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GEOLOGICAL SURVEY OF CANADA

DEPARTMENT OF MINES AND TECHNICAL SURVEYS

BULLETIN 140

SILURIAN BRACHIOPODS AND GASTROPODS OF SOUTHERN NEW BRUNSWICK

A. J. Boucot, J. G. Johnson, Charles Harper,
and Victor G. Walmsley

Price, $3.00

1966

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Available by mail from the Queen's Printer, Ottawa,
from Geological Survey of Canada,
601 Booth St., Ottawa,
and at the following Canadian Government bookshops:

OTTAWA
Daly Building, corner Mackenzie and Rideau

TORONTO
221 Yonge Street

MONTREAL
Æterna-Vie Building, 1182 St. Catherine St. West

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Price $3.00 Catalogue No. M42-140

Price subject to change without notice

ROGER DUHAMEL, F.R.S.C.
Queen's Printer and Controller of Stationery
Ottawa, Canada
1966

SILURIAN BRACHIOPODS AND GASTROPODS OF SOUTHERN NEW BRUNSWICK

2,000-1965-5380

Chief Scientific Editor
PETER HARKER
Technical Editor
PETER HARKER
Production Editor
MARGUERITE RAFUSE
Printed on ANCASTER BOOK BASIS 140M
Set in Times Roman with
20th Century captions by
HUNTER ROSE COMPANY, TORONTO
Artwork by CARTOGRAPHIC UNIT, GSC

PREFACE

The Silurian faunas of New Brunswick have been known for well over 100 years but there has been no attempt to describe them systematically either in Canada, or in the United States where Silurian rocks extend into the coastal region of Maine.

This bulletin is based on material in the collections of the Geological Survey of Canada accumulated over a number of years of geological work in the region. The stratigraphic results are of considerable interest to all concerned with the complex geology of the northern Appalachians, and the illustrations of fossils will be of value to both field geologist and palaeontological specialist.

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

OTTAWA, OCTOBER 21, 1964

BULLETIN 140 — Silurische Brachiopoden und Gastropoden vom südlichen Neubraunschweig. Von A. J. Boucot und andere

Brachiopoden und Gastropoden des südlichen Neubraunschweig und des angrenzenden Maine werden beschrieben, abgebildet und 37 bestehenden Gattungen der Ober-Llandovery-, Wenlock- und Ludlowstufen und des Spätsilurs zugeteilt.

БЮЛЛЕТЕНЬ 140 — Силурийские брахиоподы и гастроподы южного Нью-Брансуика А. Дж. Буко и др.

В работе даются описания брахиопод и гастропод верхне-лландоверского, уэнлокского и лудловского ярусов юга Нью-Брансуика и прилегающего штата Мэн. Эти животные отнесены к тридцати семи уже известным родам.

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SILURIAN BRACHIOPODS AND GASTROPODS OF SOUTHERN NEW BRUNSWICK

Abstract

Shelly faunas of southern New Brunswick and the adjacent part of Maine span a considerable portion of Silurian time. The succession comprises a lower fauna, relatively rich in genera and species of Upper Llandovery and Wenlock age; a middle shelly fauna, relatively poor in genera and species characterized by an abundance of *Salopina*, rhynchonellids, and *Howellella* of Wenlock or Ludlow age; and an upper fauna, sparse and poorly dated but occurring near the Silurian-Devonian boundary. The total fauna, described and figured, is assigned to 37 existing genera.

Résumé

Les faunes à coquille du sud du Nouveau-Brunswick et de la région adjacente du Maine occupent une partie assez considérable du Silurien. La succession comprend une faune inférieure assez riche en genres et en espèces du Llandovery supérieur et de l'âge Wenlock; une faune moyenne à coquille, assez pauvre en genres et en espèces, et caractérisée par une abondance de *Salopina*, de rhynchonellidés et de *Howellella* des âges Wenlock ou Ludlow; et une faune supérieure éparse et d'âge imprécis mais que l'on trouve près de la limite du Silurien et du Dévonien. L'ensemble de la faune décrite et illustrée a été reliée à 37 genres existants.

INTRODUCTION

Although the Silurian faunas of coastal Maine and New Brunswick have been known for well over 100 years, relatively little has been published in a descriptive way except for a series of papers on the shells from the Eastport quadrangle in southeastern Maine by H. S. Williams (Bastin and Williams, 1914, etc.)[1]

In 1952, Professor Graham S. MacKenzie of the University of New Brunswick turned over to Boucot, Geological Survey collections of Silurian brachiopods from southern New Brunswick. This material had been accumulated over a number of years of mapping in the Long Reach region (MacKenzie, 1951 a, b). At the same time Dr. L. M. Cumming of the Geological Survey of Canada guided Boucot to the Back Bay and east shore of Oak Bay, New Brunswick, collecting areas. Dr. Olcott Gates, The Johns Hopkins University, sent in collections of Pembroke Formation age from Back Bay, New Brunswick, in 1961. The material from southern New Brunswick has been supplemented by extensive collections provided by Dr. Gates' studies of the geology of southeastern Maine in the Cutler, Machias, Eastport, Calais, and Gardner Lake quadrangles. Dr. Marion Bickford, San Jose State College, guided Boucot to the old Hitchcock locality on Flint Island, Pleasant Bay, Maine; and Dr. David Stewart showed him the type section of the Ames Knob Formation, and adjacent Silurian fossil localities in the Penobscot Bay area. Boucot made extensive collections at all these localities, and familiarized himself with the stratigraphy.

With this material, as well as an acquaintance with the shells occurring in adjacent regions of the northern Appalachians, it was decided to describe the southern New Brunswick brachiopods. A report on the fauna was prepared in 1953 for Professor MacKenzie and for Dr. Cumming. In 1962 Boucot was joined in the work of describing the brachiopods and gastropods by Dr. J. G. Johnson, California Institute of Technology, and in 1963 by Dr. Victor Walmsley, University College of Swansea, Wales (temporarily at the Institute), and by Dr. Charles Harper, also of the Institute. Boucot and Johnson prepared the initial manuscript following which Dr. Walmsley restudied the Dalmanellacea and rewrote that section. Dr.

[1]Names and dates in parentheses are those of references listed in Bibliography.

Harper did the same for the Stropheodontidae. The joint authors wish to acknowledge the photographic work of Mr. E. Thorpe, Geological Survey of Canada and of Mr. Nelson W. Shupe, Washington.

This study of the brachiopods from southern New Brunswick demonstrates that they are very similar generically and specifically to those found elsewhere in the northern Appalachians, exclusive of the Arisaig region, Nova Scotia (McLearn, 1924). However, the Pembroke-Jones Creek fauna, characterized by an abundance of *Salopina*, is very reminiscent of faunas found in the Arisaig Region.

New species of *Isorthis* and *Protomegastrophia* are described, as well as the fragmentary gastropods which include a new genus based on material from Gotland and Back Bay, New Brunswick.

The text of this paper is essentially as submitted in the first half of 1963. It was not possible to incorporate a thorough reassessment of new biostratigraphic and systematic advances at the time proofs were prepared (1966). The writers now regard the rhynchonellids described as *Stegerhynchus*? spp. (p. 31) as probable representatives of *Ancillotoechia*. In addition, we regard the genus *Plectatrypa* (p. 33) as a member of the subfamily Atrypinae.

AGE OF FAUNAS

The Silurian faunas of southern New Brunswick (and adjacent Maine) span a large part of Silurian time, but owing to the almost complete absence of graptolites they have never been too satisfactorily correlated with the standard succession. At present, however, we have more extensive data about the coastal New Brunswick and Maine shelly faunas and, more significantly, a better understanding of the evolutionary history of certain groups of brachiopods.

In the whole coastal region from North Haven in Penobscot Bay, Maine, northeast through the Eastport-Mascarene region of Maine and New Brunswick to the Long Reach region of New Brunswick there is a relatively similar faunal succession despite major local differences in thickness and lithologic succession. This faunal succession can be briefly characterized as consisting of: a lower shelly fauna, relatively rich in genera and species (*see* Table I) and ranging in age from C_3 of the Upper Llandovery through the Wenlock; a middle shelly fauna, relatively poor in genera and species but characterized by an abundance of *Salopina*, rhynchonellids, and *Howellella*, which is concluded to be Wenlock or Ludlow[1] age; an upper fauna occurring in or associated with red beds, and containing a very restricted shelly fauna plus scattered fish fragments and abundant inarticulate brachiopod debris. The upper fauna is as yet very poorly dated, but belongs somewhere near the Silurian-Devonian boundary.

On the Westport and adjoining Hampstead maps (GSC Papers 51-15 and 51-19) in the Long Reach region of New Brunswick, the Long Reach Formation was mapped by MacKenzie as being younger than the Jones Creek Formation. A subsequent structural interpretation of the Long Reach Formation showed it to be older than the Jones Creek Formation (MacKenzie, written communication, 1953). The occurrence of *Costistricklandia* and *Eocoelia* sp. in the Long Reach Formation limits its age to C_6 to Wenlock. The Jones Creek brachiopod fauna described here-

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[1]Latex squeezes of ostracods from the Jones Creek Formation, Jones Creek and Highway, New Brunswick, were examined by Anders Martinsson and Jean Berdan. The rock with the moulds from which the squeezes were made was returned to the Geological Survey of Canada. The squeezes represent the beyrichiid ostracods *Londinia* sp. and *Sleia* sp. This fauna is close to, but not identical with, that of the Pembroke Formation of Maine. According to Martinsson, similar forms occur in the lower Downton Castle Sandstone of the British Isles, and could be considered Skala in age.

Table I

Stratigraphic Occurrence of Brachiopods and Gastropods in the Silurian of Southern New Brunswick

	Unnamed beds, Back Bay, N.B. GSC loc. 55050	LONG REACH FM. GSC loc. 55061	JONES CREEK FM. All localities
Rhynobolus sp. A	X	X	
Dolerorthis cf. *D. rustica*	X		
Skenidioides sp.	X		
Dicaelosia sp.	X		
Dalejina cf. *D. hybrida*	X		?
Resserella cf. *R. concavoconvexa*	X		
Resserella cf. *R. visbyensis*		X	
Salopina submedia		X	X
Isorthis mackenziei		X	
Isorthis sp.	X		X
Anastrophia sp.	X		
Sieberella sp.	X		
Pentamerus sp.	X		
Costistricklandia cf. *C. gaspéensis*		X	
Plectodonta (*Eoplectodonta*?) cf. *E. millinensis*	X		
Leangella sp.	X		
Pentlandina cf. *P. parva*	X		
Leptaena spp.	X	X	
Amphistrophia sp.	X		
Strophonella cf. *S. euglypha*	X		
Protomegastrophia prima	X		
Chilidiopsis spp.	X	X	
Protochonetes? sp.	X		
Stegerhynchus? spp.	X		X
Sphaerirhynchia? sp.	X		
Ferganella sp.	X		
Plectatrypa imbricata	X		
Atrypa "reticularis"	X	X	
Eocoelia cf. *E. sulcata*		X	
Meristina sp.	X		
Nucleospira sp.	X		
Eospirifer sp.	X	X	
Macropleura sp.	X		
Cyrtia sp.	X		
Howellella sp. 1	X		X
Howellella sp. 2		X	
Howellella sp. 3		X	
Oriostoma cf. *O. globosum*	X		
Pseudoscalites cf. *P. lindstroemi*	X		
Euomphalopterus sp.	X		
Indet. gastropod	X		

in and previously mentioned by Boucot (1960) is probably of Wenlock or Ludlow age, however, it should be made clear that this age determination is based upon a correlation with the Pembroke Formation on the Eastport-Mascarene region, which contains an almost identical shelly fauna. These faunal determinations confirm MacKenzie's unpublished conclusions about the relative ages of the Long Reach and Jones Creek Formations.

At Back Bay, New Brunswick in the Mascarene area, there are unnamed Silurian beds containing a rich fauna that is probably of Late Llandovery, C_4-C_5 age because of the presence of *Pentamerus* s.s. which has been commonly found in beds of about C_4-C_5 age in both Europe and North America. If the significance of *Pentamerus* were discounted, the age determination would have to be considerably broader. Among the other elements in the fauna, *Pentlandina* and *Leangella* indicate a pre-Ludlow age: *Protomegastrophia prima* suggests a Late Llandovery age as it is a form which is morphologically transitional between earlier Llandovery species of *Protomegastrophia* and those of the later Silurian. *Macropleura* suggests a C_4-C_5 age or younger.

On the east shore of Oak Bay, opposite Cookson Island, in the Mascarene area, Cumming directed Boucot to two localities belonging to the "Mascarene Series". The stratigraphically lower one contained *Leptaena "rhomboidalis"*, a chonetid, a stropheodontid, and a dalmanellid. The stratigraphically higher (in loose blocks about 100 yards south of the first) yielded *Salopina* sp., a chonetid, and a rhynchonellid. All this material is very poorly preserved, having been greatly distorted and baked to a hornfels by an adjacent intrusion. The stratigraphically higher fauna can be correlated with the Jones Creek and Pembroke Formations as well as the upper zone of the Ames Knob Formation in Penobscot Bay; the lower fauna can be inferred by stratigraphic position only, to be of C_3 to Wenlock age. The underlying Oak Bay Conglomerate is relatively unfossiliferous and essentially assigned to the Silurian only because it is conformable with the overlying beds on both sides of Oak Bay (those of the western side are somewhat better dated by means of fossils than those on the eastern side).

The stratigraphic succession in the Eastport region is as follows from bottom to top: Quoddy Formation, Dennys Formation, Edmunds Formation, Pembroke Formation, Eastport Formation. The Quoddy Formation is of Late Llandovery age as it has yielded graptolites indicating a zonal placement of about 21-22 (W.B.N. Berry, written communication, 1962) and eospiriferids suggesting a C_3 or younger assignment. The probably correlative "Little River Formation" of the Machias area has yielded a C_4-C_5 species of *Stricklandia*. The unnamed beds at Back Bay, New Brunswick, are concluded to be correlative with the Quoddy Formation at least in part. The Dennys and Edmunds Formations both contain relatively rich shelly faunas dated as C_5 to Wenlock. The Pembroke Formation has been concluded to be of Wenlock or Ludlow age, largely because of the similarity of its fauna to that of the Jones Creek Formation.

Southwest from the Eastport-Mascarene region, the next area of fossiliferous Silurian rocks is on the northeast end of Flint Island, Pleasant Bay, Maine. There hornfels adjacent to a granitic intrusion yielded specimens of *Dalejina* similar to

those from the unnamed beds at Back Bay. However, the Flint Island fauna is too restricted for anything more to be concluded than that it is pre-Pembroke and C_3 or younger age.

On North Haven in Penobscot Bay, Maine, Dr. David Stewart of the U.S. Geological Survey directed Boucot to several localities in the Ames Knob Formation. The total thickness of the formation at the type section is no more than a few hundred feet, but in the lower 20 feet *Pentamerus* has been found, suggesting a correlation with the Quoddy and the unnamed beds at Back Bay. In the middle part a fauna of C_5 to Wenlock age has been found (*Atrypa "reticularis"*, *Leptaena "rhomboidalis"*, *Strophonella euglypha, Hyattidina* sp., *Gypidula* sp., *Dalejina* sp., *Macropleura* sp., *Delthyris* sp., *Mesodouvillina* sp., *Rhynchospirina* sp., *Isorthis* sp., *Sphaerirhynchia* sp., *Plectodonta* sp., *Howellella* sp.), and in the upper part a Pembroke-type fauna (*Salopina submedia*, "*Chonetes*" sp., "*Camarotoechia*" sp., *Mesodouvillina*? sp., *Howellella*? sp.), followed by red beds which on adjoining Vinalhaven contained linguloid fragments and fish fragments.

LOCALITY INDEX

The following descriptions refer to localities in the Westfield (51-15) and Hampstead (51-19) map-areas (G. S. MacKenzie, 1951a; 1951b), and to a locality in the St. George map-area (1094A) [S. C. Perry and F. J. Alcock, 1960]:

GSC Locality

55050 Unnamed beds of map unit 4, St. George map-area (1094A), beach south of the village of Back Bay, 0.5 mile northwest of the west end of Douglas Island.

55051 Jones Creek Formation, Hampstead map-area (PM 51-19), 1.1 miles southeast of Brokeneck Mountain; longitude 66°10′ and 1.6 miles from south boundary of map-area.

55052 Jones Creek Formation, Hampstead map-area (PM 51-19); Jones Creek, 0.35 mile west of highway bridge at Central Greenwich.

55053 Jones Creek Formation, Hampstead map-area (PM 51-19), west side of road, 0.85 mile northwest of Oak Point wharf.

55054 Jones Creek Formation, Hampstead map-area (PM 51-19), 1.15 miles northwest of Oak Point wharf, on west side of road north of Oak Point.

55055 Jones Creek Formation, Hampstead map-area (PM 51-19), one mile due north of the Oak Point wharf.

55056 Jones Creek Formation, Hampstead map-area (PM 51-19), road-cut, old road on east side of main highway south of Central Greenwich; 0.2 mile south of the mouth of Jones Creek.

55057 Jones Creek Formation, Hampstead map-area (PM 51-19), road-cut, old road approximately 0.15 mile south of bridge at Central Greenwich.

55058 Jones Creek Formation, Westfield map-area (PM 51-15), mouth of northern inlet to an unnamed lake, 2.15 miles northeast of Nerepis.

55059 Jones Creek Formation, Hampstead map-area (PM 51-19), west side of eastern road to Hamilton Mountain, 1.35 miles north of triple road junction 0.9 mile southeast of Blue Mountain.

55060 Jones Creek Formation, Westfield map-area (PM 51-15), north side of road, 1.25 miles northeast of Nerepis.

55061 Long Reach Formation, Hampstead map-area (PM 51-19), stream bed of southwesterly flowing unnamed brook, 0.75 mile from its junction with the Nerepis River near Armstrong Corner; 0.45 mile northeast of the Nerepis River.

55062 Jones Creek Formation, Hampstead map-area (PM 51-19), 0.5 mile northeast of Lynch Corner.

55063 Jones Creek Formation, Westfield map-area (PM 51-15), 2.15 miles southeast of Champlain Mountain.

55064 Jones Creek Formation, Hampstead map-area (PM 51-19), 0.65 mile northwest of Lynch Corner.

55065 Jones Creek Formation, Hampstead map-area (PM 51-19), 0.5 mile east of Hamilton Mountain, from bed of unnamed stream flowing easterly into Long Lake.

SYSTEMATIC PALAEONTOLOGY

Phylum BRACHIOPODA

Class INARTICULATA

Order NEOTREMATA Beecher, 1891

Superfamily TRIMERELLACEA Davidson and King, 1874

[*nom. transl.* Schuchert and LeVene, 1929 (*ex* Trimerellidae Davidson and King, 1874)]

Family TRIMERELLIDAE Davidson and King, 1874

Genus ***Rhynobolus*** Hall, 1871

Type species. Obolus galtensis Billings, 1862, p. 168, fig. 151

Discussion. Study of the New Brunswick trimerellids brought up the problem of defining *Dinobolus* and *Rhynobolus*. Brachial valves are very much alike, but the deltidium of each of the two genera appeared to be fundamentally different according to Hall and Clarke's figures (1892, pl. 4B) and to those of Norford (1960), which show a slightly convex, ungrooved deltidium in *Dinobolus*. However, *Rhynobolus* bears a so-called pedicle groove in the long deltidium of its type species (Hall and Clarke, 1892, pl. 4B, fig. 7). The New Brunswick *Rhynobolus* sp. A and *Rhynobolus* sp. B (*see* page 9) both show this feature, but it is variably developed from specimens with a deep groove to those with merely a gently concave deltidium and in these a cardinal socket may be seen. In most brachial valves of *Rhynobolus* there is a triangular elevation medially, corresponding to the "pedicle groove" on the deltidium of the pedicle valve that would serve effectively to prevent the passage of a functional pedicle as suggested for *Dinobolus* by Norford (1960, p. 244).

Considering the variability of the length of the deltidium and the depth of its median groove in *Rhynobolus*, the distinction between it and *Dinobolus* is mini-

mized. However, as shown by Hall and Clarke (1892, pl. 4B) and by Norford (1960), *Dinobolus* has a well-developed cardinal buttress. In *Rhynobolus* this structure is not developed and it is mainly by this difference that we distinguish the two genera.

Rhynobolus sp. A

Plate I, figures 1-11; Plate II, figures 1-3

Material and occurrence. Hypotypes A,B,C,E,G, GSC Nos. 18917, 18918, 18919, 18922, 18923, unnamed beds, Back Bay, N.B., GSC locality 55050; hypotypes D,F, GSC Nos. 18920, 18921, Long Reach Formation, GSC locality 55061.

Exterior. The brachial valve is subcircular and the pedicle valve is slightly elongate, subcircular. The posterior two thirds of the brachial valve is gently convex, and the anterior third is strongly convex due to a marked change in curvature anteriorly. The lateral and anterior margins of both valves are evenly rounded. The beak of the pedicle valve protrudes posterior to that of the brachial valve. The beak region of the brachial valve is evenly rounded, that of the pedicle valve is weakly acuminate. The deltidium is convex along its lateral edges and concave medially, forming a more or less well-developed pedicle groove. The deltidium is bounded laterally by weakly developed grooves at the inner edges of the areal borders. The deltidium and the areal borders are weakly striate transversely.

Interior of pedicle valve. The median and lateral scars are strongly developed and deeply striated by concentric growth lines. These muscle scars lie on the anterior part of the platform. The platform vaults are very shallow. A well-developed median partition supports the platform. Umbonal chambers may be weakly developed or absent. A cardinal buttress is not developed. In some specimens the lateral muscle scars are divided by longitudinally directed, low ridges. Umbo-lateral scars are small and strongly impressed.

Interior of brachial valve. The most prominent features of the interior are the medially situated anterior scar (=median partition) and median scar and the laterally situated lateral scars. The platform vaults are present under the lateral scars but do not penetrate very far posteriorly. The presence of growth lines on the muscle scars is variable. Both the anterior and median scars may be strongly impressed by transverse growth lines and the lateral scars by growth lines parallel to the long axis of the scars. In some specimens the anterior scar is non-striated by growth lines and looks far more like a simple partition than a muscle attachment site. Laterally directed cardinal impressions (Norford, 1960, p. 243) are well developed.

Rhynobolus sp. B

Plate XVII, figures 4-11; Plate XVIII, figures 1-9

Material. Hypotypes, GSC Nos. 19068, 19069, 19070, 19071, 19071a, 19072, 19073, 19074, 19075a.

Exterior. The valves are transversely suboval in outline and biconvex in lateral profile. The suboval outline is modified by a tongue-like median extension anteriorly. The brachial valve bears a distinct shallow rounded groove that widens only slightly anteriorly. Sparse concentric growth lines are present over most of the shell. These are deflected anteriorly as they cross the median groove.

The beak is straight, or slightly incurved. The deltidium is broadly triangular with an apical angle slightly less than 90 degrees. The sides of the deltidium are very slightly arcuate and encompass a smaller angle away from the apex. Transverse growth lines are well marked across the entire deltidium. Medially on the deltidium there is a more or less well defined pedicle groove with sub-rectilinear margins that diverge away from the beak. In some specimens the groove is rounded in cross-section and merges relatively smoothly with the lateral parts (=deltidial ridges of Hall and Clarke, 1892, pl. 4B, fig. 7) of the deltidium, whereas in others it is fairly well marked by sharply incised boundaries. The deltidium protrudes outward at its edges but is nearly flat across most of its width, and thus is set above the general level of the areal borders. The areal borders bear strongly lamellose growth lines that are more widely spaced than those on the deltidium.

Interior of pedicle valve. A cardinal buttress is not developed. Umbo-lateral scars have not been seen. The platform is broad and arcuate and is unvaulted or nearly so. In the case of vestigial development of platform vaults there is a poorly developed ramp-like median "plate" at the anterior edge of the platform. The crown is continuous from the inner edges of the areal borders and diverges widely anteriorly, curves anteriorly at the side and with a slight re-entrant at the posterior of the crescent end.

Interior of brachial valve. The cardinal area is broadly triangular posterior to the crown of the crescent. It bears strong growth lines and a medial elevation corresponding to the pedicle groove in the deltidium of the pedicle valve. The platform is acutely angular anteriorly with sides along the lateral scars curved and convex laterally. The anterior scar forms a slight rounded projection at the anterior edge of the platform. Platform vaults are vestigial.

Comparison. Rhynobolus sp. B may be a new species on the basis of the median groove on the exterior of the brachial valve. This distinguishes it from *Rhynobolus* sp. A, which lacks such a groove. However, the exteriors of the named species of *Rhynobolus, R. galtensis,* and *R. davidsoni* have not been described.

Occurrence. Unnamed beds (map-unit 6C, GSC Map 8-1963), 0.2 mile west of mouth Little Popelogan Brook, Southeast Upsalquitch River, Restigouche co., New Brunswick.

Class ARTICULATA

Suborder ORTHOIDEA Schuchert and Cooper, 1931

Superfamily ORTHACEA Woodward, 1852

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

Family DOLERORTHIDAE Öpik, 1934

Genus *Dolerorthis* Schuchert and Cooper, 1931

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

Dolerorthis cf. *D. rustica* (Sowerby, 1839)

Plate II, figures 4-11

Orthis rustica Sowerby *in* Murchison, 1839, p. 624, pl. 12, fig. 9.

Remarks. J. W. Kee (written communication, 1961) pointed out that the dolerorthids may be divided into two groups, viz., those possessing a relatively flat brachial valve and very convex pedicle valve and those having a relatively equal degree of convexity in both valves. The latter include "*D.*" *flabellites* (Foerste, 1889), the only dolerorthid not having abundantly, anteriorly bifurcating plications. The Back Bay specimens are allied with the former group.

Material and occurrence. Hypotypes A-E, GSC Nos. 18924-18928; unnamed beds, Back Bay, N.B., GSC locality 55050.

Exterior. The valves are transverse and subequally biconvex with the pedicle valve being more convex than the brachial valve. The greatest width is at the hinge line. The lateral and anterior margins are evenly rounded and strongly crenulate. The interarea of the pedicle valve is apsacline and about twice as long as the anacline interarea of the brachial valve. The delthyrium is unmodified and includes an angle of about 90 degrees. The radial ornament consists of prominent costellae that increase in size anteriorly, supplemented by secondary and tertiary costellae that originate by bifurcation. As in other dolerorthids, there is a pair of first order secondary costellae branching medially off the median primary pair on the brachial valve. The costellae are concentrically ornamented by prominent filae of the hesperorthid and dolerorthid type.

Interior of pedicle valve. Stout hinge teeth are situated on either side of the anterior margins of the delthyrium. The muscle field is cordate and situated on a raised layer of secondary material in the umbonal cavity. The peripheral region is strongly crenulated by the impress of the costellae.

Interior of brachial valve. The cardinalia consist of a blade-like cardinal process and a pair of stout brachiophores. The dental sockets are relatively small, antero-laterally directed, and raised from the floor of the valve on a deposit of secondary material. A broad, low myophragm bisects the relatively poorly impressed muscle field.

Family SKENIDIIDAE Kozlowski, 1929

Genus *Skenidioides* Schuchert and Cooper, 1931

Type species. S. billingsi Schuchert and Cooper, 1931

Skenidioides sp.

Plate II, figure 12

Material and occurrence. Hypotype A, GSC No. 18929, unnamed beds, Back Bay, GSC locality 55050.

Interior of brachial valve. A single brachial valve is characterized by the presence of a median septum which reaches almost to the anterior margin. Posteriorly, it joins the blade-like cardinal process. A prominent posteriorly situated cruralium is present, formed from the medial fusion of the supporting plates with the median septum and cardinal process. The dental sockets are relatively small. The interior is strongly crenulated by the impress of the costellae. The hinge line is straight and is the point of maximum width. The lateral and anterior margins are crenulate and weakly sulcate. The interarea is short and anacline.

Superfamily ENTELETACEA Waagen, 1884

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

Family RHIPIDOMELLIDAE Schuchert, 1913,
emended Boucot, Johnson, and Walmsley, 1965

Genus ***Dalejina*** Havlíček, 1953

Type species. Dalejina hanusi Havlíček, 1953, p. 5, pl. 1, figs. 10, 12-13; pl. 2, fig. 4

Dalejina cf. *D. hybrida* (Sowerby, 1839)

Plate II, figures 14, 15; Plate III, figures 1-14

Material. Hypotypes A-I, GSC Nos. 18930-18938; unnamed beds, Back Bay, N.B., GSC locality 55050.

Exterior. The valves are subequally biconvex with the pedicle valve having a greater degree of convexity. The maximum width is situated near the midlength. The hinge line is straight and equivalent to about half the maximum width. The shells are transversely elliptical. The lateral and anterior margins are evenly rounded and the commissure is strongly crenulate. The radial ornament consists of costellae which increase in number by bifurcation. The valves bear several prominent concentric growth lines. The interarea of the brachial valve is anacline and relatively short. The interarea of the pedicle valve is somewhat longer, and is apsacline.

Interior of pedicle valve. The dental lamellae are relatively short and support stubby hinge teeth. The muscle field consists of flabellate diductor impressions that enclose the relatively small adductor field postero-medially. A prominent, transversely striate, pedicle callist is present at the posterior end of the delthyrial cavity.

The lateral and anterior margins are crenulated in a manner similar to that of the opposite valve.

Interior of brachial valve. The cardinalia consist of a pair of stout brachiophores laterally and a blade-like cardinal process bearing a posterior myophore. The dental sockets are floored by lateral extensions of the brachiophores. The muscle field is quadripartite, weakly impressed, and medially divided by a broad, low ridge. The lateral and anterior margins of the valve are crenulated by flattish, medially grooved crenulations.

Occurrence. Back Bay, N.B. in unnamed beds, GSC locality 55050, and possibly from GSC locality 55060 in the Jones Creek Formation.

Family DALMANELLIDAE Schuchert 1913

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

Genus *Resserella* Bancroft, 1928

Type species. Orthis canalis (J. de C. Sowerby) *in* Murchison, 1839, p. 630, pl. 13, fig. 12a

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

Plate III, figures 15-17, 21-25

Material and occurrence. Hypotypes, GSC Nos. 18939, 18939a, 18940-18945; unnamed beds, Back Bay, N.B., GSC locality 55050.

Description. Plano-convex, with the pedicle valve strongly convex and the brachial valve convex only in the postero-lateral parts—otherwise slightly concave and having a median sulcus which is narrow posteriorly but becomes wide and shallow towards the anterior. The outline is shield shaped. Hinge line is straight and equal to about two thirds of the greatest shell width, which is slightly anterior of midlength. The cardinal angles are rounded and the lateral margins curve slightly before rounding the antero-lateral margins and meeting the strongly curved anterior margin. Posterior to the hinge line, the beak of the pedicle valve projects almost one quarter of shell length and is incurved so as to overhang the brachial valve. Anterior commissure rectimarginate and crenulate. Lateral commissures straight. The interarea of the pedicle valve is curved and orthocline to anacline. The brachial valve interarea is less than half as long, plane and almost hypercline. The notothyrium is triangular, enclosing 90 degrees and partly filled by the bifid myophore of the cardinal process.

Shell, costellate, costellae increasing by bifurcation, fairly coarse (3 per mm at 5 mm length)—about 60 costellae on brachial valve 10 mm wide. The median sulcate area of the brachial valve has the distinctive asymmetric branching pattern characteristic of *Resserella,* in which successive branches are given off alternately

to left and right. The median four costellae constitute a slightly smoother, triangular zone.

Interior of pedicle valve. A poorly impressed muscle field is confined to the posterior third of the valve and in larger specimens has a faintly raised narrow median area. Long narrow diductor tracks flank the raised median area and extend to about midlength, beyond which a very narrow extension of the median raised area persists towards the anterior margin. Short dental lamellae are concave medially and separate lateral cavities from the delthyrial cavity.

Crenulations of the anterior margin of the valve are low, narrow, rounded, and separated by rounded interspaces.

Interior of brachial valve. A faintly impressed adductor muscle field occupies the median third of the posterior half of the valve. It is divided by a low, narrow median ridge, one seventh as wide as the muscle field, becoming narrower at its anterior extremity. Margins of the muscle field are barely discernible. The brachiophores are widely divergent, their bases enclose an angle of 90 degrees. Relatively small, triangular, crenulated sockets are partly excavated beneath the interarea. No fulcral plates present. The cardinal process arises with a short thick shaft from the median ridge where it widens to fill the space between the brachiophores. The myophore is bilobed and occupies the apical part of the wide notothyrium above which it protrudes slightly.

Crenulations of the anterior margin are low, narrow, rounded, and separated by narrow, rounded interspaces.

Resserella cf. *R. visbyensis* (Lindström, 1861)

Plate III, figures 18-20.

Material and occurrence. Hypotypes A, B, GSC Nos. 18946, 18947; Long Reach Formation, GSC locality 55061.

Description. Only internal and external moulds of one brachial valve are available. The valve is faintly concave and has a median sulcus, which is sharp and narrow posteriorly but becomes wider and shallow towards the anterior. The postero-lateral parts of the valve are faintly convex. The outline is shield shaped, slightly wider than long with a straight hinge line three quarters as wide as the greatest width which is near midlength, gently curved lateral margins and a more strongly curved anterior margin. The anterior commissure is crenulate and faintly unisulcate. Lateral commissures straight. The interarea is strongly hypercline, the notothyrium triangular, open, and occupied by the cardinal process.

The surface is costellate, costellae increasing by bifurcation and in the sulcate median area having the typically resserellid asymmetric pattern of branching in which costellae arise as lateral branches on alternate sides of the previous costella. A narrow triangular median zone with fainter costellae appears almost smooth.

Interior of brachial valve. The well-impressed adductor muscle field is slightly

less than one third as wide as the greatest width and extends to slightly beyond mid-length. It is almost twice as long as wide, has an elliptical outline with pointed anterior end and is raised on a low platform. A low, rounded, median ridge one quarter as wide as the muscle field narrows slightly anteriorly and separates the muscle impressions. The edges of the platform form slightly raised margins which merge posteriorly into the bases of the brachiophores. Very faint transverse ridges separate smaller anterior impressions from the much larger posterior ones. The brachiophore bases diverge at about 90 degrees. The brachiophores are thin plates only slightly divergent. The sockets are wide, triangular, and crenulated. The cardinal process arises from the median ridge, is trilobed, wide, and flat. Anterior crenulations are low, narrow, pointed, and bear a median groove. They are separated by narrow, deep interspaces. The imprint of these crenulations reaches from the valve margin to the edge of the adductor platform.

Comparison. Comparison of this valve with specimens of *R. visbyensis* available from the Visby Marl, Gotland, leaves little doubt that it is conspecific. However, no pedicle valve is available.

Family SCHIZOPHORIIDAE Schuchert and LeVene, 1929

Subfamily SCHIZOPHORIINAE Schuchert and LeVene, 1929

Genus *Salopina* Boucot, 1960

Type species. Orthis lunata J. de C. Sowerby *in* Murchison, 1839, p. 611, pl. 5, fig. 15

Salopina submedia (McLearn, 1924)

Plate III, figures 26-28; Plate IV, figures 1-14

Dalmanella lunata Williams, 1913, p. 337, pl. 30, figs. 1-5, 8.
Dalmanella elegantula var. *submedia* McLearn, 1924, p. 53, pl. 3, figs. 3-6, pl. 4, fig. 8.
Salopina lunata Boucot, 1960, p. 3, pl. 1, figs. 6-12, *not* Sowerby.

Material. Holotype, GSC No. 18948, paratype, GSC No. 18948a, Long Reach Formation, GSC locality 55061. Hypotypes A-J, GSC Nos. 18949-18958, Jones Creek Formation, GSC locality 55056.

Description. Unequally biconvex, to almost plano-convex, barely sulcate, subcircular. Hinge line straight, equal to two thirds greatest width, which is near mid-length. Cardinal angles well rounded, lateral margins strongly curved, continuing smoothly round to curved anterior margin. Anterior commissure crenulated and faintly sulcate, lateral commissure straight. Length one sixth greater than width. Thickness equals about one third of width. Shell costellate, having hollow costellae, costellae increasing by bifurcation.

Exterior of pedicle valve. Evenly and moderately convex, outline subcircular. Beak projects one seventh total length beyond hinge line. Interarea curved, apsacline, delthyrium open, triangular, enclosing about 60 degrees.

Exterior of brachial valve. Subcircular, very slightly convex with faint, wide, median sulcus extending from the umbo to the anterior margin. Interarea plane, anacline, notothyrium triangular enclosing about 45 degrees, open, partly occupied by cardinal process. Pattern of rib branching in median area of brachial valve at 5 mm length is characterized by medial tertiaries of the median primary costellae being offset by as much as one fifth shell length. Posterior costellae, strongly curved so as to meet the hinge line at a considerable angle (in large specimens up to six costellae cut the hinge line between the beak and the cardinal angle). Costellae coarse (3.5 per mm at 5 mm length), rounded to subangular, with narrow interspaces on which very fine costellae may be interpolated.

Interior of pedicle valve. The muscle field is confined to the median fifth and the posterior half of the valve. No median ridge is present but the wide diductor tracks can be seen to be separated in some specimens by a very faintly raised median area (about one fifth as wide as the muscle field) as they emerge from the delthyrial cavity. This presumed adductor track can be traced with difficulty into the posterior end of the delthyrial cavity. The diductor tracks fade gradually anteriorly at about midlength, leaving no well-defined anterior limit. Laterally they are defined by very low, subparallel margins which are forward extensions of the dental lamellae. The short dental lamellae are concave towards the median line and produce the distinctive curved impressions on internal moulds. They separate small but deep lateral cavities from the delthyrial cavity and support moderately large teeth which project normal to the hinge line. Neither crural fossettes, nor pedicle callist are present. Crenulations of the anterior margin are low, rounded, and separated by rounded interspaces.

Interior of brachial valve. The weakly impressed adductor muscle field is one quarter as wide as the greatest width and is confined to the posterior half of the valve. A low wide median ridge (one quarter as wide as muscle field) fades before reaching midlength, and posteriorly widens to fill the space between the brachiophore bases. It separates the adductor impressions, which are bounded laterally by slightly raised, weak marginal ridges subparallel to the median ridge. Anteriorly they curve medially and fade. Posteriorly they are directed external to the brachiophore bases but on some specimens can be seen to make a sharp curve and fuse with them. Faint transverse ridges directed slightly postero-laterally separate the four impressions. The brachiophores are moderately thick straight plates triangular in profile with an anterior edge normal to the commissural plane, diverging in line with the margins of the notothyrium from beneath which they emerge. Short curved fulcral plates connect the external faces of the brachiophores to the under-surface of the interarea, flooring deep, pointed sockets which are partly roofed over by the area. Deep, pointed lateral cavities exist beneath the fulcral plates. The cardinal process arises as a carina on the median ridge where it passes between the brachiophores and posteriorly becomes a semicylindrical shaft expanding into a simple, bulbous myophore with a crenulated posterior face occupying the apical part of the notothyrium.

Crenulations of the anterior shell margin are wide, flat with median groove,

separated by narrower, deep, rounded interspaces. Crenulations often visible over one fifth of shell length.

Discussion. This species was described and figured (Boucot, 1960, p. 3, and pl. 1, figs. 6-12) as *Salopina lunata* (J. de C. Sowerby). Although close to *S. lunata* it can be clearly distinguished by its less convex brachial valve, its more circular outline, the shorter brachial muscle field, the thicker and less pointed brachiophores and the costellae which are coarser and swing round posteriorly to intersect the hinge line at a high angle.

Occurrence. GSC localities 55061, 55051, 55052, 55053, 55059, 55056, 55057, 55062, 55064, 55065, 55055, 55054, 55058, 55063, 55060 from the Long Reach and Jones Creek Formations. Also Edmunds Formation (Gates F.40), shore southwest of Wilbur Point, Eastport quadrangle; Pembroke Formation (Gates F.17), Leighton grey shale Member, Leighton (Schooner) Cove, Eastport quadrangle; Ames Knob Formation, Penobscot Bay, Maine; Mount Wissick Formation, Quebec; and from loose blocks of the Pembroke Formation from the east side of Oak Bay, Charlotte county, N.B. From beds believed to be Late Llandovery (C_5?) to Ludlow age in coastal Maine and New Brunswick and in beds ranging from the French River Formation (C_5?) to Wenlock to the Stonehouse Formation (Gedinnian), in Arisaig, Nova Scotia.

Subfamily ISORTHINAE Schuchert and Cooper, 1931

Genus *Isorthis* Kozlowski, 1929

Type species. I. szajnochai Kozlowski, 1929, p. 75, pl. 2, figs. 24-41

Isorthis mackenziei n. sp.

Plate IV, figures 17-20

Name. This species is named after Dr. G. S. MacKenzie, former professor in the Department of Geology, University of New Brunswick.

Diagnosis. Unequally biconvex, faintly sulcate with subcircular outline. Median ridge of pedicle valve short, ending anteriorly in gentle slope. Brachial valve muscle field weakly impressed, quadripartite with broad median ridge. Brachiophores massive, triangular, sockets wide, lacking fulcral plates. Cardinal process simple with short thick shaft.

Material. Holotype, GSC No. 18959, paratype A, GSC No. 18960; Long Reach Formation, GSC locality 55061.

Description. Unequally biconvex to almost plano-convex with very weak, wide sulcus in brachial valve. Subcircular outline, hinge line straight, two thirds as wide as greatest width, which is at midlength. Cardinal angles slightly rounded, antero-lateral margins well rounded. Anterior commissure crenulate and faintly unisulcate,

lateral commissures straight. Length approximately equal to width and more than twice the thickness. Shell multicostellate increasing by bifurcation.

Exterior of pedicle valve. Evenly convex, with beak projecting one eighth total length posterior to hinge line. Interarea gently concave, apsacline, delthyrium triangular enclosing about 60 degrees, open.

Exterior of brachial valve. Very slightly and evenly convex with a weak, shallow median sulcus widening anteriorly. Outline subcircular, with rounded cardinal angles and antero-lateral margins. Interarea shorter than in pedicle valve, plane, anacline. Notothyrium triangular, enclosing about 60 degrees, open, partly filled by protruding cardinal process. Pattern of rib branching in median area of brachial valve typical for the genus. Median tertiary branches of the median pair of primary costellae appear at about 5 mm length.

Interior of pedicle valve. A low, rounded median ridge arises from the floor of the delthyrial cavity at a point below the hinge line and widens slightly anteriorly to about midlength, where it ends in a gradual slope. The posterior part of the umbonal cavity bears a flattened median area which may represent the adductor tracks. Long, narrow, subparallel, well-impressed diductor tracks flank the median ridge and end with it at about midlength, beyond which slightly more divergent vascular grooves extend antero-laterally. Laterally the diductor tracks are bounded by thick, parallel dental lamellae, which have flattened anterior edges and are normal to the commissural plane, and by low forward extensions of them. The dental lamellae support teeth that bear crural fossettes on their inner faces, and separate small lateral cavities from the delthyrial cavity. A small pedicle callist is present.

Interior of brachial valve. The weakly impressed adductor muscle field is confined to the median third of the posterior half of the valve. A low, rounded median ridge about one quarter as wide as the muscle field extends to midlength. Posteriorly it fills the space between the brachiophores. Faintly raised lateral margins, subcircular in outline, bound the muscle impressions which have a quadripartite aspect resulting from the greater impression of the anterior pair. Posteriorly the lateral margins merge into the bases of the brachiophores. The brachiophores increase in thickness as they extend forward from the margin of the notothyrium, so that they flank the median ridge as massive triangular structures whose anterior faces are parallel to the hinge line and are unusually wide. Their widely diverging lateral faces form steeply sloping sides to the dental sockets, the curved posterior faces of which are excavated beneath the interarea. It is not clear whether fulcral plates are present. The massive brachiophores are continuous with solid platforms beneath the wide sockets. These platforms may result from adventitious calcite submerging fulcral plates, or may be an alternative support for the sockets. The cardinal process arises with a short thick shaft from the median ridge between the brachiophores and expands slightly to form a myophore which protrudes from the notothyrium. Its triangular posterior face bears paired crenulations which are directed antero-medially.

Crenulations of the anterior shell margins are low, broad, rounded and separated by narrow rounded interspaces.

Comparison. This species may be distinguished from *I. orbicularis* (J. de C. Sowerby) by its less sulcate brachial valve in which the adductor muscle field is less well impressed, and by the massive brachiophores. In the pedicle valve the delthyrial cavity is relatively deeper than in *I. orbicularis,* the thicker dental lamellae are more nearly vertical and have flatter anterior edges and there are no distinct adductor impressions flanking the median ridge.

Occurrence. Long Reach Formation, GSC locality 55061; Ames Knob Formation, Penobscot Bay, Maine; unnamed beds, Township 7, Range 9, ledges south of road, about 0.5 mile W. of County line, Penobscot County, Maine (Traveler Mountain quadrangle).

Type. Holotype, GSC No. 18959, internal mould of brachial valve, Plate IV, figure 18, Long Reach Formation, GSC locality 55061.

Isorthis sp.

Plate IV, figures 15-16; Plate V, figures 1-6

Material and occurrence. Hypotypes A,D,E, GSC Nos. 18961, 18964, 18965, unnamed beds, Back Bay, N.B., GSC locality 55050; hypotypes B,C, GSC Nos. 18962, 18963, Jones Creek Formation, GSC locality 55052.

Description. Unequally biconvex with pedicle valve having greater convexity. Subcircular to transversely elliptical. Cardinal angles rounded. Anterior commissure crenulate and rectimarginate to faintly sulcate. Lateral commissure straight. Hinge line straight, equal to half greatest width of shell, which is at midlength. Width equal to or slightly greater than length. Shell multicostellate, costellae increasing by bifurcation.

Exterior of pedicle valve. Evenly convex with beak projecting about one seventh shell length posterior to hinge line. Interarea curved, apsacline, delthyrium triangular subtending 50 degrees, open. Lateral margins of interarea sharp.

Exterior of brachial valve. Convex with very faint, wide, median sulcus in some specimens. Outline transversely subelliptical, interarea one third as long as in pedicle valve, plane, anacline. Notothyrium triangular, open, partly filled by cardinal process.

Interior of pedicle valve. A wide, low, median ridge arising in the posterior part of the delthyrial cavity, extends forward to the centre of the valve, where it descends in a broad slope to the valve floor. In the posterior half of the delthyrial cavity, faint, narrow adductor tracks flank the median ridge, which anteriorly separates narrow, deeply impressed, slightly divergent diductor tracks extending to the end of the median ridge. Beyond this point vascular grooves continue in the line of the diductor tracks, diverging and fading towards the anterior margin. Laterally the diductor tracks are bounded by forward extensions of the vertical

dental lamellae, which are fairly thick and have flattened anterior edges. In some specimens they extend well beyond the end of the median ridge, lateral to the vascular grooves. Teeth moderately large, triangular in plan and section with blunt extremities, laterally directed accessory sockets and shallow crural fossettes in the commissural plane. A small pedicle callist is present.

Interior of brachial valve. A well-impressed brachial adductor muscle field confined to the central third of the posterior half of the valve, is bounded by subcircular, raised margins, which posteriorly fuse with the bases of the brachiophores and anteriorly fade towards the median ridge. The median ridge is rounded and narrow—equal to one seventh width of muscle field between the larger, anterior pair of impressions and wider between the posterior pair. The quadrantal anterior pair are more deeply impressed than the trigonal posterior impressions resulting in a marked step across the muscle field, normal to the median ridge and a quadripartite aspect.

The brachiophores are thin blades with vertical anterior edges, diverging at 60 degrees. They bound the moderately large sockets, which are raised on solid platforms. No distinct fulcral plates can be seen. It is not clear whether they are present but obscured by adventitious calcite. The cardinal process arises with a very short shaft from the posteriorly thickened median ridge between the brachiophores. The myophore is bulbous and unlobed.

Family DICAELOSIIDAE Cloud, 1948

Genus *Dicaelosia* King, 1850

Type species. Anomia biloba Linnaeus, 1767, p. 1154

Dicaelosia sp.

Plate II, figure 13

Material and occurrence. Hypotype GSC No. 18966; unnamed beds, Back Bay, GSC locality 55050.

Interior of pedicle valve. Obsolescent dental lamellae support stout hinge teeth. The muscle field is cordate and consists of a median, raised adductor track laterally bounded by a pair of elongate diductor impressions. The hinge line is short. Maximum width is near the anterior margin. The lateral margins curve evenly round into the indented anterior margin and the valve is strongly sulcate. The peripheral regions are strongly crenulated.

Suborder SYNTROPHIOIDEA Ulrich and Cooper, 1936

Superfamily SYNTROPHIACEA Schuchert, 1896

[*nom. transl.* Schuchert and Cooper, 1931 (*ex* Syntrophiidae Schuchert, 1896)]

Family CAMERELLIDAE Hall and Clarke, 1895

Genus *Anastrophia* Hall, 1867

Type species. Pentamerus verneuili Hall, 1857, p. 104, figs. 1, 2

Anastrophia sp.

Plate V, figures 7, 8

Material and occurrence. Hypotypes, GSC Nos. 18967, 18967a; unnamed beds, Back Bay, N.B., GSC locality 55050.

Exterior. Only a single brachial valve is available; it is subcircular in outline. The specimen is too small for the presence or absence of a fold to be determined. Lateral and anterior margins evenly rounded; interarea short. The ornament consists of costae with angular cross-sections and angular interspaces. The costae increase anteriorly by bifurcation. The shell is strongly convex.

Interior of brachial valve. Well-developed, discrete, subparallel brachial lamellae are present. Lateral alae occur on the posterior part of the brachial lamellae. The lamellae extend to about one third the distance to the anterior margin.

Suborder PENTAMEROIDEA Schuchert and Cooper, 1931

Superfamily PENTAMERACEA M'Coy, 1844

[*nom. transl.* Schuchert, 1896 (*ex* Pentameridae, M'Coy, 1844)]

Remarks. In a previous paper (Boucot and Siehl, 1962) comments have been made about the distinctions between the critical characters of the Gypidulinae and Pentamerinae, which together make up the family Pentameridae. These distinctions are essentially as follows: gypidulinids possess brachial lamellae with a lyre-shaped cross-section, whereas pentamerinids possess brachial lamellae that in cross-section are essentially co-planar; gypidulinids invariably have a very short median septum and spondylium in the pedicle valve, whereas most pentamerinids possess a relatively long median septum and spondylium; gypidulinids commonly possess short interareas in both valves, whereas pentamerinids lack them. The Stricklandiidae possess a relatively short median septum and spondylium in the pedicle valve, a very well developed interarea in both valves, and relatively small brachial lamellae whose form differs from that of other pentameroids.

Family PENTAMERIDAE M'Coy, 1844

Subfamily GYPIDULINAE Schuchert and LeVene, 1929

Genus *Sieberella* Oehlert, 1887

Type species. Pentamerus sieberi von Buch *in* Barrande, 1847, p. 103, pl. 21, figs. 1, 2

Sieberella sp.

Plate V, figures 9-11

Material and occurrence. Hypotypes A,B, GSC Nos. 18968, 18969; unnamed beds, Back Bay, N.B., GSC locality 55050.

Exterior. Pedicle valve is deeply convex; brachial valve gently convex. Brachial valve bears a shallow, broad sulcus, and the pedicle valve bears a corresponding fold. Radial ornament is absent. Interarea of pedicle valve is about two thirds maximum width, which is near midlength. Lateral and anterior margins are evenly rounded, and anterior commissure is faintly uniplicate. Interarea of pedicle valve is incurved and apsacline. Valves are subcircular.

Interior of pedicle valve. A short spondylium is basally supported by an anteriorly inclined median septum, which reaches to about midlength. The delthyrium includes an angle of about 45 degrees and appears to be unmodified.

Interior of brachial valve. Only one badly crushed brachial valve interior is present, but it displays medially conjunct brachial lamellae having a lyre-shaped cross-section. The interior is smooth.

Subfamily PENTAMERINAE M'Coy, 1844

[*nom. transl.* Gill, 1871 (*ex* Pentameridae M'Coy, 1844)]

Genus ***Pentamerus*** Sowerby, 1813

Type species. P. oblongus Sowerby, 1839

Pentamerus sp.

Plate V, figures 12, 13

Material and occurrence. Hypotypes, GSC Nos. 18970, 18970a; unnamed beds, Back Bay, N.B., GSC locality 55050.

Exterior. The single brachial valve available is subcircular, smooth except for concentric growth lines, and evenly convex.

Interior of brachial valve. The presence of subparallel brachial lamellae confirms the generic assignment of this specimen. A narrow myophragm bisects the anterior part of the adductor field.

Family STRICKLANDIIDAE Hall and Clarke, 1895

Genus ***Costistricklandia*** Amsden, 1953

Type species. Stricklandia gaspéensis Billings, 1859, p. 134

Costistricklandia cf. *C. gaspéensis* (Billings, 1859)

Plate V, figures 14-19; Plate VI, figures 1, 2

Material and occurrence. Hypotypes, GSC Nos. 18971, 18972, 18972a, 18973; Long Reach Formation, GSC locality 55061.

Exterior. Brachial valve is very gently convex, pedicle valve is strongly convex; both are subcircular to elongate. Hinge line is relatively short and equal to about one half the maximum width, which is near the midlength. Lateral and anterior margins are evenly rounded and crenulate. Interarea of the pedicle valve is incurved and apsacline, that of the brachial valve is relatively flat and orthocline.

Interior of pedicle valve. The spondylium and median septum are relatively large. The umbonal region is smooth due to the deposition of secondary material, but the peripheral regions are strongly crenulated by the impress of the costellae.

Interior of brachial valve. Well-developed inner plates fuse laterally with the interarea to form the dental sockets and fuse medially with the brachial processes. The brachial processes are rod-like and are cemented basally to the floor of the valve. Outer plates are either vestigial or absent altogether, being submerged in secondary material on the floor of the valve. The adductor field is strongly impressed and consists of a long, linear pair of impressions medially separated by a well-defined myophragm. There are several longitudinal subdivisions of the adductor field. The postero-lateral regions are pustulose.

Suborder STROPHOMENOIDEA Maillieux, 1932

Superfamily PLECTAMBONITACEA Jones, 1928

[*nom. transl.* Cooper and Williams, 1952 (*ex* Plectambonitinae Jones, 1928)]

Family PLECTAMBONITIDAE Jones, 1928

[*nom. transl.* Kozlowski, 1929 (*ex* Plectambonitinae Jones, 1928)]

Subfamily PLECTAMBONITINAE Jones, 1928

Genus ***Plectodonta*** Kozlowski, 1929

Subgenus *Eoplectodonta* Kozlowski, 1929

Type species. Sowerbyella precursor Jones, 1928, p. 437, pl. 23, figs. 3-5

Plectodonta (*Eoplectodonta*?) sp. cf. *E. millinensis* (Jones, 1928)

Plate VI, figures 3-12

Sowerbyella millinensis Jones, 1928, p. 444, pl. 23, figs. 13-16

Material and occurrence. Hypotypes A-E, GSC Nos. 18974-18978; unnamed beds, Back Bay, N.B., GSC locality 55050.

Exterior. The shells are transversely subcircular in outline and concavo-convex in lateral profile. Maximum width is at the hinge line. Beak of pedicle valve is strongly incurved. The surface is parvicostellate. From seven to eleven primary costellae are found on the brachial valve at about midlength, and additional coarse secondary costellae originate by implantation. Numerous very fine costellae are inserted between the coarser primary and secondary costellae.

Interior of pedicle valve. There is a short median septum in the posterior of the pedicle valve. The diductor scars are long, well impressed, and taper anteriorly. The vascular impressions are well marked lateral to the diductor scars.

Interior of brachial valve. Only the median lobe of the cardinal process is exposed between disjunct chilidial plates. A low median septum extends about one third of the way towards the anterior and bisects the adductor muscle field. The median pair of brachial lamellae are high and thin posteriorly, but become more or less low and rounded anteriorly. The outer lamellae form a complex group that increases in number anteriorly by implantation.

Comparison. The Back Bay species also resembles *Plectodonta transversalis* Davidson (Jones, 1928) in exterior shape and in the brachial interior.

Family LEPTESTIIDAE Öpik, 1933

[*nom. transl.* Williams, 1953 (*ex* Leptestiinae Opik, 1933)]

Subfamily LEPTESTIINAE Öpik, 1933

Genus ***Leangella*** Öpik, 1933

Type species. Plectambonites scissa Salter var. *triangularis* Holtedahl, 1916, p. 84, pl. 15, figs. 5, 6

Leangella sp.

Plate VI, figures 13-15

Material and occurrence. Hypotypes A, B, GSC Nos. 18979, 18980; unnamed beds, Back Bay, N.B., GSC locality 55050.

Exterior. The shell is concavo-convex and transverse in outline with a slightly carinate pedicle valve. The greatest width is at the hinge line. Six or eight fine primary costae occur on the pedicle valve, and very fine costellae are faintly defined in the interspaces.

Interior of pedicle valve. The muscle field is bilobate and suboval and is bisected in its anterior half by a thin myophragm. The muscle field is bounded laterally by well-developed ridges that increase in height along the anterior margin of the muscle field to form distinct lamellae. The interior has a concentric flange that rests against the brachial diaphragm.

Interior of brachial valve. Cardinal process not seen. Brachial lamellae flabellate, divided by a myophragm anteriorly. A diaphragm is concentrically situated, paralleling the anterior commissure.

Superfamily STROPHOMENACEA King, 1846

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

Family LEPTAENIDAE Hall and Clarke, 1895

Genus ***Pentlandina*** Bancroft, 1949

Types species. P. tartana (=*Orthis antiquata* Sowerby, 1839, subspecies *tartana* Bancroft, 1949, p. 13, pl. 1, fig. 10; Davidson, 1871, pl. 44, figs. 7-9)

Pentlandina cf. *P. parva* Bancroft, 1949

Plate VI, figures 16-18; Plate VII, figures 1-10

Strophomena (*Pentlandina*) *parva* Bancroft, 1949, p. 13, pl. 1, fig. 9.
Holtedahlina parva Williams, 1951, p. 118, pl. 7, figs. 8-10.

Material and occurrence. Hypotypes A-G, GSC Nos. 18981-18987; unnamed beds, Back Bay, N.B., GSC locality 55050.

Exterior. The shells are transversely subcircular in outline and resupinate in lateral profile. Hinge line is long and straight, and is the place of maximum width. The ornament is rugose-parvicostellate with the primary costellae on the crests between shallow furrows that develop in the costellate interspaces. The rugae are more or less concentrically arranged and consist of double radial rows of alternating depressions in each shallow intercostal furrow.

The delthyrium is covered by a pseudodeltidium. An apical foramen appears to be lacking. Pedicle interarea is apsacline, and brachial interarea is anacline.

Interior of pedicle valve. The diductor muscle scars are subcrescentic to triangular, and join with short dental lamellae postero-laterally. Antero-laterally, the diductor area is elevated slightly above the base of the valve. Antero-medially, the elevated lamellae are depressed and sessile. The muscle scar is bisected by a sharp myophragm that widens anteriorly and extends slightly farther towards the anterior than does the diductor muscle area. The place of adductor muscle attachment appears to have been elongate, narrow grooves adjacent to the myophragm. The primary costellae and rugae are impressed onto the interior shell surface.

Interior of brachial valve. Cardinal process bilobed, each lobe triangular in cross-section with a myophore on its posterior face. Cardinal process sessile, continuous with a short, stout myophragm that bifurcates anteriorly. A single, median pair of adductor plates extend anteriorly parallel to one another. Lateral to the adductor plates are wide, flat, and slightly divergent brachial processes.

Remarks. Pentlandina seems to be much more closely related to the leptaenoids

than to any other group. This is shown by the subcrescentic and almost completely enclosed diductor muscle field in the pedicle valve and by the sharp myophragm that bisects it. In the brachial valve, the flat, widely divergent brachial processes and the adductor plates are also leptaenoid structures as is obvious from Cooper's (1956, pp. 820-859) study of Middle Ordovician leptaenoids.

Cooper (1956, p. 820) stresses that the leptaenoids usually bear a conspicuous apical foramen behind a large pseudodeltidium. The pedicle beak region is not well shown in the Back Bay specimens of *Pentlandina,* but well-preserved specimens from the upper Visby Marl of Gotland that are identical in all respects, except the fine details of ornament, were available for study. Several of the Gotland shells bear a foramen, but it does not penetrate through to the interior of the shell.

Comparison. Pentlandina is a most unusual leptaenoid genus in its resupinate lateral profile, but it may also be distinguished from other members of the Leptaenidae by other differences. *Drummuckina* Bancroft, 1949 is plano- to slightly concavo-convex and is finely and evenly costellate. In addition the hinge line is said to be minutely denticulate along the entire length of the hinge. *Murinella* Cooper, 1956, resembles *Drummuckina* in shape and ornament, but *Murinella* has a very distinctive muscle scar in the pedicle valve and a marginal flange in the brachial valve. Both features also distinguish *Murinella* from *Pentlandina. Cyphomena* Cooper, 1956, has a muscle scar in the pedicle valve like *Drummuckina* and *Pentlandina,* but it is finely costellate and non-resupinate. *Cyphomena* most closely resembles *Drummuckina* of any of the leptaenoid genera studied by Cooper (1956), but it differs from *Drummuckina* in its mildly geniculate lateral profile.

Hesperina Cooper, 1956, may be distinguished from *Pentlandina* because it is plano- to concavo-convex and lacks adductor plates. *Teratelasma* Cooper, 1956, has a muscle scar on the pedicle valve that is not bounded by a ridge anteriorly and in addition is biconvex and finely multicostellate. *Dactylogonia* Ulrich and Cooper, 1942, is concavo-convex, geniculate, and has four adductor plates, whereas *Pentlandina* has only two. *Limbimurina* Cooper, 1956, is geniculate and frilled anteriorly, distinguishing it from other leptaenoids. *Bellimurina* Cooper, 1956, has ornament like *Pentlandina,* but is biconvex to concavo-convex and lacks adductor plates. *Leptaena* Dalman, 1828, differs from *Pentlandina* in being geniculate and in having continuous concentric rugae.

Williams (1951) placed *P. parva* in the strophomenacean genus *Holtedahlina* which *Pentlandina* resembles in the shape of the muscle scar in the pedicle valve and in being resupinate, but *Holtedahlina* lacks adductor plates and has a distinctly different ornament than *Pentlandina.*

The subgenus *Gunnarella* Spjeldnaes, 1957, is like *Pentlandina* in ornament and resupination, but the brachial interior of *Gunnarella* is poorly known. The muscle scars in the pedicle valve are open anteriorly.

Genus *Leptaena* Dalman, 1828

Type species. Leptaena rugosa Dalman, 1828, pl. 1, fig. 1

Leptaena spp.

Plate VII, figures 11, 12; Plate VIII, figures 1-6

Material and occurrence. Hypotypes A, B, GSC Nos. 18988, 18989; unnamed beds, Back Bay, N.B., GSC locality 55050. Hypotypes C, D, GSC Nos. 18990, 18991, 18991a; Long Reach Formation, GSC locality 55061.

Exterior. The specimens from Back Bay are transverse and subquadrate in outline and geniculate in lateral profile. The pedicle interarea is apsacline and the brachial interarea is anacline. The specimens from the Long Reach Formation are proportionately less wide and are mucronate. The Long Reach shells have numerous closely spaced, only slightly impressed rugae. Fine, evenly spaced growth lines are parallel to the rugae and are crossed by fine rounded costae that are wider than the interspaces, and that increase in number anteriorly by intercalation and by bifurcation.

Interior of pedicle valve. The specimens from Back Bay have very thick shells and well-impressed musculature, but those from the Long Reach Formation are thin-shelled and the ornament is impressed on the internal mould. The muscle fields are suboval, slightly transverse for the Back Bay shell, and elongate in the Long Reach shell. In the Back Bay shell the paired adductor scars are pyriform, divided by a thin myophragm.

Interior of brachial valve. The cardinal process is bilobed and is set between widely divergent hinge plates. The adductor muscle field is well impressed in the Back Bay shell and there is a myophragm that arises prominently near the mid-length.

Comparison. The species from the Long Reach Formation has much finer rugae than *L. rhomboidalis* (*see* Poulsen, 1943). It more closely resembles *L. depressa,* but also has finer rugae than that species.

Family STROPHEODONTIDAE Caster, 1939

Subfamily STROPHEODONTINAE Caster, 1939

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

Type species. Strophomena striata Hall, 1843, p. 104, fig. 3

Amphistrophia sp.

Plate VIII, figures 7-13

Material and occurrence. Hypotypes A-E, GSC Nos. 18992-18996; unnamed beds, Back Bay, N.B., GSC locality 55050.

Exterior. The shells are subsemicircular in outline and resupinate in lateral profile and strongly geniculate at their antero-lateral margins. The cardinal angles

are not well preserved enough to reveal presence or absence of mucronation. Shells are covered with flattened, paired costellae that are wider than the interspaces. Pedicle interarea is apsacline.

Interior of pedicle valve. Diductor muscle field is typical for the genus, forming an inverted, heart-shaped impression bisected by a thin myophragm. Laterally, the diductor impressions are bounded by distinct, smoothly curving ridges. Anteriorly, the muscle field blends with the shell at about midlength on some shells and is weakly impressed on others. The adductor muscle scars are situated posteriorly within the diductor impressions. The denticulations are confined to the median half of the hinge line.

Interior of brachial valve. A bilobed cardinal process is present at the posterior end of a short myophragm. The lobes of the cardinal process are directed ventrally and bear a median groove on their ventral face. The cardinal process is flanked by short socket plates. The myophragm separates short, semi-oval adductor scars.

Comparison. The Back Bay species closely resembles *Amphistrophia* aff. *funiculata* of Williams (1953, pl. 12, figs. 7, 8), but it differs from *A. funiculata* of Davidson (1867-1871, pl. 40, figs. 11, 12, 13) in the shape of the muscle field in the pedicle valve. *Strophonella loeblichi* Amsden, 1951 from the Henryhouse Shale of Oklahoma is an *Amphistrophia,* but it differs from the Back Bay species in being parvicostellate. *A. striata* Hall is a larger, more rectangular shell than the Back Bay species and is not geniculate.

Genus *Strophonella* Hall, 1879

Type species. Strophomena semifasciata Hall, 1863, p. 210

Strophonella cf. *S. euglypha* (Hisinger, 1819)

Plate VIII, figures 14-16; Plate IX, figures 1-8

Material and occurrence. Hypotypes, GSC Nos. 18997, 18998, 18999, 18999a, 19000, 19001, 19002, 19003; unnamed beds, Back Bay, N.B., GSC locality 55050.

Exterior. The shells are of medium size and resupinate, with the pedicle valve strongly concave anteriorly. The ornament is parvicostellate. The interarea of the pedicle valve is apsacline.

Interior of pedicle valve. The muscle field is quadrate in outline about three quarters as long as wide, and its antero-lateral margins are faintly lobed. It widens abruptly away from the beak so that its postero-lateral margins are concave towards the hinge, the reverse of the condition in *Amphistrophia.* The muscle field is bounded by a pair of ridges that extend along its postero-lateral margins, bend abruptly anteriorly and extend parallel to the median line to the anterior end of the muscle field where they extend medially about perpendicular to the median line. The

adductor muscle scars are situated posteriorly within the diductor impressions and are strongly impressed at their posterior end. A thin myophragm divides the diductor scar centrally. Lateral to the muscle scar the surface is pustulose on one specimen. On another specimen the shell is thinner and the exterior ornament is impressed on the interior. The denticulations extend less than half the length of the hinge.

Interior of brachial valve. The cardinal process is bilobed and flanked laterally by socket plates which diverge at a high angle.

Comparison. Strophonella alterniradiata Amsden and *S. prolongata* Foerste from the Henryhouse Formation of Oklahoma are both smaller and relatively more transverse than the Back Bay specimens. S. *semifasciata* Hall is less concave ventrally and *S. podolica* (Siemiradzki) has much more distant primary costellae.

Genus ***Protomegastrophia*** Caster, 1939

Type species. Leptaena profunda Hall, 1852, p. 61, pl. 21, fig. 4

Protomegastrophia prima[1] n. sp.

Plate IX, figures 9-13; Plate X, figures 1-9; Plate XI, figure 1

Material and occurrence. Holotype, GSC No. 19004, paratypes, GSC Nos. 19005, 19006, 19007, 19008, 19009, 19009a, 19010, 19010a; unnamed beds, Back Bay, N.B., GSC locality 55050.

Exterior. The shells are subsemicircular, concavo-convex, and widest at the hinge line. Pedicle valve varies from gently convex with a height about one tenth the length to strongly convex with a height about four tenths the length; brachial valve varies from very gently concave or almost flat to moderately concave. Pedicle interarea varies from apsacline in gently convex shells to orthocline in strongly convex shells; brachial interarea is anacline and about one fifth as high as the pedicle interarea. Upper half of the delthyrium is filled with a pseudodeltidium which is strongly concave outwards. The ornament is parvicostellate to finely parvicostellate.

Interior of pedicle valve. Diductor muscle scar is subtriangular with straight to very slightly arcuate lateral margins and confined to the posterior half of the valve. Small, elongate, oval adductor scars confined to the posterior part of the muscle field are impressed in some specimens. Muscle field is impressed only posteriorly and it blends with the interior shell surface anteriorly. Postero-lateral regions are pustulose. The denticulations are confined to the middle quarter of the hinge line.

Interior of brachial valve. The cardinal process is bilobate. The lobes are conjunct or nearly so posteriorly and divergent as subvertical plates anteriorly. The attachment faces are directed posteriorly. Well-developed socket plates diverge at a high angle to the median line. The small, semi-oval adductor scars are impressed only posteriorly and are separated by a broad low myophragm.

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[1] *See* addendum, page 41.

Comparison. P. prima n. sp. differs from all other species of *Protomegastrophia* in that it varies from gently to strongly concavo-convex whereas all other species are consistently strongly concavo-convex. It differs from *Protomegastrophia profunda* in that it has a subtriangular diductor scar in the pedicle valve and a pair of semi-oval adductor scars in the brachial valve. *P. profunda* has a circular to transversely oval diductor field in the pedicle valve and two pairs of adductor scars in the brachial valve.

Holotype. Specimen GSC No. 19004—Mould of interior of pedicle valve, Plate X, figures 2 and 4.

Superfamily ORTHOTETACEA Waagen, 1884

[*nom. transl.* Williams, 1953 (*ex* Orthotetinae Waagen, 1884)]

Family CHILIDIOPSIDAE, Boucot, 1959

Genus ***Chilidiopsis*** Boucot, 1959

Type species. Fardenia reedsi Amsden, 1951, p. 84, pl. 17, figs. 1-8

Chilidiopsis spp.

Plate XI, figures 2-10; Plate XII, figures 1-5

Material and occurrence. Hypotypes, GSC Nos. 19011, 19011a, 19012, 19014; unnamed beds, Back Bay, N.B., GSC locality 55050. Hypotype, GSC No. 19013; Long Reach Formation, GSC locality 55061.

Exterior. The surface is covered by very fine growth lines and fine radial costae that are distinctly raised above the surface and have a rounded cross-section. Costae increase in number anteriorly by implantation, usually along one side of the interspace where they originate. On one specimen a count showed 11 costae in 5 mm in the median region at a distance of 15 mm from the beak. The outline is subsemicircular, transverse and widest at the hinge line. The valves are very thin in lateral profile. Pedicle interarea apsacline with a small pseudodeltidium; brachial interarea anacline with a large, convex chilidium.

Interior of pedicle valve. Hinge teeth supported by short, widely divergent dental lamellae which border the diductor muscle impressions posteriorly. Diductor scars not impressed anteriorly, but separated by a very thin and faintly developed myophragm. Adductor scars small, faintly impressed at a central position, within the muscle field. Anterior shell margin with split crenulations.

Interior of brachial valve. Bifid cardinal process present against the interior surface of the convex chilidium. Chilidium with growth lines. Widely divergent brachiophores present, originating beneath the post-lateral margins of the cardinal process. Brachiophores supported by crural plates. Anterior shell margin crenulate as in pedicle valve, but splitting is much less common.

Suborder CHONETOIDEA Muir-Wood, 1955

Superfamily CHONETACEA Waagen, 1884

[*nom. transl.* Shrock and Twenhofel, 1953 (*ex* Chonetinae Waagen, 1884)]

Family CHONETIDAE Waagen, 1884

[*nom. transl.* Hall and Clarke, 1895 (*ex* Chonetinae Waagen, 1884)]

Subfamily DEVONOCHONETINAE Muir-Wood, 1962

Genus ***Protochonetes*** Muir-Wood, 1962

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

Protochonetes? sp.

Plate XII, figure 6

Material and occurrence. Hypotype A, GSC No. 19015; unnamed beds, Back Bay, GSC locality 55050.

Exterior. A single specimen of a pedicle internal mould is questionably assigned to *Protochonetes.* It is transverse in outline and finely costellate with about four costellae per millimetre at midlength. An enlarged median rib is not present. The valve is fairly strongly convex, but may be deformed.

Interior of pedicle valve. A median septum is present in the posterior, and it becomes sharply narrower anteriorly. At the hinge line there are about five hollow slots on either side of the midline, indicating the position of the spine bases. The slots converge posteriorly towards the midline at nearly a right angle to the probable position of the spines themselves.

Suborder RHYNCHONELLOIDEA Moore, 1952

Superfamily CAMAROTOECHIACEA Schuchert and LeVene, 1929

[*nom. transl.* Havlíček, 1960 (*ex* Camarotoechiidae Schuchert and LeVene, 1929)]

Family CAMAROTOECHIIDAE Schuchert and LeVene, 1929

Genus ***Stegerhynchus*** Foerste, 1909

Type species. Rhynchonella whitii Hall, 1863, p. 216

Stegerhynchus? spp.

Plate XII, figures 7-14

Material and occurrence. Hypotypes A, D, GSC Nos. 19016, 19019; unnamed beds, Back Bay, N.B., GSC locality 55050. Hypotypes B, C, GSC Nos. 19017, 19018; Jones Creek Formation, GSC locality 55056.

Exterior. Pedicle valve is slightly elongate, tapering regularly towards the beak; brachial valve is suboval. Maximum width is slightly anterior to midlength. Brachial fold and pedicle sulcus are only poorly defined except at the anterior margin. The surface is covered with sharply angular costae numbering four on the fold and three in the sulcus. There are seven prominent and two obscure costae on the flank of one brachial valve. On one pedicle valve the second pair of costae lateral to the sulcus do not reach the beak.

Interior of pedicle valve. Short dental lamellae are present. The muscle field is not impressed. The interior of the shell is strongly affected by the impress of the costae.

Interior of brachial valve. A median septum and septalium are present in the brachial valve.

Family RHYNCHOTREMATIDAE Schuchert, 1913

[*nom. transl.* Cooper, 1956 (*ex* Rhynchotreminae Schuchert, 1913)]

Genus *Ferganella* Nikiforova, 1937

Type species. F. turkestanica Nikiforova, 1937, p. 41, pl. 7, figs. 10-16

Ferganella sp.

Plate XII, figures 15-25

Material and occurrence. Hypotypes, GSC Nos. 19020, 19020a, 19020b, 19021; unnamed beds, Back Bay, N.B., GSC locality 55050.

Exterior. The two specimens available for study are transverse and are covered with rounded costae. There are three costae in the pedicle sulcus, four on the fold, and five on each flank on the pedicle valve. The sulcus is distinct in the anterior half of the shell but is not prominently set off by steep-sided bounding costae.

Interior of pedicle valve. Rudimentary dental lamellae appear to have been present. The muscle field occupies a slightly raised triangular platform that lies medially within the costae that bound the sulcus. It is divided medially by a short, low, myophragm that splays at its anterior end to form a raised adductor scar.

Interior of brachial valve. A median septum traverses the posterior half of the shell and is thicker posteriorly. The septum divides to form a hemispherical-shaped septalium. Medially in the septalium there is a blade-like cardinal process.

Discussion. The Back Bay specimens bear a close resemblance to a specimen illustrated as *Camarotoechia* (?) *borealis* by Nikiforova (1954, pl. 10, fig. 4; Text-fig. 15, p. 98) from the upper Llandovery Kitaigorod Formation of Podolia.

Family HEBETOECHIIDAE Havlíček, 1960

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

Type species. Terebratula wilsoni J. Sowerby, 1816

Sphaerirhynchia? sp.

Plate XIII, figures 1, 2

Material and occurrence. Hypotypes A, B, GSC Nos. 19022, 19023; unnamed beds, Back Bay, N.B., GSC locality 55050.

Exterior. A single specimen is available to show that the species had a strongly inflated brachial valve and subcircular outline. The costae are low and rounded and number four on the fold. There are at least three distinct costae on the visible flank of the brachial valve. The costae do not strongly affect the shell interior.

Interior of pedicle valve. Short dental lamellae are present and converge towards the bottom of the valve. The muscle field is long, narrow, triangular, and impressed into secondary shell material present posteriorly.

Interior of brachial valve. A median septum is present. It thickens posteriorly and bifurcates, forming a V-shaped septalium. It appears that the septalium was partly covered over its anterior part by the inner hinge plates. The posterior part of the valve is thickened by secondary shell material.

Suborder ATRYPOIDEA Moore, 1952

Superfamily ATRYPACEA Gill, 1871

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

Family ATRYPIDAE Gill, 1871

Subfamily CARINATININAE Rzhonsnitskaya, 1960

Genus ***Plectatrypa*** Schuchert and Cooper, 1930

Type species. Terebratula imbricata Sowerby *in* Murchison, 1839, p. 624

Plectatrypa imbricata (Sowerby, 1839)

Plate XIII, figures 3-16

Material and occurrence. Hypotypes A-I, GSC Nos. 19024-19032; unnamed beds, Back Bay, N.B., GSC locality 55050.

Exterior. The valves are biconvex and transversely suboval in full-sized specimens. A single small shell appears to be elongate oval. The surface of the valves is covered by branching costae and costae that arise anteriorly by implantation. On

one specimen, six costae arise at the beak, but there are approximately 40 at the commissure. The costae are crossed by numerous, evenly spaced, lamellose growth lines. A more or less prominent fold occupies the median region of the brachial valve, corresponding to a poorly defined sulcus in the pedicle valve. The pedicle beak is fairly strongly incurved over the beak of the brachial valve.

Interior of pedicle valve. Dental lamellae are absent. The pedicle cavity is impressed into secondary shell material in the posterior. Just anterior of the pedicle cavity the paired adductor scars are elongate heart-shaped and are bounded by short lateral septa. Diductor tracks are linear and impressed, flanking the lateral ridges. Interior surface of the valve is only slightly impressed anteriorly by the costae.

Interior of brachial valve. Area for diductor attachment non-striate. The sockets are non-crenulate. The adductor scars consist of lateral and medial elongate pairs, fairly strongly impressed.

Subfamily ATRYPINAE Gill, 1871

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

Genus ***Atrypa*** Dalman, 1828

Type species. Anomia reticularis Linnaeus (partim) 1758, p. 702

Atrypa "reticularis" (Linnaeus, 1758)

Plate XIII, figures 17, 18; Plate XIV, figures 1-15

Material and occurrence. Hypotypes, GSC Nos. 19033, 19033a, 19034, 19034a, 19035, 19035a, 19040; Long Reach Formation, GSC locality 55061. Hypotypes, GSC Nos. 19036, 19037, 19038, 19039, 19041; unnamed beds, Back Bay, N.B., GSC locality 55050.

Exterior. Several specimens from Back Bay and from the Long Reach Formation are assigned to this cosmopolitan species. Specimens from the Long Reach Formation are slightly more transverse, more finely ribbed and bear fairly strong, irregular concentric rugae. The Back Bay specimens bear slightly lamellose growth lines, but they are less strong than the bifurcating costae.

Interior of pedicle valve. Short dental lamellae are present. The muscle field is broad and flabellate. The post-lateral regions bear ovarian pits adjacent to the muscle field.

Interior of brachial valve. The hinge plates are discrete and the sockets are crenulate. The area for diductor attachment is faintly striate. A low myophragm bisects the posterior part of the poorly defined muscle field.

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 *in* Murchison, 1839, p. 637

Eocoelia cf. *E. sulcata* (Prouty, 1923)

Plate XIV, figures 16-21; Plate XV, figures 1, 2

Coelospira sulcata Prouty, 1923, Md. Geol. Surv., Silurian, p. 466, pl. 27, figs. 6-8

Material and occurrence. Hypotypes, GSC Nos. 19042, 19043, 19044, 19044a; Long Reach Formation, GSC locality 55061.

Exterior. The shells are small and subcircular or slightly transverse-oval in outline and plano-convex in lateral profile. The anterior commissure is rectimarginate. Very low, simple plications are developed on the umbonal regions but do not extend to the anterior margin.

Interior of pedicle valve. The teeth are unsupported by dental lamellae and are attached directly to the inner wall of the valve. The teeth bear crural fossettes on their medial sides. The musculature is only faintly impressed.

Interior of brachial valve. The socket plates arise directly from the wall of the valve, which serves as the outer side of the sockets. Medially there is a slight thickening, but a cardinal process is not present. A low myophragm bisects the faintly impressed adductor muscle scars in the posterior part of the shell.

Suborder SPIRIFEROIDEA Allan, 1940

Superfamily ATHYRACEA M'Coy, 1844 emend. Davidson, 1881

[*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 *Meristina* Hall, 1867

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

Meristina sp.

Plate XV, figures 3-5

Material and occurrence. Hypotypes, GSC Nos. 19045, 19045a; unnamed beds, Back Bay, N.B., GSC locality 55050.

Exterior. A single small specimen is assigned to *Meristina.* It is transversely suboval in outline and bears a shallow and narrow median sulcus in the pedicle valve. The maximum width is slightly anterior to midlength.

Interior of pedicle valve. The pedicle cavity is well defined by dental lamellae. The dental lamellae continue anteriorly as strong ridges bordering the muscle field. The muscle field is triangular, impressed, and longitudinally striate.

Family NUCLEOSPIRIDAE Davidson, 1881

Genus *Nucleospira* Hall, 1859

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

Nucleospira sp.

Plate XV, figures 6-13

Material and occurrence. Hypotypes, GSC Nos. 19046, 19046a, 19047; unnamed beds, Back Bay, N.B., GSC locality 55050.

Exterior. Two specimens are assigned to *Nucleospira.* The shells are transversely oval in outline and lenticular in profile. The outer shell surface is smooth, no fine spines being preserved.

Interior of pedicle valve. Dental lamellae are lacking. A thin low median septum persists nearly to the anterior margin. The diductor muscle field is broad and suboval and is slightly impressed postero-laterally. The small adductor scars are impressed within the posterior part of the muscle field.

Interior of brachial valve. A broad, free cardinal plate is present, and it is apparently not pierced by an apical foramen. A thin low median septum traverses most of the length of the valve.

Superfamily DELTHYRIACEA Phillips, 1841

[*nom. transl.* Ivanova, 1960 (*ex* Delthyridae Phillips, 1841)]

Family EOSPIRIFERIDAE Schuchert and LeVene, 1929

[*nom. transl.* Boucot, 1963 (*ex* Eospiriferinae Schuchert and LeVene, 1929)]

Subfamily EOSPIRIFERINAE Schuchert and LeVene, 1929

Genus *Eospirifer* Schuchert, 1913

Type species. Spirifer radiatus Sowerby, 1839 (=*Spirifer lineatus* Sowerby, 1825, p. 151, pl. 493, figs. 1, 2; not *Spirifer lineatus* Martin)

Eospirifer sp.

Plate XV, figures 14-17

Material and occurrence. Hypotypes, GSC Nos. 19048, 19049; unnamed beds, Back Bay, N.B., GSC locality 55050. Hypotype, GSC No. 19050; Long Reach Formation, GSC locality 55061.

Exterior. Specimens from Back Bay as well as from the Long Reach Formation were available for study. All of these are fragmentary pedicle valve moulds, and they show the exterior configuration to a fair extent. The palintrope is low and apsacline, and the beak is incurved. The pedicle valves are transversely suboval with the maximum width near midlength. On one specimen the fine radial striae are very well preserved.

Interior of pedicle valve. The dental lamellae are very long and divergent enclosing a longitudinally striate muscle field.

Genus ***Macropleura*** Boucot, 1963

Type species. Delthyris macropleurus Conrad, 1840, p. 207

Macropleura sp.

Plate XV, figures 20, 21; Plate XVI, figures 1, 2

Material and occurrence. Hypotypes A-C, GSC Nos. 19051-19053; unnamed beds, Back Bay, N.B., GSC locality 55050.

Exterior. Several internal moulds are available, but they do not show well the configuration of the shell. Shells are large, but of moderate size for genus. The pedicle valve bears a very broad and deep sulcus that is subangular at its bottom. In contrast, the lateral plications are much smaller, but are rounded and are separated by U-shaped interspaces. Moulds of the external shell surface show the fine radial striae to be very well developed.

Interior of pedicle valve. The dental lamellae are strong but short, and do not project along the lateral margin of the muscle field. The diductor muscle scars are separately and deeply impressed, being divided medially by the trough of the sulcus. The impressions are longitudinally striate.

Interior of brachial valve. Short subparallel crural plates are present. The medial adductor muscle scars are impressed. The area of diductor attachment is unstriated.

Subfamily CYRTIINAE Fredericks, 1924

Genus ***Cyrtia*** Dalman, 1828

Type species. Anomites exporrectus Wahlenberg, 1821, p. 64

Cyrtia sp.

Plate XV, figures 18, 19

Material and occurrence. Hypotypes A, B, GSC Nos. 19054, 19055; unnamed beds, Back Bay, N.B., GSC locality 55050.

Exterior. Only two internal moulds are available and these are of the posterior of the shell and do not show well the external configuration. The palintrope is high and flat and the delthyrium is long and narrow as is typical for the genus.

Interior of pedicle valve. Dental lamellae are present.

Interior of brachial valve. Short subparallel crural plates are present. The medial adductor scars are impressed and are divided by a low myophragm. The deltidium is long and narrow.

Family DELTHYRIDAE Phillips, 1841

Subfamily DELTHYRINAE Phillips, 1841

[*nom. transl.* Waagen, 1883 (*ex* Delthyridae Phillips, 1841)]

Genus ***Howellella*** Kozlowski, 1946

Type species. Delthyris elegans Muir-Wood, 1925 (=*Terebratula crispa* Hisinger, 1827, *not* Linnaeus, 1758)

Howellella sp. 1

Plate XVI, figures 11-14

Material and occurrence. Hypotypes A, C, GSC Nos. 19056, 19058; Jones Creek Formation, GSC locality 55056. Hypotypes B, D, GSC Nos. 19057, 19059; unnamed beds, Back Bay, N.B., GSC locality 55050.

Exterior. A number of specimens from Back Bay and from the Jones Creek Formation belong to strongly plicate *Howellella* species. The shells are small and roughly as wide as they are long. There are six plications on the pedicle valve and two plications on either side of the brachial fold. The plications are rounded and strongly impressed and separated by U-shaped interspaces.

Interior of pedicle valve. Slightly divergent dental lamellae are present at the lateral edges of the two plications that bound the pedicle sulcus.

Interior of brachial valve. Crural plates are present. In the Back Bay specimen they are subparallel, but in the Jones Creek specimen they are more divergent.

Howellella sp. 2

Plate XVI, figures 7-10

Material and occurrence. Hypotypes, GSC Nos. 19060, 19060a; Long Reach Formation, GSC locality 55061.

Exterior. A single shell from the Long Reach Formation probably belongs to the genus. The external configuration is not preserved, but the surface of the pedicle valve is covered by four or five broad, low plications on each flank. The pedicle sulcus is rounded and only moderately deep.

Interior of pedicle valve. Thin, slightly divergent dental lamellae are present at the lateral edges of the plications that border the sulcus.

Howellella sp. 3

Plate XVI, figures 3-6

Material and occurrence. Hypotypes, GSC Nos. 19061, 19061a; Long Reach Formation, GSC locality 55061.

Exterior. A single brachial valve from the Long Reach Formation is assigned to the non-plicate *Howellella* group. The valve is only slightly convex. The outline is nearly semicircular with the maximum width only slightly anterior to the hinge line as is common in species of this group. The cardinal angles are acute and rounded. A low, flat fold is present on the brachial valve, bordered by shallow narrow furrows. The fold widens consistently towards the anterior. The surface of the valve is covered with very even and closely spaced growth lines, along which are arranged radial rows of fine spines. Between 10 and 15 growth lamellae per millimetre occur on the anterior part of the shell.

Interior of brachial valve. Short crural plates are present.

Phylum MOLLUSCA

Class GASTROPODA Cuvier, 1797

Subclass PROSOBRANCHIA Milne Edwards, 1848

Order ARCHAEOGASTROPODA Thiele, 1925

Suborder TROCHINA Cox and Knight, 1960

Superfamily ORIOSTOMATACEA Wenz, 1938

[*nom. transl.* Knight, Batten, and Yochelson, 1960 (*ex* Oriostomatidae Wenz, 1938)]

Family ORIOSTOMATIDAE Wenz, 1938

Genus ***Oriostoma*** Munier-Chalmas, 1876

Type species. O. barrandei, 1876, p. 103

Oriostoma cf. *O. globosum* (Schlotheim, 1820)

Plate XVI, figures 15-23

Trochilites globosus Schlotheim, 1820, p. 162.
Oriostoma globosum Lindstrom, 1884, p. 160, pl. 17, figs. 24, 25, 29-31.

Material and occurrence. Hypotypes, GSC Nos. 19062, 19063, 19063a, 19064; unnamed beds, Back Bay, N.B., GSC locality 55050.

Description. Whorls coiled dextrally in a low spiral. Sutures deep. Last two whorls bear an obtuse shoulder. As many as nine subequally spaced revolving costae are present. Growth lines are foliaceous and are turned up at the costae. On the last whorl, growth lines appear at the rate of about 3 or 4 per millimetre.

An operculum is present. Specimens are seen both in place and free. The ornament consists of spiral costae and lirae that expand counterclockwise. The profile of the exterior is low conical. The interior surface is nearly flat with a broad low spiral ridge. The margin is thickened into a rectangular flange.

Suborder PLEUROTOMARIINA Cox and Knight, 1960

Superfamily PLEUROTOMARIACEA Swainson, 1840

[*nom. transl.* Wenz, 1938 (*ex* Pleurotomariae, Swainson, 1840)]

Family EUOMPHALOPTERIDAE Koken, 1896

Genus ***Euomphalopterus*** Roemer, 1876

Type species. Turbinites alatus Wahlenberg, 1821, p. 69

Euomphalopterus sp.

Plate XVII, figures 2, 3

Material and occurrence. Hypotype A, GSC No. 19065; unnamed beds, Back Bay, GSC locality 55050.

Description. Whorls coiled dextrally in a low spiral. Base widely phaneromphalous. Revolving costae or lirae lacking. Growth lines prominent and angular, nearly foliaceous. At the beginning of the last whorl there are 3 or 4 growth lines per millimetre. The last whorl bears a broad pendant frill.

Comparison. The Back Bay specimen resembles *E. alatus* fairly closely, but that species bears a revolving costa around the umbilicus (Lindström, 1884, pl. 10, figs. 20, 23).

Family EOTOMARIIDAE Wenz, 1938

[*nom. transl.* Knight, Batten, and Yochelson, 1960 (*ex* Eotomariinae Wenz, 1938)]

Subfamily EOTOMARIINAE Wenz, 1938

Tribe PTYCHOMPHALIDES Wenz, 1938

[*nom. transl.* Knight, Batten, and Yochelson, 1960 (*ex* Ptychomphalinae Wenz, 1938)]

Genus *Pseudoscalites* n. gen.

Type species. P. lindstroemi nom. nov. (=*Pleurotomaria labrosa* Lindström, 1884, p. 113, pl. 9, figs. 30-38, *not* Hall, 1859, p. 339).

Holotype. Specimen illustrated by Lindström (1884, pl. 9, fig. 30).

Diagnosis. Gradate (scalitiform), with revolving cords crossing growth lines basally. Ramp with growth lines only. Sinus absent.

Pseudoscalites cf. *P. lindstroemi* nom. nov.

Plate XVI, figure 25; Plate XVII, figure 1

Material and occurrence. Hypotype A, GSC No. 19066; unnamed beds, Back Bay, GSC locality 55050.

Description. A single specimen from New Brunswick shows well the gradate form, the ramp and its collabral ornament, the selenizone and lunules and the basal ornament of revolving cords and growth lines.

Systematic Position Uncertain

Gastropod indet.

Plate XVI, figure 24

Material and occurrence. Hypotype A, GSC No. 19067; unnamed beds, Back Bay, GSC locality 55050.

Description. A single mould is available showing turbiniform shape with moderately deep sutures. Growth lines are faintly marked. Revolving ornament is apparently lacking. The shell is somewhat suggestive of an anomphalid genus.

Addendum to discussion of *Protomegastrophia prima* n. sp.:

It is worth noting here that Harper, Boucot, and Johnson have studied a large collection of *Brachyprion* cf. *arenacea* Davidson 1871 (British Fossil Brachiopods, vol. 3, pp. 296-7, pl. 42, fig. 6 *non* 7,8; = *B. arenacea* Davidson, Lamont & Gilbert, 1945, Annals & Magazine of Nat. Hist., ser. 11, vol. 12, pp. 664-7, pl. 5, figs. 1-10, pl. 7, fig. 1,4 *non* pl. 6, figs. 1-6, *non* pl. 7, figs. 2,3) from the Pentamerus Limestone, Upper Llandovery, grid reference 928/358, small quarries on north side of Norbury-Linley rd. about one-quarter mile west of Norbury, map-sheet 129 (Ludlow), Great Britain (USNM locality 10547) and found that the population shows all intergrades between gently concavo-convex forms characteristic of *Leptostrophia* and strongly concavo-convex forms characteristic of *Brachyprion* (a genus closely related to, if not congeneric with *Protomegastrophia* differing principally in size). This British species is thus comparable to *Protomegastrophia prima* n. sp., described herein, which shows all intergrades between *Leptostrophia* and *Protomegastrophia*. Early *Leptostrophia* was apparently ancestral to the douvillinid group of stropheodontids as well; the authors have studied a large collection made by Dr. A. M. Ziegler of the University of Chicago from his locality T-M-A, Damery Beds, beds of Upper Llandovery C_5 age, Tortworth, grid reference ST 7268/9212, Great Britain and found it to include all intergrades between individuals with a muscle field in the pedicle valve as in typical *Leptostrophia* and individuals with a muscle field like that found in the genus *Mclearnites* Caster, 1939 (=*Mesodouvillina* Williams, 1950).

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PLATES I TO XVIII

PLATE I

Figures 1–11. *Rhynobolus* sp. A Page 9.

1. Mould of interior of brachial valve (x2). Note the transversely striate anterior scar, smooth median scar, and striate lateral scars. The platform vaults appear to be filled in, but may have been very minute and had the fillings broken off during preparation. Unnamed beds, Back Bay, GSC loc. 55050. Hypotype A, GSC No. 18917.

2. Rubber impression of specimen in figure 1 (x2). Note the strongly impressed lateral scars, median scar, and anterior scar. The postero-lateral parts of the crescent are well developed.

3. Mould of interior of brachial valve (x1½). Note the minute fillings of the platform vaults, the postero-lateral parts of the crescent, and the strongly striate median scar. Unnamed beds, Back Bay, GSC loc. 55050. Hypotype B, GSC No. 18918.

4. Rubber impression of specimen in fig. 3 (x1½). Note the low median partition, depressed, smooth anterior scar, transversely striate median scar, and strongly striate lateral scars.

5. Mould of interior of brachial valve (x1½). Reverse of specimen in fig. 6. Note the absence of platform vault fillings, the striate lateral scars, the relatively continuous form of the anterior scar and the median scar, and the absence of a well-defined median partition. Unnamed beds, Back Bay, GSC loc. 55050. Hypotype C, GSC No. 18919.

6. Mould of interior of pedicle valve (x1½). Note the minute umbonal chamber fillings, transversely striate area anterior to the delthyrial region, postero-lateral form of the crescent, and weakly developed median partition. Hypotype C, GSC No. 18919.

7. Mould of interior of brachial valve (x1½). Note the minute platform vault fillings, the postero-lateral parts of the crescent, and the cardinal impression fillings. Long Reach Formation, GSC loc. 55061. Hypotype D, GSC No. 18920.

8. Rubber impression of specimen in fig. 7 (x1½). Note the unstriated condition of the muscle field, the short median partition, and the continuous form of the median and anterior scars.

9. Rubber impression of specimen in fig. 10 (x1). Note the subcircular outline and the concentric growth lines. Unnamed beds, Back Bay, GSC loc. 55050.

10. Mould of exterior of brachial valve (x1). Note the concentric growth lines. Hypotype E, GSC No. 18922.

11. Mould of interior of pedicle valve (x1½). Negative of fig. 1, Pl. II. Note the chamber vault fillings, the striate form of the muscle field, the umbonal chamber fillings, the transversely striate area anterior of the delthyrial region, the transversely striate, concave delthyrial area laterally bounded by raised areas which in turn are bounded laterally by low grooves, and the short median partition. Long Reach Formation, GSC loc. 55061. Hypotype F, GSC No. 18921.

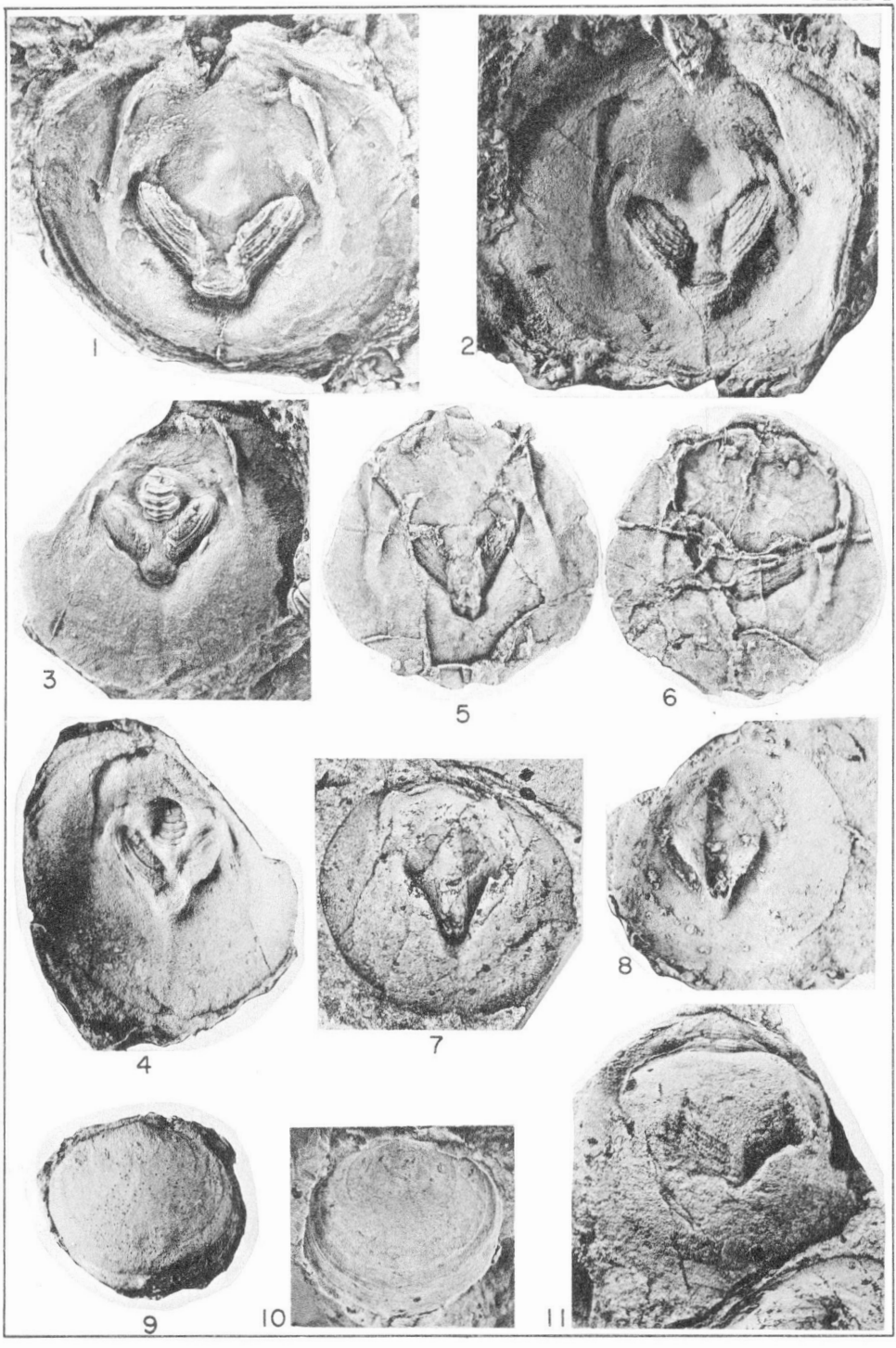
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PLATE II

Figures 1–3. *Rhynobolus* sp. A — Page 9.

1. Rubber impression of interior of pedicle valve (x1½). Note the concave form of the delthyrial area, and the depressed anterior scar which is unstriated. Long Reach Formation, GSC loc. 55061. Hypotype F, GSC No. 18921.

2. Rubber impression of specimen of fig. 3 (x1½). Note the concave delthyrial area bordered laterally by low ridges, which in turn are bounded laterally by broad grooves. The umbonal chambers are minute as are the platform chambers. The median partition is broad and rounded in section. The lateral scars are laterally divided by a series of longitudinal ridges.

3. Mould of interior of pedicle valve (x1½). Note the platform chamber fillings, the transversely striate area anterior to the delthyrial region, the posterolaterally impressed parts of the crescent, and the transversely striate nature of the muscle field. Unnamed beds, Back Bay, GSC loc. 55050. Hypotype G, GSC No. 18923.

Figures 4–11. *Dolerorthis* cf. *D. rustica* (Sowerby, 1839) — Page 11.
Unnamed beds, Back Bay, GSC loc. 55050.

4. Mould of interior of pedicle valve (x2). Counterpart of specimen in fig. 10. Hypotype A, GSC No. 18924.

5. Rubber impression of specimen in fig. 10 (x1.5). Note the anteriorly bifurcating secondary and tertiary costae.

6. Mould of interior of brachial valve (x2). Note the blade-like cardinal process and the stout brachiophores. Hypotype B, GSC No. 18925.

7. Rubber impression of specimen in fig. 8 (x1½). Note the anteriorly bifurcating costae, and the growth line.

8. Mould of exterior of brachial valve (x1½). Note the prominent filae. Hypotype C, GSC No. 18926.

9. Rubber impression of specimen in fig. 4 (x2½). Note the peripheral crenulations, the short dental lamellae, and the prominent interarea.

10. Mould of fragment of exterior of pedicle valve (x1½). Note the presence of well-developed filae. Hypotype D, GSC No. 18927.

11. Mould of interior of brachial valve (x2). Hypotype E, GSC No. 18928.

Figure 12. *Skenidioides* sp. — Page 12.
Mould of interior of brachial valve (x3). Note the prominent median septum, blade-like cardinal process, and spondylium formed by their fusion with the supporting plates. Hypotype A, GSC No. 18929. Unnamed beds, Back Bay, GSC loc. 55050.

Figure 13. *Dicaelosia* sp. — Page 20.
Mould of interior of pedicle valve (x3). Note the outline of the shell and form of the muscle field. Hypotype A, GSC No. 18966. Unnamed beds, Back Bay, GSC loc. 55050.

Figures 14–15. *Dalejina* cf. *D. hybrida* (Sowerby, 1839) — Page 12.
Unnamed beds, Back Bay, GSC loc. 55050.

14. Mould of interior of brachial valve (x2½). Note the short, broad, low median ridge bisecting the poorly impressed muscle field, the linear cardinal process, and the position of the dental sockets. Counterpart of fig. 6, Pl. III. Hypotype A, GSC No. 18930.

15. Rubber impression of specimen in fig. 14 (x2). Note the form of the interarea and the flat medially grooved peripheral crenulations.

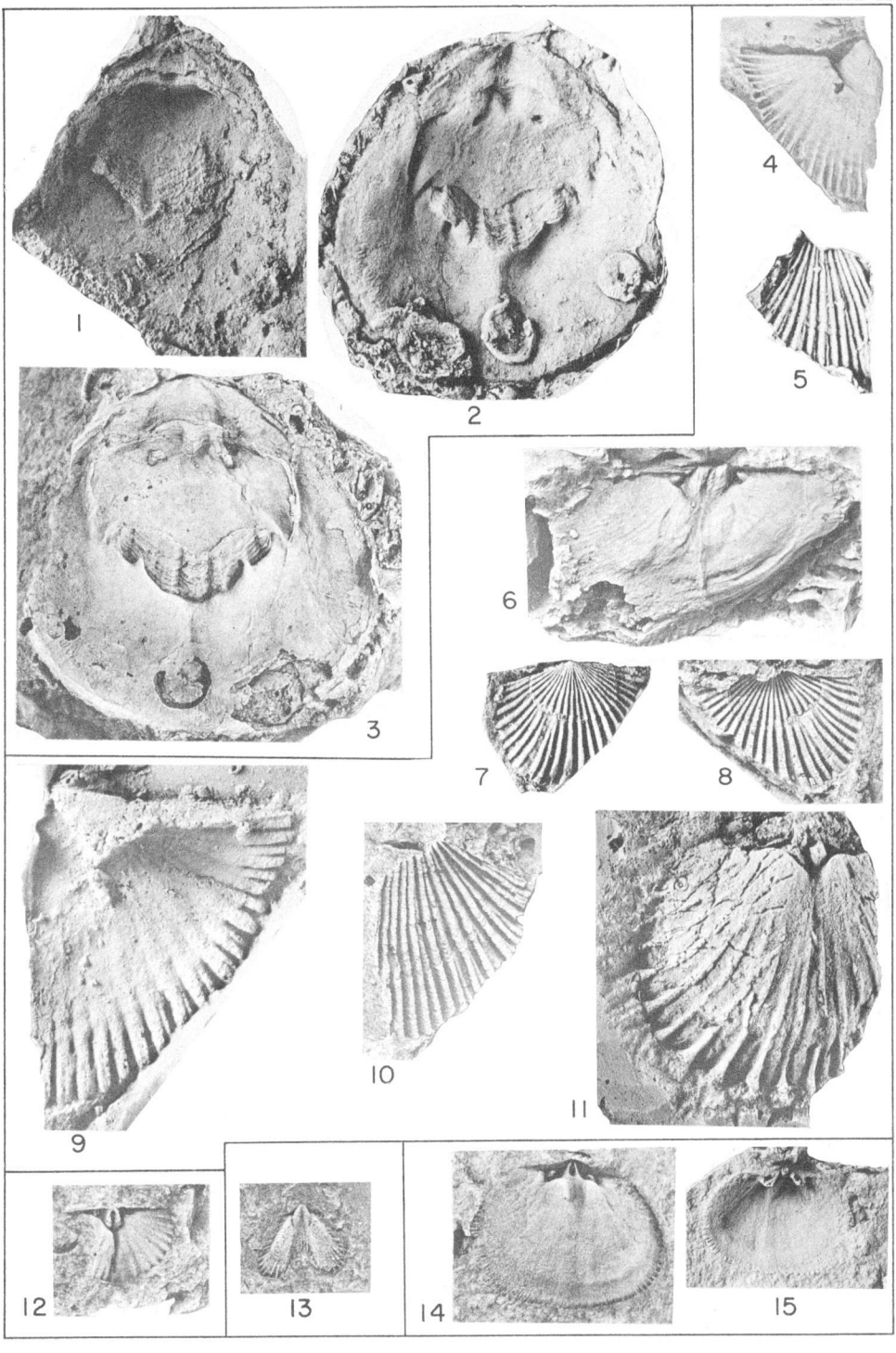
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PLATE III

Figures 1–14. *Dalejina* cf. *D. hybrida* (Sowerby, 1839) Page 12.
Unnamed beds, Back Bay, GSC loc. 55050.

1. Mould of interior of pedicle valve (x2). Note the outline of the diductor field, and the postero-medially situated adductor impressions, the pedicle callist and the short, narrow median ridge. Hypotype B, GSC No. 18931.
2. Mould of interior of brachial valve (x3). Note the broad, low median ridge bisecting the muscle field and the divergent brachiophores. Hypotype C, GSC No. 18932.
3. Mould of interior of pedicle valve (x2). Note the form of the diductor field, the postero-medially situated adductor impressions and the pedicle callist. Hypotype D, GSC No. 18933.
4. Mould of interior of brachial valve (x3). Note the form of the cardinal process and the poorly impressed adductor impressions. Hypotype E, GSC No. 18934.
5. Rubber impression of specimen in fig. 6 (x2).
6. Mould of exterior of brachial valve (x2½), counterpart of fig. 14, of Pl. II. Hypotype F, GSC No. 18935.
7. Rubber impression of specimen in fig. 8 (x2). Note the outline and the concentric growth lines.
8. Mould of exterior of pedicle valve (x2). Note the width of the brachial valve interarea. Hypotype G, GSC No. 18936.
9. Mould of interior of pedicle valve (x2). Note the form of the flabellate diductor impressions. Hypotype H, GSC No. 18937.
10. Rubber impression of specimen in fig. 9 (x2). Note the flattish, medially grooved peripheral crenulations, the divergent dental lamellae, and the narrow median ridge.
11–14. Mould of interior (x3), brachial view, pedicle view, anterior view, posterior view (note the subequal convexity of the valves). Hypotype I, GSC No. 18938.

Figures 15–17. *Resserella* cf. *R. concavoconvexa* (Twenhofel, 1928) Page 13.
Unnamed beds, Back Bay, GSC loc. 55050.

15. Mould of interior of pedicle valve (x3). Counterpart to fig. 16. Note the impression of the curved dental lamellae. Hypotype, GSC No. 18939.
16. Mould of exterior of pedicle valve (x3). Note relatively coarse costellae. Hypotype, GSC No. 18939a.
17. Mould of interior of pedicle valve (x2). Note the shield-shaped outline, short dental lamellae, and anterior crenulations. Hypotype, GSC No. 18940.

Figures 18–20. *Resserella* cf. *R. visbyensis* (Lindström, 1861) Page 14.
Long Reach Formation, GSC loc. 55061.

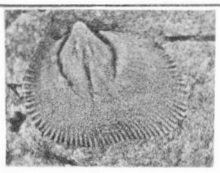
18. Rubber impression of specimen in fig. 19 (x3). Note the form of the raised muscle field, the divergent brachiophore bases, the wide sockets, and anterior crenulations.
19. Mould of interior of brachial valve (x2). Note the hypercline interarea and outline. Hypotype A, GSC No. 18946.
20. Mould of exterior of brachial valve (x2). Note the asymmetrical pattern of costellae bifurcation in the sulcus and the narrow triangular median smooth zone. Hypotype B, GSC No. 18947.

Figures 21–25. *Resserella* cf. *R. concavoconvexa* (Twenhofel, 1928) Page 13.
Unnamed beds, Back Bay, GSC loc. 55050.

21. Rubber impression of exterior of brachial valve (x2). Note the concavity of valve. Hypotype, GSC No. 18941.
22. Mould of interior of brachial valve (x2). Note the faintly impressed margins of the adductor muscle field, the anteriorly narrowing median ridge, the widely divergent brachiophore bases, the cardinal process and the crenulated sockets. Hypotype, GSC No. 18942.
23. Mould of exterior of brachial valve (x2). Note the median triangular zone of fine costellae. Hypotype, GSC No. 18943.
24. Mould of interior of brachial valve (x2). Note anteriorly narrowing median ridge and smaller anterior pair of adductor impressions. Hypotype, GSC No. 18944.
25. Mould of interior of pedicle valve (x2). Note low median ridge becoming narrower anteriorly and thick curved dental lamellae. Hypotype, GSC No. 18945.

Figures 26–28. *Salopina submedia* (McLearn, 1924) Page 15.
Jones Creek Formation, GSC loc. 55056.

26. Mould of interior of brachial valve (x2). Note the quadrilobate adductor muscle field. Hypotype A, GSC No. 18949.
27. Mould of interior of pedicle valve (x2). Hypotype B, GSC No. 18950.
28. Mould of exterior of pedicle valve (x2). Hypotype C, GSC No. 18951.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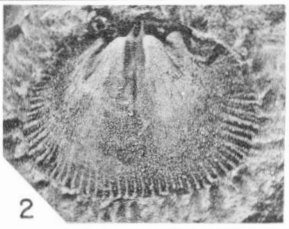
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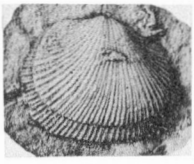
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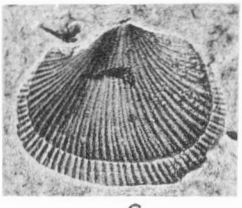
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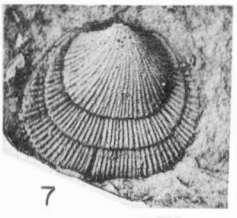
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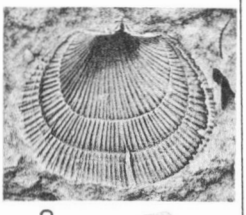
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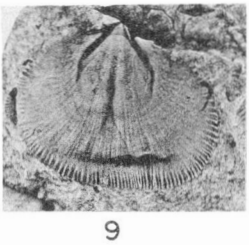
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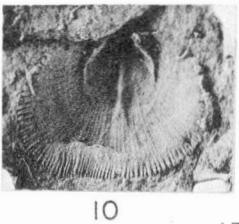
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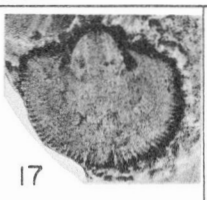
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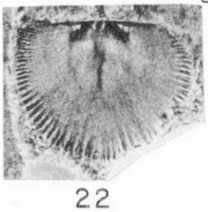
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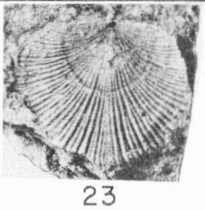
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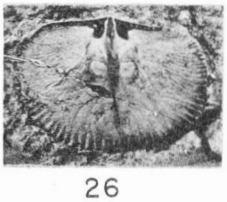
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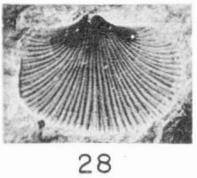
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Figures 1–14. *Salopina submedia* (McLearn, 1924) Page 15.
Figs. 1, 2, and 12, Long Reach Formation, GSC loc. 55061; figs. 3-11, 13, 14, Jones Creek Formation, GSC loc. 55056.

1. Mould of exterior of brachial valve (x2). Note the minute fillings of the "hollow costellae" along the exterior margin, and curved posterior costellae cutting the hinge line. Counterpart to specimen figured in fig. 12. Holotype, GSC No. 18948.

2. Rubber impression of specimen in fig. 1. Note the concentric growth lines and the origin of costellae by bifurcation.

3. Mould of interior of brachial valve (x2). Note the form of the cardinal process and brachiophore bases, the pustulose postero-lateral regions, and the form of the muscle field with lateral margins posteriorly directed external to the brachiophore bases. Hypotype D, GSC No. 18952.

4. Mould of exterior of pedicle valve (x2). Hypotype E, GSC No. 18953.

5. Rubber impression of specimen in fig. 6 (x2). Note the form of the muscle field, the brachiophores and fulcral plates, the small cardinal process and the anterior crenulations.

6. Mould of interior of brachial valve (x2). Note the brachiophore bases and the quadrilobate adductor field. Hypotype F, GSC No. 18954.

7. Mould of posterior (x3). Hypotype G, GSC No. 18955.

8. Rubber impression of specimen in fig. 7. Note beak and interarea of pedicle valve and open delthyrium and notothyrium.

9. Mould of interior of brachial valve (x2). Note the form of the muscle field, presence of fulcral plates, and the narrow cardinal process. Hypotype H, GSC No. 18956.

10. Rubber impression of specimen in fig. 9 (x2). Note the form of the interarea, cardinal process, the stubby brachiophores more deeply impressed, anterior adductor scars, the anterior crenulations, and the flexure at the posterior end of the muscle field margin where it joins the brachiophore.

11. Mould of interior of pedicle valve (x1½). Note the anterior extent of the muscle field. Hypotype I, GSC No. 18957.

12. Mould of interior of brachial valve (x2). Counterpart of specimen in fig. 1. Note the form of the cardinalia and the muscle field. Holotype, GSC No. 18948a.

13. Mould of interior of pedicle valve (x2). Note the impressions of the curved dental lamellae. Hypotype J, GSC No. 18958.

14. Rubber impression of specimen in fig. 13. Note the form of the hinge teeth and concave dental lamellae, and the small lateral cavities.

Figures 15, 16. *Isorthis* sp. Page 19.
Unnamed beds, Back Bay, GSC loc. 55050.

15. Rubber impression of specimen in fig. 16 (x2). Note slightly divergent diductor tracks, and anterior slope of wide median ridge.

16. Mould of interior of pedicle valve (x2). Note the divergent vascular grooves diverging from the anterior end of diductor track and the wide dental lamellae with flattened anterior edges. Hypotype A, GSC No. 18961.

Figures 17–20. *Isorthis mackenziei* n. sp. Page 17.
Long Reach Formation, GSC loc. 55061.

17. Rubber impression of specimen in fig. 18 (x3). Note the broad median ridge, and subcircular margin of the adductor muscle field.

18. Mould of interior of brachial valve (x2). Note the triangular bases of the brachiophores, the weakly impressed muscle field and the form of the cardinal process. Holotype, GSC No. 18959.

19. Mould of interior of pedicle valve (x2). Note the short triangular median ridge, the thick dental lamellae and the pedicle callist. Paratype A, GSC No. 18960.

20. Rubber impression of specimen in fig. 19 (x2). Note anterior crenulations, thick, straight dental lamellae and crural fossettes on teeth.

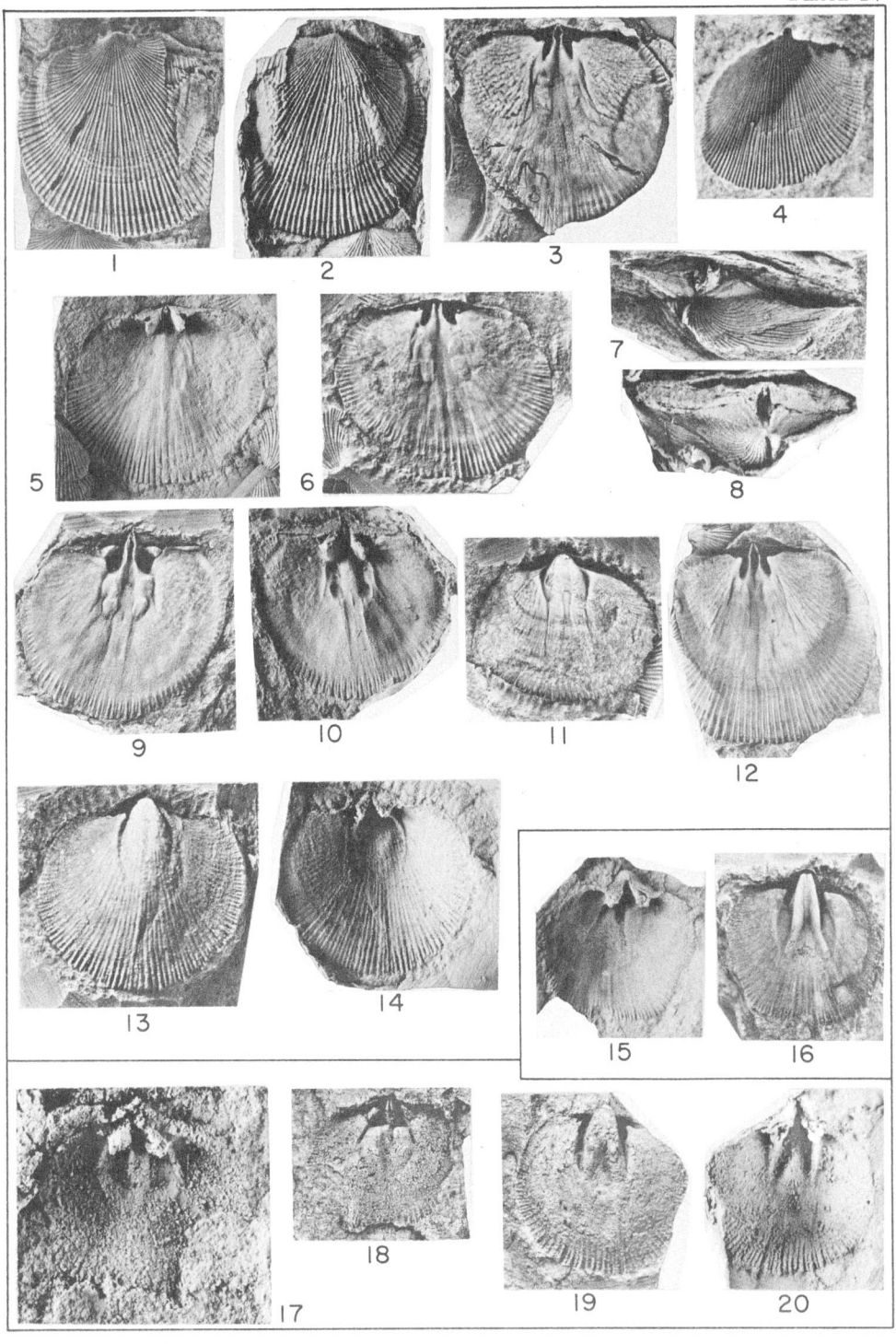
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PLATE V

Figures 1–6. *Isorthis* sp. Page 19.
Figs. 1-4, Jones Creek Formation, GSC loc. 55052; figs. 5-6, unnamed beds, Back Bay, GSC loc. 55050.

1. Rubber impression of specimen in fig. 2 (x2). Note adductor muscle impressions, thin brachiophores, and simple cardinal process.
2. Mould of interior of brachial valve (x2). Note the median sulcus, lateral margins of muscle field, and bases of brachiophores. Hypotype B, GSC No. 18962.
3. Mould of interior of pedicle valve (x2). Note the divergent diductor tracks, thick dental lamellae, and short median ridge. Hypotype C, GSC No. 18963.
4. Rubber impression of specimen in fig. 3 (x2). Note the broad anterior slope ending the median ridge and flattened anterior edges of the dental lamellae.
5. Mould of interior of brachial valve (x2). Note the well-impressed quadripartite adductor muscle field, the anteriorly narrowing median ridge, and the brachiophore bases. Hypotype D, GSC No. 18964.
6. Mould of interior of brachial valve (x3). Note the impressed adductor muscle field with larger anterior pair of impressions. Hypotype E, GSC No. 18965.

Figures 7, 8. *Anastrophia* sp. Page 21.
Unnamed beds, Back Bay, GSC loc. 55050.

7. Mould of interior of brachial valve (x1½). Note the posteriorly situated slit on the left brachial lamella which was occupied by one of the lateral alae. Hypotype, GSC No. 18967.
8. Mould of exterior of brachial valve (x1½). Counterpart of specimen in fig. 7. Note the anteriorly bifurcating costae. Hypotype, GSC No. 18967a.

Figures 9–11. *Sieberella* sp. Page 22.
Unnamed beds, Back Bay, GSC loc. 55050.

9. Mould of interior of brachial valve (x2). Despite the crushed nature of the specimen, the lyre-shaped cross-section of the brachial lamellae can be made out. The matrix has been removed from the impression of the lamellae except for the left anterior portion. Hypotype A, GSC No. 18968.
10. Mould of interior of pedicle valve (x1½). Note the small size of the spondylium. Hypotype B, GSC No. 18969.
11. Rubber impression of specimen in fig. 10 (x1½). Note the anterior inclination of the median septum.

Figures 12, 13. *Pentamerus* sp. Page 22.
Unnamed beds, Back Bay, GSC loc. 55050.

12. Mould of interior of brachial valve (x2). Note the subparallel brachial lamellae. Hypotype, GSC No. 18970.
13. Mould of exterior of brachial valve (x2). Counterpart of specimen in fig. 12. Note the concentric growth lines. Hypotype, GSC No. 18970a.

Figures 14–19. *Costistricklandia* cf. *C. gaspéensis* (Billings, 1859) Page 23.
Long Reach Formation, GSC loc. 55061.

14. Rubber impression of specimen in fig. 17 (x3).
15. Mould of interior of pedicle valve (x1). Note the short median septum and spondylium. Hypotype, GSC No. 18971.
16. Rubber impression of specimen in fig. 15 (x1). Note the form of the spondylium and median septum.
17. Mould of interior of pedicle valve (x1). Note the short median septum and the smooth umbonal regions. Hypotype, GSC No. 18972.
18. Rubber impression of specimen in fig. 19 (x1). Note the form of the costae and the shell outline.
19. Mould of exterior of pedicle valve (x1). Counterpart of specimen in fig. 17. Note the anteriorly bifurcating costae. Hypotype, GSC No. 18972a.

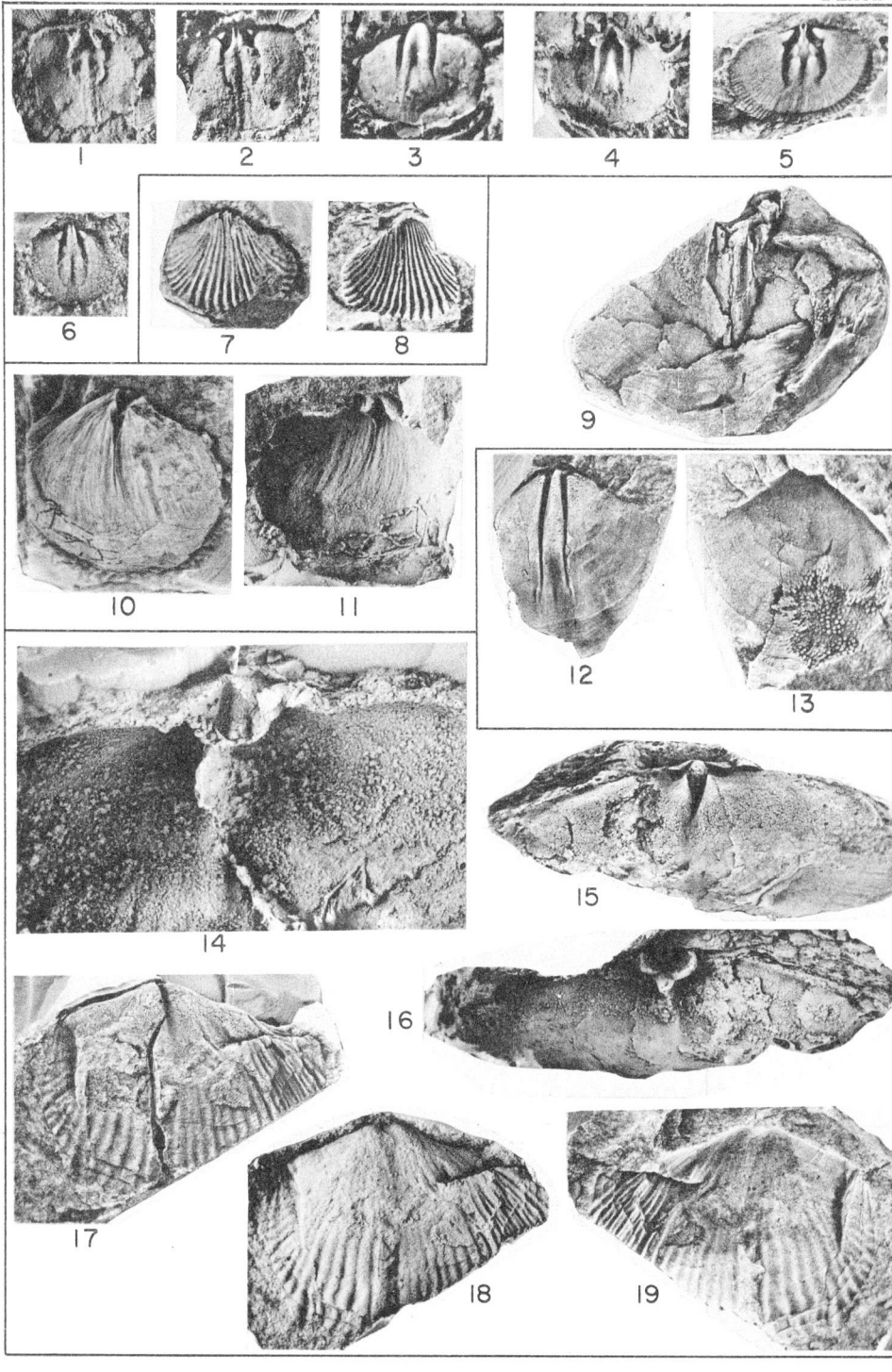
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PLATE VI

Figures 1, 2. *Costistricklandia* cf. *C. gaspéensis* (Billings, 1859) Page 23.

1. Mould of interior of brachial valve (x1½). Note the absence of slits for the outer plates, the presence of pustules in the umbonal regions, and the form of the adductor field. Long Reach Formation, GSC loc. 55061. Hypotype, GSC No. 18973.

2. Rubber impression of specimen in fig. 1 (x1½). Note the narrow dental sockets formed by the intersection of the inner plates and the interarea, and the rod-like brachial processes which are well fused laterally to the inner plates.

Figures 3–12. *Plectodonta* (*Eoplectodonta*?) cf. *E. millinensis* (Jones, 1928) Page 23.
Unnamed beds, Back Bay, GSC loc. 55050.

3. Mould of exterior of brachial valve (x3). Hypotype A, GSC No. 18974.

4. Rubber impression of specimen in fig. 3 (x3). Note disjunct chilidial plates and median lobe of the cardinal process projecting between.

5. Rubber impression of specimen in fig. 6 (x3).

6. Mould of exterior of pedicle valve (x3). Hypotype B, GSC No. 18975.

7. Mould of interior of brachial valve (x2). Hypotype C, GSC No. 18976.

8. Rubber impression of specimen in fig. 7 (x2). Note well-developed brachial ridges.

9. Rubber impression of specimen in fig. 10 (x2).

10. Mould of exterior of brachial valve (x2). Hypotype D, GSC No. 18977.

11. Mould of interior of pedicle valve (x2). Hypotype E, GSC No. 18978.

12. Rubber impression of specimen in fig. 11 (x2).

Figures 13–15. *Leangella* sp. Page 24.
Unnamed beds, Back Bay, GSC loc. 55050.

13. Mould of interior of pedicle valve (x3). Hypotype A, GSC No. 18979.

14. Rubber impression of specimen in fig. 13 (x3).

15. Mould of interior of brachial valve (x3). Hypotype B, GSC No. 18980.

Figures 16–18. *Pentlandina* cf. *P. parva* Bancroft, 1949 Page 25.
Unnamed beds, Back Bay, GSC loc. 55050.

16. Mould of exterior of brachial valve (x2). Hypotype A, GSC No. 18981.

17. Mould of interior of brachial valve (x2). Hypotype B, GSC No. 18982.

18. Rubber impression of specimen in fig. 17 (x2). Note bifurcating myophragm and part of flat brachial lamella on the right side. Note single adductor ridge extending anteriorly from between myophragm and brachial lamella.

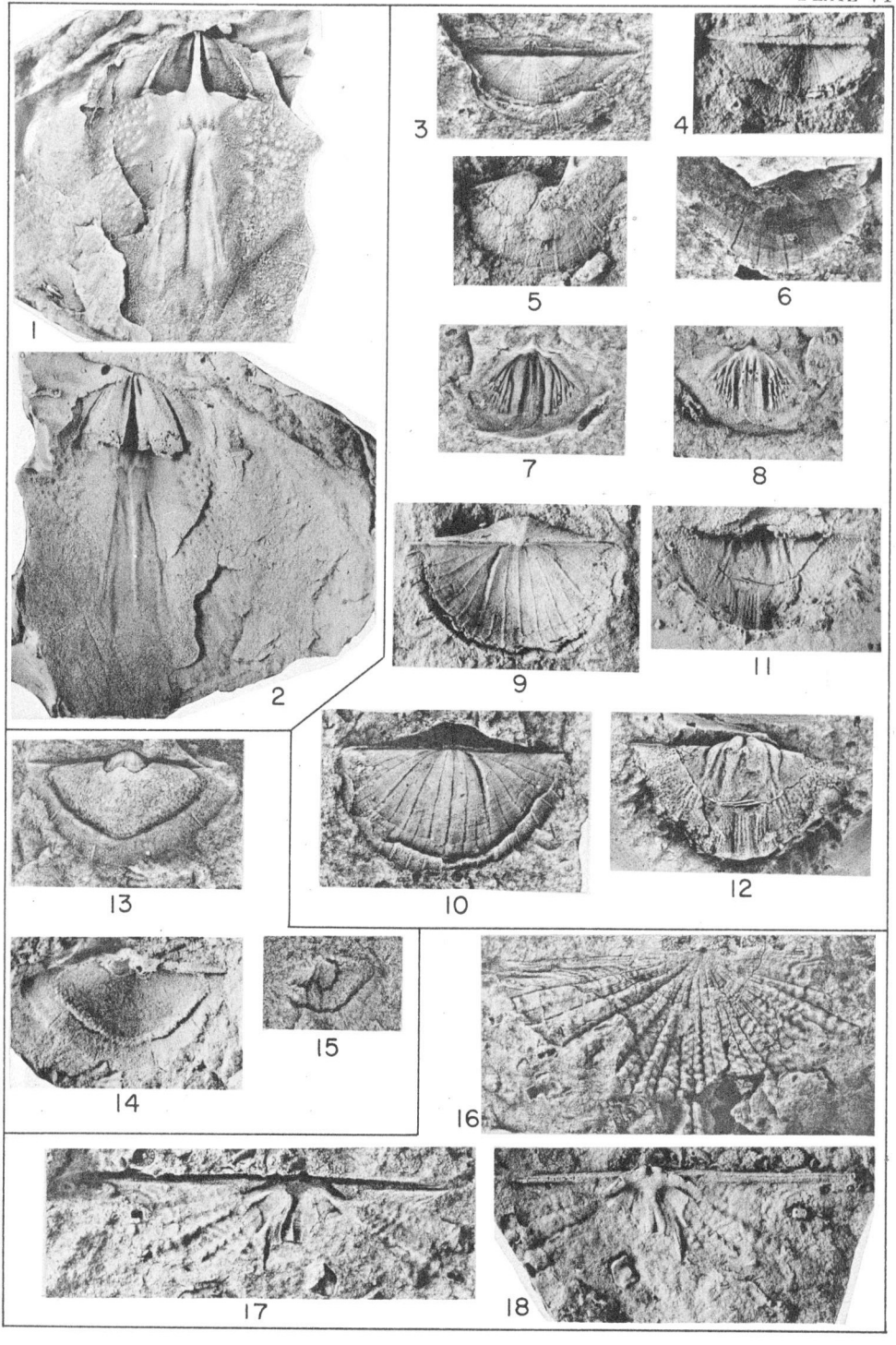
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PLATE VII

Figures 1–10. *Pentlandina* cf. *P. parva* Bancroft, 1949 — Page 25.
Unnamed beds, Back Bay, GSC loc. 55050.

1. Rubber impression of brachial exterior (x2). Hypotype A, GSC No. 18981.
2. Mould of pedicle interior (x2). Hypotype C, GSC No. 18983.
3. Rubber impression of specimen in fig. 2 (x2).
4. Rubber impression of specimen in fig. 5 (x2).
5. Mould of pedicle interior (x2). Hypotype D, GSC No. 18984.
6. Mould of brachial interior (x1.5). Note well-developed parallel adductor ridges. Hypotype E, GSC No. 18985.
7. Rubber impression of specimen in fig. 8 (x2).
8. Mould of exterior of brachial valve (x2). Hypotype F, GSC No. 18986.
9. Mould of exterior of pedicle valve (x2)., Hypotype G, GSC No. 18987.
10. Rubber impression of specimen in fig. 9 (x2).

Figures 11, 12. *Leptaena* sp. — Page 27
Unnamed beds, Back Bay, GSC loc. 55050.

11. Mould of interior of brachial valve (x2). Hypotype A, GSC No. 18988.
12. Rubber impression of specimen in fig. 11 (x2).

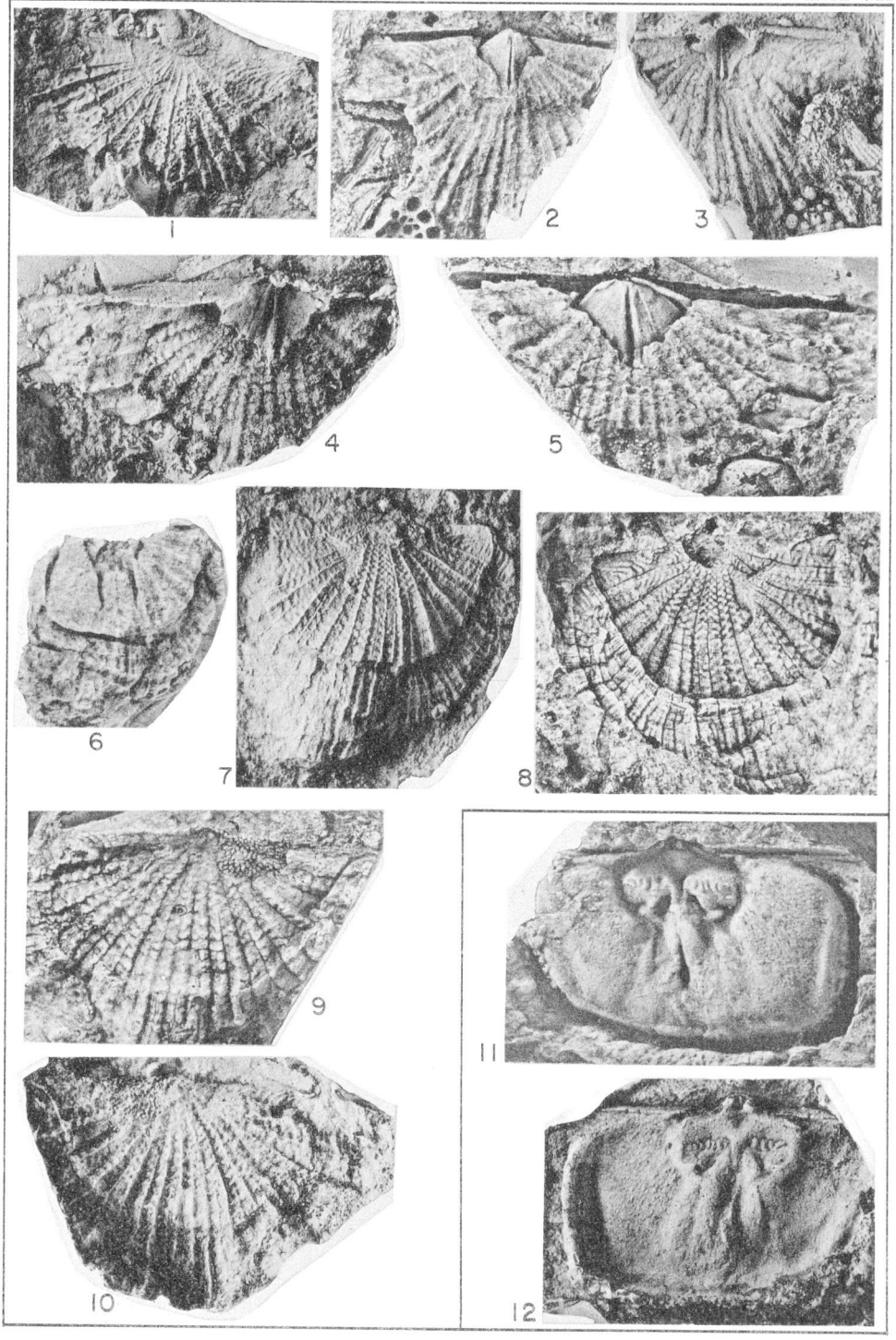
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PLATE VIII

Figures 1–6. *Leptaena* spp. Page 27.

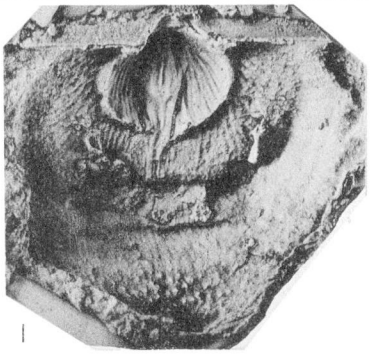
1. Rubber impression of specimen in fig. 2 (x2).
2. Mould of interior of pedicle valve (x2). Unnamed beds, Back Bay, GSC loc. 55050. Hypotype B, GSC No. 18989.
3. Mould of interior of brachial valve (x1.5). Long Reach Formation, GSC loc. 55061. Hypotype C, GSC No. 18990.
4. Rubber impression of specimen in fig. 3.
5. Mould of interior of pedicle valve (x1). Long Reach Formation, GSC loc. 55061. Hypotype D, GSC No. 18991.
6. Mould of exterior of pedicle valve (x1) counterpart of specimen in fig. 5. Hypotype E, GSC No. 18991a.

Figures 7–13. *Amphistrophia* sp. Page 27.
Unnamed beds, Back Bay, GSC loc. 55050.

7. Mould of interior of brachial valve (x2). Hypotype A, GSC No. 18992.
8. Rubber impression of specimen in fig. 7 (x2).
9. Mould of interior of pedicle valve (x2). Hypotype B, GSC No. 18993.
10. Mould of interior of brachial valve (x2). Hypotype C, GSC No. 18994.
11. Mould of interior of pedicle valve (x2). Hypotype D, GSC No. 18995.
12. Rubber impression of specimen in fig. 11 (x2).
13. Mould of exterior of brachial valve (x2). Hypotype E, GSC No. 18996.

Figures 14–16. *Strophonella* cf. *S. euglypha* (Hisinger, 1819) Page 28.
Unnamed beds, Back Bay, GSC loc. 55050.

14. Mould of interior of brachial valve (x2). Hypotype, GSC No. 18997.
15. Mould of interior of pedicle valve (x2). Note impression of ridge bordering muscle scar post-laterally and its shape convex towards the midline. Note scalloped lateral border of the muscle scar. Hypotype, GSC No. 18998.
16. Rubber impression of specimen in fig. 15.



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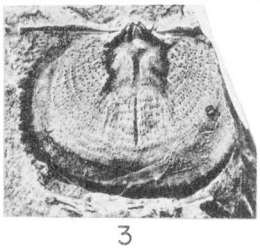

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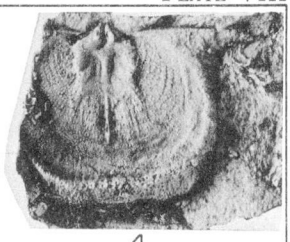

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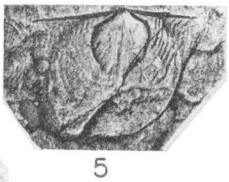

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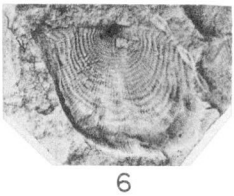

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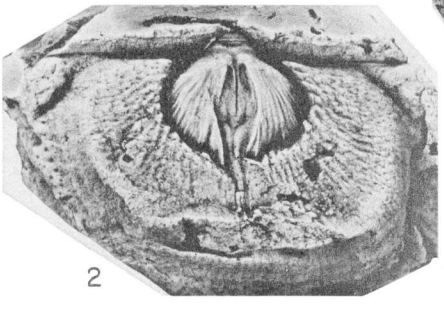

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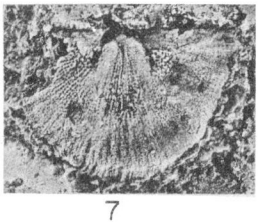

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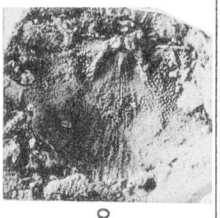

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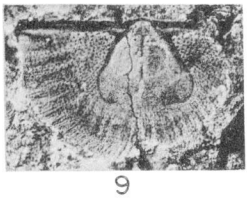

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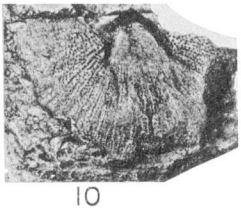

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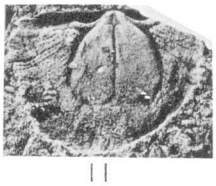

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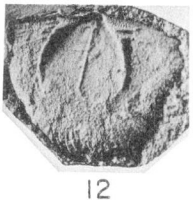

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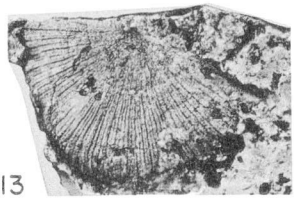

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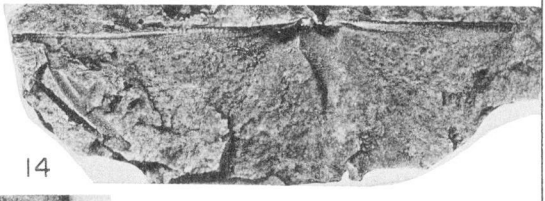

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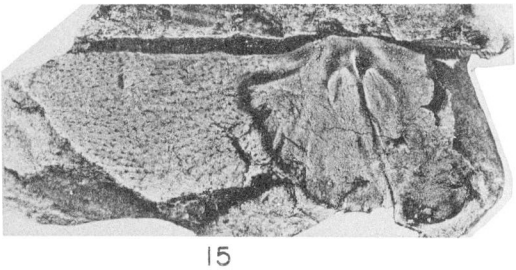

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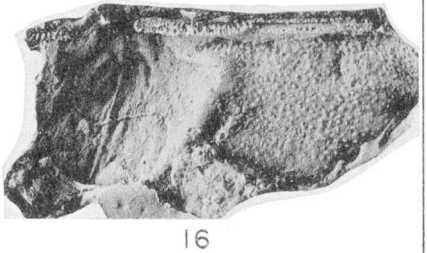

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PLATE IX

Figures 1–8. *Strophonella* cf. *S. euglypha* (Hisinger, 1819) Page 28.
Unnamed beds, Back Bay, GSC loc. 55050.

1. Mould of interior of pedicle valve (x1.5). Hypotype, GSC No. 18999.
2. Rubber impression of specimen in fig. 3 (x1.5).
3. Mould of exterior of pedicle valve (x1.5). Hypotype, GSC No. 18999a. Counterpart of specimen in fig. 1.
4. Mould of interior of brachial valve (x1). Hypotype, GSC No. 19000.
5. Rubber impression of specimen in fig. 1 (x1.5).
6. Mould of interior of brachial valve (x1). Hypotype, GSC No. 19001.
7. Mould of interior of brachial valve (x1). Hypotype, GSC No. 19002.
8. Mould of interior of brachial valve (x1.5). Hypotype, GSC No. 19003.

Figures 9–13. *Protomegastrophia prima* n. sp. Page 29.
Unnamed beds, Back Bay, GSC loc. 55050.

9. Mould of interior of brachial valve (x4). Paratype, GSC No. 19005.
10. Rubber impression of specimen in fig. 9 (x4).
11. Rubber impression of specimen in fig. 12 (x2).
12. Mould of interior of brachial valve (x4). Paratype, GSC No. 19005.
13. Mould of exterior of pedicle valve (x1.5). Paratype, GSC No. 19007.

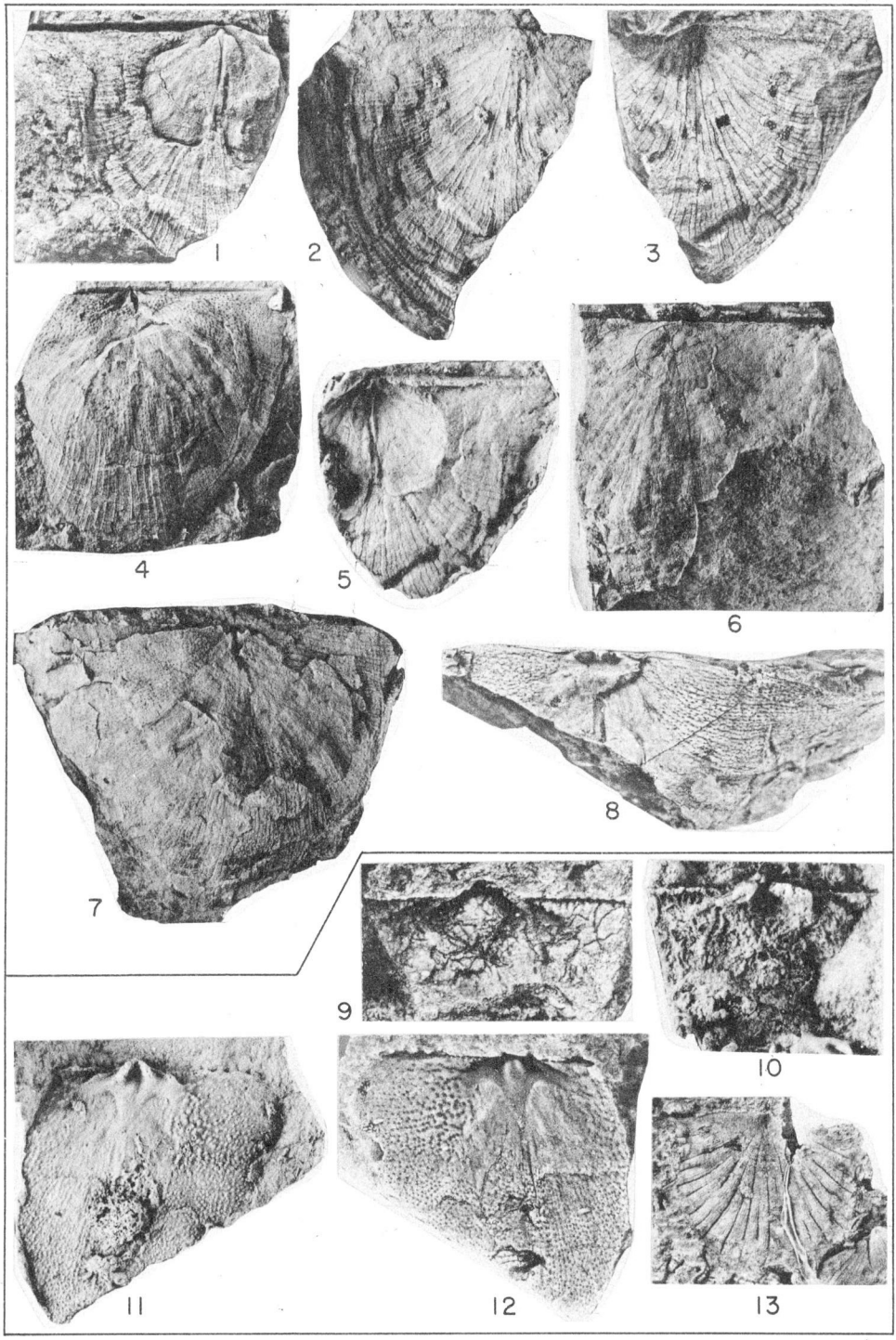
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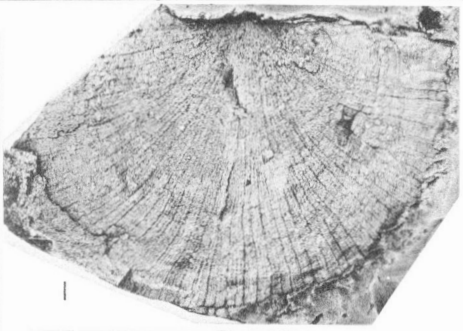
Plate X

Figures 1–9. *Protomegastrophia prima* n. sp. Page 29.
Unnamed beds, Back Bay, GSC loc. 55050.

1. Mould of exterior of brachial valve (x2). Paratype, GSC No. 19008.
2. Mould of interior of pedicle valve (x2). Holotype, GSC No. 19004.
3. Rubber impression of specimen in fig. 1 (x2).
4. Rubber impression of specimen in fig. 2 (x2).
5. Mould of interior of pedicle valve (x2). Paratype, GSC No. 19009.
6. Mould of exterior of pedicle valve (x2). Paratype, GSC No. 19009a. Counterpart to specimen in fig. 5.
7. Rubber impression of specimen in fig. 5 (x2).
8. Rubber impression of specimen in fig. 6 (x2).
9. Mould of interior of pedicle valve (x2). Paratype, GSC No. 19010.



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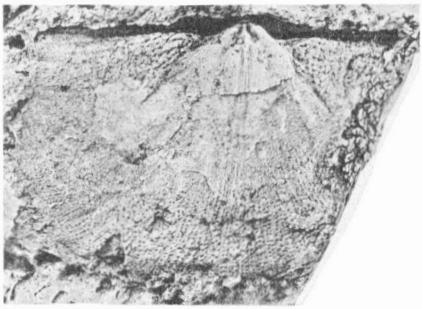

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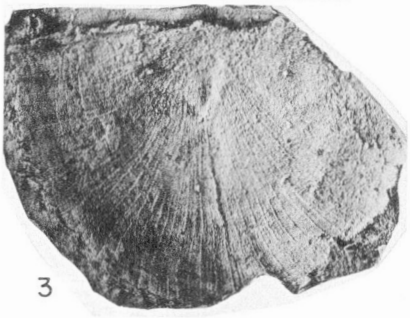

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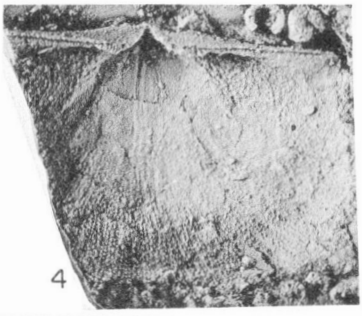

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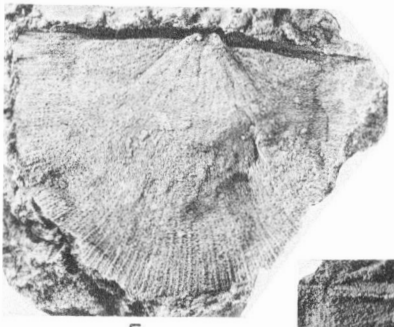

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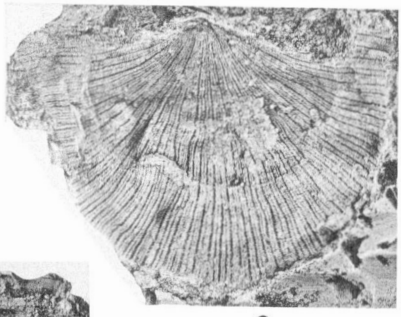

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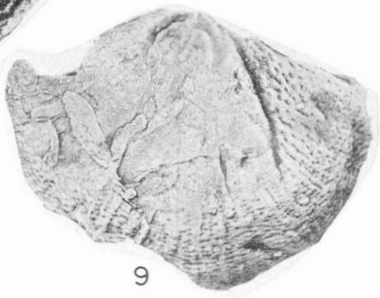

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PLATE XI

Figure 1. *Protomegastrophia prima* n. sp. Page 29.
Mould of exterior of brachial valve (x2). Paratype, GSC No. 19010a. Counterpart to the reverse of the specimen in fig. 9, Pl. X. Unnamed beds, Back Bay, GSC loc. 55050.

Figures 2–10. *Chilidiopsis* sp. Page 30.
Unnamed beds, Back Bay, GSC loc. 55050.

2. Mould of exterior of pedicle valve (x1½). Hypotype, GSC No. 19011.

3. Rubber impression of specimen in fig. 2 (x1.5).

4–8. Internal mould, brachial, pedicle, side, anterior, and posterior views (x2). Hypotype, GSC No. 19011a. Counterpart to specimen in fig. 2.

9. Rubber impression of specimen in fig. 10 (x1.5).

10. Mould of interior of brachial valve (x1.5). Hypotype, GSC No. 19012.

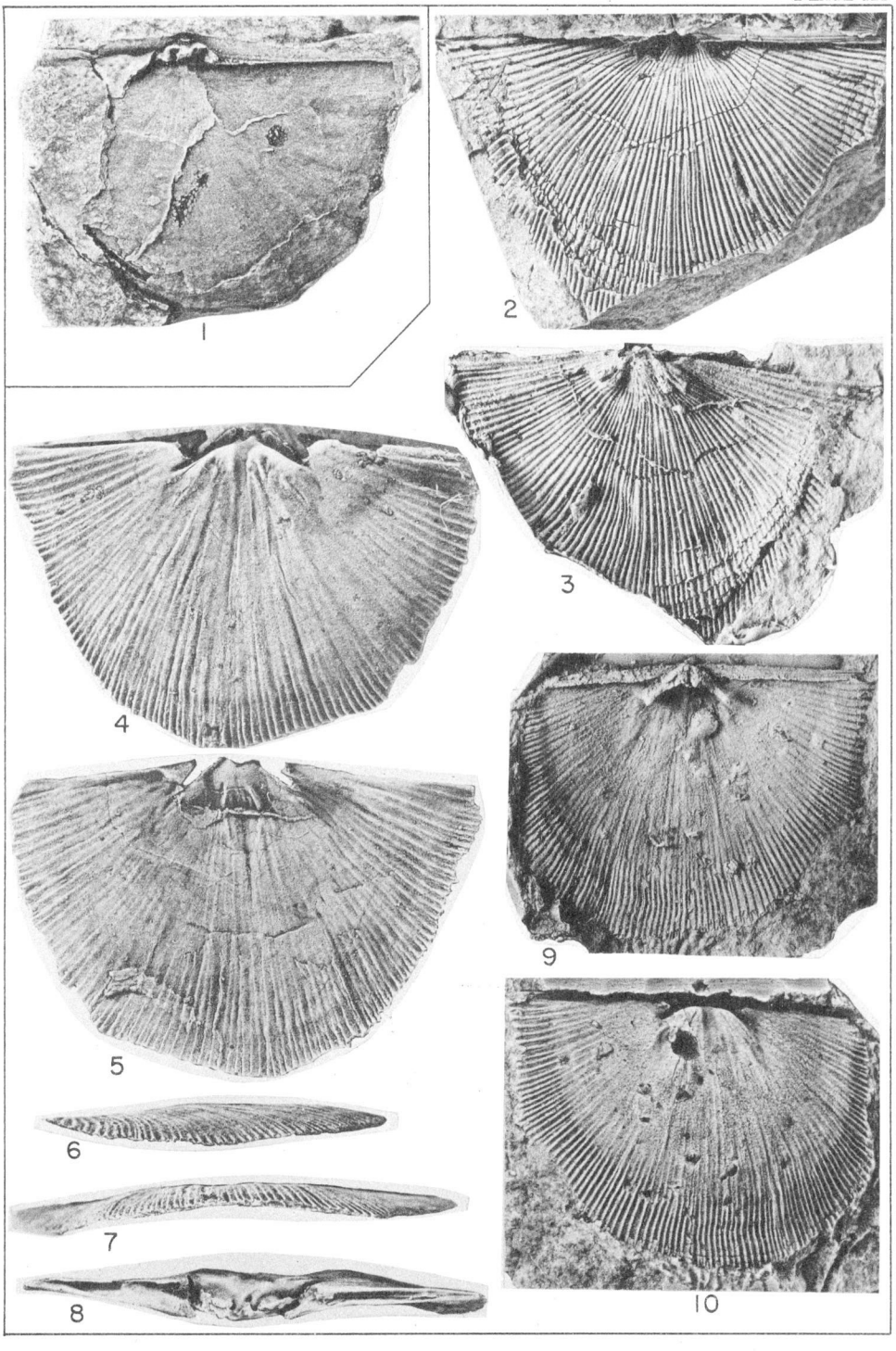
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PLATE XII

Figures 1–5. *Chilidiopsis* spp. Page 30.

1. Mould of exterior of pedicle valve (x1.5). Hypotype, GSC No. 19013. Long Reach Formation, GSC loc. 55061.

2. Rubber impression of specimen in fig. 1 (x1.5).

3. Rubber impression of posterior of specimen in fig. 2, Pl. XI (x3). Note complete chilidium.

4. Mould of interior of pedicle valve (x1.5). Hypotype, GSC No. 19014. Unnamed beds, Back Bay, GSC loc. 55050.

5. Rubber impression of specimen in fig. 4 (x1.5).

Figure 6. *Protochonetes*? sp. Page 31.

Mould of interior of pedicle valve (x2). Hypotype A, GSC No. 19015. Unnamed beds, Back Bay, GSC loc. 55050.

Figures 7–14. *Stegerhynchus*? spp. Page 31

7. Mould of interior of pedicle valve (x3). Hypotype A, GSC No. 19016. Unnamed beds, Back Bay, GSC loc. 55050.

8. Exterior of pedicle valve (x1.5). Hypotype B, GSC No. 19017. Jones Creek Formation, GSC loc. 55056.

9. Mould of interior of brachial valve (x1.5). Hypotype C, GSC No. 19018. Jones Creek Formation, GSC loc. 55056.

10–14. Mould of interior, pedicle, anterior, anterior, brachial, and side (x3). Hypotype D, GSC No. 19019. Unnamed beds, Back Bay, GSC loc. 55050.

Figures 15–25. *Ferganella* sp. Page 32.
Unnamed beds, Back Bay, GSC loc. 55050.

15. Mould of exterior of brachial valve (x1.5). Hypotype, No. 19020a. Counterpart of specimen in fig. 25.

16. Mould of exterior of pedicle valve of same individual as in fig. 15 (x1.5). Hypotype, GSC No. 19020b. Counterpart of specimen in fig. 24.

17. Rubber impression of specimen in fig. 15.

18. Rubber impression of specimen in fig. 16.

19–21. Pedicle, brachial, and posterior views of internal mould (x2). Hypotype, GSC No. 19021.

22–25. Posterior, anterior, pedicle and brachial views of internal mould (x2). Hypotype, GSC No. 19020.

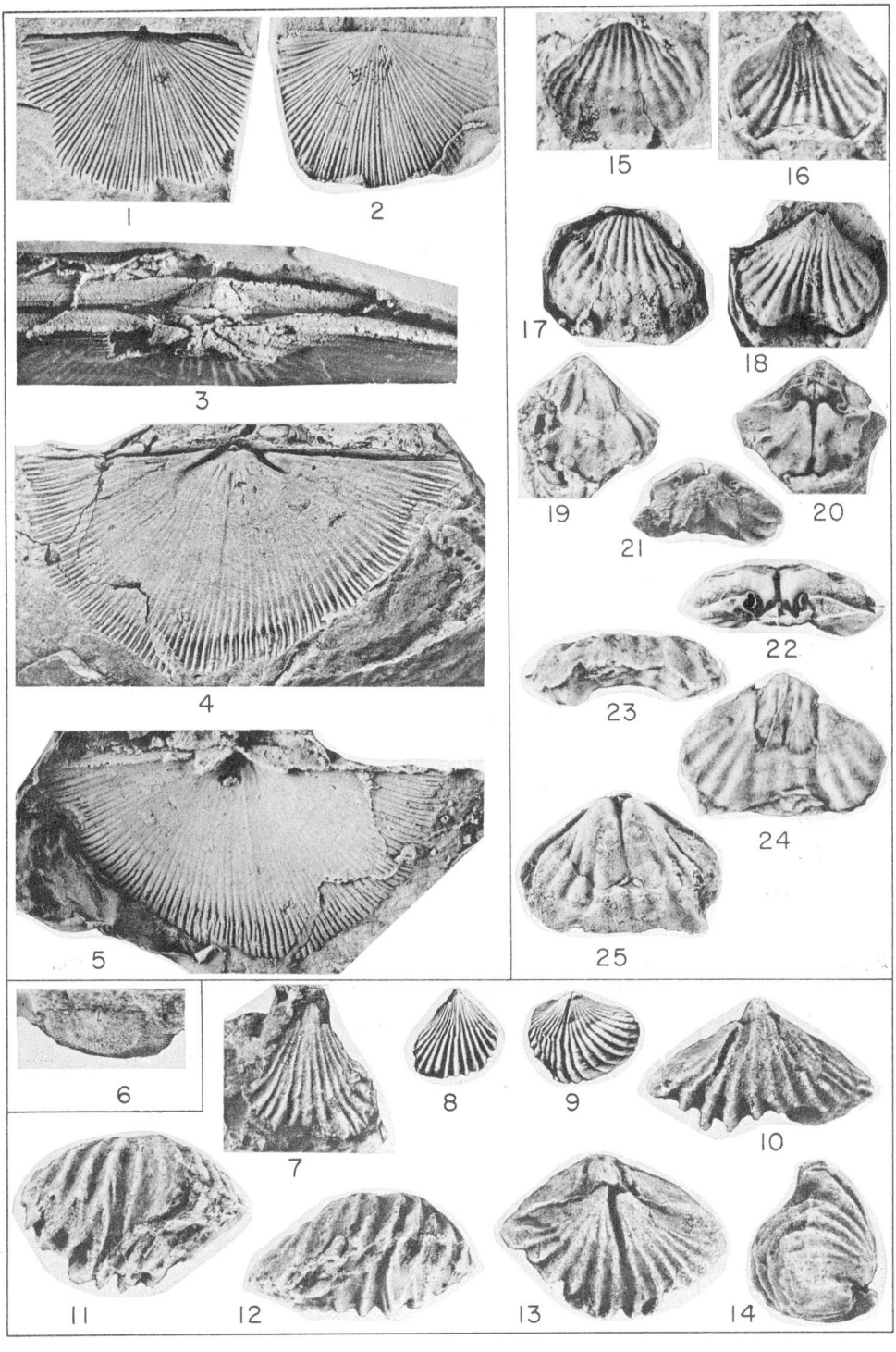
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PLATE XIII

Figures 1, 2. *Sphaerirhynchia*? sp. Page 33.
Unnamed beds, Back Bay, GSC loc. 55050.

1. Mould of interior of brachial valve (x2). Hypotype A, GSC No. 19022.

2. Mould of interior of brachial and pedicle valves conjoined (x3). Hypotype B, GSC No. 19023.

Figures 3–16. *Plectatrypa imbricata* (Sowerby, 1839) Page 33.
Unnamed beds, Back Bay, GSC loc. 55050.

3. Mould of exterior of brachial valve (x1.5). Hypotype A, GSC No. 19024.

4. Mould of exterior of conjoined brachial and pedicle valves (x1.5). Hypotype B, GSC No. 19025.

5. Mould of interior of conjoined brachial and pedicle valves (x3). Hypotype C, GSC No. 19026.

6. Mould of interior of pedicle valve (x2). Hypotype D, GSC No. 19027.

7. Mould of interiór of pedicle valve (x2). Hypotype E, GSC No. 19028.

8–10. Pedicle, brachial, and posterior views of an internal mould (x3). Hypotype F, GSC No. 19029.

11. Mould of interior of pedicle valve (x2). Hypotype G, GSC No. 19030.

12. Rubber impression of specimen in fig. 11 (x2).

13. Rubber impression of specimen in fig. 14 (x2).

14. Mould of interior of brachial valve (x2). Hypotype H, GSC No. 19031.

15–16. Lateral and brachial views of rubber impression of exterior (x2). Hypotype I, GSC No. 19032.

Figures 17, 18. *Atrypa "reticularis"* (Linnaeus, 1758) Page 34.
Long Reach Formation, GSC loc. 55061.

17. Mould of exterior of pedicle valve (x1). Hypotype, GSC No. 19033.

18. Mould of interior of pedicle valve (x1). Hypotype, GSC No. 19033a. Counterpart of specimen in fig. 17.

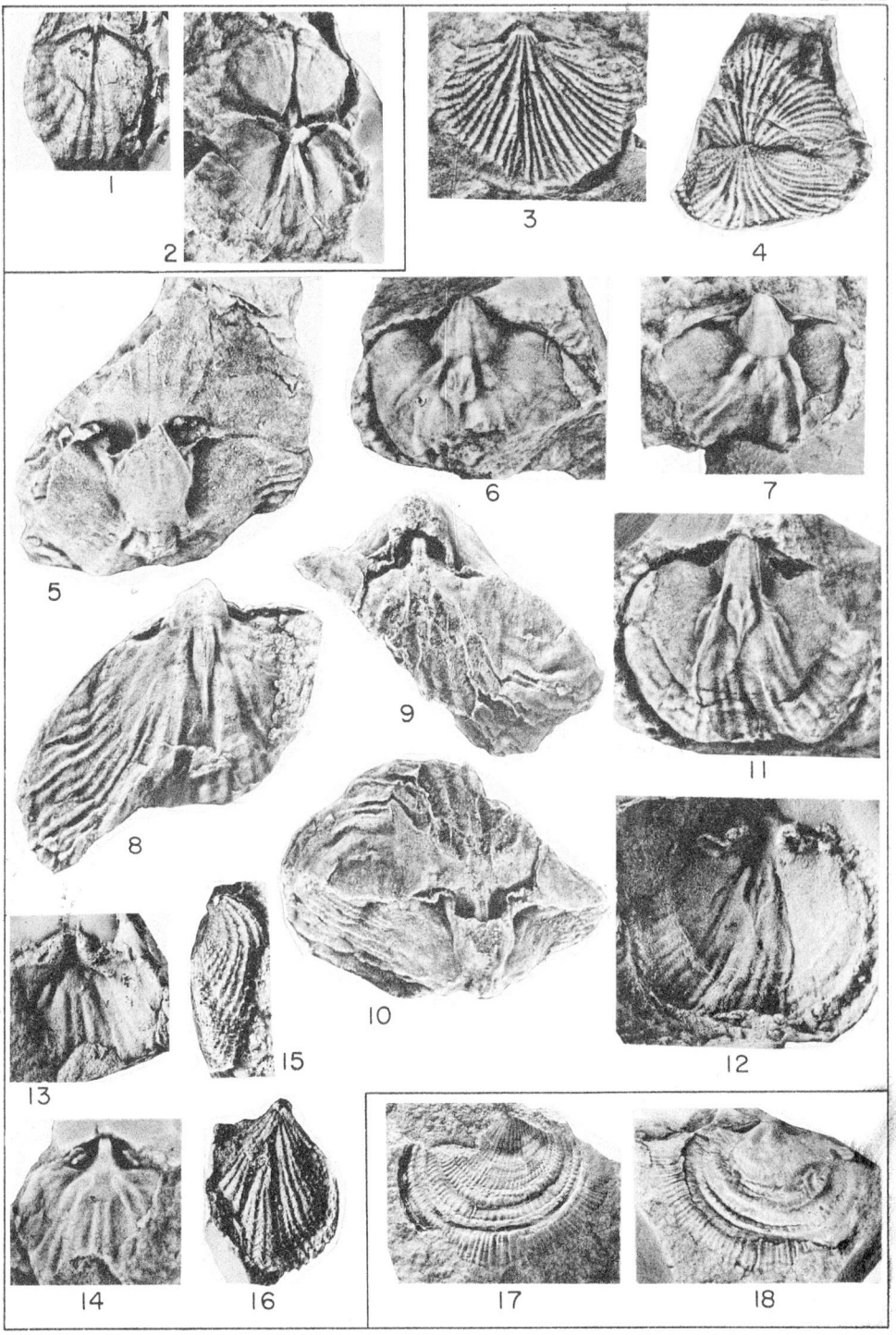
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PLATE XIV

Figures 1–15. *Atrypa "reticularis"* (Linnaeus, 1758) Page 34.

1. Mould of interior of brachial valve (x2). Hypotype, GSC No. 19034 set in place on mould of exterior of pedicle valve.
2. Mould of exterior of pedicle valve (x2). Hypotype, GSC No. 19034a. Long Reach Formation, GSC loc. 55061.
3. Mould of exterior of brachial valve (x1). Hypotype, GSC No. 19035. Long Reach Formation, GSC loc. 55061.
4. Rubber impression of specimen in fig. 3 (x1).
5. Mould of interior of brachial valve (x2). Hypotype, GSC No. 19036. Unnamed beds, Back Bay, GSC loc. 55050.
6. Mould of interior of pedicle valve and cardinalia of brachial valve (x2). Hypotype, GSC No. 19037. Unnamed beds, Back Bay, GSC loc. 55050.
7. Rubber impression of specimen in fig. 8 (x1).
8. Mould of interior of brachial valve (x1). Hypotype, GSC No. 19035a. Counterpart of specimen in fig. 3.
9. Rubber impression of specimen in fig. 10 (x2).
10. Mould of exterior of pedicle valve (x1.5). Hypotype, GSC No. 19038. Unnamed beds, Back Bay, GSC loc. 55050.
11. Mould of interior of pedicle valve (x2). Hypotype, GSC No. 19039. Unnamed beds, Back Bay, GSC loc. 55050.
12. Mould of interior of brachial valve (x2). Hypotype, GSC No. 19040. Long Reach Formation, GSC loc. 55061.
13. Rubber impression of specimen in fig. 12 (x2).
14. Mould of exterior of pedicle valve (x1.5). Hypotype, GSC No. 19041. Unnamed beds, Back Bay, GSC loc. 55050.
15. Rubber impression of specimen in fig. 14.

Figures 16–21. *Eocoelia* cf. *E. sulcata* (Prouty, 1923) Page 35.
Long Reach Formation, GSC loc. 55061.

16. Rubber impression of specimen in fig. 17 (x2).
17. Mould of exterior of pedicle valve (x2). Hypotype, GSC No. 19042.
18. Rubber impression of specimen in fig. 19 (x2).
19. Mould of interior of brachial valve (x2). Hypotype, GSC No. 19043.
20. Mould of interior of pedicle valve (x3). Hypotype, GSC No. 19044.
21. Rubber impression of specimen in fig. 20 (x3).

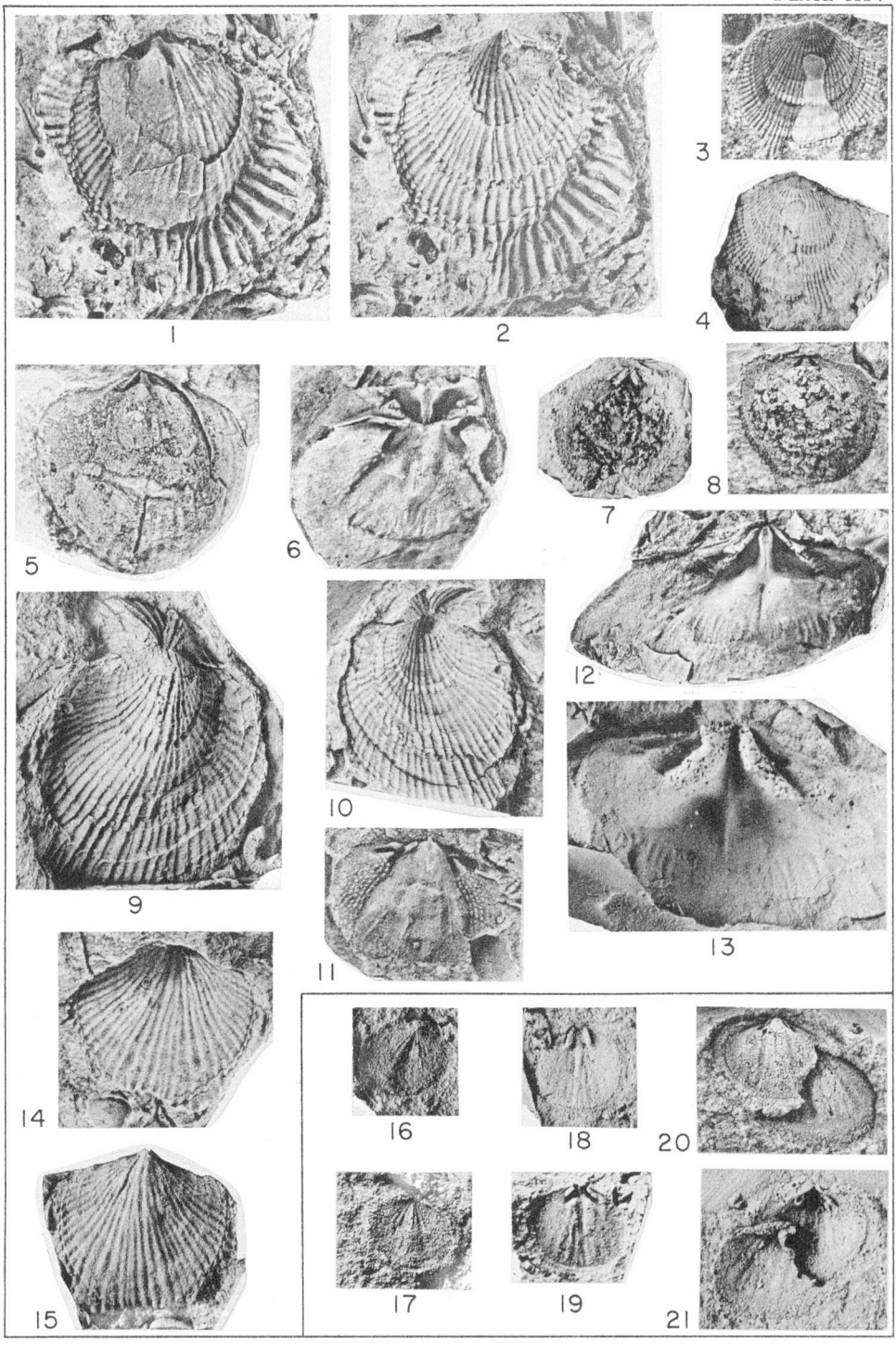
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PLATE XV

Figures 1, 2. *Eocoelia* cf. *E. sulcata* (Prouty, 1923) Page 35.
Long Reach Formation, GSC loc. 55061.

1. Rubber impression of specimen in fig. 2 (x3).

2. Mould of exterior of pedicle valve (x3). Hypotype, GSC No. 19044a. Counterpart of specimen in fig. 20, Pl. XIV.

Figures 3–5. *Meristina* sp. Page 35.
Unnamed beds, Back Bay, GSC loc. 55050.

3. Mould of interior of pedicle valve (x2). Hypotype, GSC No. 19045.

4. Mould of exterior of pedicle valve (x1). Hypotype, GSC No. 19045a. Counterpart of specimen in fig. 3.

5. Rubber impression of specimen in fig. 4 (x1).

Figures 6–13. *Nucleospira* sp. Page 36.
Unnamed beds, Back Bay, GSC loc. 55050.

6. Rubber impression of specimen in fig. 7 (x2).

7. Mould of exterior of pedicle valve (x2). Hypotype A, GSC No. 19046a. Counterpart of specimen in figs. 8-12.

8–12. Posterior, brachial, pedicle, lateral, and anterior views of an internal mould (x2). Hypotype B, GSC No. 19046.

13. Mould of interior of pedicle valve (x2). Hypotype C, GSC No. 19047. Note long myophragm and position of muscle scars.

Figures 14–17. *Eospirifer* sp. Page 37.

14. Mould of interior of pedicle valve (x2). Hypotype A, GSC No. 19048. Unnamed beds, Back Bay, GSC loc. 55050.

15. Mould of interior of pedicle valve (x1.5). Hypotype B, GSC No. 19049. Unnamed beds, Back Bay, GSC loc. 55050.

16. Mould of interior of pedicle valve (x1.5). Hypotype C, GSC No. 19050. Long Reach Formation, GSC loc. 55061.

17. Rubber impression of specimen in fig. 16 (x1.5).

Figures 18, 19. *Cyrtia* sp. Page 38.
Unnamed beds, Back Bay, GSC loc. 55050.

18. Posterior view of internal mould of brachial and pedicle valves (x2). Hypotype A, GSC No. 19054.

19. Posterior view of internal mould of brachial and pedicle valves (x1.5). Hypotype B, GSC No. 19055. Note short, subparallel impressions of crural plates.

Figures 20, 21. *Macropleura* sp. Page 37.
Unnamed beds, Back Bay, GSC loc. 55050.

20. Posterior view of internal mould (x2). Hypotype A, GSC No. 19051.

21. Posterior view of mould of interior of pedicle valve (x2). Hypotype B, GSC No. 19052.

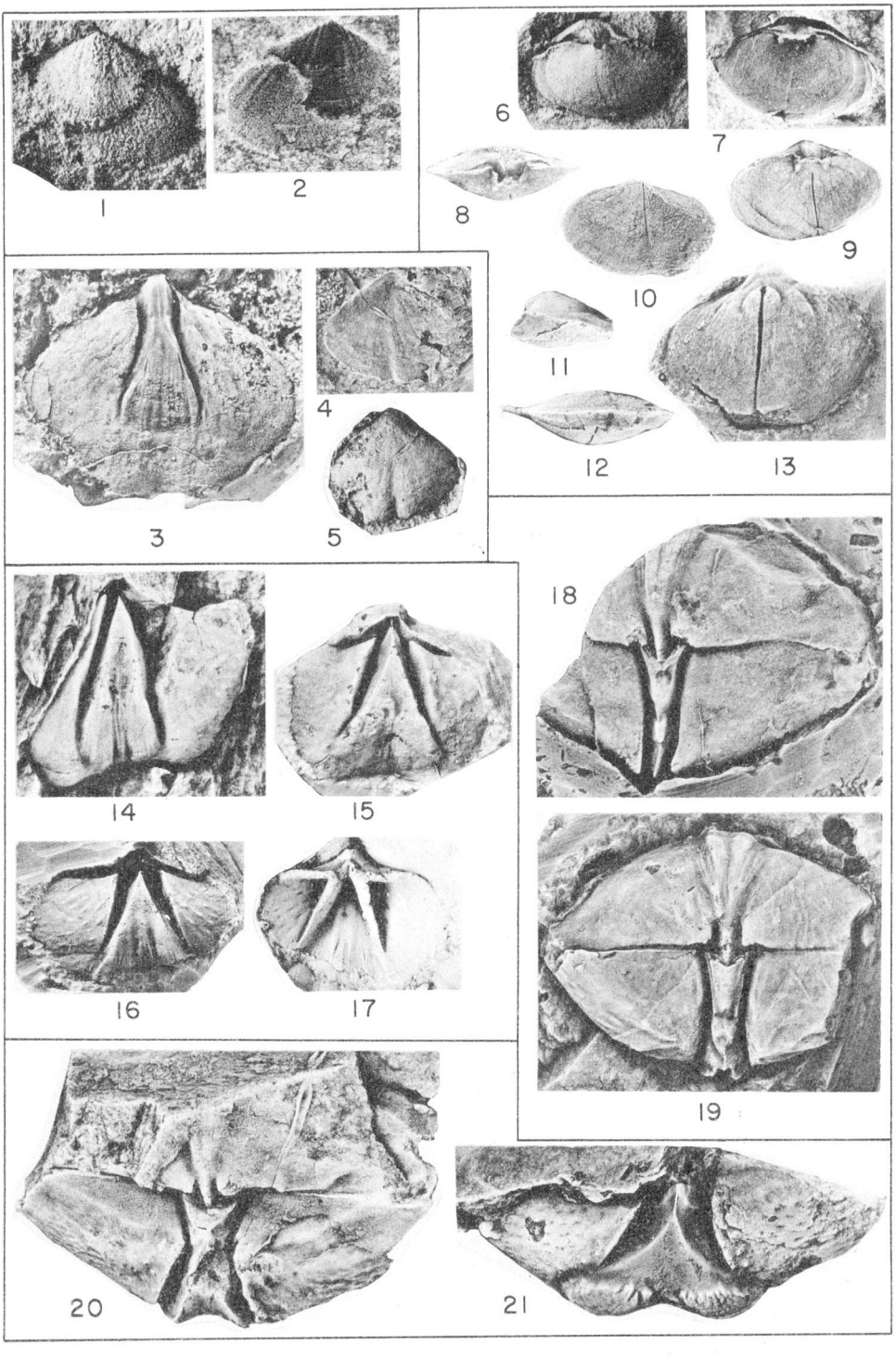
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PLATE XVI

Figures 1, 2. *Marcopleura* sp. Page 37.

Lateral and pedicle views of mould of interior of pedicle valve (x1). Hypotype C, GSC No. 19053. Note lateral plications (fig. 1). Unnamed beds, Back Bay, GSC loc. 55050.

Figures 3–6. *Howellella* sp. 3. Page 39.
Long Reach Formation, GSC loc. 55061.

3. Rubber impression of specimen in fig. 4 (x1.5).
4. Mould of exterior of brachial valve (x1.5). Hypotype, GSC No. 19061a.
5, 6. Brachial and posterior views of an internal mould (x1.5). Hypotype, GSC No. 19061.

Figures 7–10. *Howellella* sp. 2 Page 38.
Long Reach Formation, GSC loc. 55061.

7. Rubber impression of specimen in fig. 9 (x2.5).
8. Rubber impression of specimen in fig. 10 (x2.5).
9. Mould of exterior of pedicle valve (x1.5). Hypotype, GSC No. 19060.
10. Mould of interior of pedicle valve (x1.5). Hypotype, GSC No. 19060a. Counterpart of specimen in fig. 9.

Figures 11–14. *Howellella* sp. 1 Page 38.

11. Mould of interior of pedicle valve (x2). Hypotype A, GSC No. 19056. Jones Creek Formation, GSC loc. 55056.
12. Mould of interior of brachial valve (x2). Hypotype B, GSC No. 19057. Unnamed beds, Back Bay, GSC loc. 55050.
13. Mould of interior of brachial valve (x3). Hypotype C, GSC No. 19058. Jones Creek Formation, GSC loc. 55056.
14. Mould of interior of pedicle valve (x2). Hypotype D, GSC No. 19059. Unnamed beds, Back Bay, GSC loc. 55050.

Figures 15–23. *Oriostoma* cf. *O. globosum* (Schlotheim, 1820) Page 40.
Unnamed beds, Back Bay, GSC loc. 55050.

15. Rubber impression of specimen in fig. 16 (x2).
16. Mould of base of last whorl and operculum (x2). Hypotype, GSC No. 19062.
17. Mould of inner side of operculum (x1.5). Hypotype, GSC No. 19063.
18. Rubber impression of specimen in fig. 17 (x1.5).
19. Rubber impression of specimen in fig. 20 (x1.5).
20. Mould of outer side of operculum (x1.5). Hypotype, GSC No. 19063a. Counterpart of specimen in fig. 17.
21. Mould of exterior (x1.5). Hypotype, GSC No. 19064.
22, 23. Two views of rubber impression of specimen in fig. 21 (x1.5).

Figure 24. indet. gastropod sp. Page 41.

Rubber impression of exterior (x3). Hypotype A, GSC No. 19067. Unnamed beds, Back Bay, GSC loc. 55050.

Figure 25. *Pseudoscalites* cf. *P. lindstroemi* n. gen. and n. sp. Page 41.

Rubber impression of specimen in fig. 1, Pl. XVII (x1). Unnamed beds, Back Bay, GSC loc. 55050.

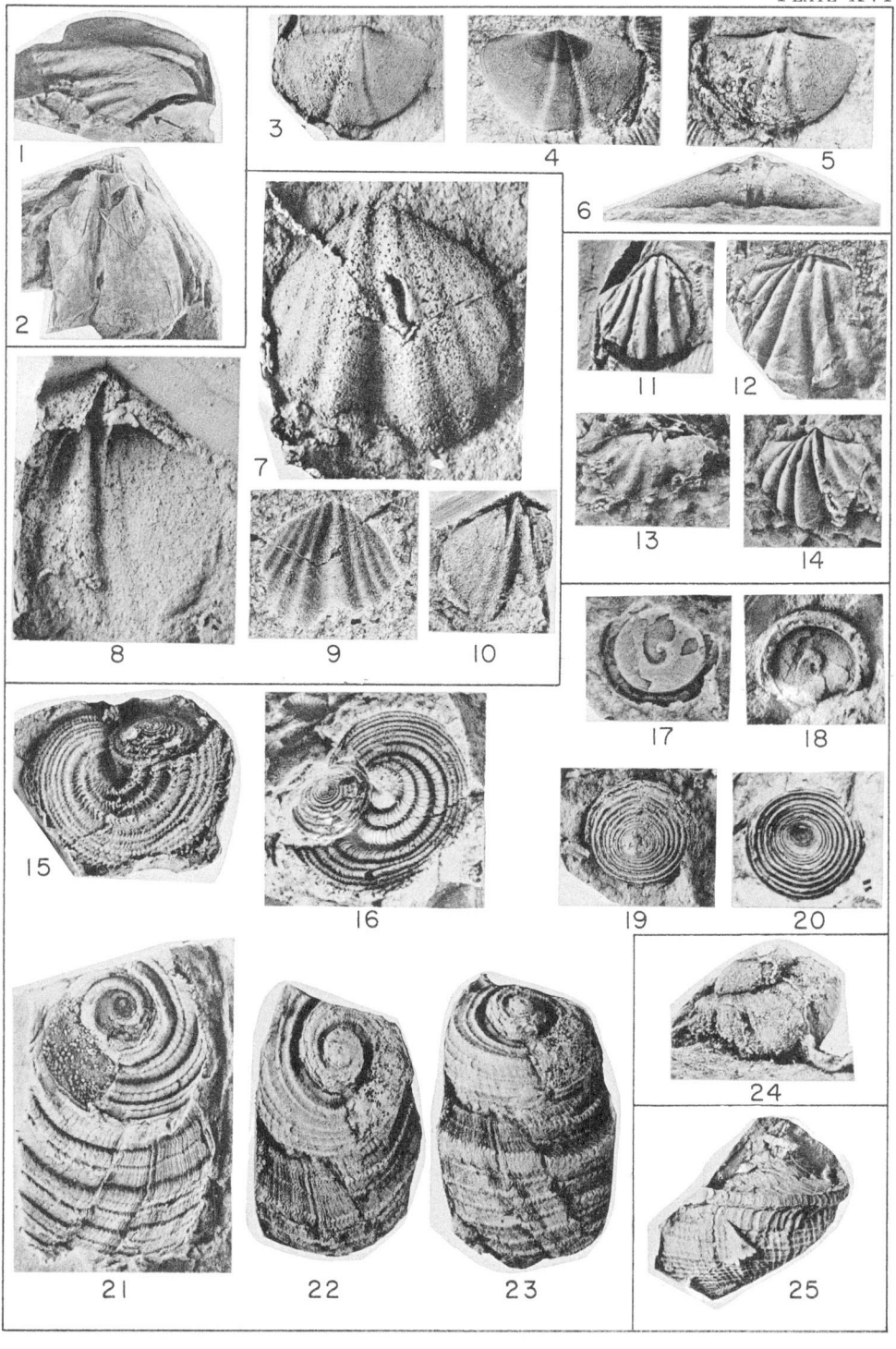
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PLATE XVII

Figure 1. *Pseudoscalites* cf. *P. lindstroemi* n. gen. and n. sp. Page 41.

Mould of exterior (x2). Hypotype A, GSC No. 19066. Unnamed beds, Back Bay, GSC loc. 55050.

Figures 2, 3. *Euomphalopeterus* sp. Page 40.

2. Rubber impression of specimen in fig. 3 (x1.5).

3. Mould of umbilicus (x1.5). Hypotype A, GSC No. 19065. Unnamed beds, Back Bay, GSC loc. 55050.

Figures 4–11. *Rhynobolus* sp. B Page 9.

4. Mould of exterior of brachial valve (x1.5). Hypotype, GSC No. 19068.

5. Rubber impression of specimen in fig. 4 (x1.5).

6. Mould of interior of pedicle valve (x1.5). Hypotype, GSC No. 19069.

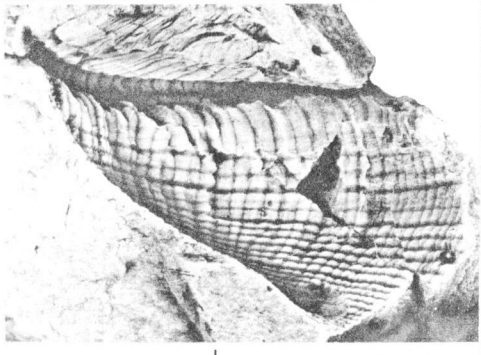
7. Rubber impression of specimen in fig. 6 (x1.5).

8. Mould of exterior of brachial valve (x1.5). Hypotype, GSC No. 19071.

9. Rubber impression of specimen in fig. 8 (x1.5).

10. Rubber impression of specimen in fig. 11 (x1.5).

11. Mould of interior of pedicle valve (x1.5). Hypotype, GSC No. 19072.



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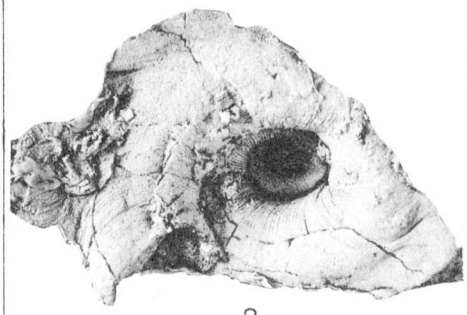

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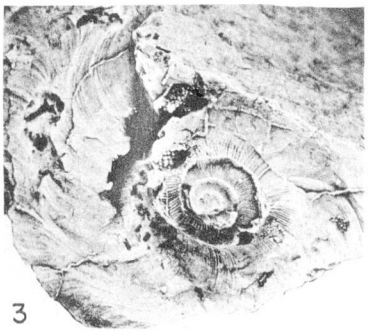

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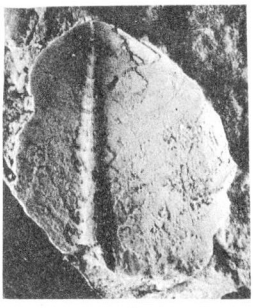

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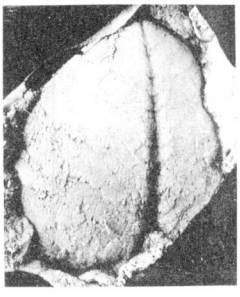

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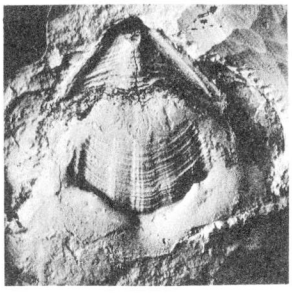

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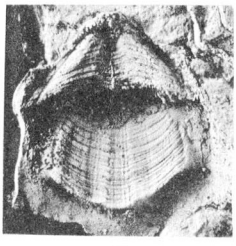

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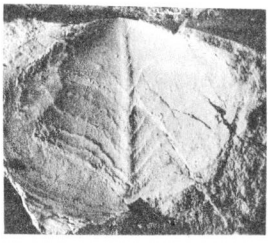

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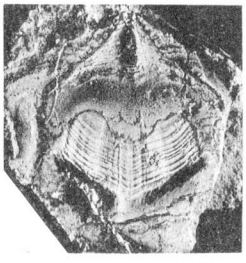

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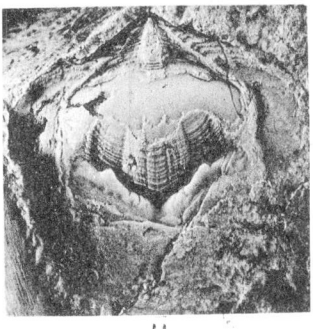

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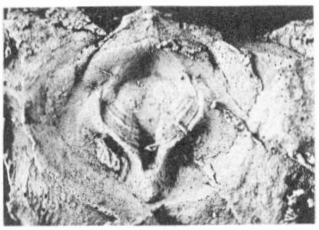
PLATE XVIII

Figures 1–9. *Rhynobolus* sp. B Page 9.

1. Rubber impression of specimen in fig. 2 (x1.5).
2. Mould of interior of brachial valve (x1.5). Hypotype, GSC No. 19071a. Counterpart of specimen in fig. 8 of Pl. XVII.
3. Rubber impression of specimen in fig. 4 (x1.5).
4. Mould of interior of brachial valve (x1.5). Hypotype, GSC No. 19070.
5. Mould of interior of brachial valve (x1.5). Hypotype, GSC No. 19073.
6. Rubber impression of specimen in fig. 5 (x1.5).
7. Rubber impression of specimen in fig. 8 (x1.5).
8. Mould of interior of pedicle valve (x1.5). Hypotype, GSC No. 19074.
9. Rubber replica of exterior of brachial valve (x1.5). Impression of GSC No. 19075a.



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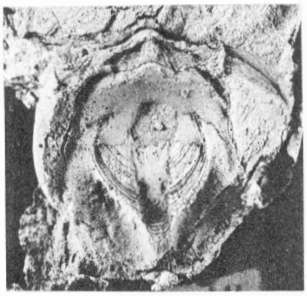

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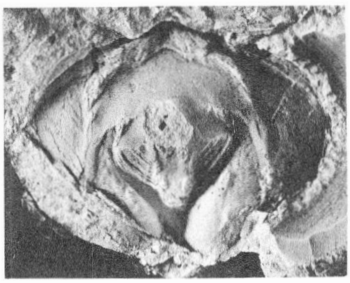

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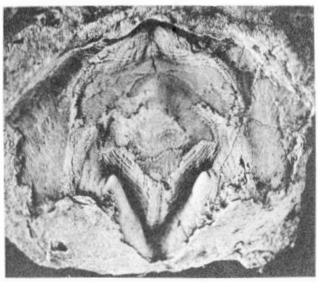

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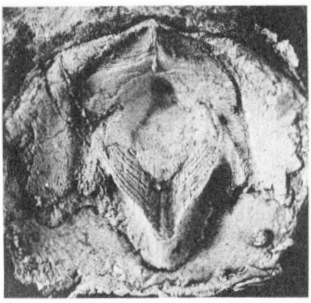

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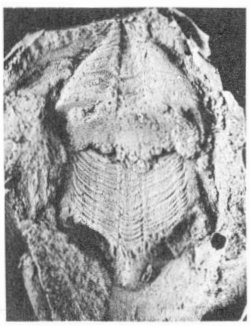

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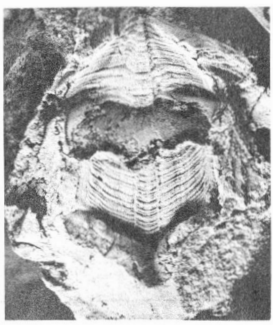

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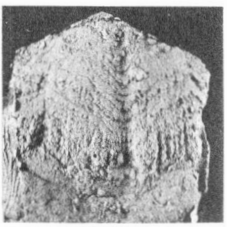

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