaterally from the base of the chilidial plates, bounded laterally by short, slightly curved socket ridges; slightly divergent anderidia flank short, broad, median septum which extends anteriorly about 1/3 the valve length; adductor scars, when impressed, are semioval in outline and confined to the posterior 1/3 of the valve; interior pustulose and marked by impress of the costellae.

Comparison. Protochonetes tenuistriatus differs from *P. ludloviensis* (Muir-Wood, 1962) in being smaller, more strongly concavo-convex, and in having a median ridge in the pedicle valve which does not bifurcate posteriorly.

Occurrence. Upper member, Ross Brook Formation (late Llandovery (C_6) age), locs. USNM 10126, 10127, 10128, 10129, 10923, Arisaig area; locs. USNM 10832, 10833, Pictou County.

Material. 392 specimens.

Protochonetes novascoticus (Hall, 1860)

Plate XVI, figures 10–19

1860. *Chonetes novascoticus* Hall, p. 144, fig. 2.
1924. *Chonetes novascoticus* Hall, McLearn, p. 65, pl. 5, figs. 35, 36; pl. 6, fig. 1.
1924. *Chonetes novascoticus* mut. *crassistriatus* McLearn, p. 66, pl. 5, fig. 37.

Description

Exterior. Valves relatively large (up to 4 cm wide), transverse, gently to moderately strongly concavo-convex, 1/2 to 2/3 as long as wide, semielliptical in outline with the greatest width about at midlength; cardinal angles somewhat rounded; hinge line about 4/5 as long as the greatest width; gentle sulcus rarely developed in the pedicle valve and a gentle fold rarely developed in the brachial valve; anterior commissure crenulate and rectimarginate to gently uniplicate; interarea of pedicle valve planar, high apsacline, about 1/15 as high as long; interarea of brachial valve planar, high anacline or oriented perpendicular to the plane of commissure, and about 1/2 as high as the pedicle interarea; apical pseudodeltidium, small chilidial plates on lateral margins of the notothyrium; valves marked by slightly undulating rounded costellae which increase by insertion and bifurcation, and are separated by rounded interspaces of about the same width as the costellae; median costellae coarser than the other costellae on some specimens and the same weight as the other costellae on others, thirty-five

to seventy costellae cross a growth line which is 5 mm from the apex at the midline; three to five spines on each side of the interarea, extend posterolaterally at a 40–70 degree angle to the hinge; hollow tubes extend anterolaterally from the base of the spines at the upper edge of the interarea to the spine apertures along the hinge on the internal surface of the valve.

Interior of pedicle valve. Teeth small, rounded; median septum extends anteriorly 1/4 to 1/3 the valve length and may or may not bifurcate posteriorly; muscle field triangular in outline, divided by the median ridge, lateral margins of the muscle field diverge at a 100–120 degree angle to each other and extend anteriorly about 1/4 the length of the valve; adductor scars semioval in outline and confined to the posterior 1/2 of the muscle field; internal surface marked by the impress of the costellae.

Interior of brachial valve. Cardinal process bilobed proximally and quadrilobed on its distal face; sockets rounded, posteroventrally directed; socket ridges short, straight; median septum extends from cardinal process 1/2 to 2/3 the valve length; anderidia short, slightly divergent; adductor scars semioval in outline, usually only faintly impressed; internal surface pustulose and marked by impress of the costellae.

Discussion. Protochonetes novascoticus closely resembles *P. ludloviensis* Muir-Wood, 1962 in convexity, outline, ornament, pedicle valve internal features, and in having a median septum and anderidia but no accessory septa in the brachial valve. They differ in that the cardinal process is quadrilobate on its distal face in *P. novascoticus* and bilobate on its distal face in *P. ludloviensis.*

P. novascoticus differs from *P. tenuistriatus* in its larger size, and in being much less strongly concavo-convex. *P. novascoticus* has a cardinal process that is quadrilobate on its distal face, and a median septum in the pedicle valve that may bifurcate posteriorly. In *P. tenuistriatus* the cardinal process is bilobate, and the median septum does not bifurcate posteriorly.

Occurrence. French River Formation (late Llandovery (C_6) or early Wenlock age), locs. USNM 10150, 10158, 10860, Arisaig area; locs. USNM 10825, 10842, Pictou County; loc. USNM 10822, Cobequid Mountains. Doctor's Brook Formation (Wenlock age), locs. USNM 10164, 10909, Arisaig area. Either French River or Doctor's Brook Formation, loc. USNM 10841, Pictou County; loc. USNM 11183, Lochaber area. Lower member, McAdam Brook Formation (early Ludlow age), locs. USNM 10168, 10169, Arisaig area. Upper member, McAdam Brook Formation (Ludlow age), loc. USNM 10170, Arisaig area. Lower member, Moydart Formation (Ludlow age), locs. USNM 10172, 10174, 10176–10179, 10181–10183, 10908, Arisaig area; locs. USNM 10828, 10836, 10837, Pictou County; loc. 10827, Lochaber area. Stonehouse Formation (Pridoli to early Gedinnian age), locs. USNM 10189–10195, 10198, 10199, 10201, 10203–10206, 10209, 10211–10213, 10910, 10922, 10925, 10926, Arisaig area; locs. USNM 10829, 10835, 10838, 10846, GSC 46434, 46441, 46444, Pictou County; locs. USNM 10843, 10844, Cape George area; locs. USNM 11182, 11184, Lochaber area; locs. USNM 10830, 10831, GSC 68836, 68837, 68839, 68840, 68842, 68845–68848, 65910, 65913, Cobequid Mountains. Kerrowgare Formation (late Llandovery to Ludlow age), loc. USNM 10845, Pictou County. Beds of Moydart age in the *Scolithus* (worm-tube) quartzite, loc. USNM 10834, Cape George area. Locs. USNM 10839, 10840, GSC 68838, Cobequid Mountains (formation unknown).

Material. 4,245 specimens.

Protochonetes stonehousensis n. sp.

Plate XVI, figures 3, 4, 20–23

Description

Exterior. Valve small (less than 8 mm wide), semielliptical in outline, 1/2 to 2/3 as long as wide; hinge line slightly shorter than the greatest width which is at midlength; cardinal angles somewhat rounded; valves strongly concavo-convex; pedicle valve commonly with gentle sulcus; no corresponding fold was observed in any of the brachial valves studied; anterior commissure crenulate and rectimarginate; interarea of pedicle valve planar, low, apsacline; interarea of brachial valve low, planar, and anacline; notothyrium with small chilidial plates; no pseudodeltidium observed; valves marked by slightly undulating rounded costellae separated by rounded interspaces of about the same width as the costallae; costellae increase by bifurcation and insertion; about forty to fifty costellae cross a growth line which is 5 mm from the apex at the midline; spines rarely preserved; one or two posterolaterally divergent spines were observed on each side of the interarea on a few specimens.

Interior of pedicle valve. Median septum extends about 1/4 the length of the valve; teeth small and oval in outline; muscle field triangular in outline, open anteriorly, divided by the median ridge, and extends anteriorly about 1/4 the length of the valve; adductor scars not observed; internal surface marked by the impress of the costellae.

Interior of brachial valve. Cardinal process bilobed and posteriorly directed; small chilidial plates lie on each side of the cardinal process; sockets rounded at their base, posterolaterally directed; socket ridges short; median septum extends anteriorly about 1/2 the length of the valve; short anderidia present; internal surface marked by impress of the costellae.

Comparison. P. stonehousensis differs from *P. novascoticus* in that it is smaller and more strongly concavo-convex. *P. stonehousensis* has a median septum in the pedicle valve which does not bifurcate posteriorly and a bilobed cardinal process. In *P. novascoticus* the median septum in the pedicle valve may bifurcate posteriorly and the cardinal process is quadrilobate on its distal face.

P. stonehousensis differs from *P. tenuistriatus* in having coarser costellae.

Occurrence. Stonehouse Formation (Pridoli to early Gedinnian age), locs. USNM 10184, 10185, 10187, 10188, 10192, 10202, Arisaig area.

Material. 434 specimens.

Type species. Holotype, GSC No. 19404; paratypes, GSC Nos. 19405, 19406, 19623–19626.

Order ***Rhynchonellida*** Kuhn, 1949

Superfamily RHYNCHONELLACEA Gray, 1848

Genus ***Plagiorhyncha*** McLearn, 1918

Type species. *Rhynchonella glassi* Davidson, 1883, p. 155, pl. 10, fig. 22a (=*Atrypa depressa* Sowerby, 1839 (*nomen nudum*), p. 629, pl. 13, fig. 6.).

Species assigned. Rhynchonella glassi Davidson, 1883; *Plagiorhyncha plastica* McLearn, 1924, p. 781, pl. 8, figs. 6, 7, *non* 5, 33; pl. 28, fig. 11.

Species to be investigated. Terebratula thisbe Barrande, 1847, p. 63, pl. 16, fig. 4 (=*Plagiorhyncha thisbe* (Barrande), Havlíček, 1961, p. 54, 55, pl. 5, figs. 3–7.); *Terebratula niobe*

Barrande 1847, p. 78, pl. 17, fig. 9 (=*Plagiorhyncha niobe* (Barrande), Havlíček, 1961, p. 55–57, pl. 5, figs. 1, 2); *Atrypa analoga* Wieniukow, 1899, p. 120–122, pl. 1, fig. 16; pl. 7, figs. 13, 17 (=*Atrypa analoga* (Wieniukow), Nikiforova, 1954, p. 119–121, pl. 13, figs. 6–9).

Species rejected. Terebratula decemplicata Sowerby, 1839, p. 641, pl. 21, fig. 17; *Terebratula monaca* Barrande, 1847, p. 94, pl. 17, fig. 4 (=*Plagiorhyncha monaca* (Barrande), Havlíček, 1961, p. 57–58, pl. V, fig. 8).

Discussion. This genus is poorly understood as the interiors of the type species *P. glassi* are not known. The Arisaig species described here are assigned to *Plagiorhyncha* only on the basis of their close similarity to the exteriors of *P. glassi.*

McLearn assigned *Terebratula decemplicata* Sowerby, 1839 from the late Llandovery of the Malvern Hills, England, to *Plagiorhyncha,* and included some of the Arisaig forms in this species. The author has studied topotype material of this species and finds that it does not closely resemble *Plagiorhyncha glassi* externally and differs from the Arisaig species assigned to *Plagiorhyncha* herein in having dental plates. It appears closely related to "*Camarotoechia*" *bimesiornata* McLearn, 1924.

Havlíček assigned *Terebratula monaca* Barrande, 1847 from beds of Silurian age, belonging either to the Liten beds or the Kopanina beds in Bohemia, to *Plagiorhyncha.* I have rejected this species as belonging to *Plagiorhyncha* because it has a subtriangular outline, which strongly contrasts with the subpentagonal to subcircular outline of *Plagiorhyncha.*

Plagiorhyncha aff. *P. glassi* (Davidson, 1883)

Plate XVII, figures 1–15

1924. *Plagiorhyncha decemplicata* (Sowerby), McLearn, p. 77, 78, pl. 8, figs. 1–4.
1924. *Plagiorhyncha glassi* (Davidson), McLearn, p. 79, 80, pl. 8, figs. 10–17, 36; pl. 29, fig. 2.

Description

Exterior. Valves subpentagonal in outline with rounded margins; greatest width at midlength or slightly posterior to midlength; brachial valve more convex than pedicle valve; lateral margins of the pedicle valve flat or curved ventrally; posterolateral margins of many of the brachial valves are flattened and curve concave dorsally; hinge line equal to 1/3 to 2/3 the width; length varies from 4/5 to slightly greater than the width; anterior commissure uniplicate and crenulate or smooth; cardinal margins of pedicle valve flat; delthyrium triangular, broadly rounded at the apex, intercepting an angle of about 150 degrees; broad, low, rounded sulcus originates at or anterior to the apex, and bears a single, rounded, median plication; fold has two rounded plications separated by a rounded interplication of about the same width; both fold and sulcus rounded to subrectangular in cross-section; valves of some specimens bear one to five lateral plications on either side of the fold and sulcus; other specimens have valves which are completely smooth lateral to the fold and sulcus; lateral plications, when present, are rounded in cross-section, faint to coarse, and separated by rounded interplications of about the same width. All intergrades are present between specimens with coarse plications lateral to the fold and sulcus, and specimens with valves that are smooth lateral to the fold and sulcus.

Interior of pedicle valve. Teeth minute, circular in outline, and unsupported by dental plates; delthyrial cavity occupied by a low pedicle callist; muscle field well impressed, pentagonal in outline, extends anteriorly slightly less than 1/2 the valve length; diductor scars curved at their posterior end and completely enclose the small elongate oval adductor scars which are confined to the posterior half of the muscle field; on some specimens there is a

small pit adjacent and anterior to the adductor scars. The diductor scars commonly bear ridges which extend anterolaterally, and the margins of the muscle fields with such ridges are scalloped. On specimens with lateral plications, the internal surface is marked by the impress of the external ornament which extends inwards as far as the muscle field. On a few of the specimens studied, two pair of pallial marks extend anterolaterally from the anterior margin of the muscle field.

Interior of brachial valve. Cardinalia consist of a pair of hinge plates separated by a median groove, and supported by a septalium; a pair of curved socket ridges which flank the hinge plates laterally; crura; and, in some cases, a cardinal process. Median ridge extends anteriorly 1/2 to 3/4 the length of the valve and tapers in height anteriorly; crura originate at the anteromedial margins of the hinge plates; cardinal process, when present, consists of two minute oval lobes with ventrally directed attachment faces; sockets are triangular in outline, rounded at their base, and bounded medially by the hinge plates and dorsally by the curved socket ridges; muscle field consists of two pair of adductors, a posterior pair which are triangular to oval in outline, and an anterior pair which are elongate oval in outline and larger than the posterior pair; on specimens with lateral plications, the internal surface is marked by the impress of the external ornament, which extends posteriorly to the muscle field.

Comparison. P. aff. *P. glassi* appears to differ from *P. glassi* in external ornament. Sowerby (1839, pl. 13, fig. 6) and Davidson (1883, pl. 10, fig. 22), illustrate *P. glassi* as having ornament consisting of fine costellae, and *P.* aff. *P. glassi* lacks fine costellae. However, as no specimens of *P. glassi* were available, I am not sure whether it actually has fine costellae.

P. aff. *P. glassi* differs from both *P.* (?) *thisbe* from the Kopanina beds of Ludlow or Pridoli age in Bohemia and *P.* (?) *analoga* from the Kitaygorod Formation of late Llandovery age of Podolia in having a single plication on the sulcus and two plications on the fold. *P.* (?) *thisbe* may have as many as four plications and *P.* (?) *analoga* as many as two plications on the sulcus.

Occurrence. Middle member, Ross Brook Formation (late Llandovery (C_1–C_5) age), locs. USNM 10121, 10124, Arisaig area; locs. USNM 11236, 11278, 11283, 11332, Pictou County; locs. USNM 11286, GSC 52807, 68849, Cobequid Mountains. Upper member, Ross Brook Formation (late Llandovery (C_6) age), locs. USNM 10120, 10126, 10128, 10923, 10932, Arisaig area; locs. USNM 10833, 10856, 11227, 11229, 11230, 11233, 11234, 11235, Pictou County. Kerrowgare Formation (late Llandovery to Ludlow age), loc. USNM 11228, Pictou County.

Material. 803 specimens.

Plagiorhyncha plastica McLearn, 1924

1924. *Plagiorhyncha plastica*, McLearn, p. 78, pl. 8, figs. 6, 7 (*non* 5, 33); pl. 28, fig. 11.
1924. *Plagiorhyncha plastica* var. *media*, McLearn, p. 78–79, pl. 8, figs. 8, 9.

Description. Only four specimens (Peabody Museum Nos. 453–456) were available for study. Specimens 453, 454, and 456 are badly compressed and broken. They show a fold in the brachial valve, a sulcus in the pedicle valve, and an ornament of both plications and fine costellae. Specimen 455, a brachial valve, is not badly distorted and shows a pentagonal outline with rounded margins.

Occurrence. McLearn reports this species only from the Arisaig shore section at the mouth of Arisaig Brook. His type specimens are from the middle member, Ross Brook Formation, Twenhofel locality 184b.

Plagiorhyncha cf. *P. plastica* McLearn, 1924

Plate XVII, figures 16–20; Plate XVIII, figures 1, 2

Description

Exterior. Valves equally convex or pedicle valve more convex; subpentagonal in outline with rounded margins; 1/2 to 9/10 as long as wide and widest at midlength or slightly anterior to midlength; lateral margins of the pedicle valve curve ventrally in most specimens; posterolateral margins of the brachial valve are commonly flattened and curve concave outwards; fold and sulcus low, rounded, originate anterior to umbo; valves marked by fine rounded costellae which are separated by rounded interspaces of about the same width; sulcus usually bears a single median plication; fold usually bears two plications separated by a median interplication corresponding to the plication on the sulcus; valves commonly marked by two to five plications on each side of the fold and sulcus. These plications are much coarser than the costellae, and tend to die out along the periphery of large specimens. They are separated by interplications of about the same width. Some specimens lack plications on the fold and sulcus; others lack plications lateral to the fold and sulcus; a few lack plications entirely. Cardinal margin of pedicle valve flat and apsacline; delthyrium triangular, broadly rounded at apex, and intercepts an angle of about 150 degrees.

Interior of pedicle valve. Teeth minute, circular in outline, and unsupported by dental plates; delthyrial cavity floored by a broad pedicle callist; muscle field very deeply impressed and pentagonal in outline with scalloped margins; it extends anteriorly to about midlength, and may be bounded laterally and anteriorly by a low ridge; diductor scars bear numerous anterolaterally diverging ridges; diductor scars enclose the well-impressed oval adductors which are situated in the median 1/3 of the muscle field; internal surface marked by the impress of the plications which extend posteriorly to the muscle field.

Interior of brachial valve. Cardinalia consist of a pair of hinge plates separated by a median groove, and supported by a very low median ridge, a bilobed cardinal process, crura, and a pair of curved socket ridges which extend laterally from the hinge plates to the valve margins; median ridge extends anteriorly 1/2 to 3/4 the length of the valve and tapers in height anteriorly; cardinal process lobes oval in outline with flat, ventrally directed attachment faces; crura originate from the anteromedial margins of the hinge plates; sockets bounded medially by the hinge plates and dorsally by the curved socket ridges; muscle field with two pairs of adductors, one pair triangular to elongate oval in outline and confined to the posterior half of the valve, and a second pair situated anterior and adjacent to the first pair, elongate oval in outline, and somewhat larger than the first pair; internal surface marked by the impress of the plications which may extend posteriorly as far as the muscle field.

Discussion. P. cf. *P. plastica* may be conspecific with *P. plastica* but, since no specimens of the latter which show the internal structures are available, this cannot be established. It is identical to *P. plastica* in ornament. *P.* cf. *P. plastica* may possibly be related to *P. glassi*, but this cannot be established either, as no specimens of *P. glassi* are available.

P. cf. *P. plastica* differs from *P.* aff. *P. glassi* in having an ornament consisting of plications which tend to die out anteriorly and costellae, and in having a much more deeply impressed muscle field in the pedicle valve. *P.* aff. *P. glassi* has plications which increase in height anteriorly and lacks costellae.

P. cf. *P. plastica* differs from both *P.*(?) *thisbe* from the Kopanina beds of Silurian age in Bohemia and *P.* (?) *analoga* from the Kitaygorod Formation of late Llandovery age of

Podolia in having an ornament consisting of costellae and plications which tend to die out anteriorly. The latter two species have plications which increase in height anteriorly and lack costellae. *P.* cf. *P. plastica* either has one plication in the fold and two in the sulcus or lacks plications in the fold and sulcus. *P.* (?) *thisbe* may have as many as four plications and *P.* (?) *analoga* as many as two plications in the sulcus.

Occurrence. French River Formation (late Llandovery (C_6) or early Wenlock age), locs. USNM 10139, 10152, 10156, 10158–10160, 10924, 10933, 10934, Arisaig area; locs. USNM 10816, 10825, 10842, 10847, 11247, 11248, 11250, Pictou County.

Material. 541 specimens.

Plagiorhyncha sp. A

Description

Exterior. Valves unequally convex with the brachial valve more convex, subpentagonal in outline with rounded margins; length varies from 4/5 the width to slightly greater than the width; fold and sulcus faint, rounded, originate anterior to umbo; valves marked by rounded coarse costellae which increase by bifurcation or insertion, and are separated by rounded interspaces of about the same width; twenty to eighty costellae present along the periphery at a length of 1 cm. On some specimens the costellae die out at the periphery and are replaced by fine striae.

Interior of pedicle valve. Only one poorly preserved pedicle interior was available for study. It has a faintly impressed, flabellate muscle field which extends anteriorly 2/5 the valve length; diductor scars completely enclose the adductor scars; teeth small, separated by a distance equal to 1/3 the maximum width, unsupported by dental plates.

Interior of brachial valve. The brachial cardinalia and muscle field were not preserved on any of the specimens studied. A low median ridge extends anteriorly from the apex 1/2 to 3/4 the valve length.

Comparison. Plagiorhyncha sp. A is known only from twelve fragmental specimens. It differs from the other species assigned to *Plagiorhyncha* in having an ornament of coarse costellae which increase by bifurcation and insertion. *P. plastica* and *P.* cf. *P. plastica* have an ornament consisting of both coarse unbranching plications and costellae; the costellae of these two species are much finer than those of *P.* sp. A. *P.* aff. *glassi* has an ornament of coarse unbranched plications; the costellae of *P.* sp. A are much finer than those of *P.* aff. *glassi.*

Occurrence. Lower member, McAdam Brook Formation (early Ludlow age), locs. USNM 10167, 10169, Arisaig area.

Material. 12 specimens.

Genus ***Eatonioides*** McLearn, 1918

Type species. *Eatonioides lamellornatus* McLearn, 1918, p. 138.

Species assigned. E. lamellornatus McLearn, 1918.

Species rejected. Eatonioides westoni McLearn, 1924, p. 74.

Discussion. Eatonioides is here emended to include only the type species, a large, commonly transverse rhynchonellid pentagonal in outline, with lamellose imbricating growth lines, and teeth unsupported by dental plates.

"*Eatonioides*" *westoni* McLearn, 1924 (="*Camarotoechia*" *westoni* herein) does not belong to *Eatonioides* as it has dental plates and lacks the imbricating growth lines characteristic of *Eatonioides*.

Eatonioides externally resembles *Eatonia* Hall, 1857, from beds of New Scotland to Oriskany age of eastern North America, in its external form. However, *Eatonia* lacks the lamellose imbricating growth lines of *Eatonioides* and is ornamented by both plications and very fine costellae. Internally, *Eatonia* has a median septum in the pedicle valve; and a ponderous bilobed cardinal process and a well-impressed muscle field in the brachial valve. These features are lacking in *Eatonioides*. *Eatonia* and *Eatonioides* are perhaps best regarded as external homeomorphs.

Eatonioides lamellornatus McLearn, 1918

Plate XXI, figures 1–7

1918. *Eatonioides lamellornatus* McLearn, p. 138.
1924. *Eatonioides lamellornatus* McLearn, p. 75, pl. 7, figs. 22–31; pl. 8, figs. 34, 35; pl. 30, fig. 1.

Description

Exterior. Valves large (up to 3 cm wide), from 2/3 as long to as long as wide, pentagonal in outline with rounded lateral margins and the greatest width at midlength or in the posterior half of the valve; brachial valve considerably more convex than pedicle valve; deep, wide sulcus and corresponding fold originates at a point 5 to 10 mm from the apex; anterior commissure is crenulate and deeply uniplicate; valves marked by angular unbranched plications which originate at or near the apex separated by angular interplications of about the same width, and by lamellose growth lines; sulcus bears three plications and the fold bears four plications; there are two to four plications on each side of the fold and sulcus.

Interior of pedicle valve. Teeth stout, rounded, unsupported by dental lamellae; a low pedicle callist occupies the delthyrial cavity; muscle field deeply impressed, circular to oval in outline, as wide as long to slightly longer than wide, and extends anteriorly to 1/2 to 3/4 the valve length; diductor scars, when impressed, are elongate oval in outline, confined to the posterior 1/2 of the field, divided by a narrow myophragm, and completely enclosed by the diductor scars; internal surface marked by impress of the plications and the growth lamellae peripheral to the muscle field; in some specimens the muscle field is also marked by the impress of the plications.

Interior of brachial valve. Cardinalia consist of a pair of discrete hinge plates supported medially by a septalium; hinge plates triangular in outline and slightly concave on their ventral surface; crura originate from the anteromedial edge of the hinge plates and extend anteriorly about in the plane of commissure; sockets deep, anterolaterally divergent, bounded medially by the hinge plates and laterally by the margin of the valve; median septum extends anteriorly 1/3 to 1/2 the valve length and tapers in width and height anteriorly; muscle field not impressed; internal surface marked by the impress of the plications along most of their extent and by the impress of the growth lamellae.

Occurrence. Lower member, Moydart Formation (Ludlow age), locs. USNM 10183, 10908, Arisaig area; locs. USNM 10828, 10854, Pictou County; locs. USNM 10827, 11185, Lochaber area; loc. USNM 11331, Cape George area.

Material. 198 specimens.

Genus *Camarotoechia* Hall and Clark, 1893

Type species. *Atrypa congregata* Conrad, 1841, p. 55.

Discussion. Silurian and Devonian rhynchonellids are very poorly known. A number of genera have been proposed, but their interrelationships are not well understood. For this reason it is difficult to decide the diagnostic characters of the proposed genera. Further, the characters most often used involve details of the cardinalia which must be studied in thin section, and are not evident on the Arisaig specimens available to me, which are, for the most part, preserved as casts and molds. The rhynchonellid species of the Arisaig Group which are assigned to "*Camarotoechia*" (*sensu lato*) in this report will, undoubtedly, be reassigned to other genera when their morphology is better understood, or when the rhynchonellids are better understood at the generic level.

"*Camarotoechia*" *bimesiornata* McLearn, 1924

Plate XVIII, figures 3–10

1924. *Camarotoechia bimesiornata* McLearn, p. 69, pl. 5, figs. 1–5; pl. 30, fig. 9.

Description

Exterior. Valves about equally convex, subrectangular to oval in outline, transverse or elongate; anterior commissure crenulate and uniplicate; prominent sulcus in pedicle valve bears a single median plication; corresponding fold in brachial valve has two plications separated by a narrow interplication, three to six low, rounded plications separated by interplications of about the same width on each side of the fold and sulcus. The plications on the fold in the brachial valve are wider than those on the flanks. The plications that bound the sulcus in the pedicle valve are wider than the median plication and wider than the plications on the flanks. Valves marked by fine growth lines.

Interior of pedicle valve. Small teeth supported by very short dental plates; delthyrial cavity bears a low pedicle callist; muscle field is only rarely impressed, when present it is narrow, triangular in outline, and confined to the anterior half of the valve; internal surface marked by impress of the costellae along most of its extent.

Interior of brachial valve. Cardinalia consist of flat, discrete, triangular hinge plates separated by a narrow groove; crura originate from the anteromedial edges of the hinge plates; sockets anterolaterally directed, bounded medially by the hinge plates and laterally by the valve margins; a myophragm extends anteriorly from the hinge plates to about midlength and divides adductor scars which are narrow and semioval in outline; internal surface marked by the impress of the external ornament as in the pedicle valve.

Comparison. "*C.*" *bimesiornata* is very similar in shape, outline, ornament, and internal features to "*C.*" *decemplicata* (Sowerby, 1839) from the Cowleigh Park beds of upper Llandovery (C_3 or older) age in the Malvern Hills district of the Welsh borderland. The two species differ primarily in that "*C.*" *bimesiornata* has three to six plications on each side of the fold and sulcus and "*C.*" *decemplicata* may have as many as eight.

Occurrence. Beechhill Cove Formation (early Llandovery age), locs. USNM 10115, 10116, Arisaig area; locs. USNM 11257, 11260, 11271, 11276, Pictou County. Glencoe Brook Formation (early Llandovery age), loc. USNM 11262, Pictou County.

Material. 299 specimens.

"*Camarotoechia*" *rossonia* McLearn, 1924

Plate XVIII, figures 11–15; Plate XIX, figure 1

1924. *Camarotoechia llandoveriana* var. *rossonia* McLearn, p. 70, pl. 5, figs. 12–14; pl. 10, fig. 9.

Description

Exterior. Valves about equally convex, pentagonal in outline, widest at midlength or in the anterior half of the valve, and from 3/4 as wide as long to 3/4 as long as wide; fold and sulcus rectangular in cross-section, originate some distance anterior to the beak; anterior commissure crenulate and uniplicate; valves are marked by thirty to forty fine, angular plications separated by angular interplications of about the same width, fold and sulcus each bear five to eight plications.

Interior of pedicle valve. Small teeth supported by short dental plates; narrow oval diductor scars faintly impressed, separated by a low myophragm, and extend anteriorly 1/3 to 1/2 the valve length; adductor scars not impressed; delthyrial cavity bears a low pedicle callist; internal surface marked by the impress of the costellae except at the apex of the valve.

Interior of brachial valve. Cardinalia consist of flat discrete hinge plates supported medially by a septalium; median septum extends to midlength and is flanked at its anterior end by elongate oval adductor scars; sockets narrow and diverge anterolaterally; internal surface marked by impress of the costellae as in the pedicle valve.

Comparison. "*C.*" *rossonia* is very likely conspecific with "*C.*" *llandoveriana* Davidson, 1871 from the Upper Llandovery of Wales and the Welsh borderland, which it resembles in shape, outline, and ornament.

"*C.*" *rossonia* differs from the other species of "*Camarotoechia*" found in the Arisaig Group in having finer and more numerous plications.

Occurrence. Middle member, Ross Brook Formation (late Llandovery (C_1–C_5) age), loc. USNM 10124, Arisaig area. Upper member, Ross Brook Formation (late Llandovery (C_6) age), locs. USNM 10120, 10126, 10923, Arisaig area; locs. USNM 10824, 10833, Pictou County; loc. GSC 68849, Cobequid Mountains. Ross Brook Formation in beds questionably assigned to the upper member, loc. USNM 10932, Pictou County.

Material. 1,053 specimens.

"*Camarotoechia*" *westoni* (McLearn, 1924)

Plate XIX, figures 4–10

1924. *Eatonioides westoni* McLearn, p. 74, pl. 7, figs. 16, 17, 21; pl. 30, figs. 4, 7.

Description

Exterior. Valves about equally convex, subcircular to pentagonal in outline, about as wide as long and widest at midlength or slightly anterior to it; anterior commissure crenulate and uniplicate; delthyrium triangular, apparently open, with apical foramen; fold and sulcus originate about 5 mm from the apex and are subrectangular in cross-section; valves marked by fourteen to eighteen uniform, straight, angular plications separated by angular interplications of about the same width, three plications are on the sulcus and four plications on the fold.

Interior of pedicle valve. Teeth supported by very short dental plates; low pedicle callist present; muscle field oval in outline, about as wide as long, and extends almost to midlength;

oval diductor scars enclose the elongate oval adductor scars which are confined to the posterior half of the muscle field; internal surface marked by the impress of the plications peripheral to the muscle field.

Interior of brachial valve. Cardinalia consist of broad hinge plates which curve posteriorly supported by a septalium; crura originate from the anteromedial margins of the hinge plates; median septum merges anteriorly with the impress of the interspace between the two median plications; sockets diverge anterolaterally; internal surface marked by the impress of the plications along most of their extent.

Discussion. McLearn assigned "*C.*" *westoni* to *Eatonioides*. However, it lacks the imbricating growth lamellae characteristic of *Eatonioides* and has dental plates. "*C.*" *westoni* further differs from *Eatonioides* in its smaller size, and in being subequally biconvex. *Eatonioides* has a relatively flat pedicle valve and a strongly convex brachial valve.

Comparison. "*C.*" *westoni* differs from "*C.*" *bimesiornata* in having three plications on the sulcus and four on the fold which are about the same width as those on the flanks. "*C.*" *bimesiornata* has one plication on the sulcus and two on the fold which are broader than those on the flanks.

Occurrence. French River Formation (late Llandovery (C_6) or early Wenlock age), loc. USNM 11217, Pictou County; loc. USNM 10822, Cobequid Mountains. Either French River or Doctor's Brook Formation (Wenlock age), locs. USNM 10841, 11211, Pictou County.

Material. 628 specimens.

"*Camarotoechia*" *planorugosa* McLearn, 1924

Plate XXII, figure 4

1924. *Camarotoechia nucula* var. *planorugosa* McLearn, p. 69, pl. 5, figs. 6–8.

Description

Exterior. Valves about equally convex, pentagonal in outline, and widest about at midlength; anterior commissure crenulate and uniplicate; fold and sulcus originate near apex, subrectangular and crenulate in cross-section; sulcus bears three angular plications, fold has four; four to six angular plications separated by interplications of about the same width occur lateral to the fold and sulcus.

Interior of pedicle valve. Teeth supported by short dental plates; delthyrial cavity bears a low pedicle callist; muscle field elongate, oval in outline, and confined to the posterior half of the valve; internal surface marked by the impress of the plications peripheral to the delthyrial cavity.

Interior of brachial valve. Cardinalia consist of discrete, flat, hinge plates supported medially by a septalium; median septum extends anteriorly to about midlength; internal surface marked by the impress of the plications along most of their extent.

Comparison. "*C.*" *planorugosa* differs from "*C.*" *bimesiornata* in having three plications on the sulcus and four on the fold which are about the same width as those on the flanks. "*C.*" *bimesiornata* has one plication on the sulcus and two on the fold which are broader than those on the flanks. In this respect "*C.*" *planorugosa* resembles "*C.*" *westoni*, but differs in having a prominent pedicle callist and much longer dental plates. The muscle field of the pedicle valve is not impressed in the former, whereas it is impressed in "*C.*" *westoni* in specimens of comparable size.

Occurrence. Stonehouse Formation (Pridoli to early Gedinne age), Twenhofel loc. 20, locs. USNM 10184–10192, 10196, 10198, 10199, 10201–10203, 10205, 10206, 10210, 10211, 10214, 10910, 10922, 11136, Arisaig area; locs. USNM 10829, 10835, 10846, 11221, 11243, Pictou County; locs. USNM 10830, 10831, 11273, GSC 68837, Cobequid Mountains; loc. USNM 11182, Lochaber area.

Material. 1,158 specimens.

"*Camarotoechia*" sp. aff. "*C.*" *planorugosa* McLearn, 1924

Plate XIX, figures 11, 12; Plate XXII, figure 3

Description

Exterior. Valves about equally convex, pentagonal in outline, and widest in the middle or in the posterior half of the valve; anterior commissure crenulate and uniplicate; fold and sulcus originate about 3–5 mm from the apex and are subrectangular in cross-section; valves marked by twelve to fourteen angular plications separated by interplications of about the same width, three plications are on the sulcus and four on the fold.

Interior of pedicle valve. Teeth supported by slightly divergent dental plates; delthyrial cavity bears a low pedicle callist; muscle field not impressed on any of the specimens studied; internal surface marked by the impress of the plications except in the delthyrial cavity.

Interior of brachial valve. Discrete hinge plates flat and supported by a septalium; median septum extends to about midlength; sockets anterolaterally directed; internal surface marked by the impress of the plications along most of their extent.

Comparison. Specimens assigned to "*C.*" sp. aff. "*C.*" *planorugosa* closely resemble "*C.*" *planorugosa* in shape, ornament, and internal features. "*C.*" sp. aff. "*C.*" *planorugosa* is used here as a "catchall" category for "*Camarotoechia*" in beds older than Stonehouse age which resemble the Stonehouse species "*C.*" *planorugosa.* Some of these specimens differ slightly in outline from "*C.*" *planorugosa* in that they have lateral margins which are about parallel in the anterior half of the valve; the lateral margins of "*C.*" *planorugosa* extend anteromedially in the anterior half of the valve.

"*C.*" sp. aff. "*C.*" *planorugosa* differs from "*C.*" *westoni* in its somewhat smaller size, longer dental plates, and lack of a pedicle callist. The pedicle muscle field is not impressed in the former, whereas it is in specimens of "*C.*" *westoni* of comparable size.

Occurrence. French River Formation (late Llandovery (C_6) or early Wenlock age), locs. USNM 10150, 10153, 10158, 10159, Arisaig area; locs. USNM 10809, 10821, Pictou County. Doctor's Brook Formation (Wenlock age), locs. USNM 10164, 10165, 10909, Arisaig area. Either French River or Doctor's Brook Formation, locs. USNM 10812, 10841, 11211, Pictou County. Lower member, McAdam Brook Formation (early Ludlow age), locs. USNM 10168, 10169, Arisaig area. Upper member, McAdam Brook Formation (Ludlow age), loc. USNM 10170, Arisaig area. Lower member, Moydart Formation (Ludlow age), locs. USNM 10172, 10173, 10175, 10182, 10183, 10908, Arisaig area; locs. USNM 10836, 10837, 10853, 11238, 11241, 11242, 11324, 11325, 11326, 11327, 11351, Pictou County. Kerrowgare Formation (late Llandovery to Ludlow age), locs. USNM 10817, 10852, Pictou County. Beds of Moydart age in the *Scolithus* (worm-tube) quartzite, Cape George area.

Material. 2,094 specimens.

"*Camarotoechia*" *squamifera* McLearn, 1924

Plate XX, figures 9–13

1924. *Camarotoechia squamifera* McLearn, p. 71–72, pl. 5, figs. 23–27; pl. 28, fig. 7.

Description

Exterior. Valves subequally convex or brachial valve more convex, pentagonal in outline with curved lateral margins; pedicle valve varies from 4/5 as long to as long as wide; brachial valve varies from 3/4 as long as wide to slightly wider than long; greatest width about at midlength; anterior commissure crenulate and deeply uniplicate; fold and sulcus rectangular in cross-section, originate at about 5 to 8 mm from the apex; beak overhangs the brachial valve and directed posteriorly; foramen small; valves marked by sixteen to twenty-six uniform, rounded plications separated by interplications of equal width; sulcus bears three to five plications, fold four to six; plication along midline of sulcus; interplication along midline of fold; valves marked by numerous lamellose growth lines.

Interior of pedicle valve. Teeth supported by short dental plates; delthyrial cavity bears a pedicle callist; muscle field extends slightly anterior to midlength and is slightly longer than wide, diductor scars oval in outline and enclose the small, elongate, oval adductor scars which are confined to the median 1/3 of the muscle field; internal surface marked by the impress of the external ornament peripheral to the delthyrial cavity.

Interior of brachial valve. Cardinalia consist of flat discrete hinge plates supported by a septalium; median septum low, extends to about midlength; sockets diverge anterolaterally and are rounded at their base; internal surface marked by the impress of the external ornament as in the pedicle valve.

Comparison. "*C.*" *squamifera* differs from the other species in the Arisaig series assigned to "*Camarotoechia*" in having lamellose growth lines.

Occurrence. Lower member, Moydart Formation (Ludlow age), Twenhofel loc. 97, locs. USNM 10174, 10175, 10180, 10181, 10182, 10908, Arisaig area. Beds of Moydart age in the *Scolithus* (worm-tube) quartzite, loc. USNM 11246, Cape George area.

Material. 799 specimens.

"*Camarotoechia*" *moydartensis* McLearn, 1924

Plate XXII, figure 1

1924. *Camarotoechia nucula* mut. *moydartensis* McLearn, p. 70, pl. 5, figs. 9–11.

Description

Exterior. Valves pentagonal in outline, about as wide as long, globose; brachial valve more convex; anterior commissure crenulate and deeply uniplicate; low fold and sulcus originate well anterior to umbo; valves marked by fourteen angular plications separated by angular interplications of about the same width, three plications occur on the fold and four on the sulcus, plications on the fold and sulcus somewhat larger than those on the flanks.

Discussion. The above description is based on the holotype, GSC No. 5429 from the Moydart Formation in the shore section, Arisaig area. No specimens resembling the holotype were found in any of the collections from the Moydart Formation studied by the author, although McLearn (1924, p. 70) reported this species common in the formation. The holotype resembles specimens of "*C.*" *glomerosa* in ornament but is somewhat more globose.

"*Camarotoechia*" *glomerosa* McLearn, 1924

Plate XXII, figure 2

1924. *Camarotoechia glomerosa* McLearn, p. 71, pl. 5, figs. 15–19.
1924. (?) *Camarotoechia marklandensis* McLearn, p. 71, pl. 5, figs. 21, 22, *non* 20.

Description

Exterior. Valves about equally convex, slightly longer than wide, subelliptical in outline and widest at about midlength; pedicle beak incurved and directed posteriorly; anterior commissure crenulate and uniplicate; low fold and sulcus present at the anterior end of valves; valves marked by twelve to thirteen angular plications separated by interplications of about the same width, three plications on the sulcus and four on the fold. The plications on the fold and sulcus are about the same width as those on the flanks at the posterior end of the valves and expand to become wider than those on the flanks at the anterior end of the valves.

Discussion. The above description is based upon a single specimen, the holotype GSC No. 5433.

"*C.*" *marklandensis* is based on two specimens. The holotype (Peabody Museum No. 431), a brachial valve, is larger than the one specimen of "*C.*" *glomerosa* studied but resembles it in having four plications on the fold which are larger than those on the flanks; it is here assigned questionably to "*C.*" *glomerosa* (Pl. XXII, fig. 5). The paratype, GSC No. 5432, a poorly preserved pedicle valve, possibly belongs to "*C.*" *planorugosa.*

Comparison. "*C.*" *glomerosa* differs from "*C.*" *planorugosa* in having plications in the fold and sulcus which are wider at their anterior end than the plications on the flanks. The plications of "*C.*" *planorugosa* are uniform in width.

Occurrence. The one specimen described is from the Stonehouse Formation (Pridoli to early Gedinnian age), in the shore section. Arisaig area, exact locality unknown.

Genus ***Sphaerirhynchia*** Cooper and Muir-Wood, 1951

Type species. *Terebratula wilsoni* Sowerby, 1818, p. 38, pl. 118, fig. 3.

Sphaerirhynchia antiqua (McLearn, 1924)

Plate XIX, figures 2, 3

1924. *Pectorhyncha antiqua* McLearn, p. 72–73, pl. 7, figs. 1–12; pl. 29, figs. 1, 5.

Description

Exterior. Valves about equally convex, pentagonal in outline, commonly with geniculate anterior and lateral margins, about as wide as long, and about 1/3 as deep as wide; faintly developed fold and sulcus originate anterior to the umbo; pedicle beak incurved and directed dorsally; valves marked by sixteen to eighteen low rounded plications separated by low rounded interplications of about the same width; three plications in the sulcus and four in the fold; anterior commissure crenulate and gently to deeply sulcate.

Interior of pedicle valve. Small teeth unsupported by dental plates; prominent pedicle callist occupies the delthyrial cavity; muscle field extends from the delthyrial cavity to about midlength, and is triangular in outline; width of the muscle field at its anterior end about equal to 1/2 its length; triangular diductor scars enclose the elongate oval adductor scars; internal surface marked by the impress of the plications along most of their extent.

Interior of brachial valve. Flat hinge plates supported by a low septalium which extends anteriorly to about midlength; crura originate from the anteromedial margins of the hinge plates; internal surface marked by impress of the plications as in the pedicle valve.

Discussion. S. antiqua is assigned to *Sphaerirhynchia* rather than to *Pectorhyncha* as it lacks the well-developed fold and sulcus characteristic of *P. obtusiplicata*, the type of *Pectorhyncha.*

Comparison. Sphaerirhynchia antiqua is smaller than *Sphaerirhynchia wilsoni* from the Wenlock and Ludlow of Wales and the Welsh borderland, and has fewer plications.

Occurrence. The four specimens of *S. antiqua* figured by McLearn (pl. 7, figs. 1–2) are from the upper member, Ross Brook Formation (late Llandovery (C_6)age), Twenhofel loc. 169a, shore section, Arisaig. *S. antiqua* occurs in the middle member, Ross Brook Formation (late Llandovery (C_1–C_5) age), USNM 11286, Cobequid Mountains.

Material. Holotype and three paratypes; six unfigured specimens.

Sphaerirhynchia sp.

Plate XIX, figures 13–17

1924. *Pectorhyncha obtusiplicata* (Hall), McLearn, p. 73, pl. 7, figs. 13–15, 18–20; pl. 29, fig. 3; pl. 30, figs. 5, 8.

Description

Exterior. Valves circular to elongate oval in outline, as long as wide or slightly longer than wide, globose with geniculate lateral and anterior margins; thickness about equal to width; brachial valve deeper than pedicle valve; pedicle valve may bear a very faint, broad sulcus at its anterior end and the brachial valve a corresponding fold; anterior commissure crenulate and deeply uniplicate; valves marked by 15 to 20 broad, low, rounded plications separated by relatively narrow interplications; plications may have a narrow groove at their anterior end; three plications on the sulcus and four on the fold.

Interior of pedicle valve. Minute teeth unsupported by dental plates; low pedicle callist occupies the pedicle cavity; muscle field triangular in outline, divided by a low myophragm, extends anteriorly 1/3 to 1/2 the valve length; internal surface marked by impress of the plications peripheral to the muscle field.

Interior of brachial valve. Stout hinge plates supported medially by a septalium, median septum extends to about midlength and is greatly thickened by a plug of secondary material at its posterior end; sockets rounded at their base, bounded medially by the hinge plates and laterally by the valve margins; crura originate from the anteromedial margins of the hinge plates; muscle field obscure; internal surface marked by impress of the plications along most of their extent.

Discussion. McLearn (1918, p. 137; 1924, p. 73) considered the species here described to be conspecific with *Atrypa obtusiplicata* Hall, 1852 from the Lockport group of probable Wenlock age in New York which he made the type species of *Pectorhyncha* McLearn, 1918. Hall did not illustrate the interiors of *Atrypa obtusiplicata*, and no interiors were available to me for study. The specimens of *A. obtusiplicata* illustrated by Hall (1852, pl. 58, figs. 2a–h) and those in the collections of the U.S. National Museum differ from the species here described in having higher, more angular plications, and a much deeper fold and sulcus. As the species here described closely resembles *Sphaerirhynchia* spp. in shape, outline, and most of its internal features, it is assigned to *Sphaerirhynchia.*

Comparison. S. sp. differs from both *S. wilsoni* and *S. antiqua* in having a median septum in the brachial valve which is greatly thickened by a plug of secondary material. It differs from *S. wilsoni* in having fewer plications.

Occurrence. French River Formation (late Llandovery (C_6) or early Wenlock age), locs. USNM 10134, 10137, 10138, 10141, 10143, 10145–10147, Arisaig area; locs. USNM 10815, 10821, 11220, Pictou County; loc. USNM 10822, Cobequid Mountains. Doctor's Brook Formation (Wenlock age), locs. USNM 10162, 10163, 10164, 10909, Arisaig area. Either French River or Doctor's Brook Formation, locs. USNM 10841, 11330, Pictou County. Lower member, McAdam Brook Formation (early Ludlow age), locs. USNM 10167, 10168, 10169, Arisaig area. Kerrowgare Formation (late Llandovery to Ludlow age), locs. USNM 10817, GSC 45438, Pictou County.

Material. 325 specimens.

Sphaerirhynchia saffordi (Hall, 1860)

Plate XX, figures 1–8

1860. *Rhynchonella saffordi* Hall, p. 146.
1924. *Wilsonia wilsoni* var. *saffordi* (Hall), McLearn, p. 75–76, pl. 8, figs. 25–29.
1924. *Wilsonia wilsoni* mut. *stonehousensis* McLearn, p. 76, pl. 8, fig. 32.

Description

Exterior. Brachial valve more convex than pedicle valve; valves oval in outline, widest at about midlength, varying from 5/6 as wide as long to slightly wider than long; thickness from slightly less than width to equal to width; globose with high, sharply geniculate lateral and anterior margins; foramen small, circular in outline; faint broad fold and sulcus rectangular in cross-section originating well anterior to the apex in large specimens; anterior commissure crenulate and deeply uniplicate; valves marked by twenty-four to twenty-eight flat, rounded, uniform plications separated by narrow grooves, the plications often bearing a groove at their anterior end; when present, the fold and sulcus bear five to ten plications.

Interior of pedicle valve. Teeth minute and unsupported by dental plates; low pedicle callist occupies the delthyrial cavity; muscle field suboval in outline, 1/3 as wide to about as wide as long, extending anteriorly 1/3 to 3/4 the valve length and divided by a narrow myophragm; adductor scars confined to the posterior half of the muscle field and completely enclosed by the diductor scars, commonly not impressed; pallial impressions consist of straight tracks which branch at their anterior end and give rise to curved lateral branches at their posterior end; the curved lateral branches extend posteriorly and give rise, in turn, to additional lateral branches; internal surface marked by impress of the costellae peripheral to the muscle field.

Interior of brachial valve. Cardinalia consist of long narrow hinge plates supported medially by a septalium; crura not observed; median septum extends to midlength or slightly anterior to midlength and tapers in height anteriorly; narrow, elongate oval adductor scars rarely impressed; small sockets, rounded at their base, bounded anteriorly by the hinge plates and posteriorly by the valve margin; internal surface marked by impress of the plications along most of their extent.

Comparison. S. saffordi differs from both *S. antiqua* and *S.* sp. in having a greater number of plications and a pedicle valve muscle field which is oval in outline, in contrast to the more triangular muscle fields of the latter two species. It lacks the posteriorly thickened median septum found in the brachial valve of *S.* sp.

S. saffordi is very similar both internally and externally to *S. wilsoni* from the Wenlock and Ludlow of Wales and the Welsh borderland and is very likely conspecific with it. However, as adequate comparative material is not available, a positive assignment cannot be made.

Occurrence. Lower member, Moydart Formation, (Ludlow age), Twenhofel loc. 98, locs. USNM 10172, 10182, 10908, 10935, Arisaig area; locs. USNM 11325, 11329, Pictou County. Kerrowgare Formation (late Llandovery to Ludlow age), loc. GSC 46440, Pictou County. Beds of Moydart age in the *Scolithus* (worm-tube) quartzite, loc. USNM 11246, Cape George area. McLearn (1924, p. 76) described specimens from a boulder found on the shore at Arisaig near exposures of the Stonehouse Formation as *Wilsonia wilsoni* mut. *stonehousensis*. The author studied these specimens and found that they belong to the species here described. As *Sphaerirhynchia* is not known in the Stonehouse Formation, the boulder from which the specimens came was probably from the Moydart Formation.

Material. 540 specimens.

Order *Spiriferida* Waagen, 1883

Suborder *Retziidina* Boucot, Johnson, and Staton, 1964
[*nom. correct.* Boucot, Johnson, and Staton, 1965
(*pro* Retzioidea Boucot, Johnson, and Staton, 1964)]

Superfamily RETZIACEA Waagen, 1883
[*nom. transl.* Boucot, Johnson, and Staton, 1964 (*ex* Retziinae Waagen, 1883)]

Family RHYNCHOSPIRINIDAE Schuchert and LeVene, 1929

Genus *Rhynchospirina* Schuchert and LeVene, 1929

Type species. *Waldheimia formosa* Hall, 1857, p. 88.

Rhynchospirina sp. A

Plate XXII, figures 6–9, 18

Description

Exterior. Valves punctate, about equally convex, as wide as long; pedicle valve pentagonal in outline with rounded margins; brachial valve circular in outline; pedicle valve with low sulcus originating well anterior to umbo, brachial valve lacking corresponding fold; anterior commissure crenulate and rectimarginate to very slightly uniplicate; pedicle valve bears a single fine median plication in the sulcus and four coarse angular plications on each side separated by angular to rounded interplications of about the same width; brachial valve bears ten angular to rounded plications separated by interspaces of about the same width, medial two plications relatively fine; surface marked by fine growth lines.

Interior of pedicle valve. Teeth supported by very short dental lamellae; muscle field oval in outline and confined to the posterior half of the valve, commonly not impressed; internal surface marked by impress of the plications along most of their extent.

Interior of brachial valve. Cardinal plate broad, extends ventrally into the pedicle umbonal cavity; a median septum extends anteriorly from the cardinal plate to about midlength; sockets rounded at their base, laterally divergent, and bounded medially and anteriorly by the cardinal plate; muscle field not impressed; internal surface marked by impress of the plications as in the pedicle valve.

Comparison. *R.* sp. A resembles *R. formosa* from the New Scotland (upper Gedinnian) of New York in having a weak sulcus in the pedicle valve and no fold in the brachial valve. However, *R.* sp. A has fewer plications which are much coarser.

Occurrence. French River Formation (late Llandovery (C_6) or early Wenlock age), loc. USNM 10158, Arisaig area; loc. USNM 10811, Pictou County. A specimen belonging to this species was found in the Stonehouse Formation (Pridoli to early Gedinnian age), loc. USNM 10185, Arisaig area. Specimens questionably assigned to *Rhynchospirina* sp. A occur in the French River Formation, loc. USNM 10810, Pictou County; Kerrowgare Formation (late Llandovery to Ludlow age), loc. USNM 10852, Pictou County.

Material. 18 specimens.

Rhynchospirina? sp. B

Plate XXII, figures 10–12

Description

Exterior. Valves punctate, subequally convex, subelliptical in outline, and slightly wider than long to slightly longer than wide; pedicle beak strongly incurved; anterior commissure crenulate and uniplicate; pedicle valve bears a sulcus which may be faint or prominent, brachial valve bears a faint fold; valves marked by eighteen to twenty angular plications separated by interplications of about the same width, sulcus of pedicle valve has three plications, finer than those on the flanks.

Interior of pedicle valve. Stubby teeth supported by short dental plates; muscle field circular to pentagonal in outline and confined to the umbonal cavity; a pair of tracks commonly diverge anterolaterally from the muscle field; internal surface marked by impress of the plications along most of their extent.

Interior of brachial valve. Cardinalia consist of discrete, flat, hinge plates; low median septum originates just anterior to the groove between the hinge plates and extends to about midlength; sockets anterolaterally directed and bounded medially by the hinge plates; external ornament impressed as in the pedicle valve.

Comparison and discussion. *Rhynchospirina*? sp. B differs from the other species assigned to *Rhynchospirina* in having a pair of discrete hinge plates instead of a cardinal plate. It closely resembles *R. formosa*, the type species of *Rhynchospirina*, however, in external form and ornament and in its other internal features. A new genus of rhynchospirinid could be founded based on *R.*? sp. B and characterized by having discrete hinge plates. However, only a small number of fragmental specimens of this species are available and the author does not consider them to be an adequate sample upon which to base a new genus.

Rhynchospirina? sp. B differs from species assigned to *Homeospira* Hall and Clarke, 1893 in having discrete hinge plates and no cardinal process. *Homeospira* has a cardinal plate which is conjunct posteriorly and disjunct anteriorly, and has a cardinal process.

It is clear that *R.*? sp. B is not a rhynchonellid as it is punctate and has plications in the sulcus of the pedicle valve which are finer than those on the flanks.

Occurrence. French River Formation (late Llandovery (C_6) or early Wenlock age), loc. USNM 10822, Cobequid Mountains.

Material. 37 specimens.

Rhynchospirina acadiae (Hall, 1860)

Plate XXII, figure 13

1860. *Trematospira acadiae* Hall, p. 146, fig. 4.
1924. *Rhynchospira salteri* var. *acadiae* (Hall), McLearn, p. 85, pl. 10, figs. 1–7.

Description

Exterior. Valves punctate, subequally convex, transverse; pedicle valve subpentagonal in outline with rounded lateral and anterior margins; brachial valve semielliptical in outline; hinge line straight and slightly shorter than the greatest width; pedicle beak incurved and directed dorsally; anterior commissure crenulate and uniplicate; pedicle valve bears a low rounded sulcus, the brachial valve a corresponding fold; valves marked by fourteen to sixteen angular plications separated by interplications of about equal width; sulcus bears two or three plications which are usually somewhat finer than those on the flanks.

Interior of pedicle valve. Teeth small and unsupported by dental plates; muscle field not impressed on any of the specimens studied; internal surface marked by the impress of the plications along most of their extent.

Interior of brachial valve. Cardinal plate broad and extends into the umbonal cavity of the pedicle valve; a low short median septum extends anterior to the cardinal plate; internal surface marked by impress of the plications as in the pedicle valve.

Discussion. Rhynchospirina acadiae may be distinguished from other *Rhynchospirina* in the Arisaig series by its straight cardinal margin and transverse outline. It differs from *R.* sp. A in bearing fourteen to sixteen plications on each valve in contrast to the eight to ten found on the latter species. It differs from *R.*? sp. B in having finer ornament and a cardinal plate instead of discrete hinge plates.

Hall assigned this species to *Trematospira* Hall, 1859. It resembles *Trematospira* in outline, in a general way, but does not have a quadrilobate cardinal plate; it has a median septum in the brachial valve whereas *Trematospira* does not.

Occurrence. Lower member, Moydart Formation (Ludlow age), Twenhofel loc. 89, locs. USNM 10173, 10177, 10183, Arisaig area, and questionably at USNM 10828, Pictou County.

Material. 20 specimens (6 questionably assigned).

Rhynchospirina sinuata (Hall, 1860)

Plate XXII, figures 14–17

1860. *Rhynchospira sinuata* Hall, p. 146.
1924. *Rhynchospira sinuata* (Hall), McLearn, p. 86, pl. 10, figs. 18, 19.

Description

Exterior. Valves punctate, subequally convex; pedicle valve pentagonal in outline with rounded margins, widest at about midlength, slightly longer than wide; brachial valve subcircular in outline; pedicle valve with shallow sulcus which originates a short distance anterior to the beak; brachial valve with corresponding fold; anterior commissure crenulate and rectimarginate; valves bear fifteen to twenty-three coarse angular plications separated by angular interplications of about the same width; three plications on the sulcus and four plications on the fold; plications on the sulcus of the pedicle valve finer than those on the flanks; pedicle beak incurved, posteriorly directed, and bears a circular foramen at its apex.

Interior of pedicle valve. Teeth small, closely spaced, and supported by dental plates; muscle field commonly obscure but when present is circular to pentagonal in outline, about as wide as long, and extends anteriorly about 1/3 the valve length; there may be a faint myophragm; adductor impressions not observed; internal surface marked by impress of the plications peripheral to the muscle field.

Interior of brachial valve. Cardinal plate broad, curved ventrally and posteriorly to extend well up into the delthyrial cavity; crura originate from the anterolateral margins of the cardinal plate; sockets small and laterally directed; a low median septum extends anteriorly 1/2 to 3/4 the valve length and is flanked laterally by a pair of elongate oval adductor scars; internal surface marked by the impress of the plications along most of their length.

Discussion. In his original description of *R. sinuata*, Hall (1860, p. 146) states that the species has a mesial sinus beginning a little below the beak and eight or nine plications on each side of the mesial sinus. He does not figure the specimens. McLearn (1924, p. 86) described a species of *Rhynchospirina* which is common in the Stonehouse Formation as *Rhynchospira sinuata.* The Stonehouse Formation species fits the description given by Hall as does *Rhynchospirina*? sp. B from the French River Formation, Cobequid Mountains. *R.*? sp. B is not known from the Arisaig area whereas the Stonehouse species described by McLearn is common there. As Hall's specimens were from the Arisaig area, it is reasonable to assume that the specimens he referred to *R. sinuata* belong to the Stonehouse species.

Comparison. R. sinuata differs from *R.* sp. A and *R. acadiae* in having a greater number of finer plications. It differs from *R. acadiae* also in having an elongate rather than a transverse outline. *R.* sp. A has a single plication in the sulcus of the pedicle valve, *R. sinuata* has three.

R. sinuata resembles *R.*? sp. B in ornament and external form. However, it has a cardinal plate whereas *R.*? sp. B has discrete hinge plates.

R. sinuata is very similar to *R. formosa* (Hall, 1857) from the New Scotland (upper Gedinnian) of New York, externally, and in its pedicle interior and cardinalia. *R. formosa* differs from *R. sinuata* in having a more deeply impressed muscle field in the brachial valve.

Occurrence. Stonehouse Formation (Pridoli to early Gedinne age), locs. USNM 10184–10187, 10190–10193, 10198, 10201, 10204, 10206, 10211, 10910, Arisaig area; locs. USNM 10835, 10838, 11221, GSC 46444, Pictou County; locs. USNM 11273, GSC 68839, 68842, 68845, Cobequid Mountains.

Material. 281 specimens.

Suborder ***Atrypidina*** Moore, 1952
[*nom. correct.* Boucot, Johnson, and Staton, 1965]
(*pro* Suborder Atrypacea Moore, 1952)

Superfamily ATRYPACEA Gill, 1871
[*nom. transl.* Schuchert and LeVene, 1929 (*ex* Atrypidae Gill, 1971)]

Family ATRYPIDAE Gill, 1871
Subfamily ZYGOSPIRINAE Waagen, 1883

Genus ***Megumatrypa*** n. gen.

Type species. *Megumatrypa glencoensis* n. sp.

Diagnosis. Plano-convex to equally biconvex atrypids which lack a fold and sulcus and are marked by coarse, unbranched costellae. Dental plates lacking. Hinge plates separated by a

rounded groove or, less frequently, by a simple oval cardinal process; striated area for diductor attachment lacking; sockets not crenulate.

Species assigned. The only species referred to *Megumatrypa* is the type *M. glencoensis.*

Comparison. Megumatrypa closely resembles the Lower Silurian genus *Zygospiraella* Nikiforova, 1961 in its brachial valve interior, especially its cardinalia, and in its external features. It differs from *Zygospiraella* in having unbranched costellae. It differs from the related Lower Silurian genus *Alispira* Nikiforova, 1961 in its less elongate shape, and in lacking the dental plates, conjunct hinge plates supported by low crural plates, and bifurcating costellae characteristic of the latter genus.

Megumatrypa somewhat resembles *Protatrypa* Boucot, Johnson, and Staton, 1964, a widespread genus common in beds of early to late Llandovery (C_2) age. The pedicle valve interiors are strikingly similar. *Megumatrypa* differs from *Protatrypa* in having ribs which do not bifurcate, a broader and more deeply impressed pedicle valve muscle field, and no dental plates or a sulcus in the brachial valve. *Protatrypa* has bifurcating ribs, and commonly has dental plates and a weakly developed sulcus in the brachial valve. The cardinalia of *Megumatrypa* consist of a pair of hinge plates considerably less elongate than those of *Protatrypa*, and, in some specimens, a cardinal process which is lacking in *Protatrypa.*

Megumatrypa differs from *Atrypa* Dalman, 1828, in lacking crenulated sockets, a striated area for diductor attachment in the brachial valve, dental plates, and bifurcating ribs—all of which are present in *Atrypa.* The hinge plates of *Megumatrypa* are much less elongate.

Megumatrypa resembles typical *Nalivkinia* Bublitschenko, 1928 in having unbranched ribs. *Nalivkinia* has much finer ribs which only rarely bifurcate, is more elongate, and has a deeply sulcate commissure in contrast to the rectimarginate commissure of *Megumatrypa.* The brachial valve of *Nalivkinia* is more convex than the pedicle valve; the brachial valve of *Megumatrypa* varies from planar to as convex as the pedicle valve. *Nalivkinia* has dental lamellae; *Megumatrypa* lacks them. The muscle field in the pedicle valve of *Nalivkinia* is less strongly impressed than that in *Megumatrypa.*

Megumatrypa differs from *Catazyga* Hall, 1893, principally in having much coarser costellae, in lacking a sulcus on either valve, and in having a broader and more deeply impressed pedicle valve muscle field. *Catazyga* is slightly bisulcate.

Megumatrypa resembles the minute genus *Zygospira* Hall, 1862 in ornament, and in its outline and profile. However, it has more widely spaced teeth and a much more deeply impressed muscle field in the pedicle valve, and lacks the fold in the pedicle valve and sulcus in the brachial valve characteristic of *Zygospira.* The cardinalia of *Zygospira* consist of a pair of simple hinge plates. *Megumatrypa* has a pair of simple hinge plates and, in some specimens, also a cardinal process.

Megumatrypa glencoensis n. sp.

Plate XXIII, figure 15; Plate XXIV, figures 1–10

Description

Exterior. Pedicle valve moderately convex, subcircular to elongate suboval in outline, brachial valve flat to as convex as the pedicle valve and semielliptical in outline; fold and sulcus lacking; valves from 3/5 as long as wide to slightly longer than wide; anterior commissure crenulate and rectimarginate; cardinal margin of pedicle valve prominent with triangular delthyrium and apical foramen; cardinal margin of brachial valve low; valves

marked by fifteen to twenty-four coarse, rounded, straight, non-bifurcating costae which extend from the apex to the margins of the valve and are separated by interspaces of the same width as the costae, and by growth lines.

Interior of pedicle valve. Small, rounded teeth unsupported by dental plates and widely separated, the distance between them equal to about 1/2 the valve width; low pedicle callist in the delthyrial cavity; muscle field occupies the median 1/3 to 1/2 of the valve length, and varies from 3/5 to 4/5 as long as wide, semioval in outline, deeply impressed at its posterior end and decreases in depth anteriorly to reach the level of the floor of the valve. On the larger specimens the muscle field is divided into four lobes of about equal size, two on each side of the median line. Internal surface marked by impress of the costellae peripheral to the muscle field.

Interior of brachial valve. Hinge plates flat, triangular to rhomboidal in outline, overhang the surface of the valves along their lateral margins, and are usually separated by a groove of variable depth which may be parallel sided or triangular in outline, and may be broad or narrow. On a few specimens the hinge plates are separated by a simple, elongate oval cardinal process instead of a groove. Crura originate from the anteromedial margins of the hinge plates; sockets bounded medially by the hinge plates, open laterally, and rounded at their base. On some specimens they extend inwards toward the apex beneath the hinge plates. Muscle field may consist of (1) a pair of semielliptical adductors which extend anteriorly about 1/2 the length of the valve and are separated by a low rounded myophragm which tapers in height and decreases in width anteriorly, or (2) two pairs of semielliptical adductors—a posterior pair, widely separated by a broad myophragm, which extend anteriorly to about 1/4 the length of the valve, and a second pair situated medial to the first, which extend to about 1/2 the length of the valve and are separated by a very narrow myophragm. In some cases the muscle field is not impressed. Internal surface marked by impress of costellae which extend from the margins of the valve to the muscle field and cardinalia. There are spires with numerous volutions in the interior of some articulated specimens. On one specimen spires are exposed on a flat surface which truncates the specimen. These spires are not oriented symmetrically with the plane of symmetry, and so are not in place. The cones of these spires diverge at an angle of 30 degrees in the plane of the truncating surface, and hence must intercept an angle of 30 degrees or greater. The spires have not been observed in place.

Occurrence. Glencoe Brook Formation (early Llandovery age), locs. USNM 11264–11266, 11269, 11300–11304, GSC 45437, 46445, Pictou County.

Material. 1,390 specimens. Holotype, GSC No. 19523, paratypes, GSC Nos. 19517–19522, 19524–19529.

Subfamily ATRYPIINAE Gill, 1871

[*nom. transl.* Waagen, 1883 (*ex* Atrypidae, Gill, 1871)]

Genus ***Atrypa*** Dalman, 1828

Type species. *Anomia reticularis* Linné, 1758, p. 702.

Atrypa cf. *A. reticularis* (Linné, 1758)

Plate XXIV, figures 11–14

Description

Exterior. Valves equally biconvex, or unequally biconvex with the brachial valve more convex; circular in outline, and 4/5 to 1¼ as long as wide; thickness varies from 1/2 to 2/3

the width; fold and sulcus lacking; anterior commissure crenulate and rectimarginate; pedicle beak incurved; valves marked by rounded costellae separated by interspaces of about the same width as the costellae, and by closely spaced, often lamellose, growth lines. The costellae increase by bifurcation and insertion; thirty to thirty-five costellae are present at a length of 10 mm.

Interior of pedicle valve. Teeth stout, triangular in outline, crenulate, and supported by minute dental plates; delthyrial cavity bears a low pedicle callist; muscle field 1/2 to 3/5 as long as wide, extends to about midlength, and is usually divided by low, rounded, parallel ridges into a median lobe, about 1/3 as wide as the entire muscle field, and a pair of lateral lobes. The lobes have rounded posterior margins and may be marked by one to four faint ridges. The median lobe extends posteriorly further than the lateral lobes. Diductors completely enclose the oval adductors which are situated in the posterior half of the muscle field. Internal surface pustulose and often marked by impress of the costellae along the periphery.

Interior of brachial valve. Muscle field consists of oval adductors separated by a broad rounded myophragm which extends anteriorly as a narrow ridge; it is somewhat wider than long and extends anteriorly 1/3 to 1/2 the valve length; adductor scars may be divided by faint transverse ridges into an anterior pair and a slightly larger posterior pair; hinge plates widely divergent and separated by a flat, faintly striated area for diductor attachment; sockets triangular in outline, rounded at their base, and crenulate; crural bases extend from anteroventral margins of the hinge plates; internal surface pustulose and may be marked along the periphery by impress of the costellae.

Comparison. A. cf. *A. reticularis* differs from topotypes of *A. reticularis* from the Mulde marl in having a pedicle muscle field which is usually markedly trilobate. The pedicle muscle field of *A. reticularis* is either non-lobate or is only faintly differentiated into three lobes.

Occurrence. Middle member, the Ross Brook Formation (late Llandovery (C_1–C_5) age), loc. USNM 11232, Pictou County; questionably at loc. USNM 11286, Cobequid Mountains. Upper member, Ross Brook Formation (late Llandovery (C_6) age), loc. USNM 10127, Arisaig area; loc. USNM 11305, Pictou County. French River Formation (late Llandovery (C_6) or early Wenlock age), locs. USNM 10136, 10138, 10155, 10912, Arisaig area; loc. USNM 11217, Pictou County; loc. USNM 10814, Cobequid Mountains. Doctor's Brook Formation (Wenlock age), loc. USNM 10164, Arisaig area. Kerrowgare Formation in beds correlative with the French River Formation, loc. USNM 10817, Pictou County.

Material. 403 specimens.

Atrypa cf. *A. gedinniana* Fuchs, 1934

Plate XXIV, figures 15, 16; Plate XXV, figure 1

1934. *Atrypa gedinniana* Fuchs, p. 404.
1960. *Atrypa gedinniana* Fuchs, Boucot, p. 310–311, pl. 16, figs. 3–6.

Description

Exterior. Valves unequally biconvex with the brachial valve more convex; subcircular to subelliptical in outline; about as wide as long; non-sulcate; hinge line straight and slightly shorter than the greatest width, which occurs in the posterior part of the valve; anterior commissure crenulate and rectimarginate; cardinal margin of the pedicle valve well developed and extends anterolaterally from the apex on each side of the valve; valves marked by lamel-

lose growth lines and by coarse rounded costellae which are separated by interspaces of about the same width as the costellae, and increase by bifurcation and insertion. Ten to twenty costellae along the periphery at a length of 10 mm.

Interior of pedicle valve. Teeth stout, triangular in outline, crenulate, and supported by minute dental plates; delthyrial cavity bears a low pedicle callist; muscle field is flabellate, extends anteriorly 3/5 to 3/4 the valve length and is about as wide as long; diductor scars divided by a low rounded myophragm and marked by numerous low radial ridges. Diductors completely enclose the oval adductors, which are situated in the posterior half of the muscle field. Internal surface is pustulose and marked by impress of the costellae along the periphery.

Interior of brachial valve. Hinge plates tabular, widely divergent, and separated by a flat, faintly striated area for diductor attachment; sockets anterolaterally divergent, triangular in outline, and crenulate; crural bases extend from the anteroventral margins of the hinge plates; muscle field about 3/5 as long as wide, extends anteriorly 1/3 to 1/2 the length of the valve, divided by a rounded myophragm which tapers in height and width anteriorly; adductor scars longitudinally striate; internal surface pustulose and may be marked by impress of the external ornament along the periphery.

Comparison. Atrypa cf. *gedinniana* differs from *Atrypa reticularis* from Gotland, and *A.* cf. *A. reticularis* described above, in having coarser costellae. It differs from *A.* cf. *A. reticularis* in having a pedicle muscle field which is not divided into three lobes.

Occurrence. Stonehouse Formation (Pridoli to early Gedinnian age), locs. USNM 10187, 10211, Arisaig area; loc. USNM 11221, Pictou County.

Material. 56 specimens.

Superfamily DAYIACEA Waagen, 1883

[*nom. transl. Rzhonsnitskaya*, 1960 (*ex* Dayiinae Waagen, 1883)]

Family LEPTOCOELIIDAE Boucot and Gill, 1956

Genus *Eocoelia* Nikiforova, 1961

Type species. *Atrypa hemisphaerica* Sowerby, 1839, p. 637, pl. 20, fig. 7.

Discussion. Ziegler (1966) has recently completed an extensive revision of the genus *Eocoelia* and recognized four species: *E. hemisphaerica* (Sowerby, 1839), in beds of late Llandovery (C_1–C_2) age; *E. intermedia* (Hall, 1860), in beds of late Llandovery (C_3–C_4) age; *E. curtisi* (Ziegler, 1966), in beds of late Llandovery (C_5) age; and *E. sulcata* (Prouty, 1923), in beds of late Llandovery (C_6) or early Wenlock age. It appears that stratigraphic ranges of these species do not overlap. Ziegler has studied the collections of *Eocoelia* here described and assigned each to one of the species listed above; these assignments are followed herein.

Eocoelia hemisphaerica (Sowerby, 1839)

Plate XXIII, figure 1

1839. *Atrypa hemisphaerica* Sowerby, p. 637, pl. 20, fig. 7.
1966. *Eocoelia hemisphaerica* (Sowerby), Ziegler, pp. 533–536, pl. 83, figs. 13–16; pl. 84, figs. 5–11.

Questionably placed in synonomy:
1924. *Coelospira hemisphaerica* (Sowerby), McLearn, p. 90–91, pl. 10, figs. 20, 21.

Diagnosis. Eocoelia with umbonal chambers. Ribs arrive at anterior margin.

Discussion. The specimens of *Eocoelia* figured by McLearn (1924), Peabody Museum Nos. 447, 447a, are exterior impressions and cannot be assigned with certainty to *E. hemisphaerica*, *E. intermedia*, or *E. curtisi*. They are from Twenhofel loc. 186, middle member, Ross Brook Formation, shore section in the vicinity of the old mouth of Arisaig Brook, northeast of the brook along shore (about 300 feet northeast of the present mouth of Arisaig Brook).

Description

Exterior. Pedicle valve moderately to strongly convex and carinate; brachial valve flat, with low rounded sulcus. Valves subcircular to transversely subelliptical in outline and vary from about 3/4 as long as wide to slightly longer than wide; greatest width at midlength. Hinge line short. Anterior commissure crenulate and gently sulcate. Valves marked by thirteen to seventeen prominent, rounded, uniform plications which do not branch, separated by interplications of about the same width, and by concentric growth lamellae. There is a median plication along the midline in the pedicle valve and a corresponding interplication along the midline in the brachial valve. Sulcus bears two to five plications. Plications extend to commissure of valves.

Interior of pedicle valve. Teeth stout, triangular in outline, and supported by short dental plates. Each tooth bears a fossette on its medial face. Cone-shaped anterolaterally directed umbonal chambers flank the dental plates. Muscle field not impressed. Internal surface strongly marked by impress of the plications, which extend almost to the apex.

Interior of brachial valve. Crural plates discrete, anterolaterally directed at an angle of about 90 degrees to one another, and separated by a flat notothyrial platform which may bear a simple oval cardinal process. A broad median septum of uniform width extends anteriorly from the notothyrial platform 1/2 to 3/4 the valve length, and may be flanked laterally by elongate oval adductor scars. Sockets rounded at their base and bounded medially by the crural plates. The internal surface is strongly marked by impress of the plications, which extend from the cardinalia to the periphery.

Occurrence. Middle member, Ross Brook Formation (late Llandovery (C_1–C_5) age), loc. USNM 10121, Arisaig area; locs. USNM 11224, 11232, 11236, 11279, 11290, 11291, 11313, 11316, Pictou County. Specimens questionably assigned to *E. hemisphaerica* occur in the middle member, Ross Brook Formation, locs. USNM 11283, 11287, 11297, GSC 45433, 45436, Pictou County; loc. USNM 11286, Cobequid Mountains.

Material. 518 specimens (14 questionably assigned).

Eocoelia intermedia (Hall, 1860)

Plate XXIII, figures 2, 3

1860. *Leptocoelia intermedia* Hall, p. 147, fig. 5.
1966. *Eocoelia intermedia* (Hall), Ziegler, p. 536–537, pl. 83, figs. 9–12; pl. 84, figs. 1–2.

Diagnosis. Eocoelia which may or may not have umbonal chambers. Ribs arrive at anterior margin.

Description

Exterior. Pedicle valve moderately to strongly convex and carinate; brachial valve flat and bears a low rounded sulcus. Valves subcircular to transversely subelliptical in outline, from about 3/4 as long as wide to slightly longer than wide, and widest at midlength. Hinge line short. Anterior commissure crenulate and gently sulcate. Valves marked by twelve to seventeen prominent plications separated by interplications of about the same

width, and by concentric growth lamellae. Median plication along the midline in the pedicle valve commonly larger than plications on flanks. Sulcus bears two to five plications. Plications extend to commissure of valves.

Interior of pedicle valve. Teeth may or may not be supported by dental plates, thus umbonal chambers may or may not be present. Fossette present on medial face of each tooth. A myophragm extends to about midlength, muscle field not otherwise impressed. Internal surface strongly marked by impress of the plications, which extend almost to the apex.

Interior of brachial valve. Crural plates discrete, anterolaterally directed at an angle of about 90 degrees to one another, and separated by a flat notothyrial platform which may bear a simple oval cardinal process. Median septum extends 1/2 to 3/4 the valve length. Elongate oval adductor scars commonly not impressed. Internal surface strongly marked by impress of the plications, which extend from the cardinalia to the periphery.

Occurrence. Middle member, Ross Brook Formation (late Llandovery (C_1–C_5) age), loc. USNM 10858, Arisaig area; locs. USNM 11318, 11319, Pictou County; questionably at loc. USNM 11285, Pictou County.

Material. 727 specimens (26 questionably assigned).

Eocoelia curtisi Ziegler, 1966

Plate XXIII, figures 4, 5

1966. *Eocoelia curtisi* Ziegler, p. 537–538, pl. 83, figs. 7, 8; pl. 84, figs. 12–17.

Diagnosis. Eocoelia without umbonal chambers. Ribs relatively faint but reach anterior margin.

Description

Exterior. Pedicle valve moderately to strongly convex and carinate; brachial valve flat with low rounded sulcus. Valves subcircular to transversely subelliptical in outline, 3/4 as long as wide to slightly longer than wide, widest at midlength. Hinge line short. Anterior commissure crenulate and gently sulcate. Valves marked by twelve to eighteen rounded, relatively low plications separated by interplications of about the same width, and by concentric growth lamellae. Sulcus bears two to five plications. Plications extend to commissure of valves.

Interior of pedicle valve. Teeth stout, triangular in outline with fossettes on their medial face. Dental plates and umbonal chambers lacking. A low myophragm extends to about midlength on some specimens, muscle field not otherwise impressed. Internal surface marked by impress of the plications.

Interior of brachial valve. Crural plates discrete, anterolaterally directed at an angle of about 90 degrees to one another, and separated by a flat notothyrial platform which may bear a simple oval cardinal process. Median septum extends $\frac{1}{2}$ to $\frac{3}{4}$ the valve length, and may be flanked laterally by elongate oval adductor scars. Internal surface strongly marked by impress of the plications, which extend from the cardinalia to the periphery.

Occurrence. Middle member, Ross Brook Formation (late Llandovery (C_1–C_5) age), locs. USNM 10122, 10859, Arisaig area; locs. USNM 11231, 11280, 11292, 11293–11296, 11298, 11299, 11310, Pictou County; questionably at locs. USNM 11237, 11278, 11281, 11282, 11284, 11311, 11312, 11314, 11315, Pictou County. One specimen from the Kerrowgare Formation (late Llandovery to Ludlow age), loc. USNM 11226, Pictou County, is questionably assigned to *E. curtisi.*

Material. 814 specimens (107 questionably assigned).

Eocoelia sulcata (Prouty, 1923)

Plate XXIII, figures 6–14

1923. *Coelospira sulcata* Prouty, p. 466, pl. 27, figs. 6–8.
1966. *Eocoelia sulcata* (Prouty), Ziegler, p. 538, pl. 83, figs. 1–6; pl. 84, figs. 3, 4.

Diagnosis. Eocoelia without umbonal chambers. Ribs do not arrive at anterior margin in large specimens.

Description

Exterior. Pedicle valve moderately to strongly convex and carinate, brachial valve usually flat but may be gently convex or very gently concave, and bears a low rounded sulcus. Valves subcircular to transversely subelliptical in outline and vary from $\frac{3}{4}$ as long as wide to as long as wide, widest at about midlength. Anterior commissure sulcate and non-crenulate on mature specimens. Valves marked by seven to thirteen faint, rounded plications separated by interplications of about the same width, by fine radial striae, and by concentric growth lamellae. The plications die out before they reach the periphery in mature specimens. There is a single enlarged median plication along the midline of the pedicle valve, a corresponding enlarged interplication along the midline of the brachial valve, three plications on the sulcus.

Interior of pedicle valve. Teeth stout, triangular in outline, and extend anterolaterally from the apex; each tooth bears a fossette on its medial face. The delthyrial cavity is floored by a low pedicle callist. A low rounded median ridge extends anteriorly $\frac{1}{3}$ to $\frac{1}{2}$ the valve length. Muscle field usually not impressed, but a few specimens show oval adductor scars on each side of the median ridge. Internal surface marked by impress of the plications which extend from the delthyrial cavity to the anterior termination of the plications.

Interior of brachial valve. Discrete crural plates extend anterolaterally at an angle of about 90 degrees to one another, and are separated by a flat notothyrial platform with a simple oval cardinal process. Sockets rounded at their base and bounded anteriorly by the crural plates. A rounded median septum of uniform width extends anteriorly from the base of the notothyrial platform $\frac{3}{4}$ to $\frac{9}{10}$ the valve length. Adductor scars rarely impressed, elongate oval in outline. Internal surface commonly marked by faint impressions of the plications which extend from the notothyrial platform to the anterior terminations of the plications.

Occurrence. Upper member, Ross Brook Formation (late Llandovery (C_6) age), locs. USNM 10127, 10128, 10129, 10130, 10131, Arisaig area; locs. USNM 10823, 10824, 10832, 10833, 10855, 11227, 11305, 11306–11309, 11334, Pictou County.

Material. 1,564 specimens.

Suborder ***Athyrididina*** Boucot, Johnson, and Staton, 1964
[*nom. correct.* Boucot, Johnson, and Staton, 1965
(*pro* Athyridoidea Boucot, Johnson, and Staton, 1964)]

Superfamily ATHYRIDACEA M'Coy, 1844
[*nom. transl.* Williams, 1956 (*ex* Athyridae M'Coy, 1844)]

Family MERISTELLIDAE Waagen, 1883
[*nom. transl.* Hall and Clarke, 1895 (*ex* Meristellinae, Waagen, 1883)]

Subfamily MERISTELLINAE Waagen, 1883

Genus ***Cryptothyrella*** Cooper, 1942

Type species. *Whitfieldella quadrangularis* Foerste, 1906, p. 327, pl. 1, figs. 4a–c.

Cryptothyrella beechhillensis (McLearn, 1924)

Plate XXV, figures 2–7

1924. *Whitfieldella* (?) *crassa* var. *beechhillensis* McLearn, p. 87, pl. 10, figs. 14–16.
1924. *Whitfieldella*? cf. *angustifrons* (McCoy), McLearn, p. 88, pl. 10, figs. 22–24.

Description

Exterior. Valves smooth, unequally biconvex with the pedicle valve more convex, transversely to elongately elliptical in outline, $\frac{3}{4}$ as wide as long to $\frac{3}{4}$ as long as wide, circular to elliptical in cross-section, anterior commissure rectimarginate, pedicle beak strongly incurved; cardinal margin of the pedicle valve rounded; delthyrium triangular, open, rounded at the apex, and intercepts an angle of 50 to 90 degrees.

Interior of pedicle valve. Small teeth supported by long dental lamellae which extend anteriorly to about midlength and bound the muscle field laterally; delthyrial cavity triangular to broadly rounded in cross-section; muscle field triangular in outline, extends anteriorly $\frac{1}{2}$ to $\frac{2}{3}$ the valve length, longitudinally striate, deeply impressed at its posterior end and tapers in height to the level of the floor of the valve; adductor scars usually not impressed, when present they are elongate oval in outline and confined to the posterior half of the muscle field. Anterior to the delthyrial cavity the dental lamellae converge medially to form an elongate trough which extends from the delthyrial cavity to the muscle field, and is raised above the level of the floor of the valve. The umbonal chambers commonly bear numerous low ridges which curve concave medially.

Interior of brachial valve. Small, widely divergent sockets bounded laterally by the posterior margin of the valve and bounded medially by discrete hinge plates; hinge plates flat, triangular in outline, and supported medially by a sessile septalium or by a pair of minute plates which extend from the hinge plates to the floor of the valve and converge medially; narrow, elongate oval adductors, separated by a low myophragm, extend anteriorly to $\frac{1}{2}$ to $\frac{3}{4}$ the valve length.

Comparison. Cryptothyrella beechhillensis resembles *Cryptothyrella quandrangularis* (Foerste, 1906) from the Brassfield Limestone of middle Llandovery or late Llandovery (C_1–C_2) age in Adams County, Ohio, in its internal features. The latter species attains a much larger size and adult specimens are roughly quadrangular in outline with long straight margins, in contrast

to adult specimens of *C. beechhillensis*, which are elliptical in outline. Small specimens of *C. quadrangularis* in the size range of the Arisaig species correspond to the Arisaig species in outline.

McLearn referred specimens of *C. beechhillensis* to *Whitfieldella*? cf. *angustifrons* (M'Coy, 1851) (Ayrton *et al.*, 1969, p. 477). *Hemithyris angustifrons* may belong to *Hyattidina* Schuchert, 1913, or to the little known genus *Glassina* Hall and Clarke, 1893.

Occurrence. Beechhill Cove Formation (early Llandovery age), loc. USNM 10115, Arisaig area; locs. USNM 11275, 11276, 11277, Pictou County. Glencoe Brook Formation (early Llandovery age), locs. USNM 11262, 11288, 11289, Pictou County.

Material. 1,530 specimens.

Genus *Meristina* Hall, 1867

Type species. *Meristella maria* Hall, 1863, p. 212.

Meristina billingsiana (Dawson, 1880)

Plate XXV, figures 8–15; Plate XXVI, figure 1

1880. *Stricklandinia billingsiana* Dawson, p. 341 (incorrectly listed as *S. billingsi* on p. 335).
1924. *Meristina billingsi* (Dawson), McLearn, p. 89, 90, pl. 9, figs. 4, 5.
1963. "*Stricklandinia*" *billingsiana* (Dawson), Boucot and Ehlers, p. 52, 53. (Boucot and Ehlers discuss the type specimen and point out that it is a *Meristina*.)

Description

Exterior. Valves smooth, subequally biconvex, elliptical in outline, vary from $\frac{1}{2}$ as long as wide to $\frac{3}{4}$ as wide as long, widest at midlength or slightly anterior to midlength; anterior commissure rectimarginate to sulcate; cardinal margin of the pedicle rounded; delthyrium open, triangular in outline, rounded at the apex; pedicle valve commonly bears a low rounded sulcus at its anterior end; brachial valve commonly bears a corresponding fold; valves marked by faint growth lines.

Interior of pedicle valve. Teeth supported by dental lamellae which are very variable in length; the dental lamellae may be confined to the delthyrial cavity or may extend along the lateral margins of the muscle field to its anterior end. All intergrades are present between these two extremes. Delthyrial cavity triangular in outline and triangular or rectangular in cross-section; muscle field triangular in outline with a rounded posterior margin, extends anteriorly $\frac{1}{2}$ to $\frac{9}{10}$ the valve length, and longitudinally striate; the lateral margins of the muscle field diverge at an angle of 30 to 75 degrees; a rounded trough with parallel or slightly divergent lateral margins extends from the delthyrial cavity to the muscle field. The trough is depressed below the level of the floor of the valve and is bounded laterally by the dental lamellae on specimens in which the dental lamellae extend anterior to the delthyrial cavity. The trough varies in length.

Interior of brachial valve. Sockets small, widely divergent, bounded posteriorly by the margin of the valve, and anteriorly by large flat hinge plates; hinge plates lie about in the plane of commissure and are supported by a septalium formed by a median septum and a pair of plates which extend from the inner margins of the hinge plates and converge medially to join the median septum above the floor of the valve; median septum extends anteriorly $\frac{1}{2}$ to $\frac{2}{3}$ the valve length and tapers in height anteriorly; muscle field usually not impressed, a few specimens show oval adductor scars flanking the median ridge in the posterior half of the valve.

Comparison. M. billingsiana differs from *C. beechhillensis* in having a median septum in the brachial valve in contrast to the faint myophragm of the latter species and of other species belonging to *Cryptothyrella. M. billingsiana* is a much larger and much less convex species than *C. beechhillensis*, and commonly has a fold and sulcus which are lacking in *C. beechhillensis*. The trough extending from the delthyrial cavity to the muscle field in the pedicle valve of *M. billingsiana* is depressed below the level of the floor of the valve; the corresponding trough in *C. beechhillensis* is raised above the valve floor.

M. billingsiana differs from *M. maria* Hall from the Niagara group of Illinois and Indiana in being, on the average, more transverse and less convex.

Occurrence. French River Formation (late Llandovery (C_6) or early Wenlock age), locs. USNM 10135–10138, 10142, 10145, 10148, 10150–10155, 10157, 10158, 10861, 10862, 10912, 10927, Arisaig area; locs. USNM 10809, 10811, 10815, 10821, 10825, 10826, 10842, 11212, 11213, 11216, 11218, 11220, GSC 46443, Pictou County; locs. USNM 10810, 10814, 10822, Cobequid Mountains. Kerrowgare Formation in beds correlative with the French River Formation, locs. USNM 10817, 10820, Pictou County.

Material. 893 specimens.

Subfamily HINDELLINAE Schuchert, 1894

Genus ***Hyattidina*** Schuchert, 1913

Type species. *Atrypa congesta* Conrad, 1842, p. 265.

Hyattidina sp.

Plate XXVI, figures 2–11

Description

Exterior. Valves smooth, very small (less than 8 mm long), subequally biconvex; anterior commissure rectimarginate to very gently sulcate; pedicle valve subpentagonal to elongately subelliptical in outline, from $\frac{3}{4}$ as wide as long to about as wide as long, and commonly bears a shallow sulcus; brachial valve transversely elliptical in outline, from $\frac{4}{5}$ as long as wide to about as long as wide, and uniformly convex; delthyrium triangular and open.

Interior of pedicle valve. Teeth small, supported by very short erect dental plates which are confined to the delthyrial cavity, which is rounded in cross-section; muscle field triangular in outline with V-shaped anterior margin; the narrow diductor tracks diverge anterolaterally from the delthyrial cavity at a 30 to 75 degree angle to each other, extend anteriorly from slightly less than $\frac{1}{2}$ to $\frac{4}{5}$ the valve length; diductor scars completely enclose the elongate oval adductor scars which are confined to the posterior end of the muscle field; faint pallial marks commonly extend anterolaterally from the diductor tracks; umbonal chambers occasionally bear faint crescentic ridges.

Interior of brachial valve. Cardinalia consist of a pair of flat triangular hinge plates separated by a deep narrow groove; crura originate from anteromedial margins of hinge plates; sockets anterolaterally directed and rounded at their base; narrow elongate adductor scars extend anteriorly to about midlength and are separated by a linear myophragm.

Comparison. Hyattidina sp. and *H. congesta* from the Clinton Group of New York State, late Llandovery (C_3–C_5) age, closely resemble each other in outline and in the details of the cardinalia, dental plates, and muscle fields. Both species have a pair of grooves which bound

the muscle field of the brachial valve at its posterior end. However, *H. congesta* has a deep sulcus in the pedicle valve and a corresponding fold in the brachial valve, and *H.* sp. has a relatively faint sulcus, or none at all, and lacks a fold in the brachial valve.

Occurrence. Upper member, Ross Brook Formation (late Llandovery (C_6) age), locs. USNM 10127, 10128, Arisaig area; locs. USNM 10832, 11274, Pictou County.

Material. 93 specimens.

Hyattidina northumberlandensis (McLearn, 1924)

Plate XXVI, figures 12–21

1924. *Whitfieldella* (?) *northumberlandensis* McLearn, p. 87, pl. 10, fig. 8.
1924. *Meristina tumida* (Dalman)?, McLearn, p. 89, pl. 9, figs. 6, 7.

Description

Exterior. Valves smooth, strongly convex with about the same convexity, and pentagonal in outline with laterally divergent posterior margins, parallel or slightly convergent antero-lateral margins, and a straight anterior margin; anterior commissure rectimarginate; cardinal margins low and flat and divided by a triangular delthyrium at the apex of which is a circular foramen; both valves usually bear a narrow rounded sulcus.

Interior of pedicle valve. Small teeth supported by very short dental plates which bound the delthyrial cavity; delthyrial cavity is rounded at its base; straight slightly divergent diductor tracks extend from the delthyrial cavity to $\frac{1}{2}$ to $\frac{2}{3}$ the valve length; adductor scars, when impressed, are elongate oval in outline and confined to the posterior end of the muscle field.

Interior of brachial valve. Cardinalia consist of a pair of triangular unsupported hinge plates which bound the narrow rounded sockets medially; a very low narrow myophragm extends from the posterior end of the valve to about $\frac{2}{3}$ the valve length and divides the narrow elongate oval adductor scars.

Comparison. Hyattidina northumberlandensis differs from *H.* sp. from the Ross Brook Formation in that it is bisulcate and attains a larger size. The latter species may have a faint sulcus on the pedicle valve but lacks a sulcus on the brachial valve. The two species are similar internally.

Hyattidina northumberlandensis differs from *Hyattidina congesta* (Conrad, 1842), in having a sulcus in both valves. *H. congesta* has a well-developed sulcus in the pedicle valve and a well-developed fold in the brachial valve. Internally, the two species do not differ significantly.

Occurrence. French River Formation (late Llandovery (C_6) or early Wenlock age), loc. USNM 10811, Pictou County. Lower member, Moydart Formation (Ludlow age), Twenhofel loc. 97, locs. USNM 10174, 10175, 10177, 10180, 10181, 10182, Arisaig area. Beds of Moydart age in the *Scolithus* (worm-tube) quartzite, locs. USNM 10834, 11246, Cape George area.

McLearn (1924, p. 89) described a few shells from "a boulder on the shore near the middle zones of the Stonehouse Formation, Arisaig area" as "*Meristina tumida*?". These shells belong to *H. northumberlandensis.* They occur on a slab together with *Sphaerirhynchia saffordi,* which is restricted to the Moydart Formation, so the boulder which contained them was clearly derived from the Moydart Formation.

Material. 232 specimens.

Family NUCLEOSPIRIDAE Davidson, 1881

Genus *Nucleospira* Hall, 1859

Type species. *Spirifer ventricosa* Hall, 1857, p. 57.

Nucleospira sp.

Plate XXVII, figure 1

Description

Exterior. Brachial valve circular in outline, lenticular in lateral profile with a narrow median groove in its posterior half and a very faint fold in its anterior half.

Interior of brachial valve. The prominent cardinal plate extends upwards well above the plane of commissure and curves posteriorly. It is flanked laterally by minute oval sockets. A myophragm extends anteriorly to about midlength and separates the narrow oval adductor scars.

Occurrence. French River Formation (late Llandovery (C_6) or early Wenlock age), loc. USNM 10810, Cobequid Mountains.

Material. Two specimens.

Family ATHYRIDIDAE M'Coy, 1844
(emended Davidson, 1881)

Genus ***Protathyris*** Kozlowski, 1929

Type species. *Protathyris praecursor* Kozlowski, 1929, p. 224.

Protathyris? sp.

Plate XXVI, figures 22–24

A dozen specimens of a very small athyrid were found in the Stonehouse Formation. The delthyrial cavity in each of the two available pedicle interiors is much lower than that in *Hyattidina*, and the pedicle diductor tracks less divergent. The Arisaig specimens resemble *Protathyris* in shape, outline, and pedicle valve internal features. However, the one available brachial interior appears to have discrete hinge plates, and *Protathyris* has hinge plates which are conjunct posteriorly. As the nature of the hinge plates cannot be positively determined on the one available brachial interior, the Arisaig specimens are assigned provisionally to *Protathyris*.

Description

Exterior. Valves smooth, subequally biconvex, and pentagonal in outline.

Interior of pedicle valve. Teeth supported by short, slightly divergent dental plates; delthyrial cavity low; diductor tracks narrow, slightly divergent, and enclose the small adductors.

Interior of brachial valve. Hinge plates appear to be discrete but this cannot be positively determined in the one available brachial valve interior. A narrow myophragm extends to about midlength and divides the narrow, elongate oval adductor scars.

Occurrence. Stonehouse Formation (Pridoli to early Gedinnian age), locs. USNM 10187, 10202, Arisaig area.

Material. Nine specimens.

Suborder ***Spiriferidina*** Waagen, 1883
[*nom. correct.* Pitrat, 1965 (*pro* Spiriferacea Waagen, 1883)]

Superfamily DELTHYRIACEA Waagen, 1883
[*nom. transl.* Ivanova, 1959 (*ex* Delthyrinae Waagen, 1883)]

Family CYRTIIDAE Frederiks, 1924
[*nom. transl.* Ivanova, 1959 (*ex* Cyrtiinae Frederiks, 1924)]

Subfamily EOSPIRIFERINAE Schuchert and LeVene, 1929 (emended Boucot, 1963)

Genus ***Striispirifer*** Cooper and Muir-Wood, 1951

Type species. *Delthyris niagarensis* Conrad, 1842, p. 261.

Striispirifer stonehousensis (McLearn, 1924)

Plate XXVII, figures 2–5

1924. *Eospirifer stonehousensis* McLearn, p. 84, pl. 9, fig. 8.

Description

Exterior. Valves subequally biconvex, transversely semielliptical in outline, and 1/2 to 3/5 as long as wide; hinge line straight and about 9/10 as long as the greatest width, which is slightly anterior to the hinge line; cardinal angles rounded; anterior commissure sulcate, plicate, and crenulate; fold and sulcus rounded in cross-section; valves marked by eight to ten rounded costae on each side of the fold and sulcus. The costae are separated by rounded interspaces which are about the same width as adjacent costae; the size of the costae decreases lateral to the fold and sulcus. Valves bear a fine ornament of numerous prominent fila which increase by insertion and fine growth lines; pedicle beak incurved; interarea of pedicle valve apsacline, strongly curved concave outwards and from 1/8 to 1/12 as high as long; interarea of brachial valve anacline, gently curved concave outwards, and about 1/12 as high as long; interareas marked by fine growth lines which parallel the hinge line; delthyrium triangular, intercepts an angle of about 40 degrees at the apex; narrow deltidial plates present along the margins of the delthyrium on a few specimens but not preserved on most; notothyrium triangular, intercepts an angle of about 150 degrees; no chilidial plates observed.

Interior of pedicle valve. Small stubby teeth supported by blade-like dental lamellae which diverge anterolaterally at about a 45 degree angle to each other, taper in height anteriorly, and extend anteriorly about 1/4 the valve length; umbonal cavities of large specimens thickened by the deposition of secondary material; delthyrial cavity narrow and triangular in outline; floor of the delthyrial cavity may be V-shaped in cross-section or may be flat and bear a median groove; muscle field triangular in outline, usually wider than long and divided by a low myophragm. It is deeply impressed at its posterior end, tapers in height anteriorly, and extends anteriorly 1/4 to 1/2 the valve length. Diductor scars longitudinally striate; adductor scars only rarely impressed but when present are confined to the posterior end of the muscle field. Internal surface bears impress of the costae along most of their length, and in some specimens the impress of the fila; internal surface pustulose lateral to the dental lamellae.

Interior of brachial valve. Cardinalia consists of discrete, medially convergent hinge plates separated by a narrow groove; hinge plates V-shaped in cross-section and supported by erect, parallel crural plates; sockets anterolaterally divergent, rounded at their base and

floored by plates which extend from the hinge plates to the margins of the notothyrium; narrow myophragm extends anteriorly to about midlength; muscle field not impressed; internal surface bears impress of the costae along most of their length, and in some specimens the impress of the fila.

Discussion. McLearn's type specimen of *S. stonehousensis* came from a boulder collected along the Arisaig shore section, which he assumed came from the Stonehouse Formation. More detailed work has shown that *S. stonehousensis* is confined to the French River Formation, which also outcrops in the Arisaig area.

Comparison. Striispirifer stonehousensis closely resembles *Striispirifer niagarensis* (Conrad, 1842), from the Irondequoit Limestone (late Llandovery C_5–C_6), Rochester Shale, and Herkimer Sandstone (Wenlock) of New York illustrated by Hall (1852, pl. 54, figs. 5a–5t) and Boucot (1963, pl. 100, figs. 6, 7, 9–13). However, as adequate specimens of the latter species were not available for study the species cannot be unequivocably placed into synonymy.

Occurrence. French River Formation (late Llandovery (C_6) or early Wenlock age), locs. USNM 10139, 10149, 10156, Arisaig area; locs. USNM 10816, 10825, 10842, 10847, 11249, Pictou County; locs. USNM 10810, 10822, Cobequid Mountains.

Material. 61 specimens.

Family DELTHYRIDIDAE Waagen, 1883
[*nom. transl.* Ivanova, 1959 (*ex* Delthyrinae Waagen, 1883)]

Subfamily DELTHYRIDINAE Waagen, 1883

Genus ***Howellella*** Kozlowski, 1946

Type species. *Delthyris elegans* Muir-Wood, 1925, p. 89.

Howellella moydartensis (McLearn, 1924)

Plate XXVII, figures 6–9

1924. *Delthyris crispa* (Hisinger), McLearn, p. 81, pl. 8, fig. 18.
1924. *Delthyris crispa* mut. *moydartensis* McLearn, p. 82, pl. 8, figs. 19–24.

Description

Exterior. Valves unequally biconvex with pedicle valve more convex; semielliptical in outline with rounded cardinal angles, and widest a short distance anterior to the straight hinge line; pedicle valve 3/4 to 9/10 as long as wide; brachial valve about 3/5 to 3/4 as long as wide; anterior commissure crenulate and uniplicate; pedicle beak strongly incurved; interarea of pedicle valve anacline, about 1/4 as high as long, and strongly curved posteriorly; delthyrium triangular, open, and intercepts an angle of about 30 degrees; interarea of brachial valve flat, orthocline to low anacline, and about 1/10 as high as long; fold and sulcus rounded in cross-section; three to five rounded plications, separated by interplications of about the same width, on each side of the fold and sulcus; valves marked by fine growth lines crossed by capillae. Capillae commonly not preserved.

Interior of pedicle valve. Teeth supported by dental plates which diverge at about a 30 degree angle to each other at their bases and extend from the margins of the delthyrium anteriorly to about 1/4 the valve length; a faint myophragm extends anteriorly to about midlength; muscle scars not impressed on any of the specimens studied; internal surface marked by impress of the plications along most of their extent.

Interior of brachial valve. Notothyrial cavity bears a striated area for diductor attachment; curved hinge plates, supported by short crural plates, extend laterally from the notothyrial cavity to bound the sockets anteriorly; sockets rounded at their base and bounded posteriorly by the valve margin; a low myophragm extends anteriorly to about midlength; adductor scars only rarely impressed but when present are elongate oval in outline; internal surface marked by impress of the plications along most of their extent.

Discussion. A very large number of species have been assigned to the genus *Howellella* and many of these are only very poorly illustrated. It is possible that *H. moydartensis* will be found to be synonymous with an earlier defined species of *Howellella* when a thorough review of the species belonging to the genus is made. However, such a review is beyond the scope of this paper.

Occurrence. French River Formation (late Llandovery (C_6) or early Wenlock age), locs. USNM 10811, 10815, 11212, Pictou County; loc. USNM 10814, Cobequid Mountains. Doctor's Brook Formation (Wenlock age), loc. USNM 10909, Arisaig area. French River or Doctor's Brook Formation, loc. USNM 11183, Lochaber area. Lower member, McAdam Brook Formation (early Ludlow age), loc. USNM 10167, Arisaig area. Lower member, Moydart Formation (Ludlow age), locs. USNM 10172, 10174, 10181, 10908, 10935, Arisaig area; locs. USNM 10828, 10836, 10837, 10853, 11241, 11242, 11324, 11325, 11326, 11327, Pictou County; loc. USNM 10827, Lochaber area. Kerrowgare Formation (late Llandovery to Ludlow age), loc. USNM 10852, Pictou County.

Material. 2,001 specimens.

Genus ***Delthyris*** Dalman, 1828

Type species. *Delthyris elevata* Dalman, 1828, p. 120, pl. 3, fig. 3.

Subgenus *Quadrifarius* Fuchs, 1929 emended

Type species. *Spirifer* (*Quadrifarius*) *loculatus* Fuchs, 1923, p. 195–196, figs. 1–4. (According to Boucot (1957, p. 312), this species is a subjective synonym of *Spirifer dumontianus* Koninck, 1876, p. 39, pl. 1, fig. 9. Both species are based on specimens from the Gres de Gdoumont (= Weismes Schichten).)

Species assigned. Spirifer rugaecosta Hall, 1860, p. 145; *Spirifer dumontianus* Koninck, 1876, p. 39, pl. 1, fig. 9; *Spirifer* (*Quadrifarius*) *loculatus* Fuchs, 1923; *Spirifer* (*Delthyris*) *magnus* Kozlowski, 1929, p. 188–189, text-fig. 62, pl. 10, figs. 4–9; *Spirifer* (*Delthyris*?) *trescotti* Williams, 1916, p. 73–76, pl. 1, figs. 1–9, 11, 20, 22, 23, 25 (= *Spirifer cobscooki* Williams, 1916, p. 76–77 (*partim*), pl. 1, fig. 12 *only*; = *Spirifer edmundsi* Williams, 1916, p. 77–78 (*partim*), pl. 1, fig. 14 *only*).

Species rejected. Spirifer trisectus Kayser, 1883, pl. 14, fig. 2.

Diagnosis. Delthyris which bear a groove on the fold and may bear a single median plication on the sulcus.

Discussion. Fuchs (1929, p. 195) assigned three species to *Quadrifarius: Spirifer loculatus* (the type species), *S. dumontianus*, and *S. trisectus*. *S. trisectus* has been shown by Boucot (1957, p. 312) to be a reticulariid spirifer; Boucot (1962, p. 416) assigned this species to *Quadrithyris* Havlíček, 1957.

As here defined, the subgenus (*Quadrifarius*) includes five species: *D.* (*Q.*) *dumontianus* from the lower Gedinnian of Belgium and Germany, and from the Köbbinghäuser Schichten

of possible Pridoli age in Germany; *D.* (*Q.*) *loculatus*, which according to Boucot (1957, p. 312) may well be synonymous with *D.* (*Q.*) *dumontianus* (both are based on specimens from the Gres de Gdoumont = Weismes Schichten), from the Gedinnian of Belgium and Germany; *D.* (*Q.*) *magnus* from the Skala Formation of Podolia (Pridoli age); *D.* (*Q.*) *trescotti* from the Edmunds Formation, Washington County, Maine; and *D.* (*Q.*) *rugaecosta* from the Stonehouse Formation of Pridoli to Gedinne age in Nova Scotia. These species have the diagnostic characters of *Delthyris*: a prominent median septum and prominent dental lamellae in the pedicle valve, crural plates, a striated area for diductor attachment in the brachial valve, and a fine ornament of nonfrilly growth lamellae crossed by fine radial ridges which project slightly anterior to the growth lamellae. However, they differ from the Silurian representatives of *Delthyris*, including the type species, *D. elevata*, in having a groove on the fold. Typical *Delthyris* which lack this groove are here considered as belonging to *Delthyris* (*Delthyris*); they are not known in beds of post-Pridoli age.

In 1957 (p. 314) Boucot considered *Quadrifarius* synonymous with *Delthyris*. However, in view of its stratigraphic significance, it should be retained as a subgenus of *Delthyris*. The author is indebted to Dr. Boucot for suggesting that *Quadrifarius* be retained as a subgenus.

Delthyris (*Quadrifarius*) *rugaecosta* (Hall, 1860)

Plate XXVIII, figures 1–10

1860. *Spirifer rugaecosta* Hall, p. 145.
1860. (?) *Spirifer subsulcata* Hall, p. 145.
1924. *Delthyris rugaecosta* (Hall), McLearn, p. 82, pl. 8, fig. 31; pl. 9, figs. 1–3.
1924. *Delthyris rugaecosta* mut. *prima* McLearn, p. 83–84, pl. 8, fig. 30.
1924. (?) *Delthyris rugaecosta* var. *subsulcata* (Hall), McLearn, p. 85.

Description

Exterior. Pedicle valve more convex than brachial valve; valves transversely semielliptical in outline, 1/2 to 2/3 as long as wide and widest at the straight hinge line or slightly anterior to it; anterior commissure crenulate and uniplicate; interarea of pedicle valve apsacline to catacline, curved slightly concave outwards, 1/3 to 2/5 as high as long; delthyrium triangular, open, and intercepts an angle of about 30 degrees at the apex; interarea of brachial valve low anacline to orthocline, flat or slightly concave outwards and 1/12 to 1/20 as high as long; notothyrium triangular and encloses an angle of about 150 degrees; fold and sulcus rounded or somewhat flattened in cross-section; valves marked by three to eight rounded plications lateral to the fold and sulcus separated by interplications of about the same width. The plications may be straight or may curve somewhat anteriorly. The brachial fold has a median groove which may originate at the apex or several millimetres anterior to it; the pedicle sulcus only rarely bears a corresponding medial plication. Valves marked by closely spaced growth lamellae crossed by minute radial capillae that project slightly anterior to the margins of the growth lamellae. Capillae commonly not observed.

Interior of pedicle valve. Small, rounded teeth supported by prominent dental plates which extend from the margins of the delthyrial cavity to the middle of the interplications which flank the sulcus; dental plates extend anteriorly to about midlength and are curved concave laterally. A prominent median septum extends to 2/3 to 3/4 the valve length; it is high at its posterior end and tapers anteriorly. Small horizontal plates extend from the median septum to the dental plates at the posterior end of the valve; in large specimens the space beneath these plates may be filled with secondary shell deposits. Internal surface is marked by impress of the costellae along their entire length and may be marked by the impress of the imbricating growth lamellae.

Interior of brachial valve. The notothyrial cavity contains a striated area for diductor attachment and is bounded laterally by the long, laterally divergent sockets; discrete, curved hinge plates border the sockets medially and dorsally, and are supported by short crural plates; a narrow myophragm extends from the notothyrial cavity to about midlength; muscle scars not impressed on any of the specimens studied. Internal surface marked by impress of the plications along their entire length and may be marked by the impress of growth lamellae; the groove on the fold may or may not be impressed on the internal surface.

Discussion. Hall (1860, p. 145) proposed two names for spiriferids from the upper part of the Arisaig series: *Spirifer rugaecosta* and *Spirifer subsulcata.* Although neither of these species was illustrated, Hall's types are in the American Museum of Natural History—specimens American Museum of Natural History 1631 (holotype) and 1632 respectively, both pedicle valve exteriors partially imbedded in matrix. Hall describes *S. rugaecosta* as having a sulcus in the ventral valve and a fold in the dorsal valve which is depressed along the centre. From this description it is clear that the specimens upon which Hall based this species belong to the species of *D.* (*Quadrifarius*) which occurs in the Stonehouse Formation. The identity of *S. subsulcata* is not clear. Hall's description of the species which states, among other things, that it has a somewhat flattened or very slightly rounded fold on the dorsal valve applies equally well both to some small specimens of *D.* (*Q.*) *rugaecosta* and to *Howellella moydartensis.* McLearn (1924, p. 85) considered *S. subsulcata* to be a variety of *D. rugaecosta,* and *S. sulcata* is placed questionably in synonymy with *D.* (*Q.*) *rugaecosta* herein. However it is possible that the type specimen of *S. sulcata* is a *Howellella,* in which case the name *S. sulcata* would have priority over *H. moydartensis* McLearn, 1924.

McLearn (1924, p. 83–84) defined a variety *D. rugaecosta* mut. *prima* which he considered to be restricted to the lower part of the Stonehouse Formation, and to differ from *D. rugaecosta* in the upper part of the formation in having "3 to 4 plications on either side of the fold and sulcus instead of the normal 5 to 7". The author has studied several hundred specimens of *D.* (*Quadrifarius*) from a number of localities and finds that the number of plications is actually quite variable in both the lower and the upper parts of the formation. The number of plications lateral to the fold and sulcus were counted on one hundred and thirty specimens from loc. USNM 10185 and sixty-five specimens from loc. USNM 10187. The number of plications varies from three to eight in both samples, and both have a frequency distribution with a maximum at five plications. It appears that this character is of no use in zoning the Stonehouse Formation.

Comparison. D. (*Quadrifarius*) *rugaecosta* closely resembles *D.* (*Quadrifarius*) *magnus* Kozlowski, 1929 from the Skala Formation of Podolia, *D.* (*Quadrifarius*) *dumontianus* Koninck, 1876 from the Gedinnian of Belgium and Germany, and *D.* (*Quadrifarius*) *trescotti* from the Edmunds Formation of Maine. It is possible that these species are conspecific.

Occurrence. Stonehouse Formation (Pridoli to early Gedinnian age), Twenhofel loc. 73, locs. USNM 10184–10188, 10190–10193, 10195–10201, 10203, 10204, 10210, 10211, 10213, 19214, 10910, 10922, 10928, Arisaig area; locs. USNM 10829, 10835, 10838, 10846, 11320, GSC 46439, 46444, Pictou County; locs. USNM 11182, 11184, Lochaber area; locs. USNM 10830, 11222, 11223, 11323, GSC 68836, 68837, 68840, 68845, 68848, 65913, Cobequid Mountains; loc. USNM 10844, Cape George area. Beds of Stonehouse age in the Grey Blue siltstone, loc. USNM 11322, Cape George area.

A few small specimens of *Delthyris* were found at loc. USNM 10813 in the Arisaig area a few feet below the base of the red band in the lower member of the Moydart Formation,

and in the same member at loc. USNM 10827 in the Lochaber area. These possibly belong to *D.* (*Q.*) *rugaecosta*. However, only one small brachial valve was available (at USNM 10183) and it does not show a groove in the fold.

Material. 1,302 specimens.

Order ***Terebratulida*** Waagen, 1883
[*nom. transl.* Moore, 1952 (*ex* suborder Terebratulacea Waagen, 1883)]

Suborder ***Centronellidina*** Stehli, 1965

Superfamily STRINGOCEPHALACEA King, 1850
[*nom. transl.* Stehli, 1965 (*ex* Stringocephalidae King, 1850)]

Family MUTATIONELLIDAE Cloud, 1942
[*nom. transl.* Stehli, 1965 (*ex* Mutationellinae Cloud, 1942)]

Subfamily MUTATIONELLINAE Cloud, 1942

Genus ***Podolella*** Kozlowski, 1929

Type species. *Podolella rensselaeroides* Kozlowski, 1929, p. 233–236, pl. 13, figs. 1–6.

Podolella? sp.

Plate XXVI, figures 25a, b

1960. *Podolella* sp. Maehl, p. 77 (in list of fossils from the Stonehouse formation), p. 155 (in list of fossils from Maehl locality LR4, = USNM 10848).
1961. *Podolella* sp. Maehl, p. 69 (in list of fossils from the Stonehouse Formation).

Twelve minute, badly deformed specimens which resemble *Podolella* were found in the Stonehouse Formation. It is possible that these belong to *Protathyris*? sp. which also occurs in the formation. However, the pedicle muscle field is not impressed in these specimens and it is in the two available pedicle interiors of *Protathyris*? sp. which are of comparable size.

Description. The valves are smooth, biconvex, elliptical in outline, and elongate. The teeth are supported by short dental plates. The hinge plates appear to be discrete. A narrow myophragm extends to about midlength.

Occurrence. Uppermost 50 feet of the Stonehouse Formation, loc. USNM 10848, Pictou County, suggesting an early Gedinne age for the beds at this locality.

Material. 12 specimens.

LOCALITY REGISTER

1. Pictou County (*see* Fig. 3 herein and refer to detailed figures indicated, GSC open files)

Beechhill Cove Formation

USNM 10819, 11257, 11261, 11276. Wallace Brook.
11258. East French River.
11260, 11271. Road between Avondale and highway 4, west of Barney's River.
11272. Highway 4 near Antigonish county line.
11275. Junction of road to Avondale and highway 4, east of Barney's River.
11277. Baillie Brook.

Glencoe Brook Formation

USNM 11255, 11302, 11303. West of road west of Sam Cameron Brook.
11262. Brook 2 miles east of Sunnybrae.
11263. Sutherland River near South McLellan Mountain road.
11264, 11265. Tributary of McLellan Brook east of Brookville schoolhouse.
11266. Road south of MacPhersons Lake.
11267. Road northeast of Kerrowgare.
11268, 11300. Thompson Brook.
11269. Brook 2 miles west of Sunnybrae.
11288, 11289. Blanchard Brook.
11301. 3,000 feet east and 2,500 feet north of Bridgeville.
11304. Glencoe Brook.

Ross Brook Formation, middle member

USNM 11224, 11281–11284. French River.
11225. Tributary in East French River south of highway 4.
11231, 11232, 11236, 11237, 11290–11299, 11310–11319. East French River.
11279. North of highway 4 east of Baxter Brook.
11280. Middle River north of highway 4.
11285. Between Middle River and highway 4.
11287. Cross Brook(?).
11332. Highway 4 between East French and French Rivers.

Ross Brook Formation, upper member

USNM 10823. French River, 1,000 feet upstream from bridge on Antigonish–New Glasgow road.
10824, 10832, 10833, 10855, 10856, 11229, 11230, 11234, 11235, 11274, 11305–11308, 11334. French River.
11227. Tributary of East French River at highway 4.
11233. Tributary of French River.
11278. South of highway 4, south of East French River.
11309. Cross Brook.

French River Formation

USNM 10809, 10815, 10821, 11212, 11213. McLellan Brook.
10811, 10826, 11216, 11217. Harri Brook.
10816, 10825, 10842, 10847, 11247–11249. French River.
11250. Exact locality unknown.

French River or Doctor's Brook Formation

USNM 10812, 11211. Telford Brook.
10818, 11219, 11330. McLellan Brook.
10841, 11220. Harri Brook.

Moydart Formation, lower member

USNM 10828, 10854. Telford Brook.
10836, 10837, 11241, 11327. McLellan Brook.
10853, 11238, 11242, 11324–11326, 11329, 11351, 11352. Sutherland River.

Stonehouse Formation

USNM 10829, 11243. Ridge north of road between Bridgeville and Springville.
10835. Ridge east of McLean Lake.
10838. Brook feeding McLean Lake.
10846, 10848, 11221. Road east of Forbes Lake.
11320. Holmes Brook.

Kerrowgare Formation

USNM 10817. Road from Sunnybrae to Iron Ore, west bank of tributary to Blanchard Brook.
10820, 11218. Approximately a mile east of Bridgeville.
10845, 10851, 10852. Holmes Brook.
11226, 11228. Sam Cameron Brook.
GSC 45432–45439, 46439–46445, 50912. *See* Benson, 1967, pp. 17–20.

2. Cobequid Mountains

USNM 10810. French River Formation. Tatamagouche map-area (11E11 east-half), northwest of Earltown, 6,000 feet on a bearing of 324° from the falls at Earltown, Colchester County.
10813. French River or Doctor's Brook Formation. Browns Brook, one mile southwest of New Canaan, Cumberland County.
10814. French River Formation. West Brook, southeast of New Canaan, Cumberland County.
10822. French River Formation. Tatamagouche map-area (11E11 east-half), Tatamagouche River, 6,800 feet downstream from Ferguson Brook, lat. 45°36′05″N, Colchester County.
10830. Stonehouse Formation. Tatamagouche map-area (11E11 east-half), headwaters of Balmoral Brook, about 5,000 feet from North Earltown crossroads on a bearing of 215°, Colchester County.
10831. Stonehouse Formation. Portapique River, 200 feet downstream from junction of Wilson Brook and Portapique River, Cumberland County.
10839. Formation not known. Tatamagouche map-area (11E11 east-half), 5,100 feet south of bridge at crossroads of Balmoral Mills, lat. 45°38′N, long. 63°11′48″W, Colchester County.

USNM 10840. Formation not known. New Canaan, on West Brook near uppermost road bridge, 60 feet south of volcanic and sediment fault contact, Cumberland County.

11222. Stonehouse Formation. Branch of West Brook extending about 1,400 feet upstream from southwest junction of brooks a mile north of lat. 45°30′N, near long. 64°15′W, Cumberland County.

11273. Stonehouse Formation. Tatamagouche map-area (11E11 east-half), 3,000 feet on bearing of 69° from northeast corner of cemetery at Earltown, Colchester County.

11286. Ross Brook Formation, middle member. Wentworth Station, Cumberland County.

11353. Formation not known. 2.4 miles south of The Falls on highway 11, Colchester County.

GSC 52807. Ross Brook Formation, upper member. Outcrop on road beside the brook 0.86 mile south of the Jackson–Westchester road junction at Collingwood Corner, Cumberland County.

65909. Formation not known. Tatamagouche map-area (11E11 east-half), 5,500–6,000 feet from North Earltown on bearing of 22°, in brook beside highway, Colchester County.

65910. Formation not known. Tatamagouche map-area (11E11 east-half), on brook approximately halfway between Chambers Brook and East Earltown, 3,500 feet downstream from East Earltown towards Balmoral Mills Road, Colchester County.

65913. Stonehouse Formation. Tatamagouche map-area (11E11 east-half), southeast of Spidell Hill along road from Spidell Hill to The Falls, 1,200 feet west of intersection with road to Balmoral Mills, Colchester County.

65919. Formation not known. Lat. 45°33′10″N, long. 63°11′17″W, 9,400 feet due east of Nuttby Mountain, Colchester County.

68836. Stonehouse Formation. Portapique River, 1,800 feet upstream from confluence of Portapique River and Wilson Brook, Cumberland County.

68837. Stonehouse Formation. Portapique River, 500 feet upstream from confluence of Portapique River and Wilson Brook, Cumberland County.

68838. Stonehouse Formation. Portapique River, 1,700 feet upstream from confluence of Portapique River and Wilson Brook, Cumberland County.

68839. 68840. Stonehouse Formation. Portapique River, 1,300 feet upstream from confluence of Portapique River and Wilson Brook, Cumberland County.

68841. Formation not known. Portapique River, 1,700 feet downstream from confluence of Portapique River and Wilson Brook, Colchester County.

68842. Stonehouse Formation. Portapique River, 1,800 feet upstream from confluence of Portapique River and Wilson Brook, Cumberland County.

68843. Ross Brook Formation. Portapique River, 2,800 feet downstream from confluence of Portapique River and Wilson Brook, Cumberland County.

68845. Stonehouse Formation. Bass River, 4,300 feet upstream from lat. 45°30′N, Colchester County.

68846. Stonehouse Formation. Bass River, 900 feet downstream from lat. 45°30′N and 40 to 50 feet upstream from small tributary from the east, Colchester County.

GSC 68847. Stonehouse Formation. Bass River, 850 feet downstream from lat. 45°30′N and 90 to 100 feet upstream from small tributary from the east, Colchester County.

68848. Stonehouse Formation. Bass River, 800 feet downstream from lat. 45°30′N and 140 to 150 feet upstream from small tributary from the east, Colchester County.

68849. Ross Brook Formation, upper member. Whetstone Brook near Wentworth Station, approximately 700 feet downstream from railway, Cumberland County.

68850. Stonehouse Formation. Branch of Wilson Brook from northwest, approximately 3,200 feet upstream from Wilson Brook, Colchester County.

3. Arisaig, Lochaber, and Cape George areas, Antigonish County (for USNM localities, *see* Boucot *et al.* (in press) and GSC open files).

4. Arisaig area, Twenhofel, 1909 (topographic nomenclature follows Boucot *et al.*, in press).

Stonehouse Formation

20a. Outcrops along shore at Arisaig just northeast of the mouth of McEachern Brook to a point 80 feet northeast of brook.

21d. Part of Arisaig shore section 400 to 600 feet southwest of the mouth of Stonehouse Brook, in first cove northeast of McEachern Brook.

71. Part of Arisaig shore section 350 to 500 feet northeast of the mouth of Stonehouse Brook.

73. Part of Arisaig shore section 350 to 500 feet northeast of mouth of Stonehouse Brook, farther from Stonehouse Brook than loc. 71.

76. 8′10″-bed in Arisaig shore section about 250 feet stratigraphically above the Stonehouse–Moydart contact, less than 750 feet southwest of the contact (probably about 500 feet southwest).

Moydart Formation, lower member

87. Section along shore at Arisaig beginning at the top of the cliff at the west bank of the mouth of McDonalds Brook, and extending southwestward along the shore less than 100 feet to the west end of the cove at the mouth of McDonalds Brook. Thickness 28½ feet.

89. Five-foot bed in Arisaig shore section about 50 to 200 feet northeast along shore from mouth of McDonalds Brook.

97, 98. Arisaig shore section between McDonalds Brook and Moydart Point.

McAdam Brook Formation, lower member

119, 120. Shore section southwest of McAdam Brook and between 450 to 800 feet southwest of the mouth of McAdam Brook.

Doctor's Brook Formation

136. Arisaig shore section about 500 feet northeast of the mouth of McAdam Brook.

146a. Arisaig shore section roughly 1,500 to 2,000 feet northeast of the mouth of McAdam Brook.

157. Northeastern end of section of formation along shore at Arisaig, near major fault which brings Doctor's Brook Formation and Ross Brook Formation in contact along the shore.

Ross Brook Formation

169a (upper member). Arisaig shore section, lowermost 10 feet of the section at base of cliff at the mouth of Smith Brook.

181b (middle member). Flat-lying beds in part of Arisaig shore section between point about 100 feet and point about 600 feet southwest of the mouth of Arisaig Brook.

184b, c (middle member). Arisaig shore section in cliff at the mouth of Arisaig Brook.

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PLATE I

Figures 1–5. *Dolerorthis* sp. (Page 13)

Figures 1a–d, 3, 5, Glencoe Brook Formation, Pictou County, loc. USNM 11262; figures 2, 4a–b, Beechhill Cove Formation, Arisaig area, loc. USNM 10117.

1a, b. Mould and rubber impression of interior of brachial valve (x1). GSC No. 19123.

1c, d. Mould and rubber impression of exterior of brachial valve, counterpart of specimen in 1a (x1). GSC No. 19124.

2, 3. Moulds of interiors of pedicle valves (x1). GSC Nos. 19125, 19126.

4a, b. Mould and rubber impression of interior of brachial valve (x1½). GSC No. 19127.

5. Mould of interior of pedicle valve (x1). GSC No. 19128.

Figures 6, 7. *Ptychopleurella*? sp. (Page 14)

Beechhill Cove Formation, Arisaig area, loc. USNM 10117.

6a, b. Mould of interior and exterior counterpart of pedicle valve (x2). GSC Nos. 19129, 19130.

7. Mould of interior of brachial valve (x2). GSC No. 19131.

Figures 8–17. *Dalmanella*? *primitiva* McLearn, 1924 (Page 15)

Beechhill Cove Formation, Arisaig area, loc. USNM 10116.

8a–c. Mould, and top and interior views of rubber impression of interior of brachial valve (x4). GSC No. 19132.

9a, b. Mould and rubber impression of interior of brachial valve (x4). GSC No. 19133.

10. Mould of interior of brachial valve (x5). GSC No. 19134.

11 a, b. Mould and rubber impression of interior of brachial valve (x4). GSC No. 19135.

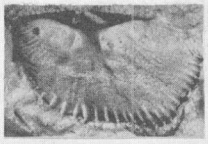
12 a, b. Rubber impression and posterior and top views (x4). GSC No. 19136.

13. Mould of interior of brachial valve (x4). GSC No. 19137.

14. Mould of exterior of pedicle valve (x4). GSC No. 19138.

15, 16. Mould of exteriors of brachial valve (x4). GSC Nos. 19139, 19140.

17. Mould of interior of pedicle valve (x4). GSC No. 19141.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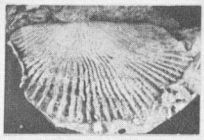
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4a


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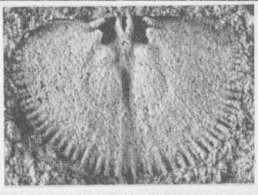
6a


6b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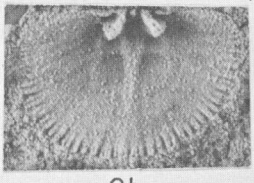
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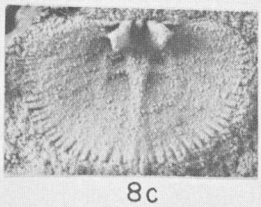
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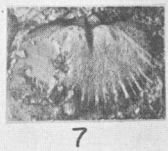
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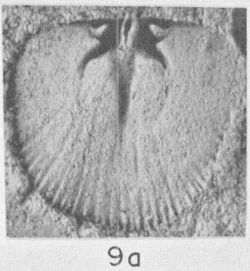
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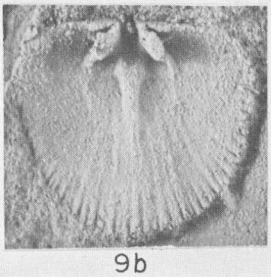
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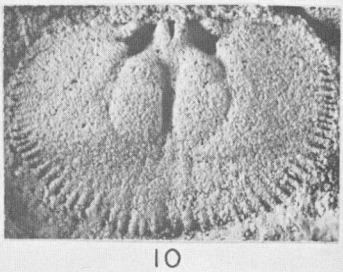
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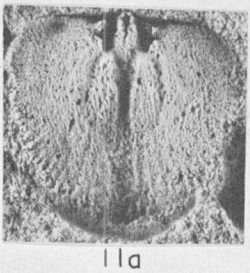
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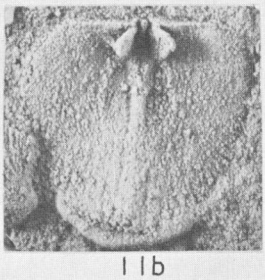
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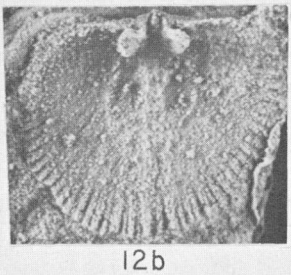
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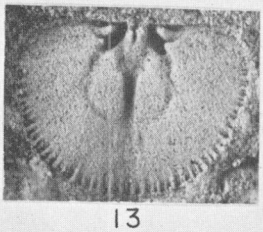
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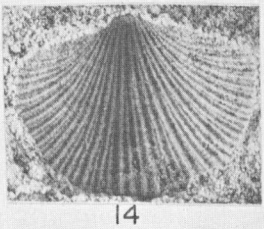
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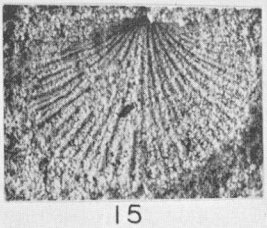
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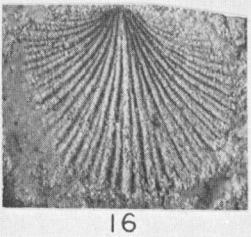
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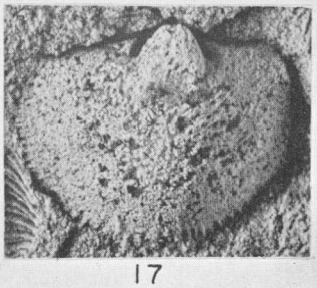
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PLATE II

Figures 1a, b. *Dalmanella*? *primitiva* McLearn, 1924 (Page 15)

Beechhill Cove Formation, Arisaig area, loc. USNM 10116.

Mould and rubber impression of interior of pedicle valve (x4). GSC No. 19142.

Figures 2–11. *Dalmanella* sp. A (Page 16)

Beechhill Cove Formation, Arisaig area, loc. USNM 10115.

2, 6. Mould and rubber impression of exterior of pedicle valve (x4, x2). GSC No. 19143.

3a, b. Mould and rubber impression of exterior of brachial valve (x2). GSC No. 19144.

4a, b. Mould and rubber impression of interior of pedicle valve (x4). GSC No. 19145.

5, 7, 8. Moulds of interiors of pedicle valves (x3, x3, x4). GSC Nos. 19146–19148.

9, 10. Moulds of interiors of brachial valves (x4). GSC Nos. 19149, 19150.

11a–c. Mould and rubber impression, top and interior views of interior of brachial valve (x3). GSC No. 19151.

Figure 12. *Dalmanella*? sp. (Page 17)

Beechhill Cove Formation, Arisaig area, loc. USNM 10115. Mould of interior of pedicle valve (x3). GSC No. 19152.

Figures 13–18. *Dalmanella* sp. B (Page 17)

Glencoe Brook Formation, Pictou County. Figures 13a, b, 16a, b, 17, loc. USNM 11264; figures 14a, b, 18a, b, loc. USNM 11265; figure 15, loc. USNM 11268.

13a, b. Mould and rubber impression of interior of pedicle valve (x2). GSC No. 19153.

14a, b. Mould and rubber impression of exterior of pedicle valve (x2). GSC No. 19154.

15. Mould of interior of brachial valve (x2). GSC No. 19155.

16a, b. Mould and rubber impression of interior of brachial valve (x2). GSC No. 19156.

17. Mould of interior of brachial valve (x2). GSC No. 19157.

18a, b. Mould and rubber impression of exterior of brachial valve (x2). GSC No. 19158.

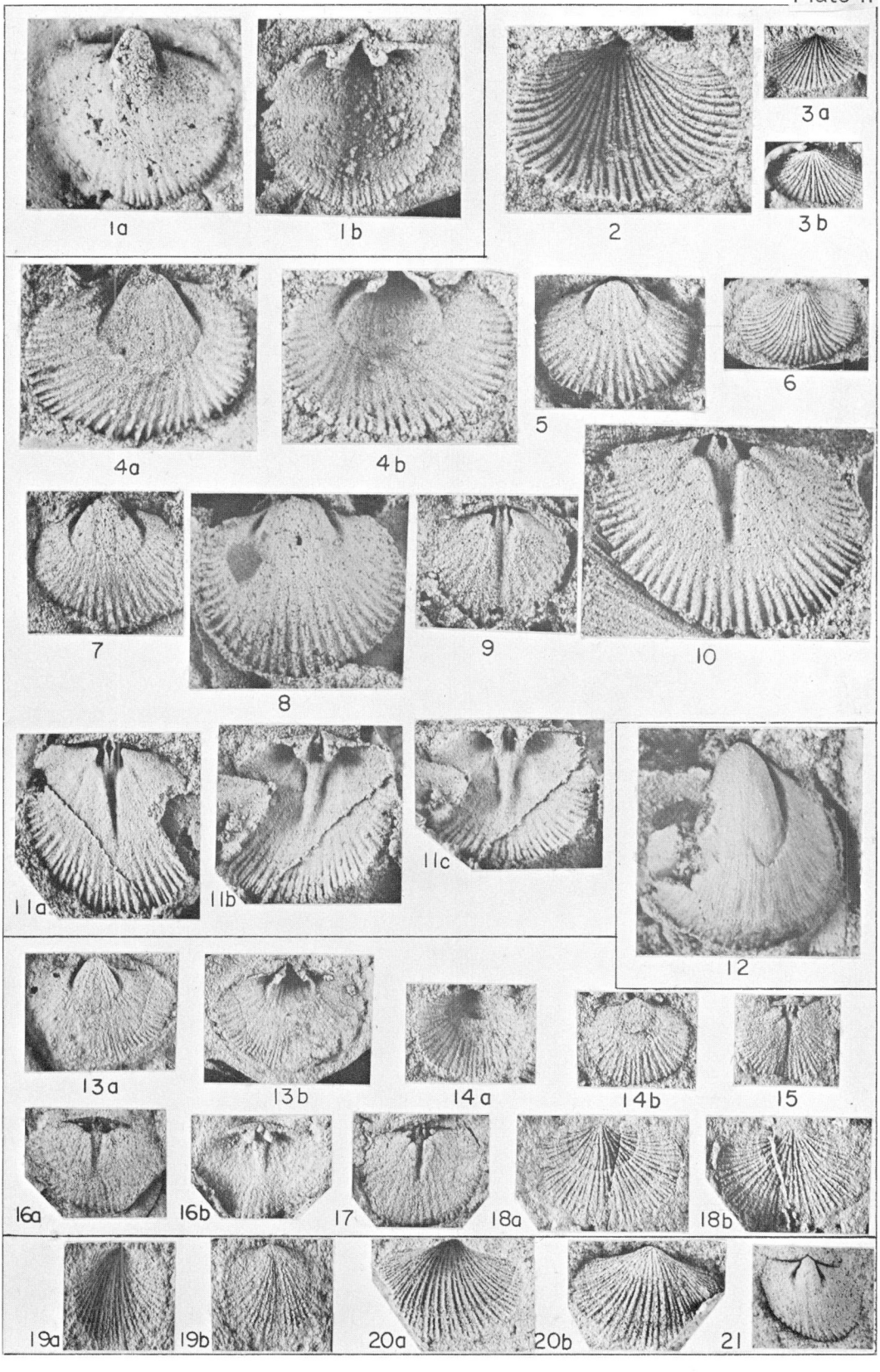
Figures 19–21. *Fascifera* sp. (Page 29)

Glencoe Brook Formation, Pictou County, loc. USNM 11255.

19a, b. Mould and rubber impression of exterior of brachial valve (x2). GSC No. 19159.

20a, b. Mould and rubber impression of exterior of pedicle valve (x2). GSC No. 19160.

21. Mould of interior of pedicle valve (x2). GSC No. 19161.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20b
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Plate III

Figures 1–5, 10. *Fascifera* sp. (Page 29)

Glencoe Brook Formation, Pictou County, loc. USNM 11255.

1a, b. Mould and rubber impression of interior of pedicle valve (x2). GSC No. 19162.

2. Mould of interior of pedicle valve (x2). GSC No. 19163.

3–5. Moulds of interiors of brachial valves (x2). GSC Nos. 19166, 19164, 19167.

10a, b. Mould and rubber impression of interior of brachial valve (x2). GSC No. 19165.

Figures 6–9. *Linoporella* sp. (Page 23)

Beechhill Cove Formation, Arisaig area. Figures 6a, b, 7a, b, 9, loc. USNM 10117; figure 8, loc. USNM 10115.

6a, b. Mould of interior of brachial valve, top and posterior views (x2). GSC No. 19211.

7a, b. Mould and rubber impression of interior of brachial valve (x2). GSC No. 19213.

8, 9. Moulds of interiors of pedicle valves (x1). GSC Nos. 19215, 19214.

Figures 11–15. *Visbyella nana* (McLearn, 1924) (Page 18)

Figures 11a, b, 12a, b, middle member, Ross Brook Formation, Arisaig shore section, Twenhofel loc. 184b; figure 13, middle member, Ross Brook Formation, Arisaig area, loc. USNM 10124; figures 14a, b, upper member, Ross Brook Formation, Pictou County, loc. USNM 11229; figure 15, Ross Brook Formation, Arisaig shore section (exact locality not known).

11a, b. Ventral and dorsal views (x3). Holotype, Peabody Museum No. 424.

12a, b. Ventral and dorsal views (x3) of steinkern. Paratype, Peabody Museum No. 425.

13. Rubber impression of interior of brachial valve (x4). GSC No. 19172.

14a, b. Mould and rubber impression of interior of pedicle valve (x4). GSC No. 19173.

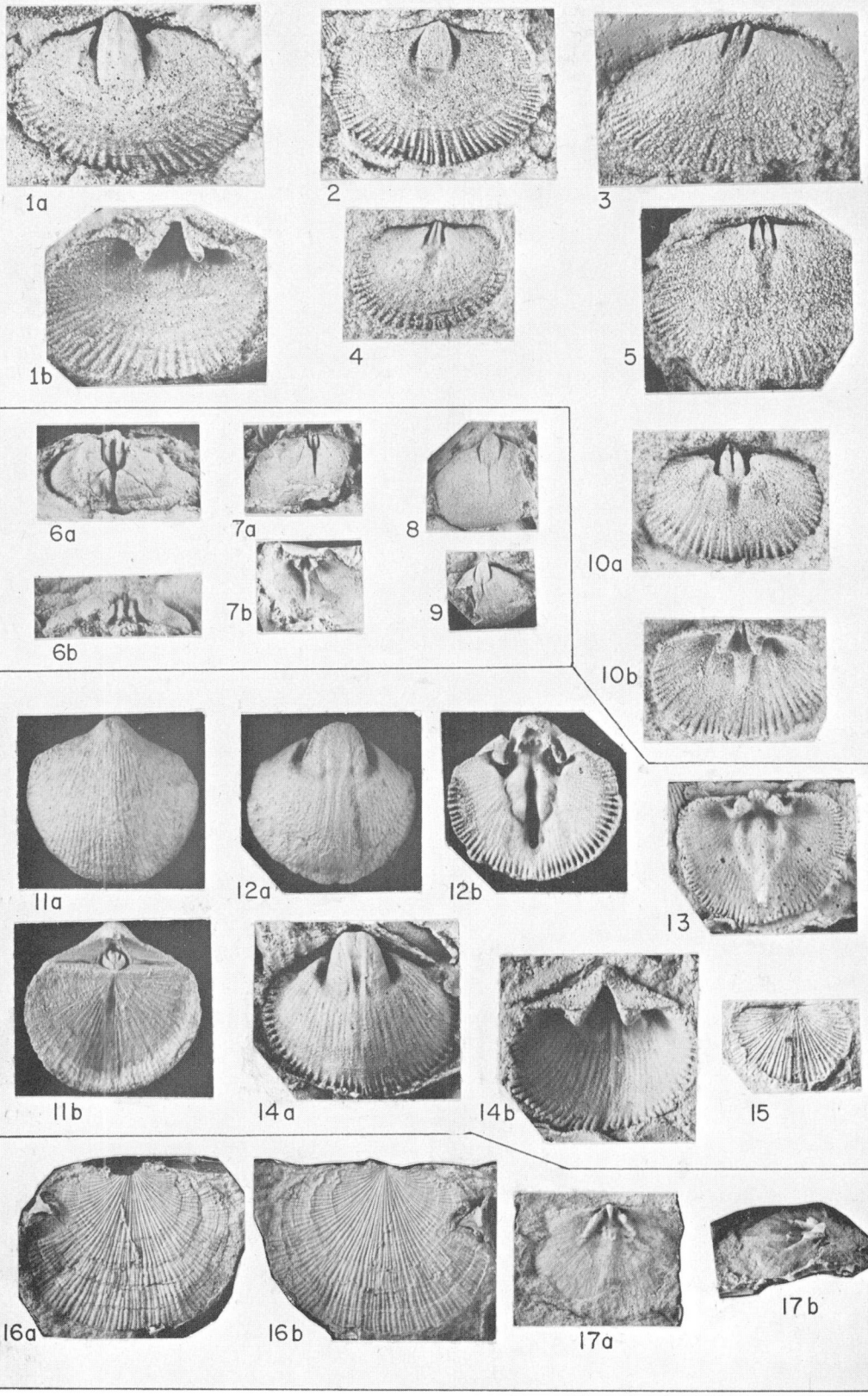
15. Mould of exterior of brachial valve (x2). GSC No. 6207 (paratype *D. conservatrix*).

Figures 16, 17. *Heterorthella maehli* (Harper, Boucot, and Walmsley, 1969) (Page 26)

French River Formation, Pictou County, loc. USNM 10847.

16a, b. Rubber impression and mould of exterior of brachial valve (x1½). GSC No. 19228.

17a, b. Rubber impressions of interior of a brachial valve (mould not figured) and side view (x1½). GSC No. 19225.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17b

PLATE IV

Figures 1a, b. *Visbyella nana* (McLearn, 1924) (Page 18)

Middle member, Ross Brook Formation, Arisaig area, loc. USNM 10124. Mould and rubber impression of interior of brachial valve (x4). GSC No. 19174.

Figures 2–9. *Resserella* cf. *R. concavoconvexa* (Twenhofel, 1928) (Page 19)

Figures 2a, b, 5a, b, 6, 7a, b, 9a, b, French River Formation, Cobequid Mountains, loc. USNM 10814; figures 3a–c, 4, French River Formation, Pictou County, loc. USNM 11217; figure 8, French River Formation, Arisaig area, loc. USNM 10155.

2a, b. Mould and rubber impression of exterior of pedicle valve (x3). GSC No. 19175.

3a–c. Mould and rubber impressions of interior of pedicle valve (x3). GSC No. 19176.

4. Mould of interior of pedicle valve (x3). GSC No. 19177.

5a, b. Mould and rubber impression of exterior of brachial valve (x3). GSC No. 19178.

6. Mould of interior of pedicle valve (x3). GSC No. 19179.

7a, b. Mould and rubber impression of interior of brachial valve (x3). GSC No. 19180.

8. Mould of interior of brachial valve (x2). GSC No. 19181.

9a, b. Mould and rubber impression of interior of brachial valve (x3). GSC No. 19182.

Figures 10–17. *Mendacella arisaigensis* (McLearn, 1924) (Page 24)

Beechhill Cove Formation. Figures 10, 11, 16a, b, Arisaig area, loc. USNM 10115; figure 12, Arisaig area, loc. USNM 10114; figures 13, 15, Pictou County, loc. USNM 11258; figure 14, Pictou County, loc. USNM 11260; figure 17, Arisaig area, Rory McDonald's Brook (=MacGillivray Brook).

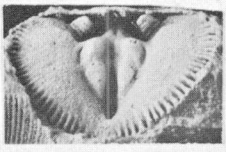
10. Mould of exterior of pedicle valve (x2). GSC No. 19183.

11, 12. Moulds of interiors of pedicle valves (x4, x3). GSC Nos. 19184, 19185.

13–15. Moulds of interiors of pedicle valves (x2). GSC Nos. 19186–19188.

16a, b. Mould and rubber impression of interior of pedicle valve (x2). GSC No. 19189.

17a, b. Mould and rubber impression of interior of pedicle valve (x1½). Holotype, Peabody Museum No. 407.



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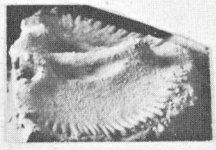

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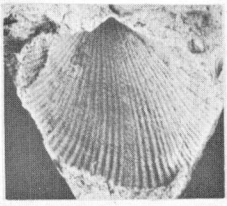

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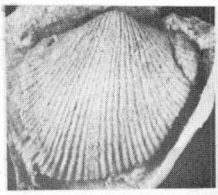

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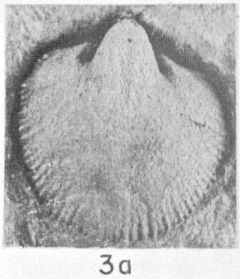

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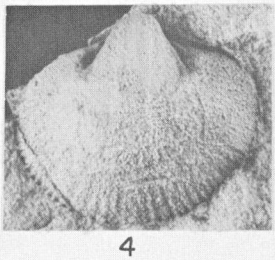

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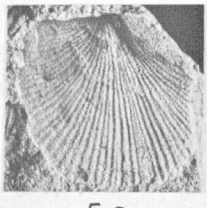

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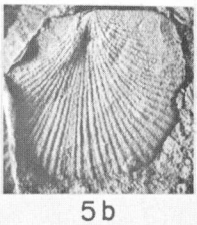

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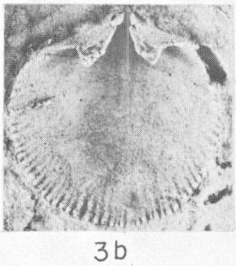

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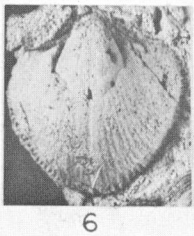

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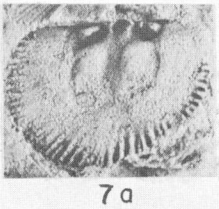

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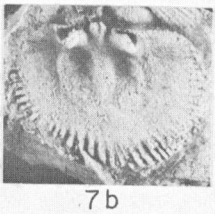

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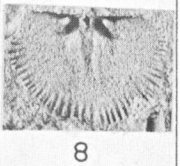

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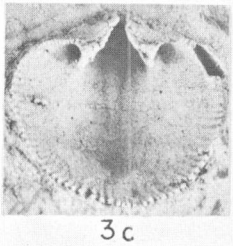

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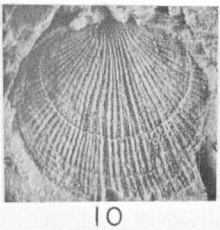

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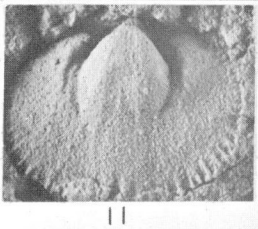

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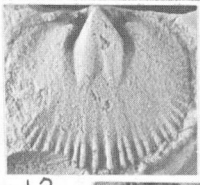

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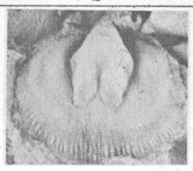

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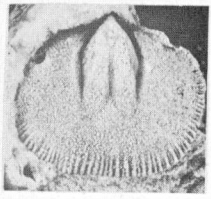

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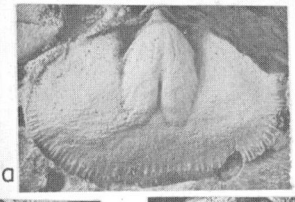

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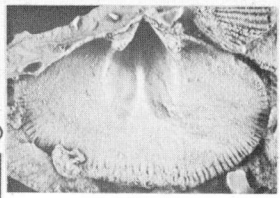

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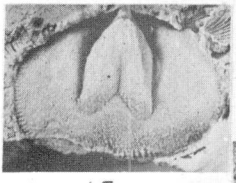

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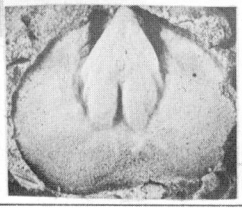

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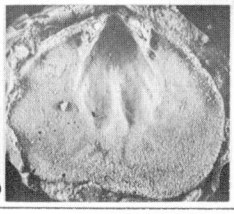

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PLATE V

Figures 1–8. *Mendacella arisaigensis* (McLearn, 1924). (Page 24)

Beechhill Cove Formation. Figures 1, 2, 4, Pictou County, loc. USNM 11258; figures 3, 8a, b, Pictou County, loc. USNM 11260; figures 5a, b, Arisaig area, loc. USNM 10115; figures 6a, b, Arisaig area, loc. USNM 10114; figure 7, Arisaig shore section.

1, 2. Moulds of interiors of pedicle valves (x2). GSC Nos. 19190, 19191.

3, 4. Moulds of interiors of brachial valves (x5, x4). GSC Nos. 19192, 19193.

5a, b. Mould and rubber impression of interior of brachial valve (x3). GSC No. 19194.

6a, b. Mould and rubber impression of interior of brachial valve (x1½). GSC No. 19195.

7. Mould of interior of brachial valve (x1½). Paratype, GSC No. 5412.

8a, b. Mould and rubber impression of interior of brachial valve (x1½). GSC No. 19196.

Figures 9, 10. *Dalejina* sp. (Page 25)

French River Formation. Figures 9a, b, Pictou County, loc. USNM 11220; figures 10a, b, Arisaig area, loc. USNM 10158.

9a, b. Mould and rubber impression of interior of pedicle valve (x3). GSC No. 19197.

10a, b. Mould and rubber impression of interior of brachial valve (x1). GSC No. 19198.

Figures 11–13. *Idiorthis matura* McLearn, 1924 (Page 28)

Doctor's Brook Formation, Arisaig shore section, Twenhofel loc. 146a.

11a–c. Ventral, dorsal, and side views (x1½) of holotype, Peabody Museum No. 23686 (old number 426).

12a, b. Ventral and dorsal views of steinkern (x1½). Paratype, Peabody Museum No. 23688 (old number 426c).

13a, b. Ventral and dorsal views of steinkern (x1½). Paratype, Peabody Museum No. 23687 (old number 426b).

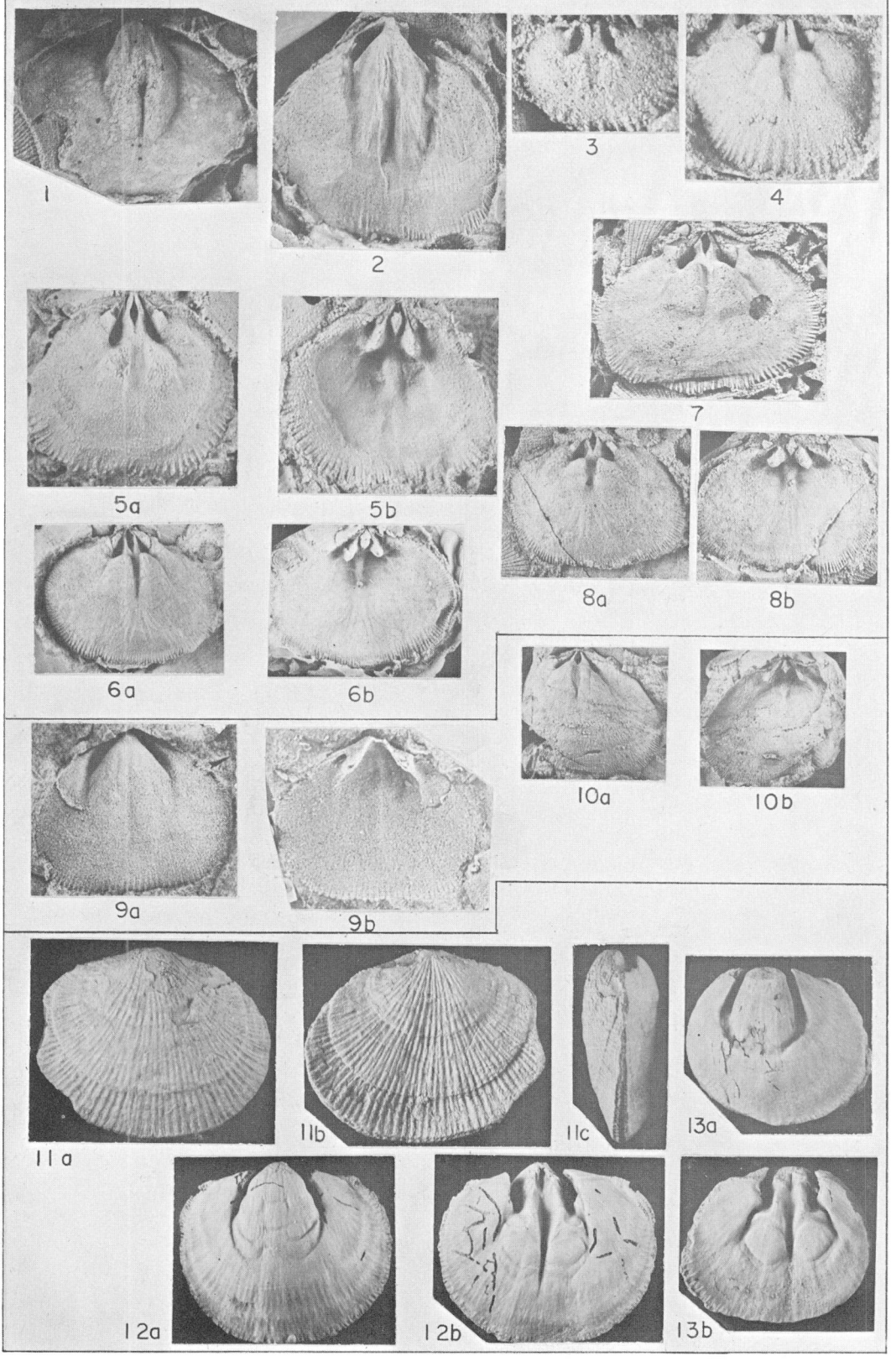
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PLATE VI

Figures 1a–3b. *Idiorthis matura* McLearn, 1924 (Page 28)

Doctor's Brook Formation, Arisaig area, loc. USNM 10164. Moulds and rubber impressions of interiors of brachial valves (x1½). GSC Nos. 19199–19201.

Figures 4–9. *Marklandella macadamica* Harper, Boucot, and Walmsley, 1969 (Page 27)

Figures 4, 5, Doctor's Brook Formation, Arisaig area, loc. USNM 10164; figures 6–9, French River or Doctor's Brook Formation, Pictou County, loc. USNM 10841.

4a, b, 5a, b. Moulds and rubber impressions of interiors of brachial valves (x1½). GSC Nos. 19203, 19212.

6a. Two moulds of interior of brachial valve (x1½). GSC No. 19206.

6b. Rubber impression of specimen in centre of 6a (x1½).

6c. Rubber impressions of specimens in 6a, posterior view (x1½).

7. Mould of interior of pedicle valve (x1½). GSC No. 19202.

8. Mould of exterior of brachial valve (x1½). GSC No. 19209.

9a, b. Mould and rubber impression of interior of brachial valve (x1½). GSC No. 19210.

Figures 10–18. *Heterorthella maehli* (Harper, Boucot, and Walmsley, 1969) (Page 26)

French River Formation, Pictou County. Figures 10, 14a, b, 15, 16, 18a, b, loc. USNM 10847; figures 11, 13, 17a, b, loc. USNM 10842; figure 12, loc. USNM 10816.

10. Mould of interior of pedicle valve (x2). GSC No. 19216.

11–13. Moulds of interiors of pedicle valves (x1½). GSC Nos. 19217, 19219, 19218.

14a, b. Mould and rubber impression of interior of brachial valve (x1½). GSC No. 19229.

15. Mould of interior of pedicle value (x1½). GSC No. 19222.

16. Rubber impression of mould of interior of pedicle valve (x2). GSC No. 19223.

17a, b. Rubber impression of mould of interior of pedicle valve, posterior and top views (x1½). GSC No. 19226.

18a, b. Mould and rubber impression of exterior of brachial valve (x1½). GSC No. 19227.

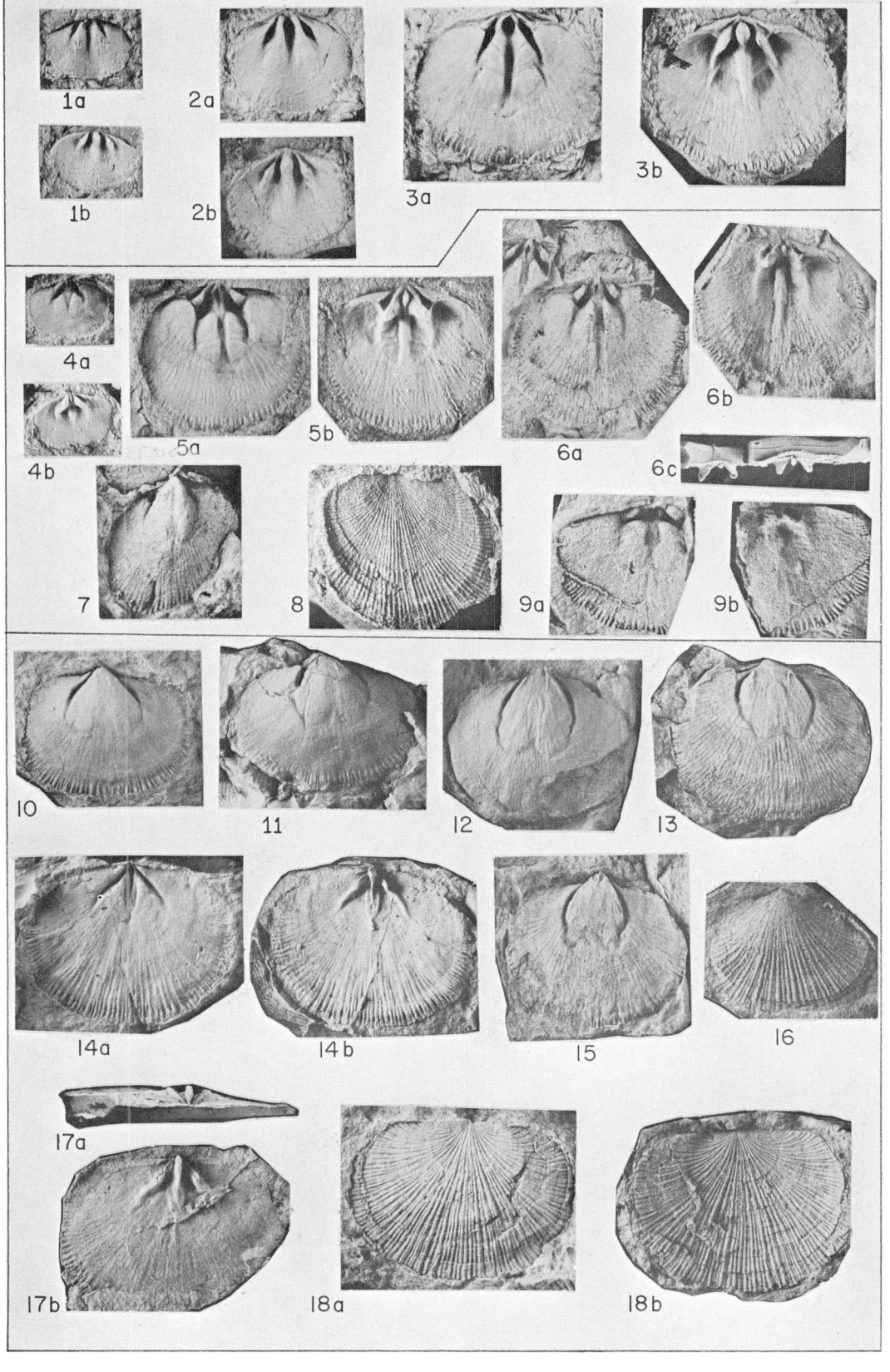
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PLATE VII

Figures 1–7. *Isorthis* (*Isorthis*) *macadamensis* n. sp. (Page 21)

French River Formation, Pictou County. Figures 1, 2, 4, 5, 7, loc. USNM 11220; figures 3, 6, loc. USNM 10815.

1a. Mould of interior of brachial valve (x3). Paratype, GSC No. 19244.

1b–d. Rubber impression of specimen in fig. 1a, top, anterior and posterior views (x3).

2a, b. Mould and rubber impression of interior of brachial valve (x3). Paratype, GSC No. 19248.

3a. Mould of interior of brachial valve (x3). Paratype, GSC No. 19249.

3b, c. Rubber impression of specimen in 3a, anterior and posterior views (x3).

4a, b. Mould of interior of pedicle valve, top and side views (x3). Paratype, GSC No. 19251.

5a. Mould of interior of pedicle valve (x3). Holotype, GSC No. 19250.

5b, c. Rubber impression of specimen in 5a, top and anterior views (x3).

6. Mould of interior of pedicle valve (x3). Paratype, GSC No. 19253.

7. Rubber impression of mould of exterior of brachial valve (x2½). Paratype, GSC No. 19245.

Figures 8–19. *Isorthis* (*Protocortezorthis*) *fornicatimcurvata* (Fuchs, 1919). (Page 22)

Figures 8, 10, 13–16, Stonehouse Formation, Arisaig shore section (exact locality not known); figures 9, 11, 18, Stonehouse Formation, Arisaig area, loc. USNM 10203; figures 12, 17, 19, Stonehouse Formation, Arisaig area, loc. USNM 10185.

8. Mould of interior of brachial valve (x1). GSC No. 19261.

9a, b. Mould and rubber impression of interior of brachial valve (x2). GSC No. 19257.

10. Mould of exterior of brachial valve (x2). GSC No. 19269.

11. Mould of interior of brachial valve (x2). GSC No. 19258.

12. Mould of interior of brachial valve (x3). GSC No. 19260.

13. Mould of exterior of pedicle valve (x2). GSC No. 19268.

14. Mould of interior of pedicle valve (x2). GSC No. 19264.

15a, b. Mould and rubber impression of interior of brachial valve (x2). GSC No. 19254.

16. Rubber impression of mould of exterior of brachial valve (x2). GSC No. 19270.

17–19. Moulds of interiors of pedicle valves (x3). GSC Nos. 19267, 19265, 19266.

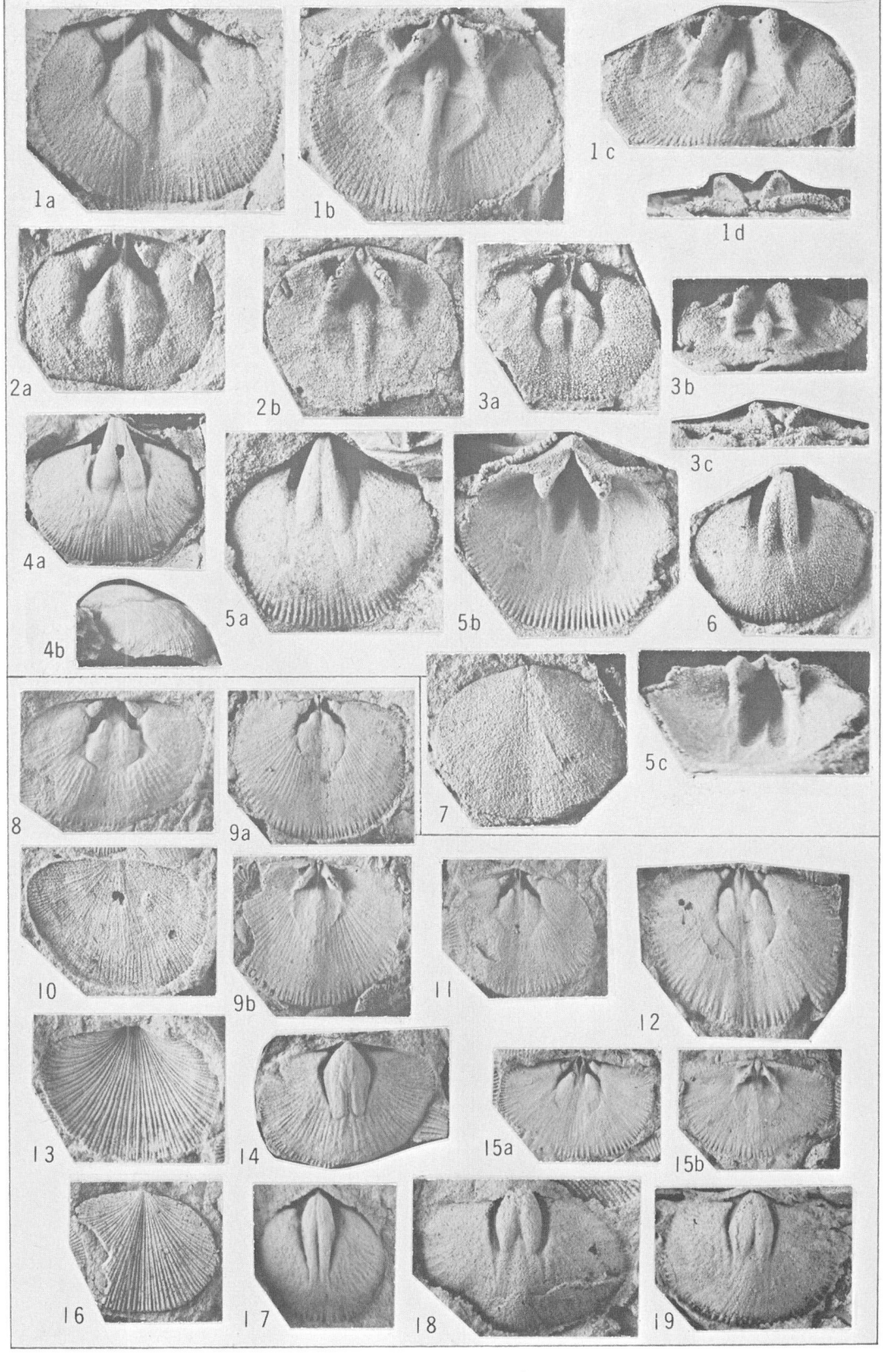
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Plate VIII

Figures 1–14, 24, 25. *Salopina submedia* (McLearn, 1924) (Page 30)

Figures 1, 2, 11–14, 24, 25, Stonehouse Formation, Arisaig shore section (exact locality not known); figures 3–5, French River Formation, Pictou County, loc. USNM 10847; figures 6, 8, 10, French River Formation, Pictou County, loc. USNM 10842; figure 7, Doctor's Brook Formation, Twenhofel loc. 136, about 500 feet northeast of the mouth of McAdam Brook along shore, Arisaig area; figure 9, McAdam Brook Formation, McAdam Brook, Arisaig area (exact locality not known).

1–3, 5. Moulds of interiors of pedicle valves (x3). GSC Nos. 19286, 19282, 19272, 19271.

4. Mould of interior of brachial valve (x3). GSC No. 19274.

6. Mould of interior of pedicle valve (x2). GSC No. 19273.

7. Mould of exterior of pedicle valve, partially abraded to show trace of dental plates (x3). Holotype, *Dalmanella elegantula transversaria* McLearn (1924, pl. 3, fig. 9), Peabody Museum No. 423.

8. Mould of interior of brachial valve (x2). GSC No. 19276.

9. Mould of interior of brachial valve (x3). Holotype *Dalmanella elegantula submedia* McLearn (1924, pl. 3, fig. 3), GSC No. 6208.

10. Mould of interior of brachial valve (x3). GSC No. 19275.

11, 12. Moulds of interiors of brachial valves (x2). GSC Nos. 19285, 19289.

13. Mould of exterior of brachial valve (x3). GSC No. 19288.

14, 25. Rubber impressions of moulds of interiors of brachial valves (x2½, x3). GSC Nos. 19293, 19294.

24. Mould of exterior of brachial valve (x2½). GSC No. 19295.

Figures 15–19, 23. *Salopina missendensis* (Straw, 1933) (Page 32)

Stonehouse Formation, Arisaig area. Figures 15, 18, 19, 23, loc. USNM 10206; figures 16, 17, loc. USNM 10205.

15a, b. Mould and rubber impression of exterior of brachial valve (x4). GSC No. 19303.

16. Mould of exterior of pedicle valve (x4). GSC No. 19305.

17. Mould of interior of pedicle valve (x4). GSC No. 19300.

18a, b. Rubber impression of mould of interior of brachial valve, top and anterior views (x4). GSC No. 19302.

19, 23. Moulds of interiors of brachial valves (x3, x4). GSC Nos. 19301, 19299.

Figures 20–22. *Salopina conservatrix* (McLearn, 1924) (Page 30)

Figures 20, 21, upper member, Ross Brook Formation, Pictou County, loc. USNM 10832; figure 22, Ross Brook Formation, Arisaig shore section (exact locality not known).

20a. Mould of interior of brachial valve (x4). GSC No. 19315.

20b, c. Rubber impression of specimen in 20a, anterior and posterior views (x4).

21a, b. Rubber impression and mould of interior of pedicle valve (x4). GSC No. 19309.

22. Mould of interior of pedicle valve (x2). Paratype, GSC No. 6206.

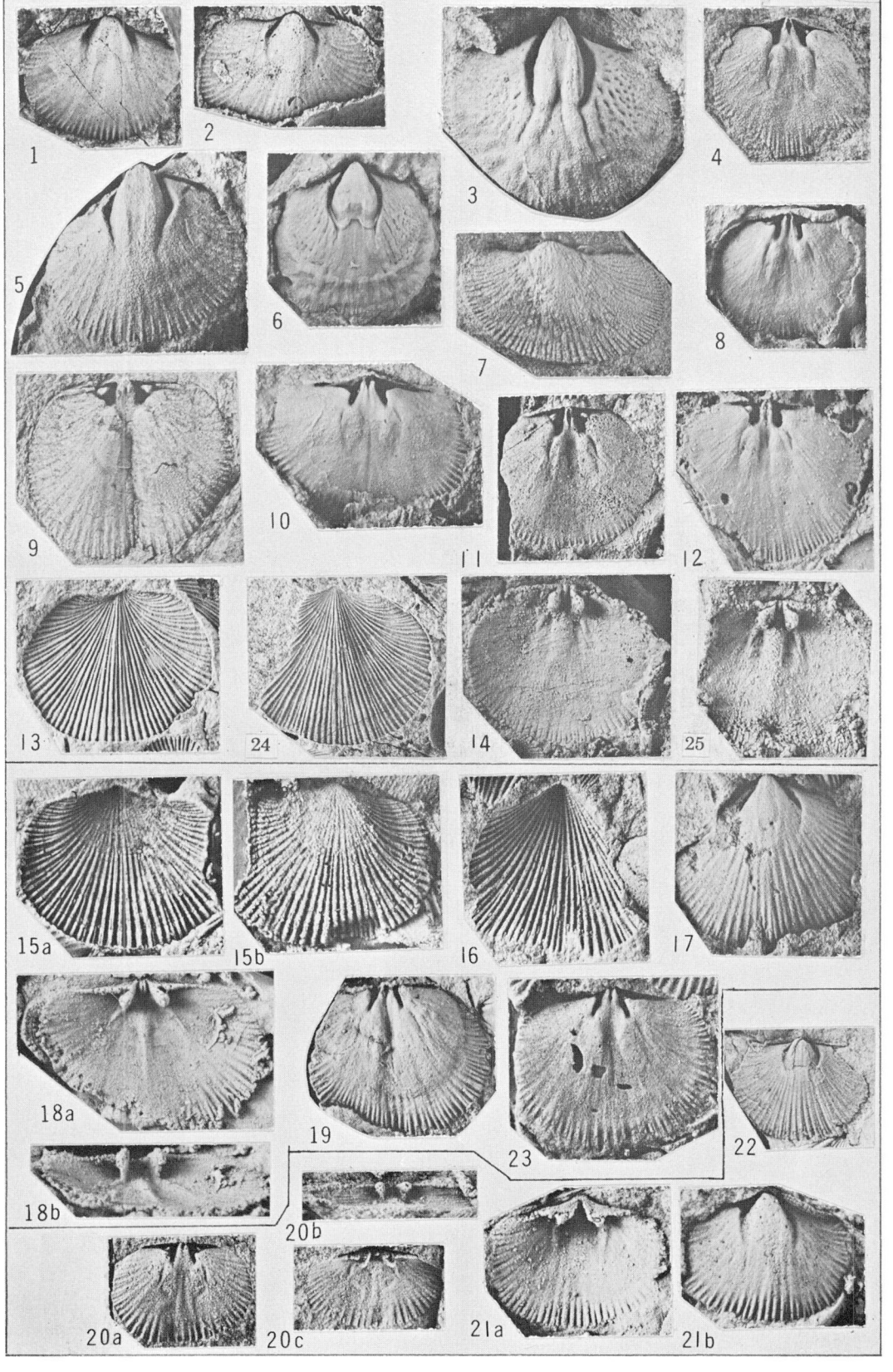
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PLATE IX

Figures 1–3. *Salopina conservatrix* (McLearn, 1924) (Page 30)

Upper member, Ross Brook Formation. Figure 1, Pictou County, loc. USNM 10832; figures 2, 3, Arisaig area, loc. USNM 10127.

1a. Mould of interior of brachial value (x4). GSC No. 19308.

1b–d. Rubber impression of specimen in 1a, top, posterior, and anterior views (x4).

2. Mould of interior of brachial valve (x4). GSC No. 19316.

3a, b. Mould and rubber impression of exterior of brachial valve (x4). GSC No. 19317.

Figures 4–9. *Hirnantia*? sp. (Page 33)

Stonehouse Formation, Pictou County. Figures 4–6, loc. GSC 45432; figures 7–9, USNM 10848.

4. Mould of interior of pedicle valve (x1½). GSC No. 19231.

5. Mould of interior of brachial valve (x1½). GSC No. 19234.

6a, b. Mould and rubber impression of interior of brachial valve (x1½). GSC No. 19235.

7a, b. Mould and rubber impression of exterior of brachial valve (x1½). GSC No. 19232.

8. Mould of interior of pedicle valve (x1½). GSC No. 19230.

9. Mould of interior of brachial valve (x1½). GSC No. 19233.

Figures 10–13. *Schizophoria* sp. (Page 33)

Stonehouse Formation, Arisaig area, loc. USNM 10187.

10a, b. Mould and rubber impression of interior of brachial valve (x3, x2). GSC No. 19236.

11, 12. Moulds of interiors of brachial valves (x3). GSC Nos. 19237, 19238.

13. Mould of exterior of brachial valve (x2). GSC No. 19239.

Figures 14–17. *Isorthis* sp. A (Page 20)

Beechhill Cove Formation, Arisaig area, loc. USNM 10115.

14a. Mould of interior of brachial valve (x5). GSC No. 19240.

14b–d. Rubber impression of specimen in 14a, top, anterior, and posterior views (x5).

15, 17. Moulds of interiors of pedicle valves (x5). GSC Nos. 19242, 19243.

16a, b. Mould and rubber impression of exterior of brachial valve (x2). GSC No. 19241.

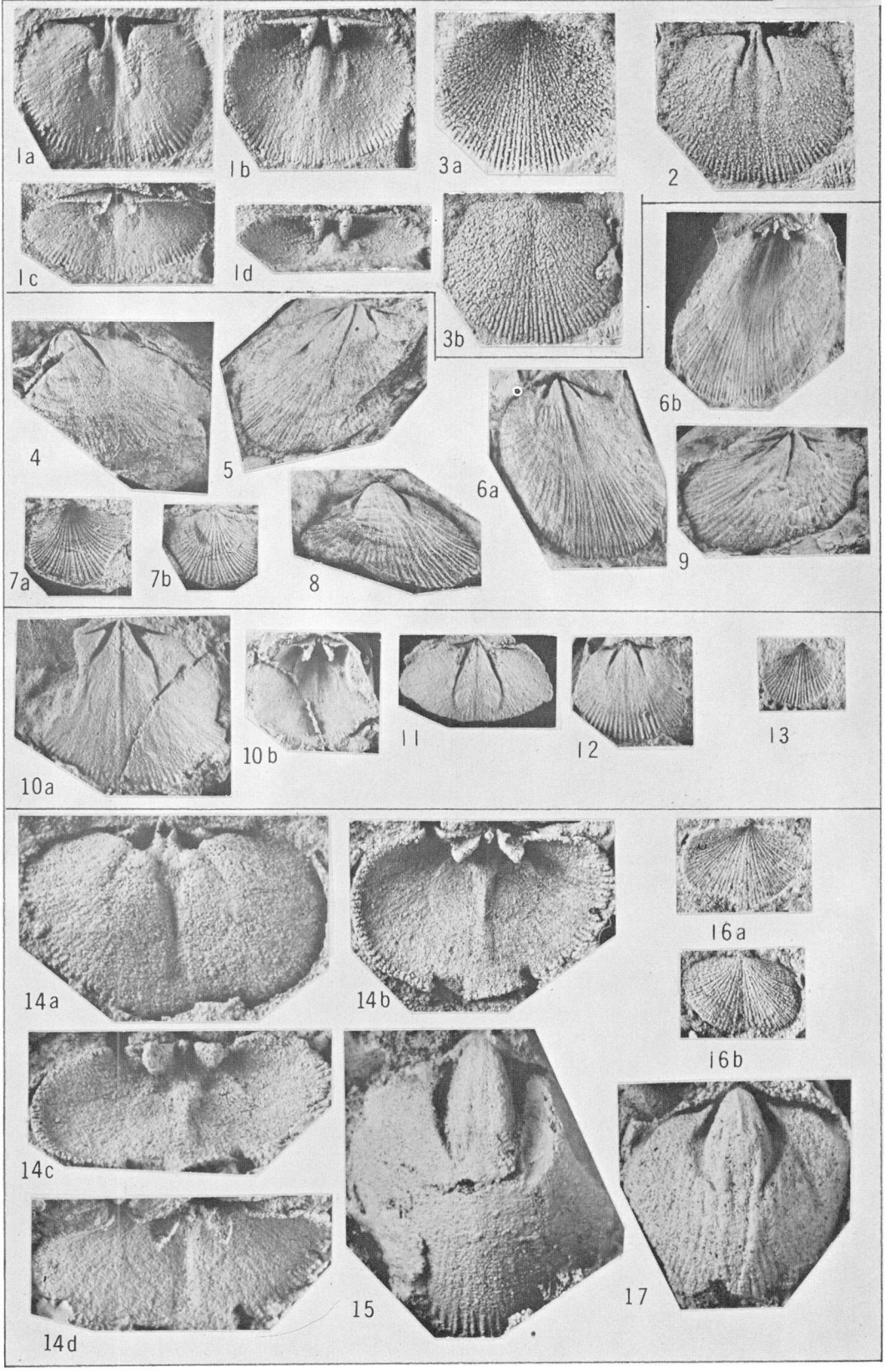
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PLATE X

Figures 1–6. *Leptostrophia beechhillensis* (McLearn, 1924) (Page 35)

Beechhill Cove Formation. Figures 1, 3, 5, Arisaig area, loc. USNM 10115; figures 2, 4, Pictou County, loc. USNM 11260; figure 6, Arisaig shore section (exact locality not known).

1a, b. Mould and rubber impression of interior of pedicle valve (x1½, x1). GSC No. 19321.

1c, d. Mould and rubber impression of exterior of pedicle valve (x1½, x1), counterpart of specimen in 1a. GSC No. 19322.

2–4. Moulds of interiors of pedicle valves (x2). GSC Nos. 19323–19325.

5a, b. Mould and rubber impression of interior of brachial valve (x2). GSC No. 19326.

6. Mould of exterior of brachial valve (x2). Holotype, GSC No. 5416.

Figures 7–11. *Leptostrophia* sp. (Page 36)

Figures 7a, b, French River Formation, Pictou County, loc. USNM 10816; figures 8, 9, Doctor's Brook Formation, Arisaig area, loc. USNM 10909; figures 10, 11, Doctor's Brook Formation, Arisaig area, loc. USNM 10164.

7a, b. Mould and rubber impression of interior of pedicle valve (x1½). GSC No. 19327.

8a, b. Mould and rubber impression of interior of pedicle valve (x2). GSC No. 19616.

9, 10. Moulds of interiors of pedicle valves (x2). GSC Nos. 19617, 19618.

11. Mould of exterior of pedicle valve (x2), counterpart of specimen in 10. GSC No. 19619.

Figures 12–17. *Amphistrophia* cf. *A. striata* (Hall, 1843) (Page 37)

French River Formation, Pictou County. Figures 12, 16, 17, loc. USNM 10815; figures 13–15, loc. USNM 10821.

12, 13. Moulds of exteriors of pedicle valves (x2). GSC Nos. 19328, 19620.

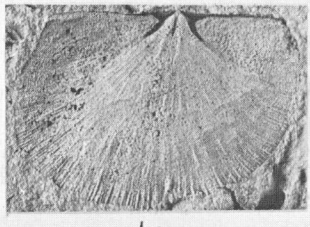
14. Mould of interior of pedicle valve (x2), counterpart of specimen in 13. GSC No. 19621.

15. Rubber impression of interior of pedicle valve (x2). GSC No. 19622.

16. Mould of interior of brachial valve (x2). GSC No. 19330.

17. Mould of interior of pedicle valve (x2). GSC No. 19329.

Plate X



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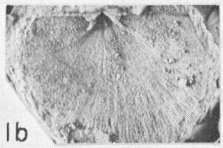

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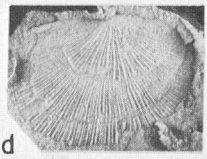

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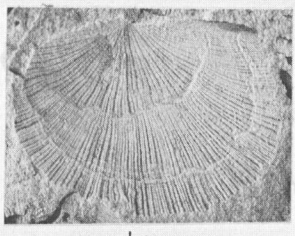

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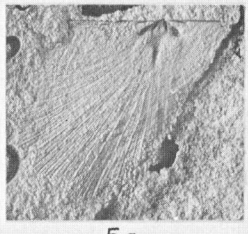

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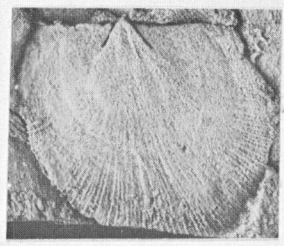

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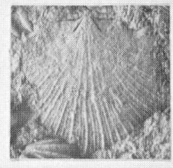

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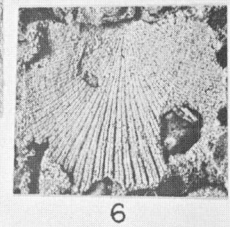

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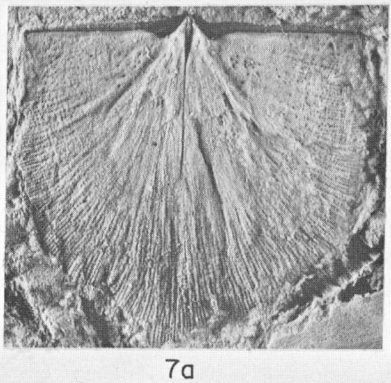

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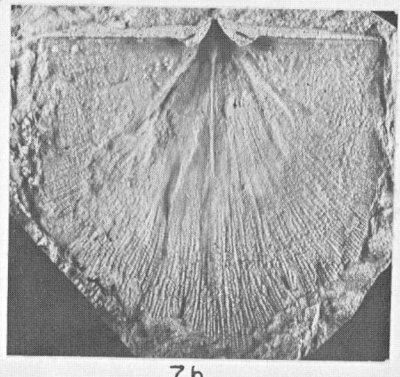

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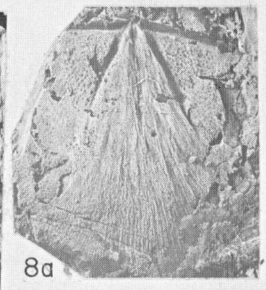

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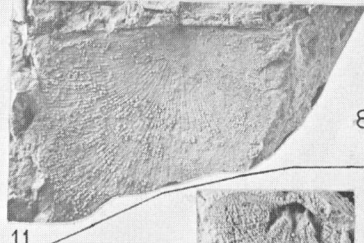

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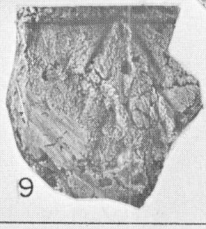

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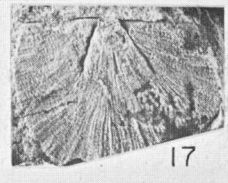

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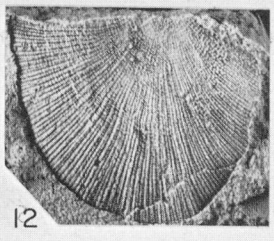

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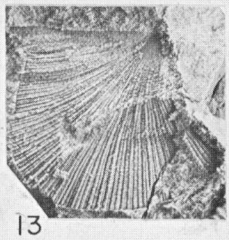

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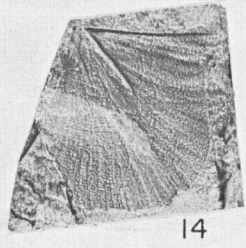

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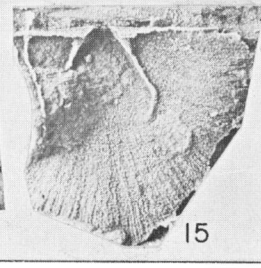

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PLATE XI

Figures 1–7. *Amphistrophia* aff. *prolongata* (Foerste, 1903). (Page 36)

Figures 1, 4, 5, 7, French River Formation, Pictou County, loc. USNM 10811; figures 2, 3, French River or Doctor's Brook Formation, Pictou County, loc. USNM 11211; figure 6, French River or Doctor's Brook Formation, Pictou County, loc. USNM 10841.

1a, b, 2a, b. Moulds and rubber impressions of interiors of pedicle valves (x1½). GSC Nos. 19331, 19332.

3a, b. Mould and rubber impression of exterior of pedicle valve (x1½). GSC No. 19333.

4. Mould of exterior of pedicle valve (x1½). GSC No. 19334.

5. Mould of interior of pedicle valve (x1½). GSC No. 19335.

6a, b. Mould and rubber impression of interior of brachial valve (x2). GSC No. 19336.

6c. Mould of exterior of brachial valve (x1½), counterpart of specimen in 6a. GSC No. 19580.

7a, b. Mould and rubber impression of interior of brachial valve (x2). GSC No. 19337.

Figures 8, 9. *Mclearnites* sp. (Page 41)

French River Formation, Arisaig area, loc. USNM 10158.

8a, b. Mould and rubber impression of interior of pedicle valve (x1). GSC No. 19338.

9a. Mould of exterior of pedicle valve (x1½). GSC No. 19339.

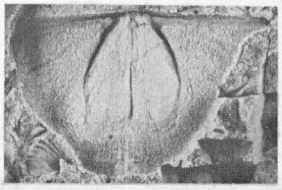
9b. Mould of interior of pedicle valve (x1½), counterpart of specimen in 9a. GSC No. 19340.

Figures 10–13. *Mclearnites mertoni* (McLearn, 1924) (Page 42)

Stonehouse Formation, Arisaig area. Figures 10, 11, shore section (exact locality not known); figures 12, 13, loc. USNM 10187.

10, 11. Moulds of interiors of pedicle valves (x1½). Holotype, GSC No. 5417; paratype, GSC No. 5419.

12, 13. Moulds of interiors of pedicle valves (x1). GSC Nos. 19341, 19342.



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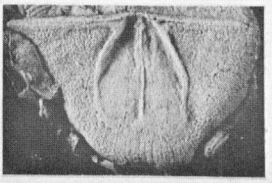

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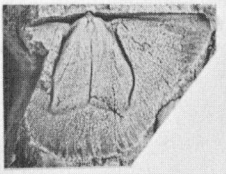

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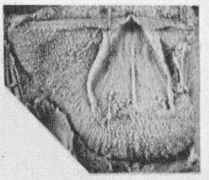

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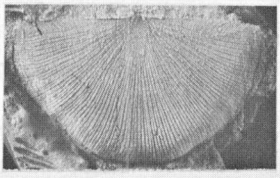

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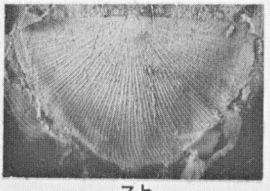

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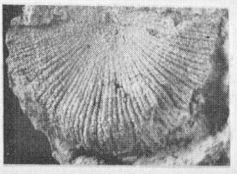

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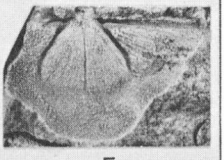

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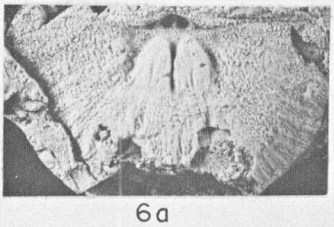

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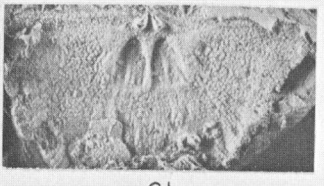

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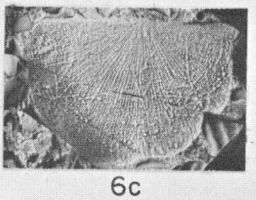

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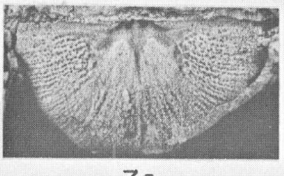

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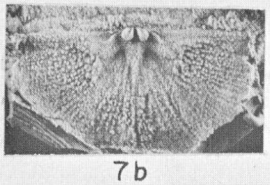

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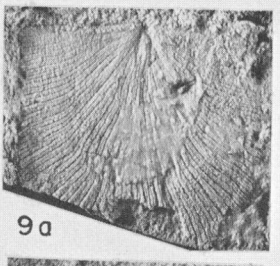

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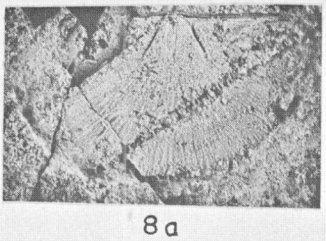

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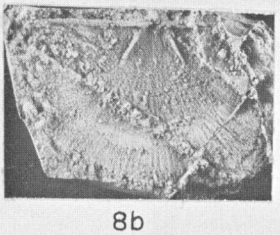

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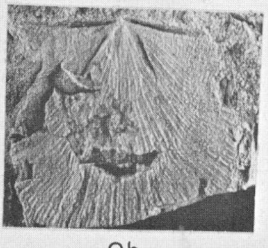

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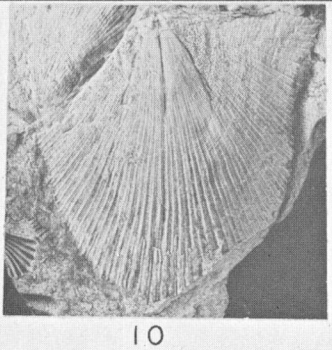

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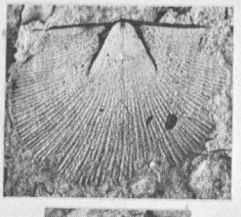

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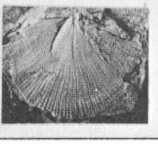


13

PLATE XII

Figures 1–5. *Mclearnites mertoni* (McLearn, 1924). (Page 42)

Stonehouse Formation, Arisaig area, loc. USNM 10187.

1a, b. Mould and rubber impression of interior of brachial valve (x1½). GSC No. 19343.

1c. Mould of exterior of brachial valve (x1½), counterpart of specimen in 1a. GSC No. 19344.

2a, b. Mould and rubber impression of interior of brachial valve (x1½). GSC No. 19345.

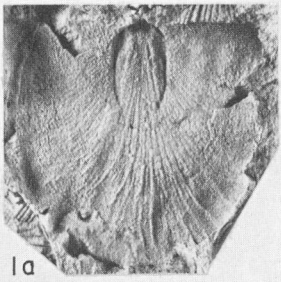
3, 5. Moulds of interiors of brachial valves (x1½). GSC Nos. 19346, 19349.

4a, b. Mould and rubber impression of interior of brachial valve (x2). GSC No. 19347.

4c, d. Mould and rubber impression of exterior of brachial valve (x2), counterpart of 4a. GSC No. 19348.

Figures 6, 7. *Shaleria gilpeni* (Dawson, 1880) (Page 39)

Stonehouse Formation, Arisaig area. Figure 6, loc. USNM 10201; figure 7, loc. USNM 10192. Moulds and rubber impressions of interiors of pedicle valves (x2). GSC Nos. 19350, 19351.



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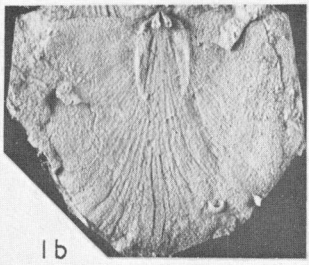

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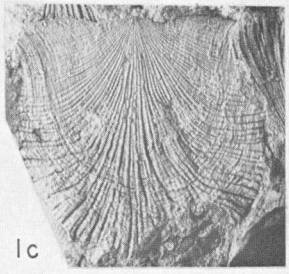

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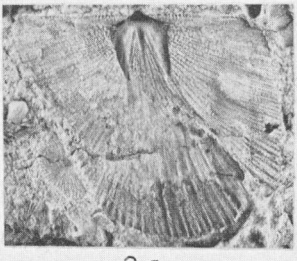

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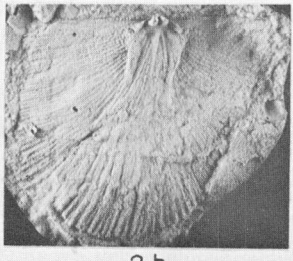

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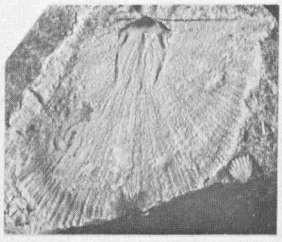

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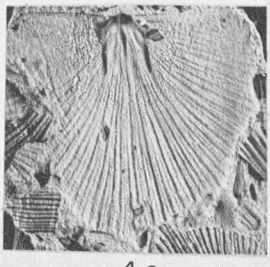

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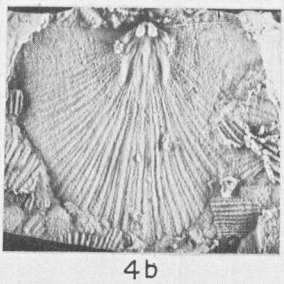

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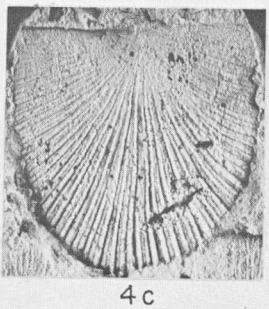

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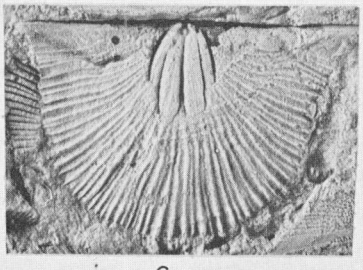

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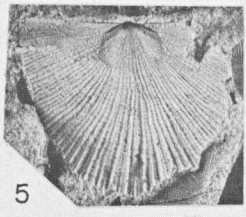

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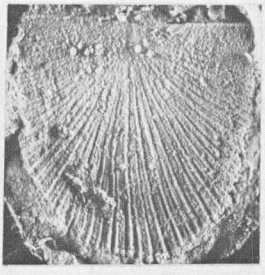
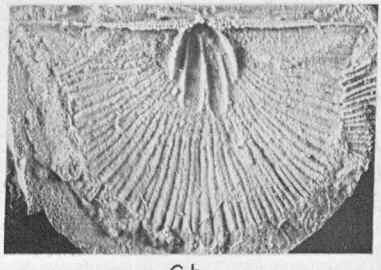


4d



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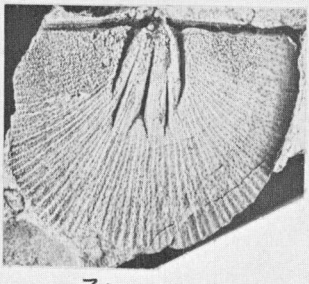

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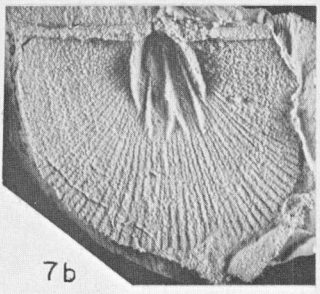


7b

PLATE XIII

Figures 1–7, 9. *Shaleria gilpeni* (Dawson, 1880) (Page 39)

Stonehouse Formation, Arisaig area. Figures 1, 6, 7, 9. loc. USNM 10192; figure 2, loc. USNM 10188; figures 3, 5, loc. USNM 10211; figure 4, loc. USNM 10185.

1, 2. Moulds of interiors of pedicle valves (x2, x3). GSC Nos. 19352, 19353.

3a, b, 4a, b. Moulds and rubber impressions of interiors of brachial valves (x2). GSC Nos. 19354, 19355.

5. Rubber impression of interior of brachial valve (mould not figured) (x2). GSC No. 19356.

6a, b. Mould and rubber impression of interior of brachial valve (x2). GSC No. 19357.

7. Mould of interior of brachial valve (x2). GSC No. 19358.

9a, b. Mould and rubber impression of exterior of brachial valve (x2). GSC No. 19359.

Figure 8. *Shaleria honeymani* (McLearn, 1924). (Page 40)

Stonehouse Formation, Arisaig shore section, Twenhofel loc. 20a. Exterior of pedicle valve (x3). Holotype, Peabody Museum No. 436.

Figure 10. *Shaleria honeymani* (McLearn, 1924) (Page 40)

Stonehouse Formation, Arisaig shore section (exact locality not known). Impression of exterior of brachial valve with portion of original shell still remaining (x2). Holotype of *Amphistrophia arisaigensis* McLearn, 1924, GSC No. 5422.

Figures 11–15. *Pholidostrophia* (*Mesopholidostrophia*) cf. *P.* (*M.*) *nitens* Williams, 1950. (Page 43)

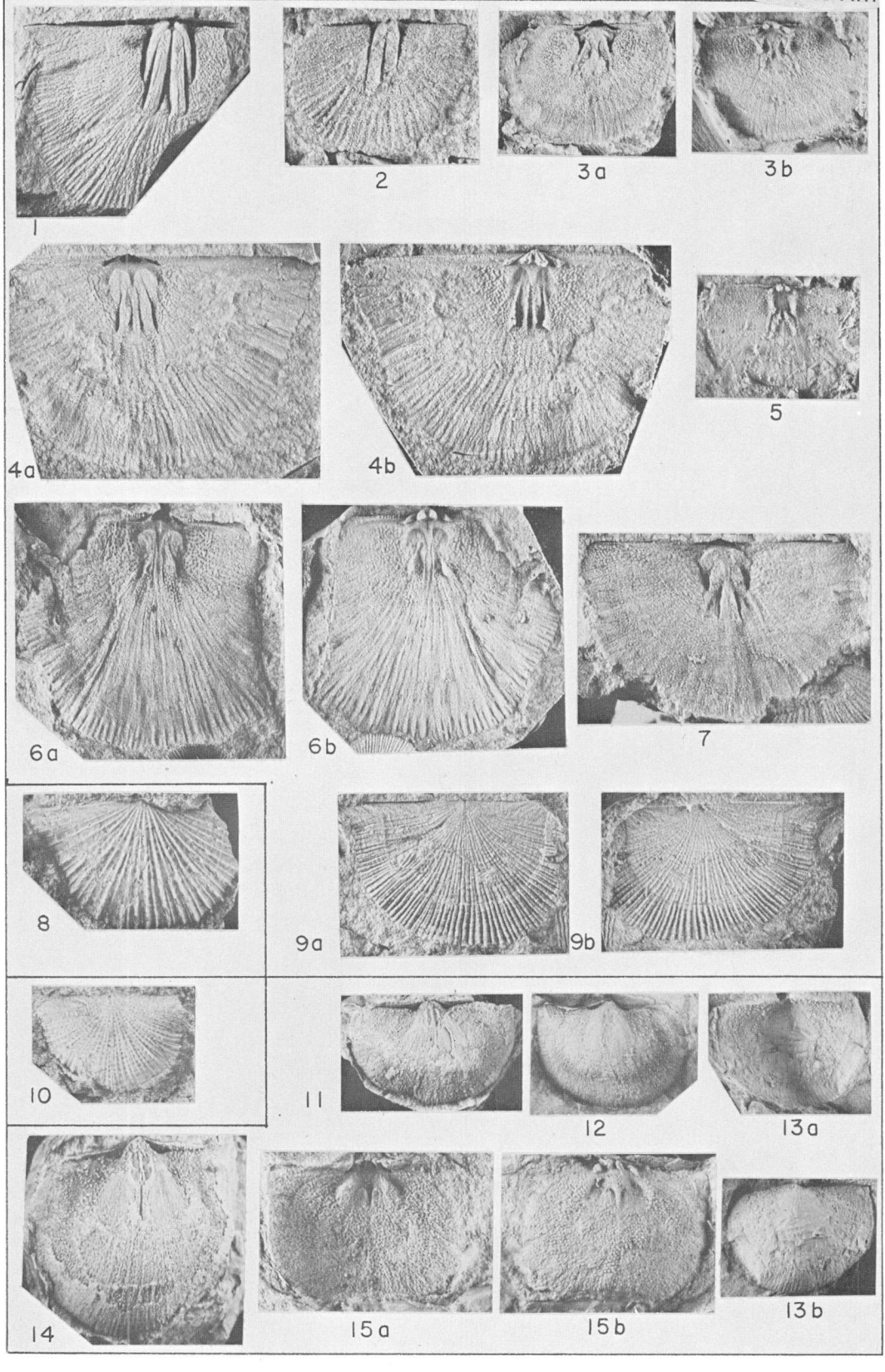
Middle member, Ross Brook Formation, Pictou County, loc. USNM 11232.

11, 12. Moulds of interiors of pedicle valves (x2). GSC Nos. 19360, 19361.

13a. b. Mould and rubber impression of exterior of pedicle valve (x2). GSC No. 19362.

14. Mould of interior of pedicle valve (x3). GSC No. 19363.

15a, b. Mould and rubber impression of interior of brachial valve (x3). GSC No. 19118.


1
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3b
4a
4b
5
6a
6b
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9a
9b
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13a
13b
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15a
15b

Plate XIV

Figures 1, 2. *Pholidostrophia* (*Mesopholidostrophia*) cf. *P.* (*M.*) *nitens* Williams, 1950 (Page 43)

Middle member, Ross Brook Formation, Pictou County, loc. USNM 11232. Moulds of exteriors of brachial valves (x2). GSC Nos. 19366, 19367.

Figures 3a, b. *Lissostrophia* sp. (Page 44)

Lower member, Moydart Formation, Arisaig area, loc. USNM 10182.

3a. Mould of interior of pedicle valve (x3). GSC No. 19368.

3b. Mould of exterior of pedicle valve (x3), counterpart of specimen in 3a. GSC No. 19369.

Figures 4, 5. *Pentlandina*? sp. (Page 44)

Lower member, Ross Brook Formation, Arisaig area, loc. USNM 10118.

4a. Mould of exterior of pedicle valve (x1½). GSC No. 19370.

4b. Mould of interior of pedicle valve (x1), counterpart of specimen in 4a. GSC No. 19371.

5. Mould of interior of brachial valve (x2). GSC No. 19372.

Figure 6. Indet. leptaenid (Page 48)

Beechhill Cove Formation, Arisaig area, loc. USNM 10117. Mould of interior of pedicle valve (x1). GSC No. 19373.

Figures 7, 8. *Leptaena* cf. *martinensis* Cocks, 1968 (Page 45)

Beechhill Cove Formation, Arisaig area, loc. USNM 10117. Moulds of interiors of brachial and pedicle valves (x1). GSC Nos. 19374, 19375.

Figures 9–16. *Leptaena* cf. *L. depressa* (Sowerby, 1823) (Page 45)

Figures 9, 10, upper member, Ross Brook Formation, Arisaig area, loc. USNM 10128; figures 11, 13, 15, French River Formation, Pictou County, loc. USNM 10811; figures 12, 14, French River or Doctor's Brook Formation, Pictou County, loc. USNM 10812; figure 16, French River Formation, Arisaig area, loc. USNM 10158.

9a. Mould of exterior of pedicle valve (x1½). GSC No. 19376.

9b. Mould of interior of pedicle valve (x1½), counterpart of specimen in 9a. GSC No. 19377.

10. Mould of interior of pedicle valve (x1). GSC No. 19378.

11a, b, 12a, b. Moulds of interiors of pedicle valves (x1). GSC Nos. 19379, 19380.

13a. b. Mould and rubber impression of interior of brachial valve (x1). GSC No. 19381.

13c. Rubber impression of specimen in 13a, posterior view (x3).

14a, b, 15a, b. Moulds and rubber impressions of interiors of brachial valves (x1). GSC Nos. 19382, 19383.

16. Mould of exterior of brachial valve (x1). GSC No. 19384.

Figures 17, 18. *Leptaena* aff. *L. rhomboidalis* (Wahlenberg, 1821) (Page 47)

Stonehouse Formation, Arisaig area, loc. USNM 10185. Moulds of interiors of pedicle valves (x2). GSC Nos. 19385, 19386.

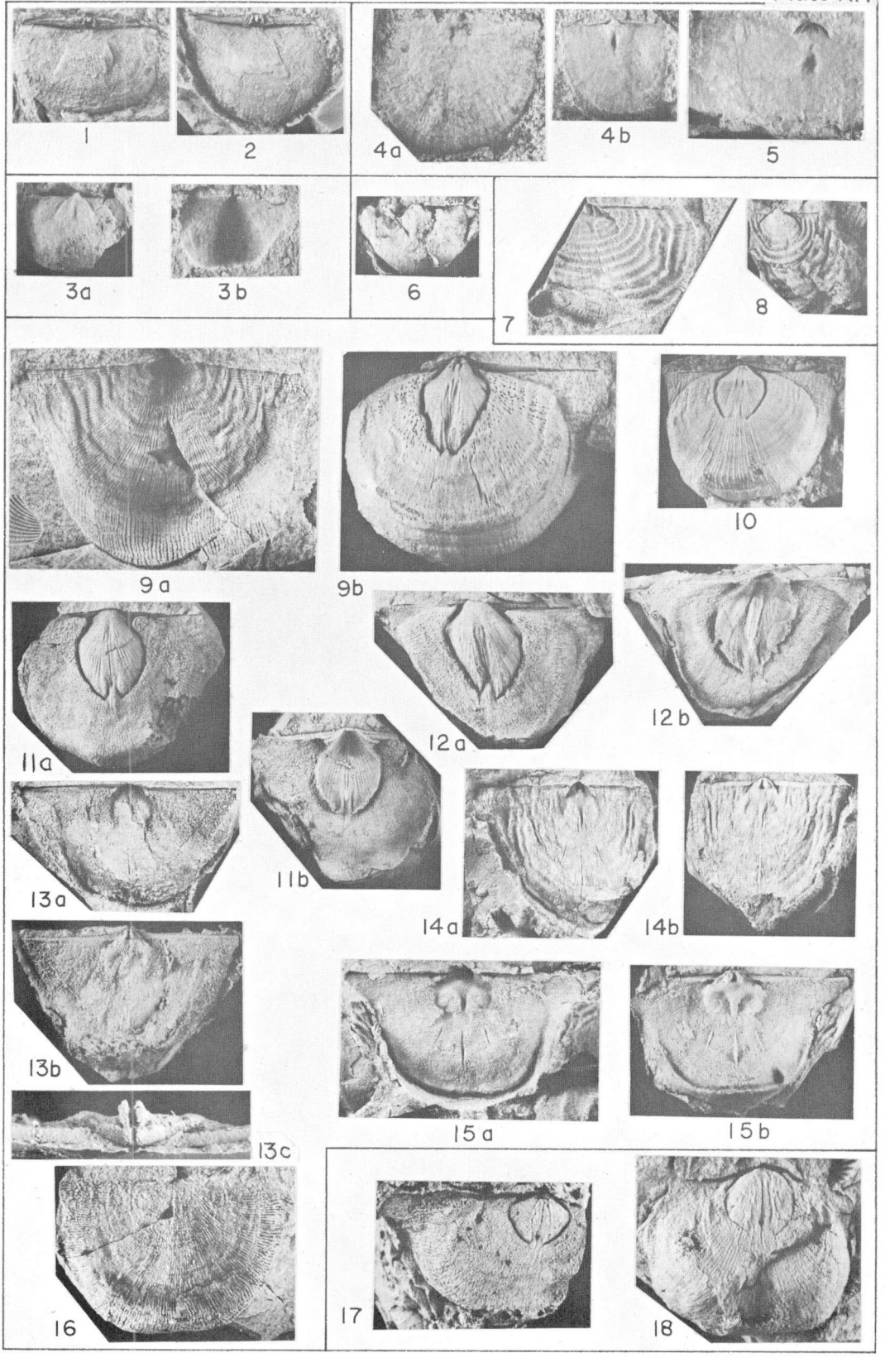
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PLATE XV

Figure 1. *Leptaena* aff. *L. rhomboidalis* (Wahlenberg, 1821) (Page 47)

Stonehouse Formation, Arisaig area, loc. USNM 10185. Mould of interior of brachial valve (x2). GSC No. 19387.

Figures 2, 3, 5. *Fardenia*? sp. (Page 48)

Figures 2, 3, Beechhill Cove Formation, Arisaig area, loc. USNM 10116; Figure 5, Glencoe Brook Formation, Pictou County, loc. USNM 11262.

2a, b. Mould and rubber impression of interior of pedicle valve (x1½). GSC No. 19388.

3a, b. Mould and rubber impression of exterior of pedicle valve (x1½), counterpart of fig. 2a. GSC No. 19389.

5. Mould of interior of brachial valve (x1½). GSC No. 19390.

Figures 4, 6–12. *Fardenia* sp. (Page 49)

Figures 4, 6, French River or Doctor's Brook Formation, Pictou County, loc. USNM 10812; figures 7, 8, 10, 11, French River or Doctor's Brook Formation, Cobequid Mountains, loc. USNM 10813; figures 9, 12, French River Formation, Pictou County, loc. USNM 10811.

4a. Mould of interior of pedicle valve (x1). GSC No. 19391.

4b, c. Mould and rubber impression of exterior of pedicle valve (x1), counterpart of specimen in 4a. GSC No. 19392.

6. Mould of interior of pedicle valve (x1). GSC No. 19393.

7. Mould of exterior of pedicle valve (x1). GSC No. 19394.

8a, b. Mould and rubber impression of interior of pedicle valve (x1). GSC No. 19395.

9a. Mould of interior of brachial valve (x1). GSC No. 19396.

9b, c. Rubber impression of specimen in 9a, top and posterior views (x1½).

10. Mould of interior of pedicle valve (x1). GSC No. 19397.

11. Mould of interior of brachial valve (x1). GSC No. 19398.

12a. Mould of interior of brachial valve (x1). GSC No. 19399.

12b. Rubber impression of specimen in 12a, top view (x1).

12c, d. Rubber impression of specimen in 12a, posterior and anterior views (x2).

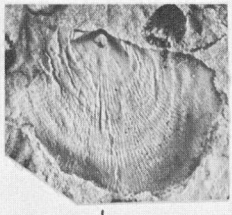
Figures 13–15. Indet. orthotetacid (Page 51)

Stonehouse Formation, Arisaig shore section (exact locality not known).

13. Interior of pedicle valve (x1½). GSC No. 5423.

14. Exterior of brachial valve (x1½). GSC No. 5423 (on slab with specimen shown in 13—figured by McLearn, 1924, pl. V, fig. 32, as "*Schuchertella pecten*").

15. Mould of exterior of pedicle valve (x1½). GSC No. 5423 (on slab with specimen shown in fig. 13).



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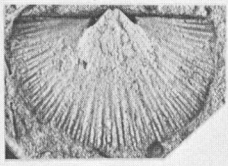

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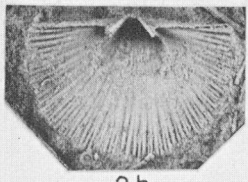

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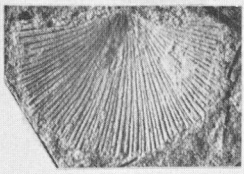

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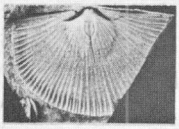

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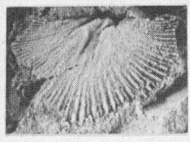

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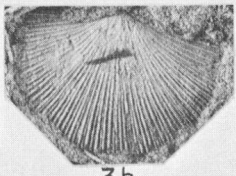

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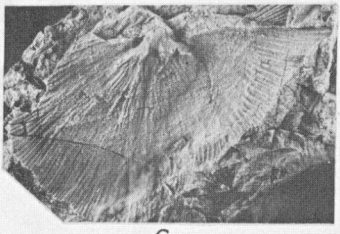

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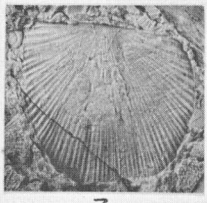

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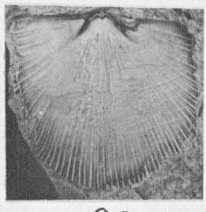

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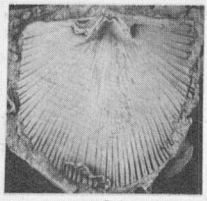

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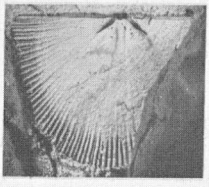

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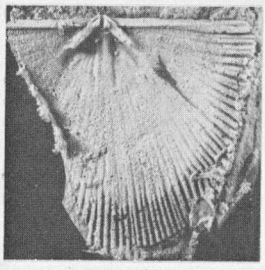

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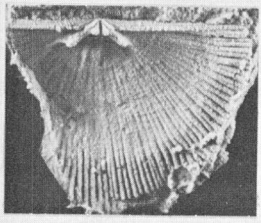

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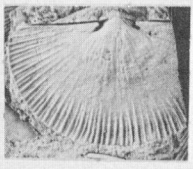

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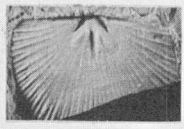

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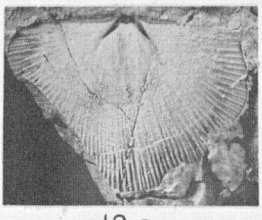

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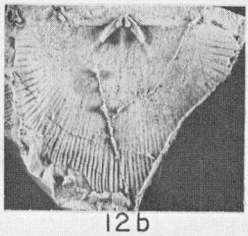

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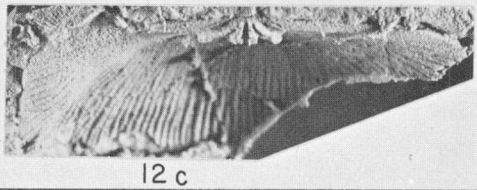

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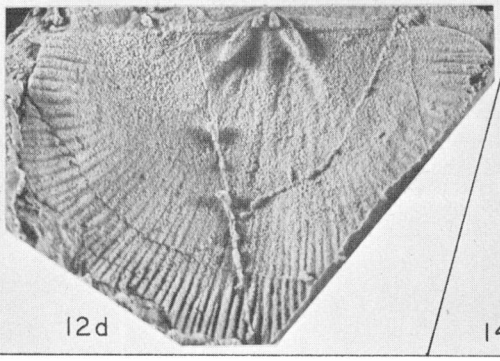

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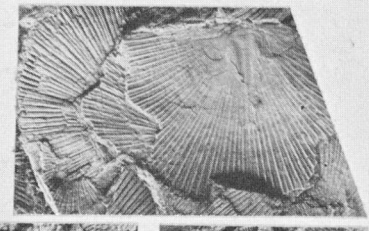

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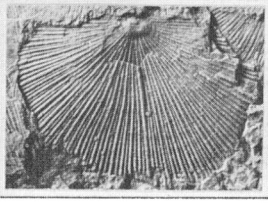

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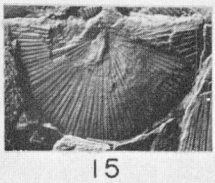

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PLATE XVI

Figures 1, 2. *Plectodonta* sp. (Page 51)

French River Formation, Cobequid Mountains, loc. USNM 10810.

1a, b. Mould of interior of pedicle valve, posterior and top views (x2). GSC No. 19400.

2a, b. Mould and rubber impression of interior of brachial valve (x2). GSC No. 19402.

2c, d. Mould and rubber impression of exterior of brachial valve (x2), counterpart of specimen in 2a. GSC No. 19403.

Figures 3, 4, 20–23. *Protochonetes stonehousensis* n. sp. (Page 55)

Stonehouse Formation, Arisaig area. Figures 3, 4, loc. USNM 10192; figures 20–23, loc. USNM 10184.

3. Mould of interior of pedicle valve (x2). Holotype, GSC No. 19404.

4a, b. Mould and rubber impression of exterior of pedicle valve (x2). Paratype, GSC No. 19405.

4c. Mould of interior of pedicle valve (x2), counterpart of specimen in 4a. Paratype, GSC No. 19406.

20–23. Moulds of interiors of brachial valves (x2). Paratypes, GSC Nos. 19623–19626.

Figures 5–9. *Protochonetes tenuistriatus* (Hall, 1860) (Page 52)

Upper member, Ross Brook Formation. Figures 5, 8, 9, Pictou County, loc. USNM 10833; figure 6, Pictou County, loc. USNM 10832; figure 7, Arisaig area, loc. USNM 10127.

5a, b. Mould and rubber impression of interior of pedicle valve (x2). GSC No. 19407.

6, 7. Moulds of interiors of pedicle valves (x2). GSC Nos. 19408, 19409.

8a, b. Mould and rubber impression of interior of brachial valve (x2, x3). GSC No. 19410.

9. Mould of exterior of brachial valve (x2). GSC No. 19411.

Figures 10–19. *Protochonetes novascoticus* (Hall, 1860) (Page 53)

Stonehouse Formation. Figures 10, 16, Arisaig area, loc. USNM 10203; figure 17, Pictou County, loc. USNM 10829. Doctor's Brook Formation. Figures 11–15, Arisaig area, loc. USNM 10909. Lower member, Moydart Formation. Figures 18, 19, Arisaig area, loc. USNM 10178.

10a, b. Mould and rubber impression of interior of pedicle valve (x1½). GSC 19412.

10c, d. Mould and rubber impression of exterior of pedicle valve (x1½), counterpart of specimen in 10a. GSC No. 19413.

11a, b. Mould and rubber impression of interior of pedicle valve (x1½). GSC No. 19414.

12. Mould of interior of pedicle valve (x2). Holotype, *Chonetes novascoticus crassistriatus* McLearn, 1924, GSC No. 5425.

13, 14. Moulds of interiors of brachial valves (x1½). GSC Nos. 19415, 19416.

15a, b. Mould and rubber impression of interior of brachial valve (x1½). GSC No. 19417.

16a, b. Mould and rubber impression of exterior of brachial valve (x1½). GSC No. 19418.

17a, b. Mould and rubber impression of interior of brachial valve (at top) and mould of exterior of pedicle valve (at bottom) (x2). GSC No. 19627.

18. Rubber impression of interior of brachial valve (x2). GSC No. 19628.

19. Rubber impression of mould of posterior end of articulated specimen (x2). GSC No. 19629.

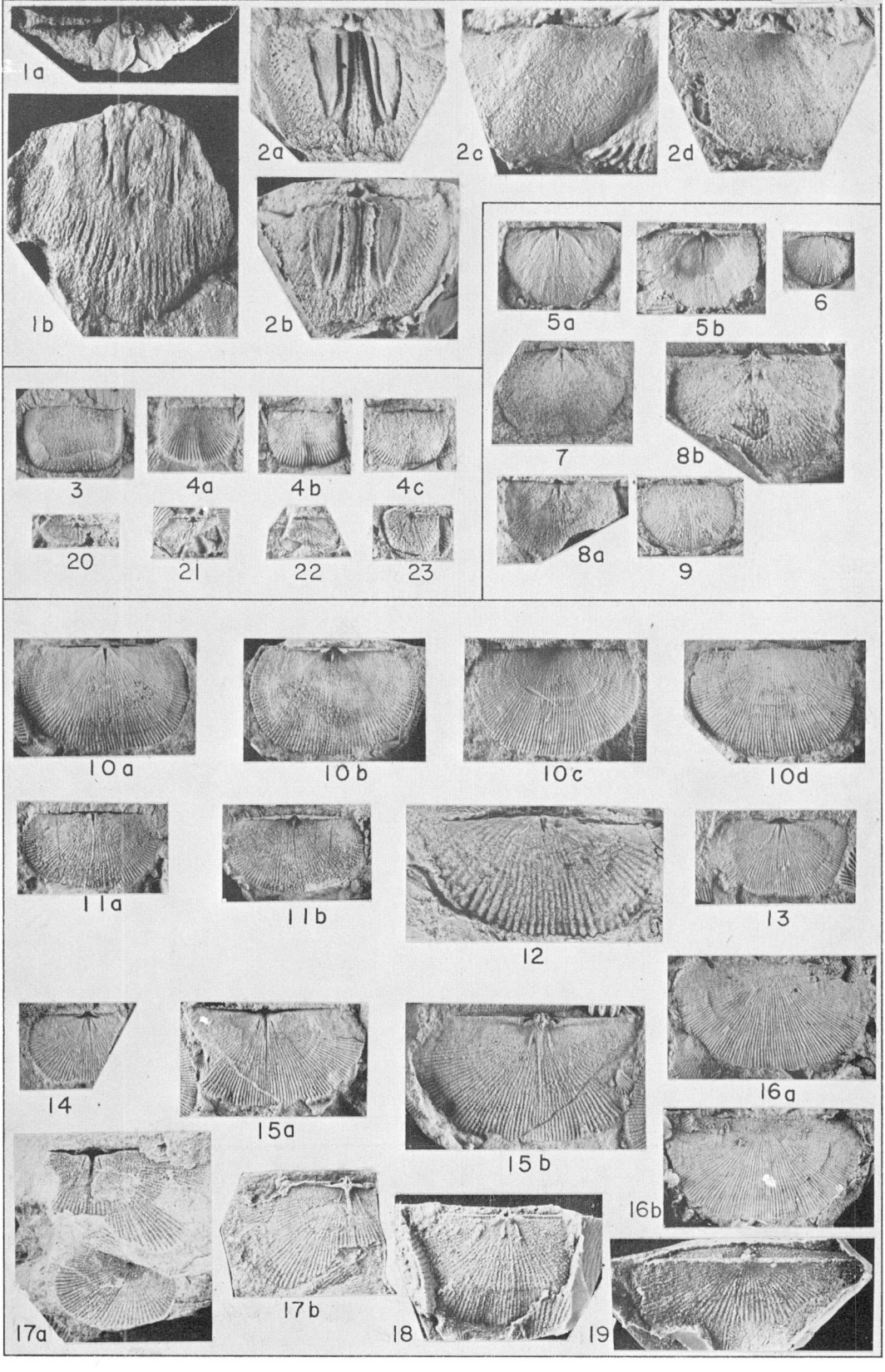
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PLATE XVII

Figure 1–15. *Plagiorhyncha* aff. *P. glassi* (Davidson, 1883) (Page 56)

Middle member, Ross Brook Formation. Figures 1, 2, 5, Arisaig area, loc. USNM 10124; figure 10, Pictou County, loc. USNM 11236. Upper member, Ross Brook Formation. Figures 3, 4, 6–9, Pictou County, loc. USNM 11229; figure 11, loc. USNM 10128; figures 12–15, Ross Brook Formation, Arisaig area (exact locality not known).

1. Mould of interior of pedicle valve (x2). GSC No. 19419.

2a, b. Mould and rubber impression of interior of pedicle valve (x1½). GSC No. 19420.

3, 4. Moulds of interiors of pedicle valves (x1½). GSC Nos. 19421, 19422.

5a. Mould of interior of pedicle valve (x2). GSC No. 19423.

5b. Mould of exterior of pedicle valve (x2), counterpart of specimen in 5a. GSC No. 19424.

6a, b. Mould and rubber impression of exterior of pedicle valve (x1½). GSC No. 19425.

7a–9b. Moulds and rubber impressions of interiors of brachial valves (x1½). GSC Nos. 19426–19428.

10, 11. Moulds of interiors of brachial valves (x2, x1½). GSC Nos. 19429, 19430.

12, 13. Moulds of interiors of pedicle valves (x3). Hypotypes *P. decemplicata* McLearn *non* Sowerby. GSC Nos. 5440, 5438.

14, 15. Moulds of interiors of brachial valves (x3). Hypotypes *P. decemplicata* McLearn *non* Sowerby. GSC Nos. 5439, 5437.

Figures 16–20. *Plagiorhyncha* cf. *P. plastica* McLearn, 1924 (Page 58)

French River Formation, Pictou County. Figure 16, loc. USNM 11247; figures 17–20, loc. USNM 10842.

16a, b. Mould and rubber impression of exterior of pedicle valve (x1½). GSC No. 19431.

17a, b. Mould and rubber impression of interior of pedicle valve (x1½). GSC No. 19432.

18. Mould of interior of pedicle valve (x1½). GSC No. 19433.

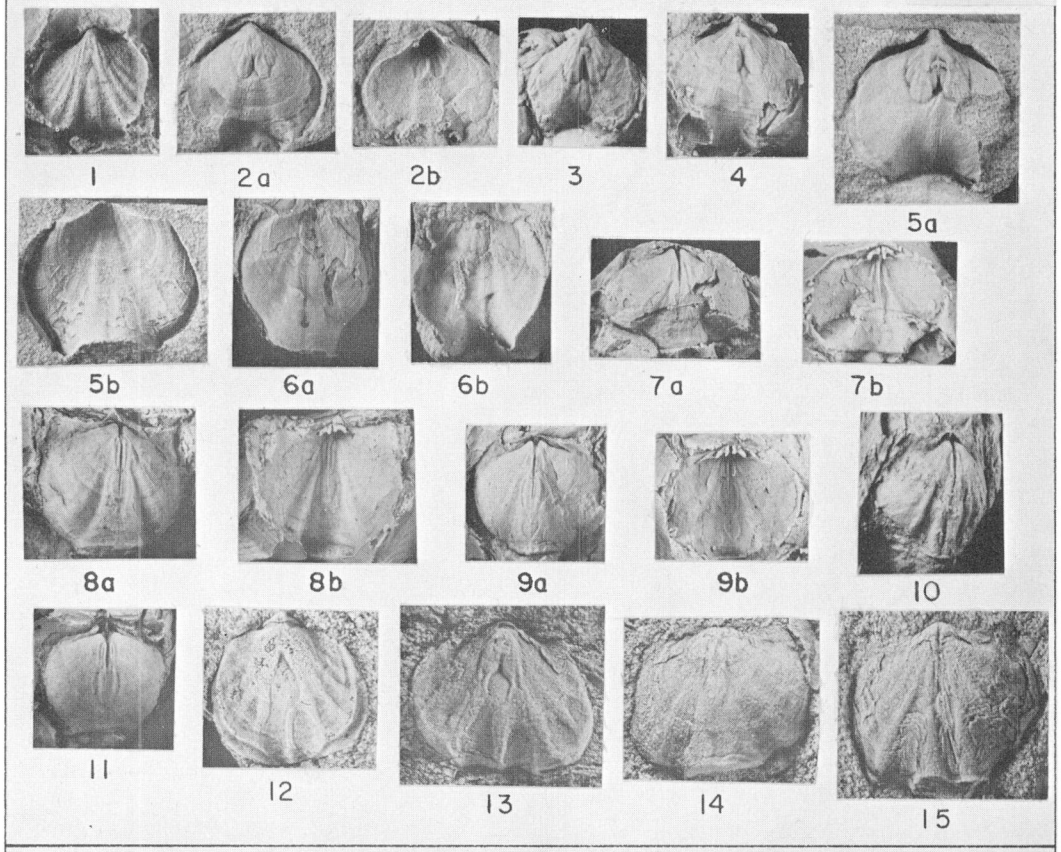
19a, b. Moulds and rubber impressions of exteriors of brachial valves (x1½). GSC No. 19434.

19c. Moulds of interiors of brachial valves (x1½), counterpart of specimen in 19a. GSC No. 19435.

19d, e. Rubber impressions of specimens on left in 19c, top and posterior views (x1½).

20a. Mould of interior of articulated valves (x1½). GSC No. 19436.

20b, c. Rubber impressions of specimen in 20a, top views of pedicle and brachial valves (x1½).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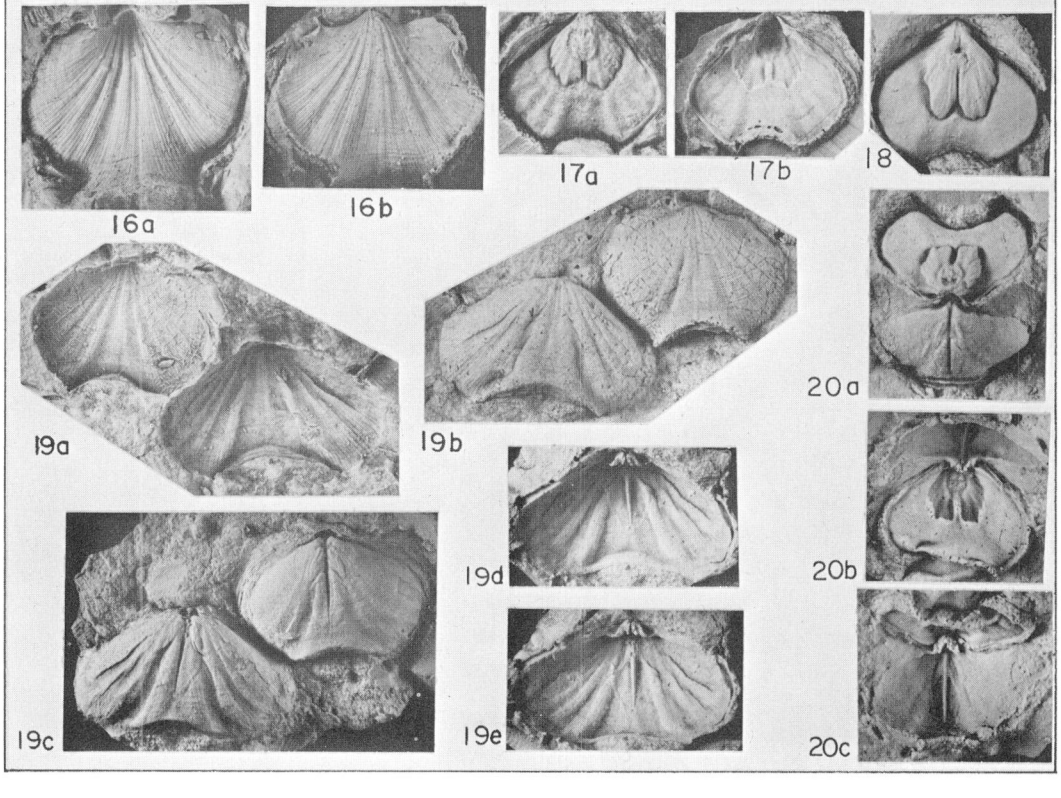
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20c

PLATE XVIII

Figures 1, 2. *Plagiorhyncha* cf. *P. plastica* McLearn, 1924 (Page 58)

French River Formation, Pictou County, loc. USNM 10842.

1a, b. Mould and rubber impression of interior of pedicle valve (x1½). GSC No. 19437.

2a, b. Moulds of interiors of brachial valves (x1½). GSC Nos. 19438, 19439.

Figures 3–10. "*Camarotoechia*" *bimesiornata* McLearn, 1924 (Page 61)

Beechhill Cove Formation. Figures 3, 4, 6, 7, 9, 10, Arisaig area, loc. USNM 10115; figures 5, 8a–c, MacGillivray Brook (exact locality not known).

3a. Mould of interior of pedicle valve (x4). GSC No. 19440.

3b. Mould of exterior of pedicle valve (x4), counterpart of specimen in 3a. GSC No. 19441.

4. Mould of interior of pedicle valve (x4). GSC No. 19442.

5. Mould of interior of pedicle valve (x3). Paratype, GSC No. 5427.

6a, b. Mould and rubber impression of interior of brachial valve (x3). GSC No. 19443.

6c. Mould of exterior of brachial valve (x3), counterpart of specimen in 6a, GSC No. 19444.

7. Mould of interior of pedicle valve (x3). GSC No. 19445.

8a–c. Steinkern, ventral, dorsal and posterior views (x3). Holotype, GSC No. 5426.

9, 10. Moulds of interiors of pedicle valves (x4). GSC Nos. 19446, 19447.

Figures 11–15. "*Camarotoechia*" *rossonia* McLearn, 1924 (Page 62)

Figure 11, Ross Brook Formation (exact locality not known); figures 12–15, middle member, Ross Brook Formation, Arisaig area, loc. USNM 10124.

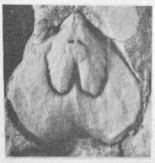
11. Dorsal view (x2). Holotype, GSC No. 5430.

12, 13. Moulds of interiors of brachial valves (x3). GSC Nos. 19448, 19449.

14a, b. Mould and rubber impression of exterior of pedicle valve (x3). GSC No. 19450.

14c. Mould of interior of pedicle valve (x3), counterpart of specimen in 14a. GSC No. 19451.

15. Mould of interior of pedicle valve (x3). GSC No. 19452.



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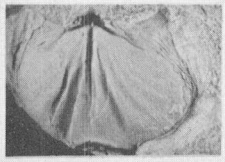

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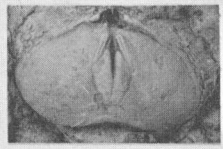

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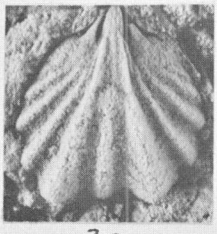

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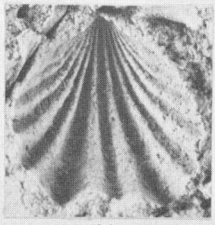

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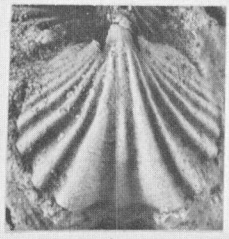

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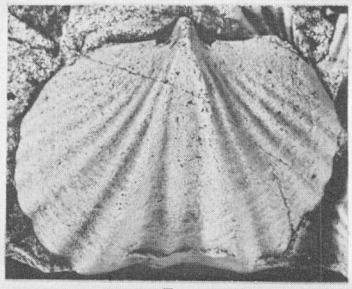

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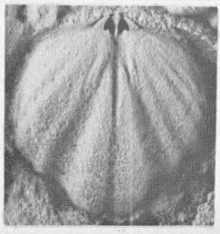

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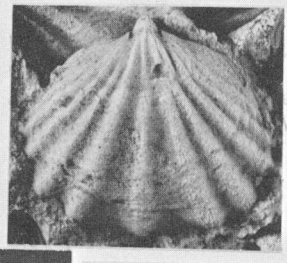

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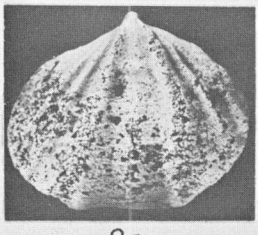

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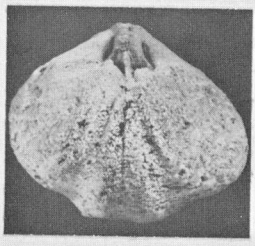

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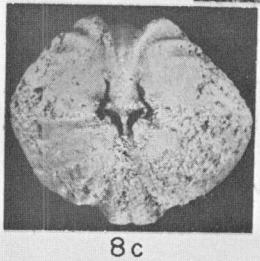

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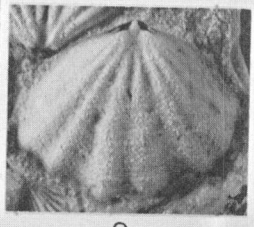

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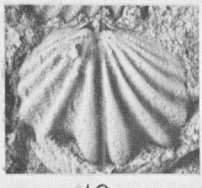

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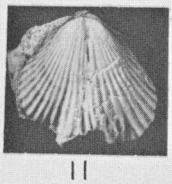

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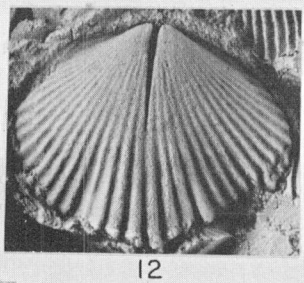

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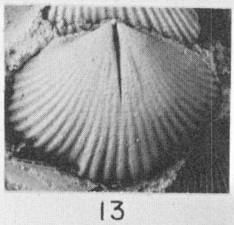

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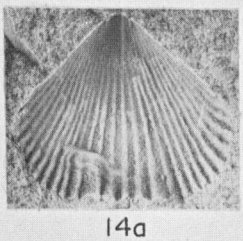

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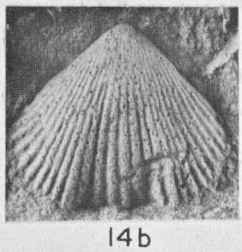

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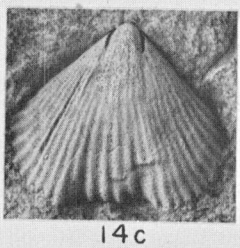

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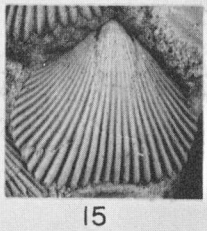

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PLATE XIX

Figure 1. *"Camarotoechia" rossonia* McLearn, 1924 (Page 62)

Middle member, Ross Brook Formation, Arisaig area, loc. USNM 10124. Mould of interior of pedicle valve (x3). GSC No. 19453.

Figures 2, 3. *Sphaerirhynchia antiqua* (McLearn, 1924) (Page 66)

Upper member, Ross Brook Formation, Arisaig area. Figure 2, Twenhofel loc. 169a; figure 3, Arisaig shore section (exact locality not known).

2a–c. Ventral, dorsal, and anterior views (x3). Holotype, Peabody Museum No. 437.

3. Mould of interior of pedicle valve (x3). Paratype, Peabody Museum No. 437c.

Figures 4–10. *"Camarotoechia" westoni* (McLearn, 1924) (Page 62)

Figures 4–7, 9, 10, French River or Doctor's Brook Formation, Pictou County, loc. USNM 11211; figure 8, French River Formation, Pictou County, loc. USNM 11217.

4a, b. Mould and rubber impression of interior of pedicle valve (x2). GSC No. 19454.

5. Mould of interior of pedicle valve (x2). GSC No. 19455.

6a, b, 7a, b. Moulds and rubber impressions of interiors of brachial valves (x2). GSC Nos. 19456, 19457.

8a, b, 9a, b. Moulds and rubber impressions of exteriors of pedicle valves (x2). GSC Nos. 19458, 19459.

10a. Mould of exterior of brachial valve (x2). GSC No. 19460.

10b. Mould of interior of brachial valve (x2), counterpart of specimen in 10a. GSC No. 19461.

Figures 11, 12. *"Camarotoechia"* sp. aff. *"C." planorugosa* McLearn, 1924 (Page 64)

French River Formation, Arisaig area. Figure 11, loc. USNM 10158; figure 12, loc. USNM 10153.

11a. Mould of exterior of pedicle valve (x2). GSC No. 19462.

11b. Mould of interior of pedicle valve (x2), counterpart of specimen in 11a. GSC No. 19463.

12. Mould of interior of brachial valve (x2). GSC No. 19464.

Figures 13–17. *Sphaerirhynchia* sp. (Page 67)

Figures 13, 14, 16, 17, French River or Doctor's Brook Formation, Pictou County, loc. USNM 10841; figure 15, French River Formation, Pictou County, loc. USNM 10821.

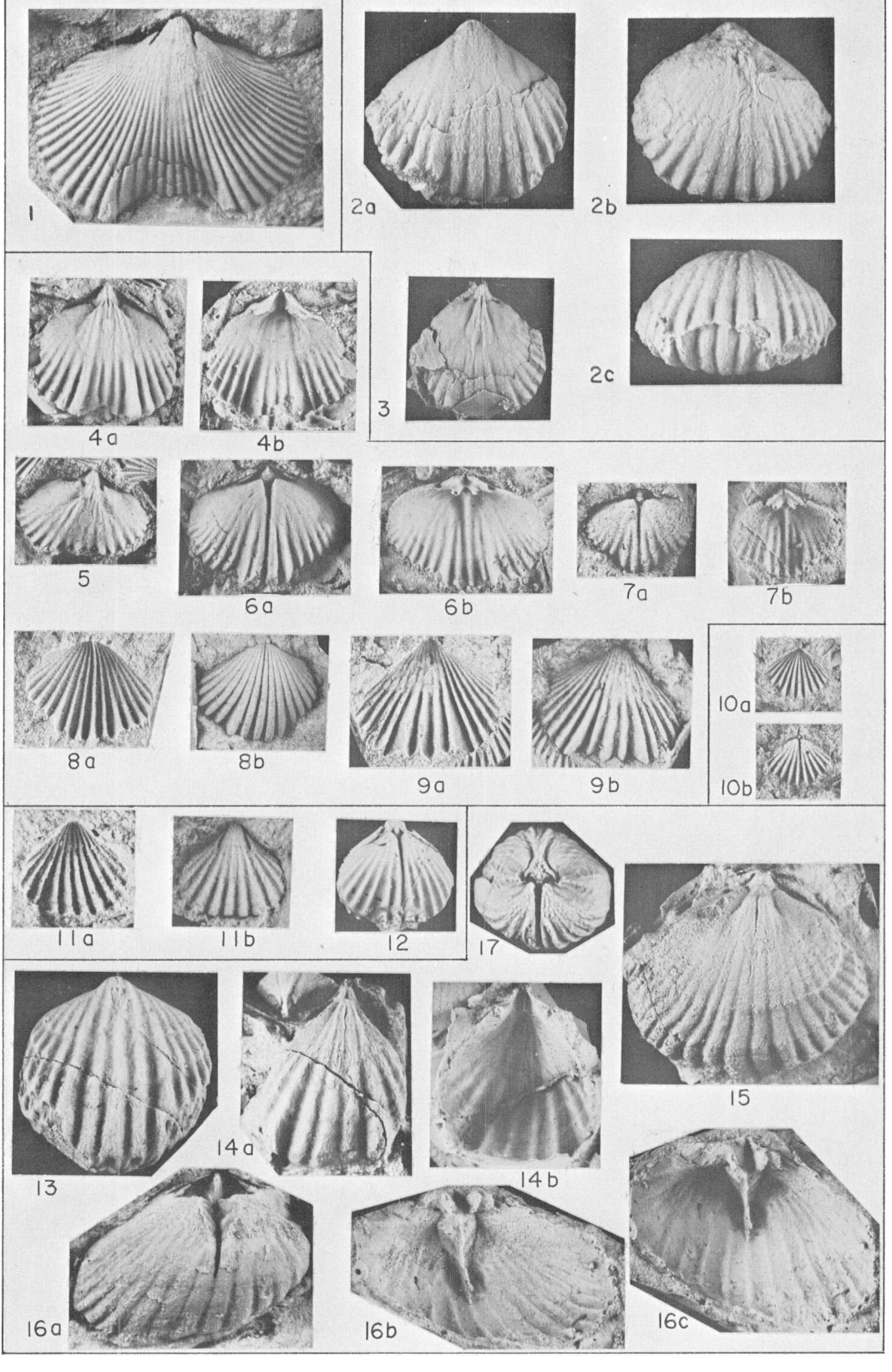
13. Mould of interior of pedicle valve (x2). GSC No. 19465.

14a, b. Mould and rubber impression of interior of pedicle valve (x2). GSC No. 19466.

15. Mould of interior of pedicle valve (x2). GSC No. 19467.

16a–c. Mould and rubber impression of interior of brachial valve (x2). GSC No. 19468.

17. Steinkern (small specimen), posterior view (x3). GSC No. 19469.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16b
16c

PLATE XX

Figures 1–8. *Sphaerirhynchia saffordi* (Hall, 1860) (Page 68)

Lower member, Moydart Formation, Arisaig area. Figures 1–3, 5, 6, loc. USNM 10182; figure 4, loc. USNM 10172; figures 7a–e, Arisaig shore section, Twenhofel loc. 98; figure 8, Arisaig shore section (exact locality not known).

1a, b. Mould and rubber impression of interior of pedicle valve (x2). GSC No. 19470.

2–4. Moulds of interiors of pedicle valves (x2). GSC Nos. 19471–19473.

5a, b, 6a, b. Moulds and rubber impressions of interiors of brachial valves (x2). GSC Nos. 19474, 19475.

7a–e. Ventral, side, dorsal, posterior, and anterior views (x2). Peabody Museum No. 443.

8. Pedicle valve (x1). Holotype, *Wilsonia wilsoni* mut. *stonehousensis* McLearn, 1924, GSC No. 5436.

Figures 9–13. "*Camarotoechia*" *squamifera* McLearn, 1924 (Page 65)

Lower member, Moydart Formation, Arisaig area. Figures 9–12, loc. USNM 10181; figure 13, Arisaig shore section, Twenhofel loc. 97.

9, 10. Moulds of interiors of pedicle valves (x2). GSC Nos. 19476, 19477.

11a, b. Mould and rubber impression of interior of brachial valve (x2). GSC No. 19478.

12a–e. Ventral, side, dorsal, anterior, and posterior views (x2). GSC No. 19479.

13a–e. Ventral, side, dorsal, anterior, and posterior views (x2). Holotype, Peabody Museum No. 435.

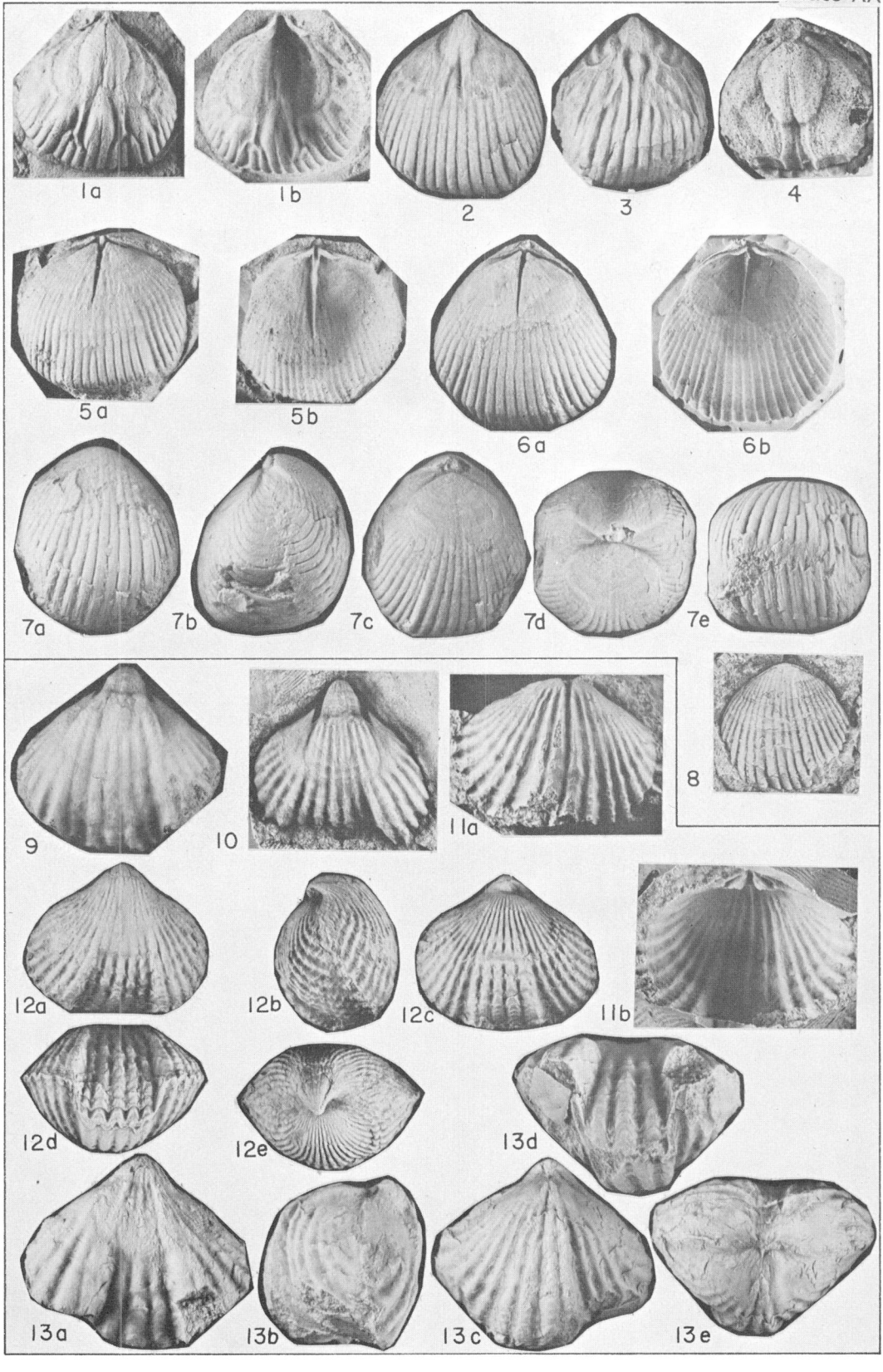
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PLATE XXI

Figures 1–7. *Eatonioides lamellornatus* McLearn, 1918 (Page 60)

Lower member, Moydart Formation, Arisaig area. Figures 1–5, loc. USNM 10183; figures 6, 7, Arisaig shore section (exact locality not known).

1a, b. Mould and rubber impression of interior of pedicle valve (x1½). GSC No. 19480.

1c. Mould of exterior of pedicle valve (x1½), counterpart of specimen in 1a. GSC No. 19481.

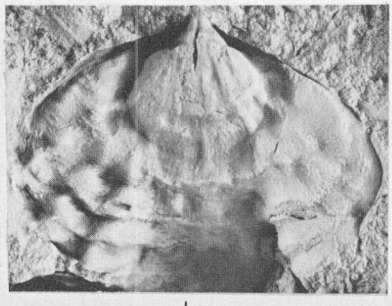
2. Mould of interior of pedicle valve (x1½). GSC No. 19482.

3a, b. Mould and rubber impression of interior of brachial valve (x1½). GSC No. 19483.

4, 5. Moulds of interiors of brachial valves (x1½). GSC Nos. 19484, 19485.

6a–d. Steinkern, ventral, dorsal, anterior, and posterior views (x1½). Paratype, GSC No. 5434.

7a–e. Dorsal, ventral, posterior, anterior, and side views (x1½). Holotype, GSC No. 5435.



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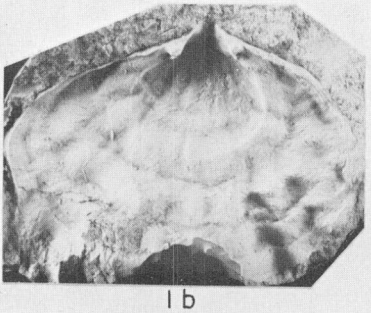

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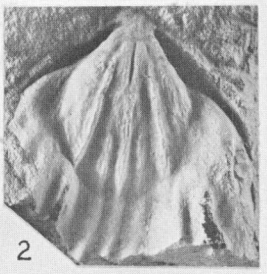

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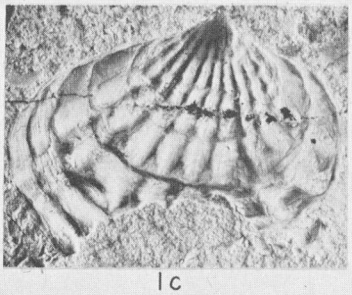

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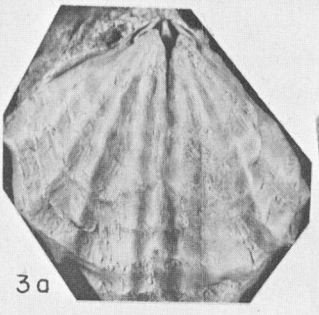

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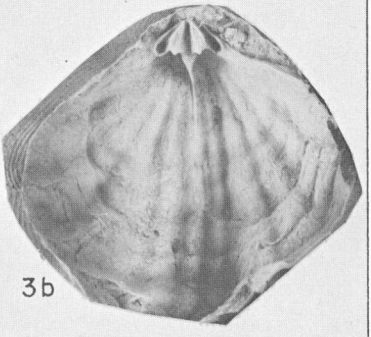

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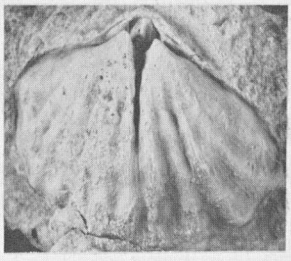

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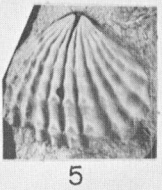

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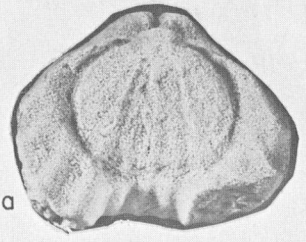

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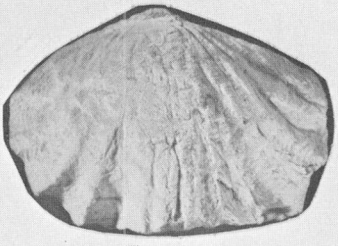

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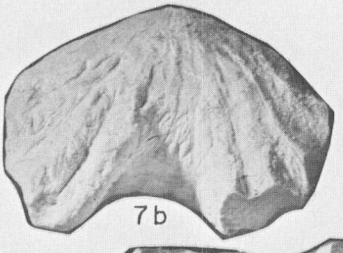

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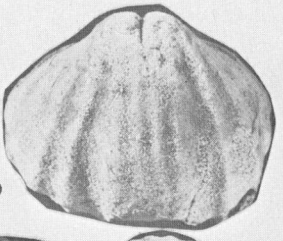

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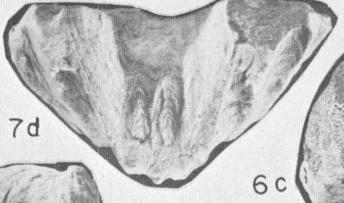

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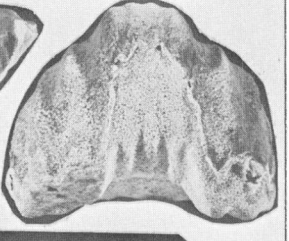

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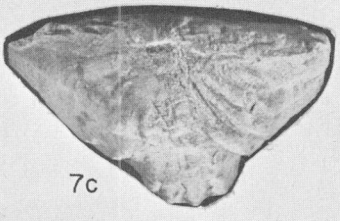

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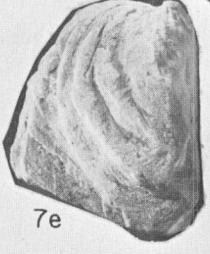

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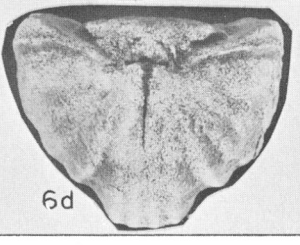

6d

Plate XXII

Figures 1a–e. "*Camarotoechia*" *moydartensis* McLearn, 1924 (Page 65)

Lower member, Moydart Formation, Arisaig shore section (exact locality not known). Ventral, dorsal, posterior, side, and anterior views (x3). Holotype, GSC No. 5429.

Figures 2a–d. "*Camarotoechia*" *glomerosa* McLearn, 1924. (Page 66)

Stonehouse Formation, Arisaig shore section (exact locality not known). Ventral, side, dorsal, and posterior views (x2). Holotype, GSC No. 5433.

Figures 3a–c. "*Camarotoechia*" sp. aff. "*C.*" *planorugosa* McLearn, 1924 (Page 64)

Lower member, Moydart Formation, Arisaig area, loc. USNM 10182.

3a. Pedicle valve (x2). GSC No. 19486.

3b. Mould of interior of brachial valve (x2). GSC No. 19487.

3c. Mould of interior of pedicle valve (x2). GSC No. 19488.

Figures 4a, b. "*Camarotoechia*" *planorugosa* McLearn, 1924 (Page 63)

Stonehouse Formation, Arisaig shore section, Twenhofel loc. 20. Ventral and dorsal views (x3). Holotype, Peabody Museum No. 432.

Figure 5. "*Camarotoechia*" *marklandensis* (McLearn, 1924)
(="*Camarotoechia*" *glomerosa* (McLearn, 1924)?) (Page 66)

Stonehouse Formation, Arisaig area, Twenhofel loc. 21d. Mould of exterior of brachial valve (x2). Peabody Museum No. 434.

Figures 6–9, 18. *Rhynchospirina* sp. A (Page 69)

French River Formation. Figures 6, 8, Arisaig area, loc. USNM 10158; figures 7, 9, Pictou County, loc. USNM 10811; figure 18, Stonehouse Formation, Arisaig area, loc. USNM 10185.

6a, b. Mould and rubber impression of exterior of brachial valve (x2). GSC No. 19489.

7a, b. Mould and rubber impression of interior of brachial valve (x2). GSC No. 19490.

8. Mould of interior of pedicle valve (x2). GSC No. 19491.

9. Mould of exterior of pedicle valve (x2). GSC No. 19492.

18. Rubber impression of interior of brachial valve (x2). GSC No. 19493.

Figures 10–12. *Rhynchospirina*? sp. B (Page 70)

French River Formation, Cobequid Mountains, loc. USNM 10822.

10, 11. Moulds of interiors of pedicle valves (x2). GSC Nos. 19494, 19495.

12. Mould of interior of brachial valve (x2). GSC No. 19496.

Figures 13a, b. *Rhynchospirina acadiae* (Hall, 1860) (Page 71)

Lower member, Moydart Formation, Arisaig shore section, Twenhofel loc. 89. Ventral and dorsal views (x2). Peabody Museum No. 445a.

Figures 14–17. *Rhynchospirina sinuata* (Hall, 1860) (Page 71)

Stonehouse Formation, Arisaig area. Figures 14, 16, loc. USNM 10192; figures 15, 17, loc. USNM 10185.

14. Mould of interior of pedicle valve (x2). GSC No. 19497.

15a. Mould of interior of brachial valve (x2). GSC No. 19498.

15b, c. Rubber impressions of specimen shown in 15a, top and anterior views (x2).

16. Mould of interior of pedicle valve (x2). GSC No. 19499.

17a, b. Mould and rubber impression of interior of brachial valve (x1½). GSC No. 19500.

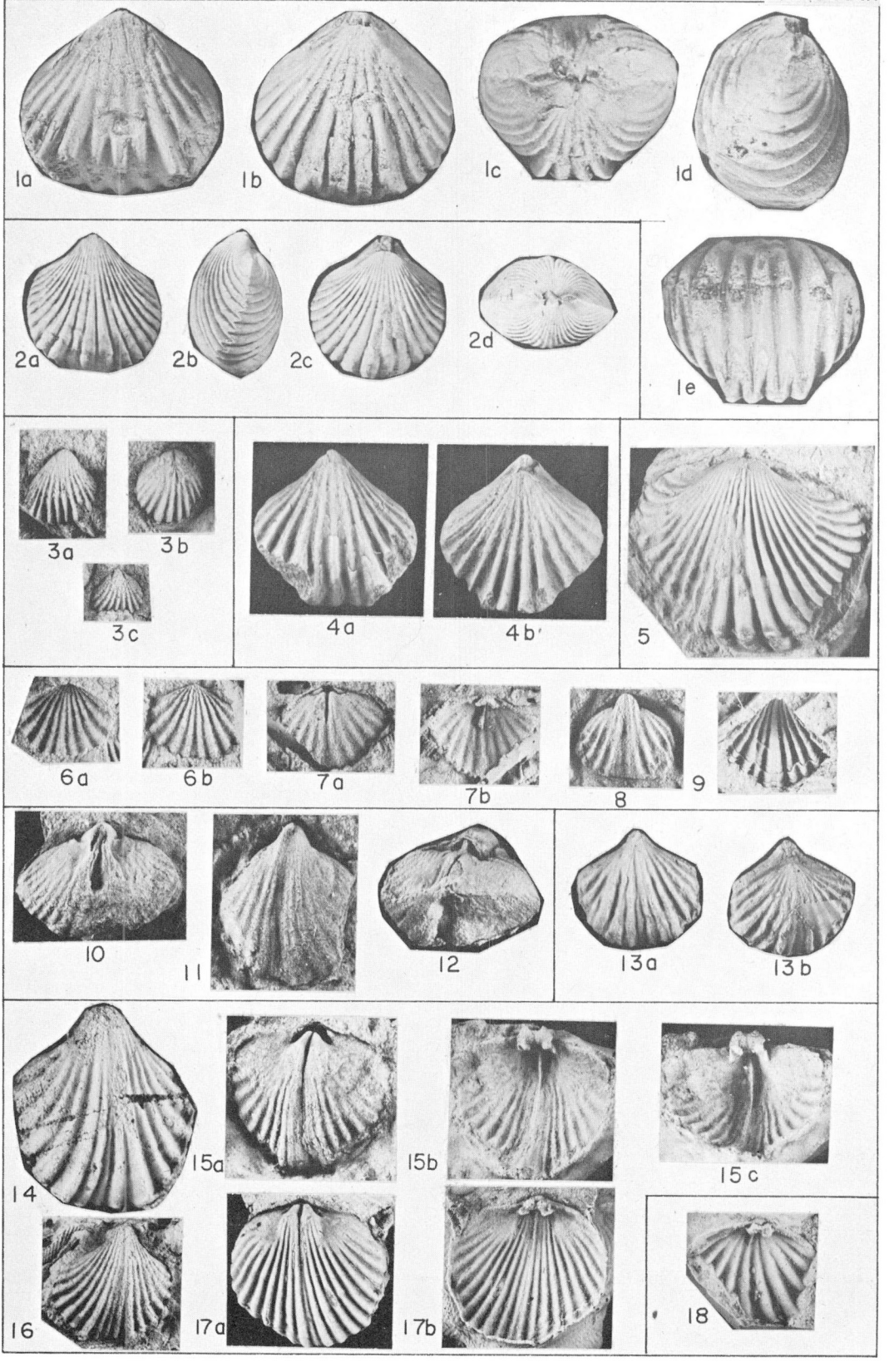
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Plate XXIII

Figure 1. *Eocoelia hemisphaerica* (Sowerby, 1839) (Page 76)

Middle member, Ross Brook Formation, Pictou County, loc. USNM 11316.

1a, b. Mould and rubber impression of exterior of brachial valve (x3). GSC No. 19501.

1c, d. Mould and rubber impression of interior of brachial valve (x3), counterpart of specimen in 1a. GSC No. 19502.

Figures 2, 3. *Eocoelia intermedia* (Hall, 1860) (Page 77)

Middle member, Ross Brook Formation, Pictou County, loc. USNM 11319.

2. Mould of interior of pedicle valve (x3). GSC No. 19503.

3a, b. Mould and rubber impression of exterior of pedicle valve (x3). GSC No. 19401.

3c. Mould of interior of pedicle valve (x3), counterpart of specimen in 3a. GSC No. 19504.

Figures 4, 5. *Eocoelia curtisi* Ziegler, 1966 (Page 78)

Middle member, Ross Brook Formation, Pictou County. Figure 4, loc. USNM 11231; figure 5, loc. USNM 11293.

4a, b. Mould and rubber impression of interior of brachial valve (x3). GSC No. 19505.

5a, b. Mould and rubber impression of exterior of brachial valve (x3). GSC No. 19506.

Figures 6–14. *Eocoelia sulcata* (Prouty, 1923) (Page 79)

Upper member, Ross Brook Formation. Figures 6–8, 10, 12, 13, Arisaig area, loc. USNM 10128; figure 9, Arisaig area, loc. USNM 10129; figures 11, 14, Pictou County, loc. USNM 10832.

6a, b. Mould and rubber impression of exterior of brachial valve (x3). GSC No. 19507.

7a. Mould of interior of brachial valve (x3). GSC No. 19508.

7b. Mould of exterior of brachial valve (x3), counterpart of specimen in 7a. GSC No. 19509.

8a, b. Mould and rubber impression of exterior of pedicle valve (x3). GSC No. 19510.

9a,b,11a,b. Moulds and rubber impressions of interiors of brachial valves (x3). GSC Nos. 19511, 19513.

10a, b. Mould and rubber impression of interior of pedicle valve (x3). GSC No. 19512.

12. Mould of interior of brachial valve (x3). GSC No. 19514.

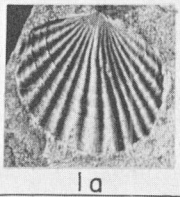
13, 14. Moulds of interiors of pedicle valves (x3). GSC Nos. 19515, 19516.

Figures 15a–d. *Megumatrypa glencoensis* n. sp. (Page 73)

Glencoe Brook Formation, Pictou County, loc. USNM 11300.

15a, b. Mould and rubber impression of exterior of brachial valve (x2). Paratype, GSC No. 19517.

15c, d. Mould and rubber impression of interior of brachial valve (x2). Paratype, GSC No. 19518.



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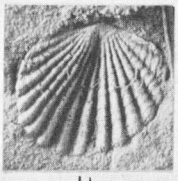

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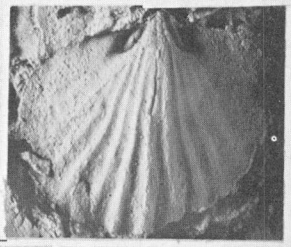

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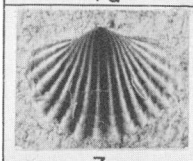

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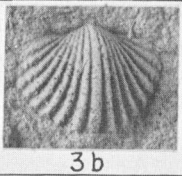

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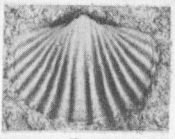

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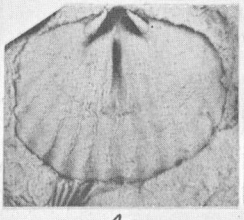

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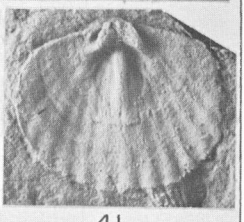

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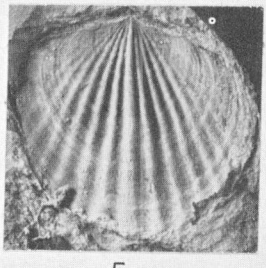

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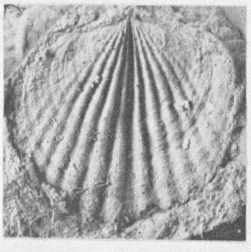

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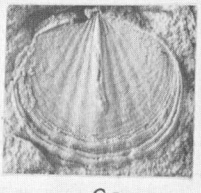

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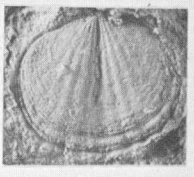

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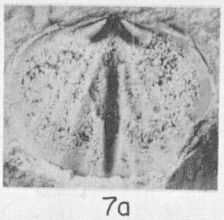

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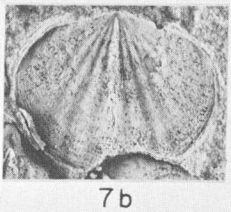

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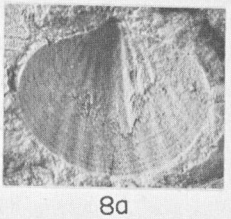

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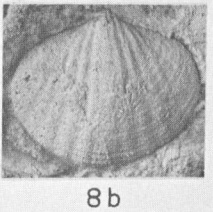

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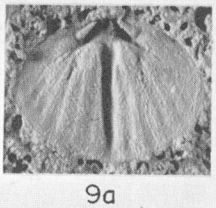

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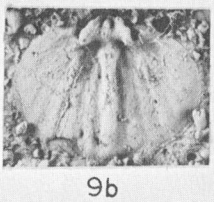

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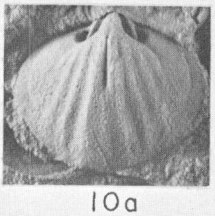

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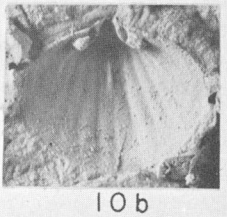

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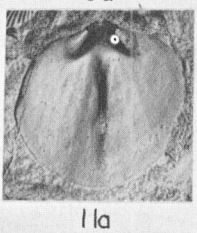

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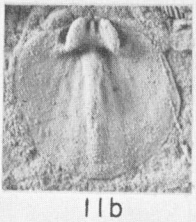

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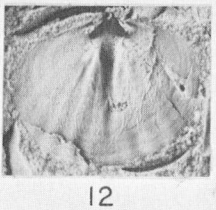

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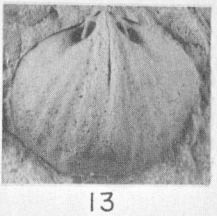

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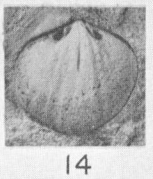

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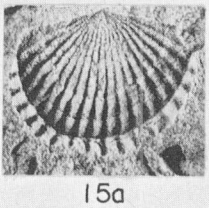

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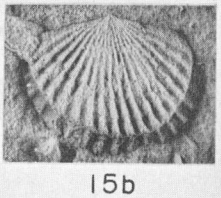

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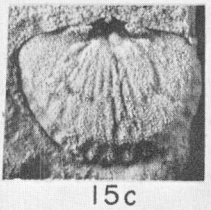

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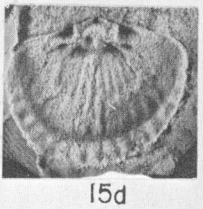


15d

PLATE XXIV

Figures 1–10. *Megumatrypa glencoensis* n. sp. (Page 73)

Glencoe Brook Formation, Pictou County. Figures 1, 5, 7, loc. USNM 11300; figures 2, 6, loc. USNM 11264; figures 3, 4, 8–10, loc. USNM 11265.

1a–3b. Moulds and rubber impressions of interiors of brachial valves (x2). Paratypes, GSC 19519–19521.

4a, b, 6a, b. Moulds and rubber impressions of interiors of pedicle valves (x2). Paratypes, GSC Nos. 19522, 19524.

5a, b. Mould and rubber impression of interior of pedicle valve (x2). Holotype, GSC No. 19523.

7a. Mould of interior of pedicle valve (x2). Paratype, GSC No. 19525.

7b. Mould of exterior of pedicle valve (x2), counterpart of specimen in 7a. Paratype, GSC No. 19526.

8. Mould of interior of pedicle valve (x2). Paratype, GSC No. 19527.

9a, b. Mould and rubber impression of exterior of brachial valve (x2). Paratype, GSC No. 19528.

10. Anterior view of internal mould of articulated specimen with spire exposed (x4). Paratype, GSC No. 19529.

Figures 11–14. *Atrypa* cf. *A. reticularis* (Linné, 1758). (Page 74)

Middle member, Ross Brook Formation, Pictou County, loc. USNM 11232.

11a, b. Mould and rubber impression of interior of brachial valve (x2). GSC No. 19530.

11c, d. Mould and rubber impression of exterior of brachial valve (x2), counterpart of specimen in 11a. GSC No. 19531.

12, 13. Moulds of interiors of pedicle valves (x2, x1), GSC Nos. 19532, 19533.

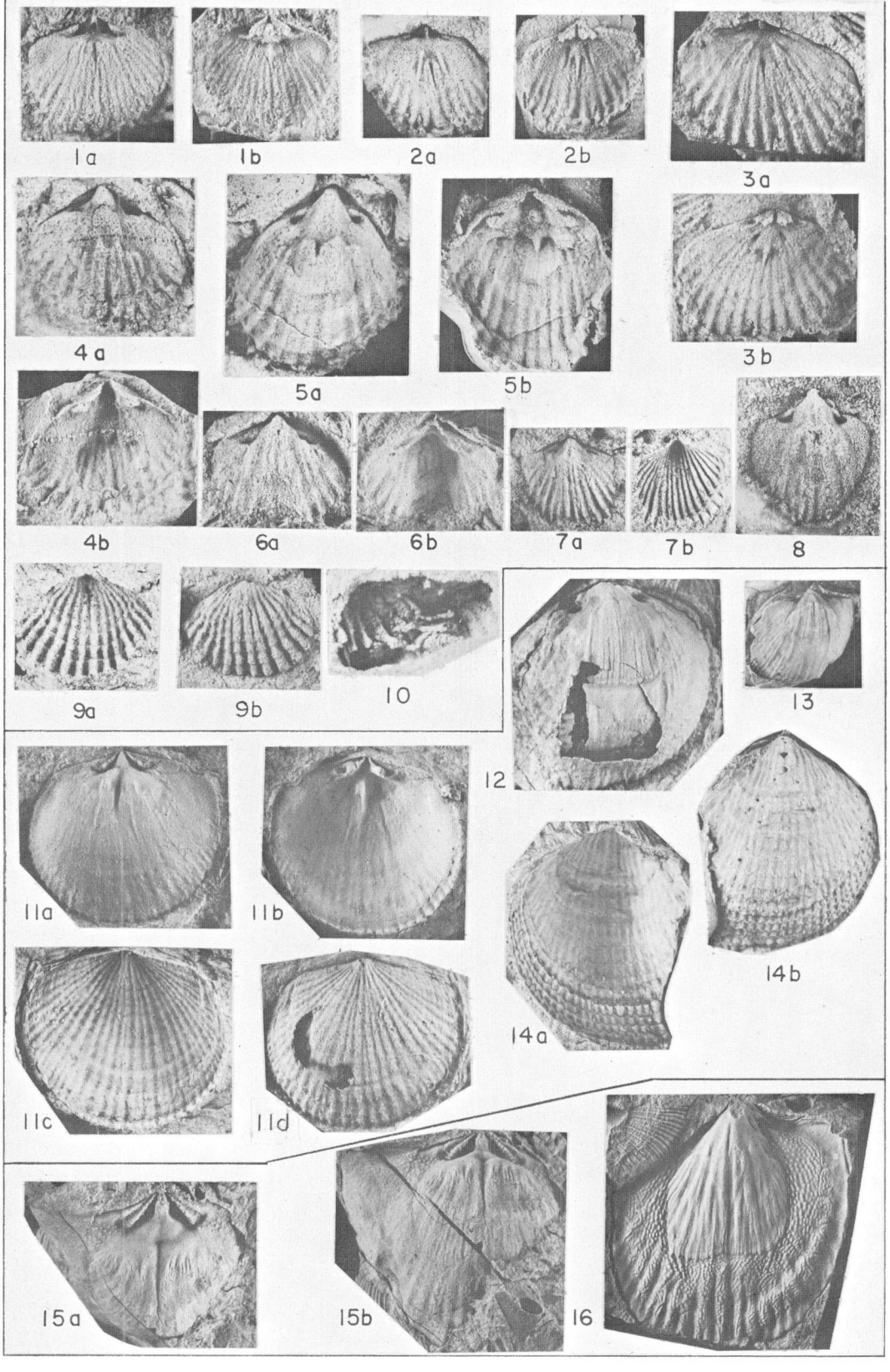
14a, b. Mould and rubber impression of exterior of pedicle valve (x2). GSC No. 19534.

Figures 15, 16. *Atrypa* cf. *A. gedinniana* Fuchs, 1934 (Page 75)

Stonehouse Formation, Arisaig area, loc. USNM 10187.

15a, b. Mould of interior of brachial valve, posterior and top views (x1½). GSC No. 19535.

16. Mould of interior of pedicle valve (x1½). GSC No. 19536.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11a
11b
14b
14a
11c
11d
15a
15b
16

Plate XXV

Figures 1a, b. *Atrypa* cf. *A. gedinniana* Fuchs, 1934 (Page 75)

Stonehouse Formation, Arisaig area, loc. USNM 10187. Mould and rubber impression of exterior of pedicle valve (x1). GSC No. 19537.

Figures 2–7. *Cryptothyrella beechhillensis* (McLearn, 1924) (Page 80)

Figures 2–6, Glencoe Brook Formation, Pictou County, loc. USNM 11262; figure 7, Cameron Brook, Pictou County (exact locality not known).

2a, b. Mould of interior of pedicle valve, posterior and top views (x2). GSC No. 19538.

2c, d. Rubber impression of figs. 2a, b, anterior and top views (x2).

3a–c. Mould of interior of pedicle valve, top, side, and posterior views (x1¼). GSC No. 19539.

3d. Rubber impression of specimen in 3a (x2).

4. Mould of interior of pedicle valve (x2). GSC No. 19540.

5a–6b. Moulds and rubber impressions of interiors of brachial valves (x2). GSC Nos. 19541, 19542.

7a–c. Steinkern. Ventral, posterior, and side views (x2). Holotype, *Whitfieldella* cf. *angustifrons* (McLearn *non* M'Coy), GSC No. 5447.

Figures 8–15. *Meristina billingsiana* (Dawson, 1880) (Page 81)

French River Formation, figure 8, Cobequid Mountains, loc. USNM 10822; figures 11, 12, Pictou County, loc. USNM 10811; figures 13, 15, Arisaig shore section (exact locality not known). Kerrowgare Formation, figures 9, 10, 14, Pictou County, loc. USNM 10817. Moulds of interiors of pedicle valves (x1). GSC Nos. 19543–19547, 5451, 19548, 5450.

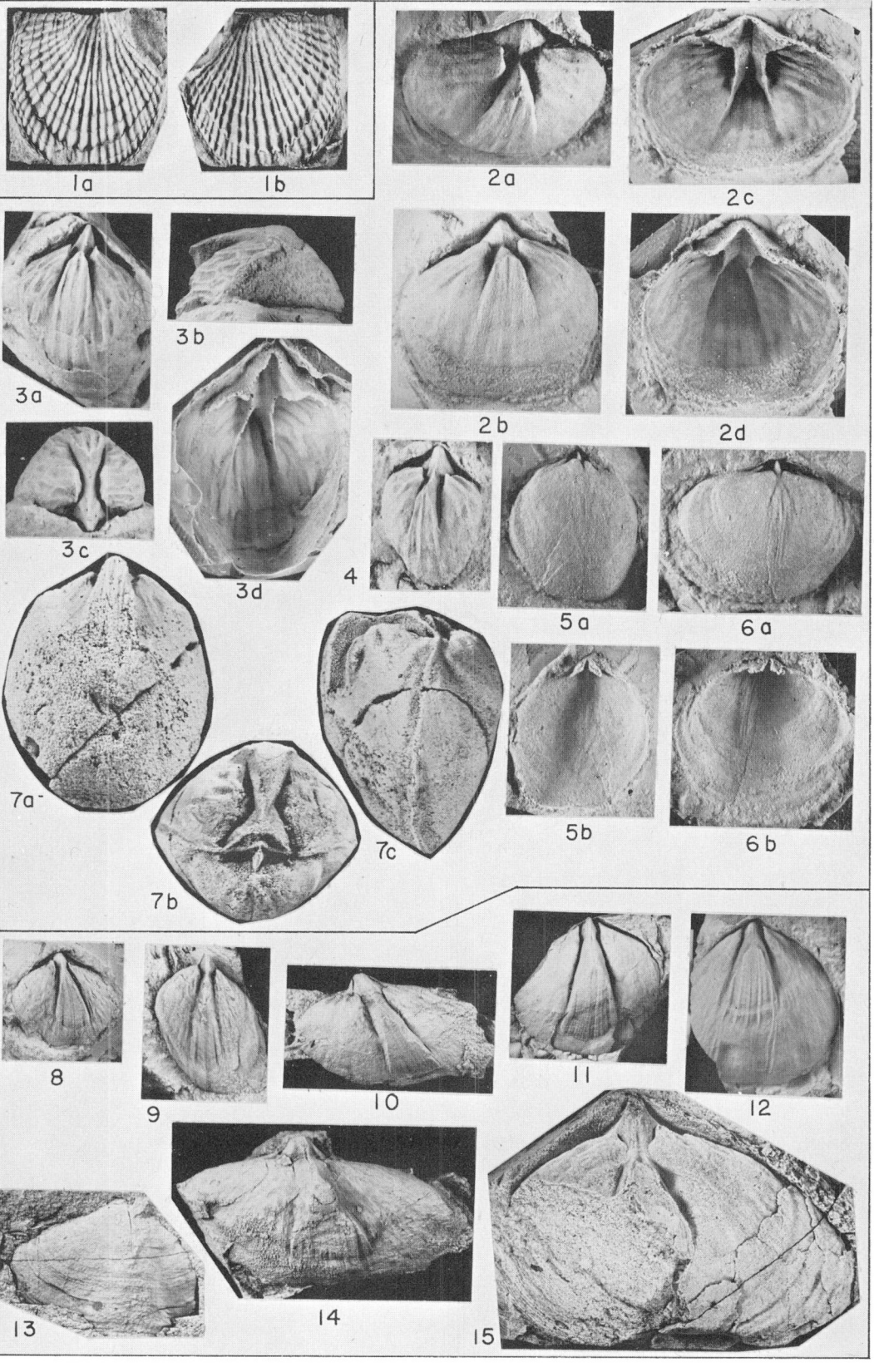
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PLATE XXVI

Figures 1a–c. *Meristina billingsiana* (Dawson, 1880) (Page 81)

French River Formation, Pictou County, loc. USNM 10842.

1a. Mould of interior of brachial valve (x1). GSC No. 19549.

1b, c. Rubber impression of 1a, top and oblique anterior views (x1, x2).

Figures 2–11. *Hyattidina* sp. (Page 82)

Upper member, Ross Brook Formation. Figures 3, 4, 6, 9, 11, Pictou County, loc. USNM 10832; figures 2, 5, 7, 8, 10, Arisaig area, loc. USNM 10128.

2, 3. Moulds of interiors of brachial valves (x5). GSC Nos. 19550, 19551.

4. Mould of interior of pedicle valve (x4). GSC No. 19552.

5–10. Moulds of interiors of pedicle valves (x5). GSC Nos. 19553–19558.

11. Mould of exterior of pedicle valve (x4). GSC No. 19559.

Figures 12–21. *Hyattidina northumberlandensis* (McLearn, 1924) (Page 83)

Figure 12, French River Formation, Pictou County, loc. USNM 10811; figure 13, Moydart Formation, Arisaig area, Twenhofel loc. 97; figures 14, 16, 17, 21, Moydart Formation, Arisaig area, loc. USNM 10182; figure 15, *Scolithus* (worm-tube) quartzite, beds correlative with Moydart Formation, Cape George area, loc. USNM 10834; figure 18, Moydart Formation, Arisaig area, loc. USNM 10175; figures 19, 20, Moydart Formation, Arisaig shore section (exact locality not known).

12. Mould of interior of pedicle valve (x3). GSC No. 19560.

13. Exterior of pedicle valve (x3). Holotype, Peabody Museum No. 445c.

14–17. Moulds of interiors of pedicle valves (x2). GSC Nos. 19561–19564.

18a. Mould of interior of pedicle valve (x2). GSC No. 19565.

18b, c. Rubber impression of specimen in 18a, top and anterior views (x2).

19, 20. Exterior of pedicle valve (x1). Hypotypes, *Meristina tumida* ? McLearn *non* Dalman, GSC Nos. 5449, 5448.

21a, b. Mould and rubber impression of interior of brachial valve (x2). GSC No. 19566.

Figures 22–24. *Protathyris*? sp. (Page 84)

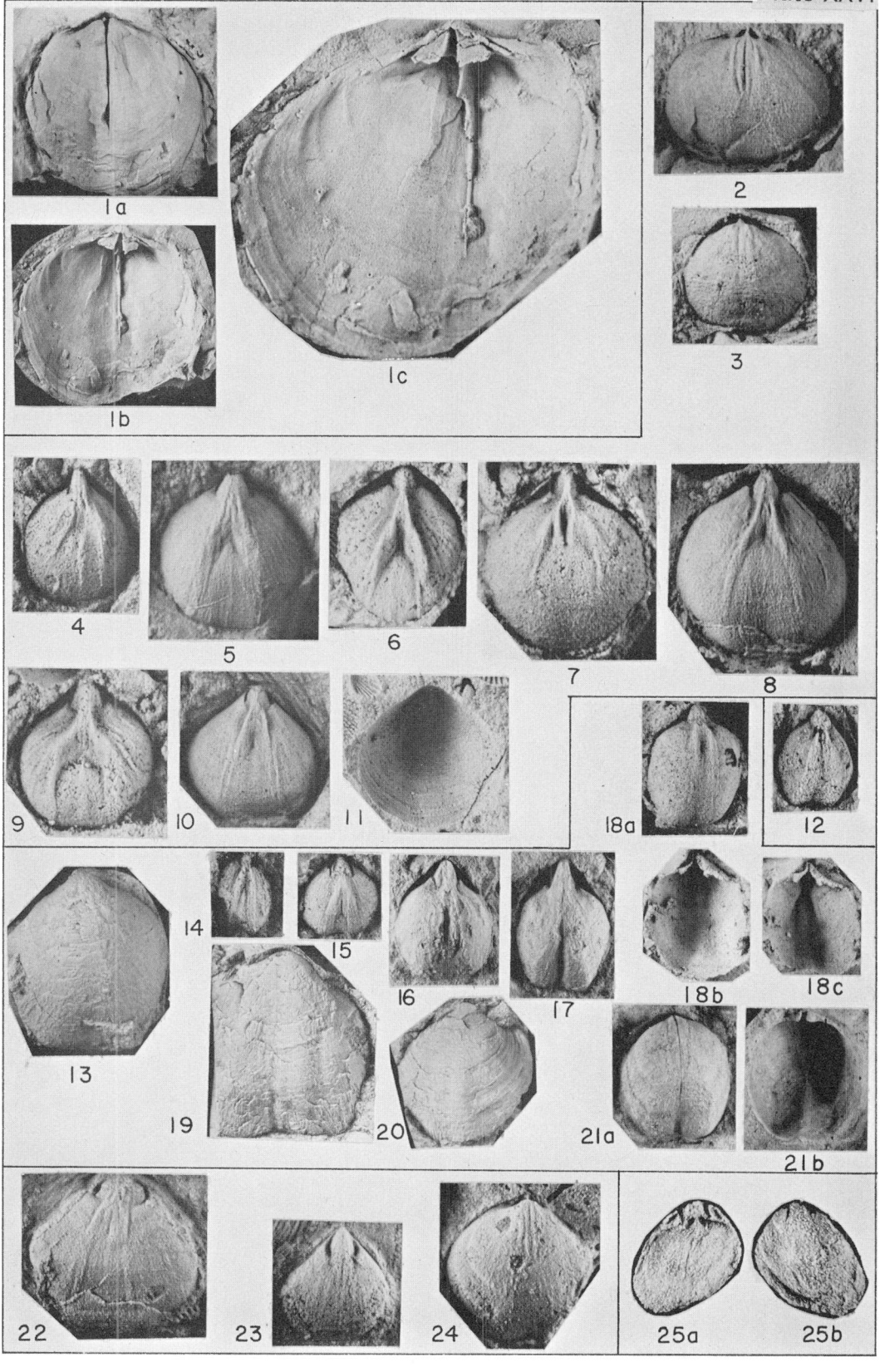
Stonehouse Formation, Arisaig area, loc. USNM 10187.

22, 23. Moulds of interiors of pedicle valves (x4). GSC Nos. 19567, 19568.

24. Mould of interior of brachial valve (x4). GSC No. 19569.

Figures 25a, b. *Podolella*? sp. (Page 90)

Stonehouse Formation, Pictou County, loc. USNM 10848. Steinkern, dorsal and ventral views (x3). GSC No. 19570.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18c
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21b
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25a
25b

PLATE XXVII

Figures 1a–e. *Nucleospira* sp. (Page 84)

French River Formation, Cobequid Mountains, loc. USNM 10810.

1a, b. Mould and rubber impression of exterior of brachial valve (x1½, x2½). GSC No. 19571.

1c. Mould of interior of brachial valve (x2½), counterpart of specimen in 1a. GSC No. 19572.

1d, e. Rubber impression of 1c, top and anterior views (x2½).

Figures 2–5. *Striispirifer stonehousensis* (McLearn, 1924) (Page 85)

French River Formation. Figure 2, Arisaig area, loc. USNM 10156; figure 3, Pictou County, loc. USNM 10847; figure 4, Pictou County, loc. USNM 10842; figure 5, Pictou County, loc. USNM 10816.

2a, b. Mould of interior of pedicle valve, posterior and top views (x1). GSC No. 19573.

3a, b. Posterior view and rubber impression of anterior view (x1, x1½) of mould of interior of articulated valves. GSC No. 19600.

4a. Mould of interior of pedicle valve (x1). GSC No. 19574.

4b, c. Rubber impression of specimen in 4a, top and anterior views (x1).

5. Mould of exterior of pedicle valve (x2). GSC No. 19575.

Figures 6–9. *Howellella moydartensis* (McLearn, 1924) (Page 86)

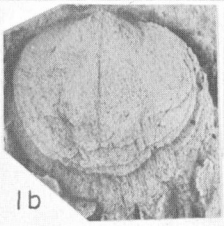
Lower member, Moydart Formation. Figures 6, 7, Arisaig area, loc. USNM 10172; figure 8, Cobequid Mountains, loc. USNM 10814; figure 9, Arisaig shore section (exact locality not known).

6, 7. Moulds of interiors of pedicle valves (x2). GSC Nos. 19576, 19577.

8. Mould of interior of brachial valve (x2). GSC No. 19578.

9a–e. Articulated specimen, side, ventral, anterior, dorsal, and posterior views (x2). GSC No. 19579.


1a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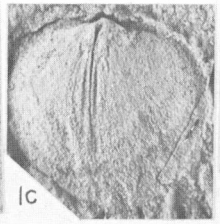
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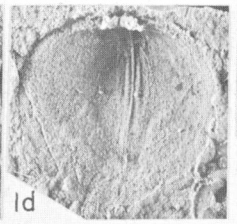
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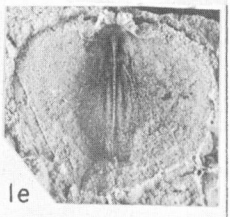
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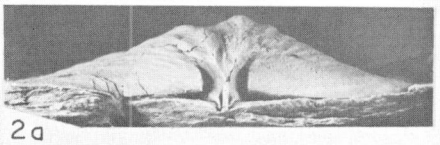
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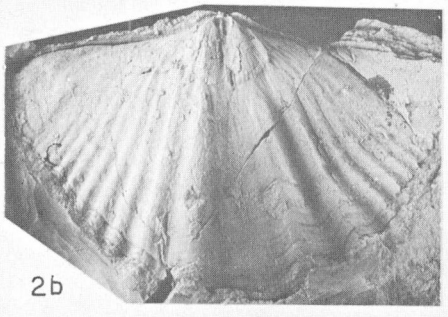
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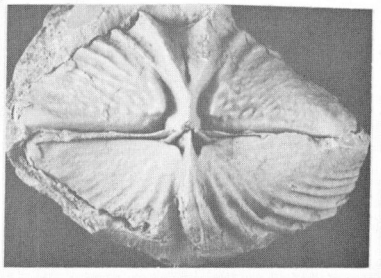
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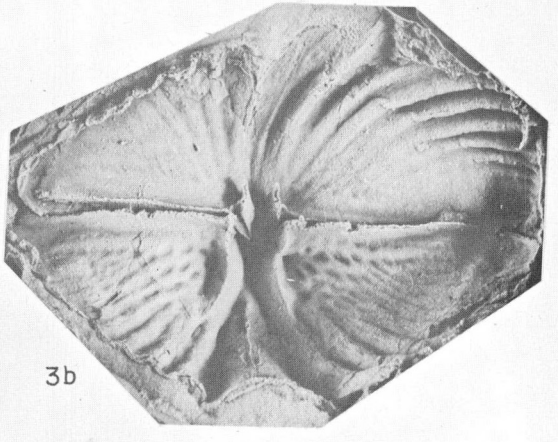
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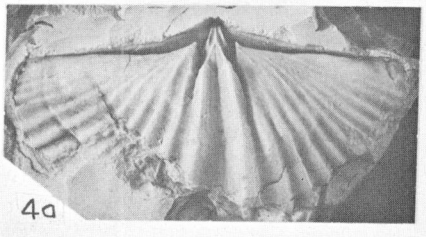
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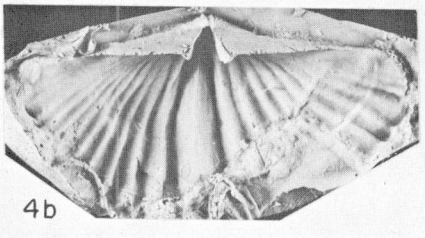
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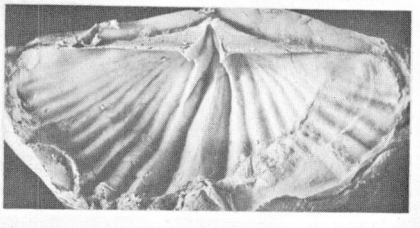
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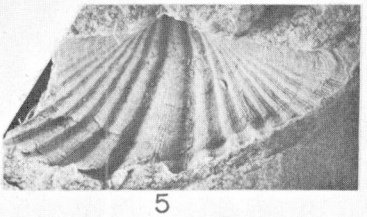
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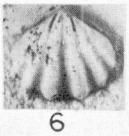
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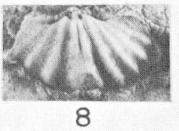
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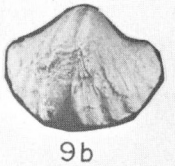
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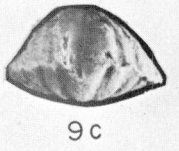
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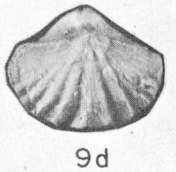
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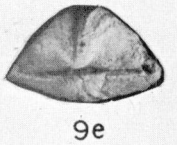

9e

PLATE XXVIII

Figures 1–10. *Delthyris* (*Quadrifarius*) *rugaecosta* (Hall, 1860) (Page 88)

Stonehouse Formation, Arisaig area. Figures 1, 2, 5, 10, loc. USNM 10201; figure 3, loc. USNM 10186; figures 4, 6, loc. USNM 10187; figure 7, loc. USNM 10192; figure 8, Arisaig shore section (exact locality not known); figure 9, Twenhofel loc. 73.

1, 2. Moulds of interiors of pedicle valves (x1½). GSC Nos. 19584, 19585.

3a, b. Mould and rubber impression of interior of pedicle valve (x2, x1½). GSC No. 19586.

4a, b. Mould and rubber impression of interior of pedicle valve (x1½). GSC No. 19587.

5a, b. Mould and rubber impression of interior of brachial valve (x2). GSC No. 19588.

6. Mould of interior of pedicle valve (x1½). GSC No. 19589.

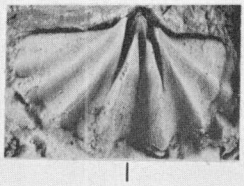
7a. Mould of interior of brachial valve (x1½). GSC No. 19590.

7b, c. Rubber impression of specimen in 7a, top and anterior views (x2).

8a, b. Steinkern, ventral and dorsal views (x2). GSC No. 3095c.

9. Brachial valve (x1). Holotype *Delthyris rugaecosta* mut. *prima* McLearn, Peabody Museum No. 442c.

10a, b. Mould and rubber impression of exterior of pedicle valve (x2). GSC No. 19591.



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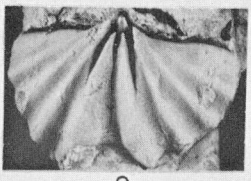

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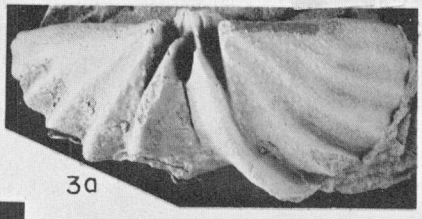

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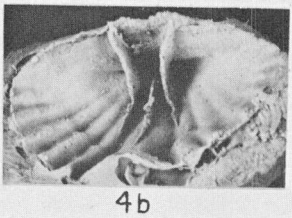

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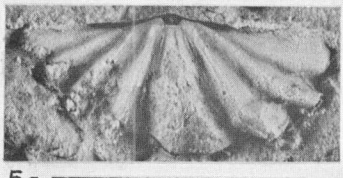

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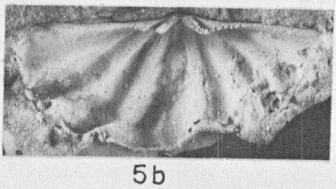

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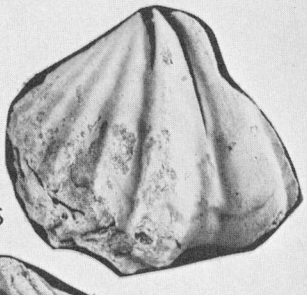

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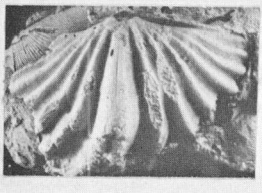

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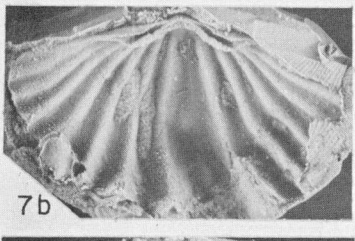

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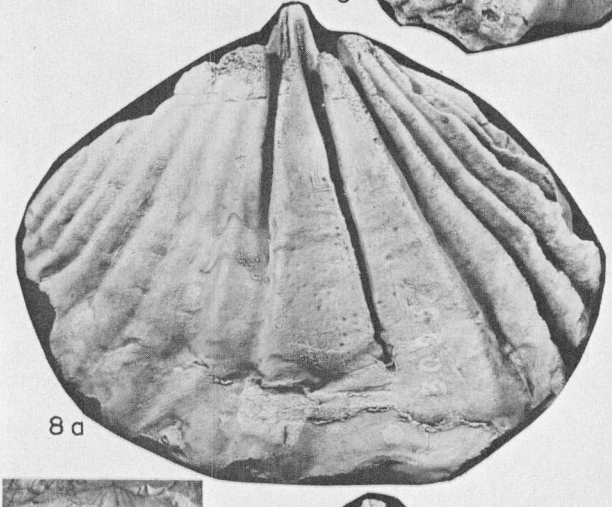

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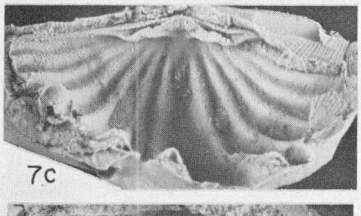

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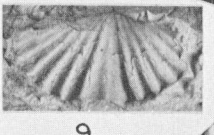

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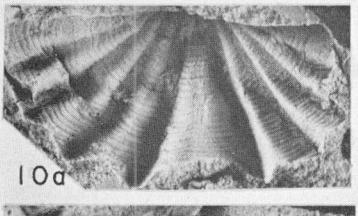

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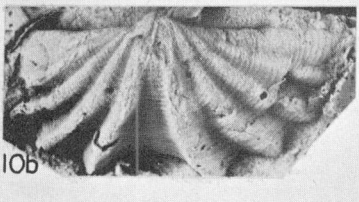

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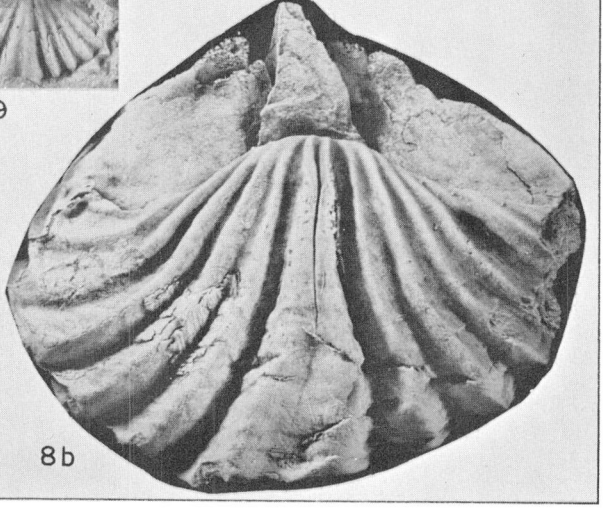

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FOSSIL INDEX

Numbers in **bold face** type indicate pages on which taxa are described.

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Geological Survey of Canada

Bulletins present the results of detailed scientific studies on geological or related subjects. Some recent titles are listed below (Information Canada No. in brackets):

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189 Precambrian fossils, pseudofossils, and problematica in Canada, *by* H. J. Hofmann, $3.00 (M42-189)

190 Surficial geology of Rosetown map-area, Sask., *by* J. S. Scott, $2.00 (M42-190)

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