AN ABSTRACT OF THE THESIS OF

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Title: LOWER DEVONIAN (LOCHKOVIAN) BRACHIOPODS, PALEOECOLOGY, AND BIOSTRATIGRAPHY OF THE CANADIAN ARCTIC ISLANDS

Abstract approved: Redacted for Privacy

J. G. Johnson

Collections from measured sections of Early Devonian, Lochkovian, age rocks from the Canadian Arctic Archipelago were examined with emphasis on the paleontology and paleoecology of the contained brachiopod faunas. The brachiopods offer a reliable basis for correlation of Lochkovian age strata in the Arctic but supplementary data from conodonts, fishes, graptolites, and trilobites are invaluable.

The Lochkovian age Arctic brachiopods are both numerous and diverse and possess a marked Old World provincial aspect. Correlative faunas are found in the Yukon Territory, Nevada, Bohemia, Podolia, and the Urals.

On Baillie Hamilton Island, Lochkovian age strata exhibit a series of successive communities produced by an overall upward shallowing trend which is a direct result of active tectonism of the

Boothia Uplift. The Communities from deepest to shallowest, in ascending order are: Graptolite Community, Notoparmella-Arctispira Community, Iridistrophia-Mesodouvillina-Schizophoria Community, Gypidula-Atrypa-Schizophoria Community, Coral Community, and Ostracode Community. Sections from Prince of Wales Island also show shallowing trends, but there, sections are of lesser stratigraphic thickness and community succession is not as well developed or evident as in the rocks on Baillie Hamilton Island.

The Boothia Uplift was the dominant factor in controlling type and amount of sediment deposited during Lochkovian times in adjacent regions of the Arctic Islands. Carbonate rocks of that age are unusually thick because of Boothia-derived clastic influx. The uplift destroyed the lagoonal, semi-restricted environment occupied by the Silurian Atrypella Community (Read Bay Formation) and initiated new environments conducive for the radically different Lochkovian age communities. Lochkovian age carbonate rocks exhibit a wide range of lithologies ranging from lime mudstones to grainstones to dolomites. The environments of deposition range from deep subtidal to intertidal-supratidal.

New brachiopod taxa include: Isorthis bistria n. sp., Protocortezorthis quadriforma n. sp., Protocortezorthis carinatus n. sp., Dalejina devonensis n. sp., Schizophoria fossula fossula n. sp., n. subsp., Schizophoria fossula transversiforma n. sp.,

n. subsp., Schizophoria protonevadaensis n. sp., Gypidula pelagica pyraforma n. subsp., Gypidula dyerensis n. sp., Leptaena nassichuki n. sp., Iridistrophia johnsoni n. sp., Iridistrophia thorsteinssoni n. sp., Barbaestrophia bieleri n. sp., Mesodouvillina musculusvarius n. sp., Mesodouvillina tuberosa n. sp., Mesododouvillina equicosta n. sp., Asymmetrochonetes spinalonga n. gen., n. sp., Machaeraria obesa n. sp., Ancillotoechia gutta rotunda n. subsp., Ancillotoechia magnaplica n. sp., Ancillotoechia plicaminor n. sp., "Tadschikia" crassiforma crassiforma n. sp., n. subsp., "Tadschikia" crassiforma producta n. sp., n. subsp., Linguopugnoides uyenoi n. sp., Notoparmella costalata n. sp., Arctispira canadensis n. gen., n. sp., Coelospira exilicosta exilicosta n. sp., n. subsp., Coelospira exilicosta orbita n. sp., n. subsp., Cyrtina maclennani n. sp., Acanthospirifer macdonaldi n. sp., Acanthospirifer norfordi n. sp.

Lower Devonian (Lochkovian) Brachiopods, Paleoecology, and Biostratigraphy of the Canadian Arctic Islands

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Roy Edward Smith

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FRONTISPIECE

Summertime, Western Prince of Wales Island

R. Thorsteinsson, "Pope" of the Arctic

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LOWER DEVONIAN (LOCHKOVIAN) BRACHIOPODS, PALEOECOLOGY, AND BIOSTRATIGRAPHY OF THE CANADIAN ARCTIC ISLANDS

INTRODUCTION

Previous Work

Among the earliest works on the geology of the Canadian Arctic Islands is that of Belcher (1855). Salter (1852) reported on fossil faunas collected during British expeditions to the Arctic regions. Several of the expeditions were undertaken in search of the missing Sir John Franklin and his crew. The reports, charts, and fossil collections made during these voyages were in part an incentive for later journeys conducted primarily in search of a Northwest Passage to the Orient.

Holtedahl (1917) reported on fossil faunas from Devon Island collected by Per Scheii during a voyage made in 1903-04.

During the summer months of 1955, scientists of the Geological Survey of Canada, Operation Franklin, investigated large tracts of the Arctic Archipelago. This reconnaissance work focused primarily on the preparation of preliminary maps and describing to some extent the regional stratigraphy and structure of the area.

In the summer of 1970, Geological Survey of Canada Operation Peel Sound under the leadership of Dr. R.L. Christie studied the structure, stratigraphy, and faunas of the rocks found on Prince of Wales Island.

During the summers of 1971-72, Geological Survey of Canada Operation Grinnell under the leadership of Dr. J. Wm. Kerr examined the very complicated structure and stratigraphy of Grinnell Peninsula, Devon Island.

Dr. R. Thorsteinsson, Geological Survey of Canada, has spent 25 years studying the rocks of the Arctic Archipelago and their contained faunas (Thorsteinsson, 1958, 1970, 1974).

A recent, important contribution to the structure and stratigraphy of Bathurst Island is that of Kerr (1974).

As geologic studies in the Arctic Islands are only now at the point where reconnaissance operations are giving way to more detailed studies, the faunas contained in the rocks have not, for the most part, been well documented.

Several papers worthy of note dealing with selected faunas are those of Boucot *et al.* (1960), Ormiston (1967), Lenz (1973), and Johnson (1975a, b).

The papers dealing with brachiopod faunas have been, for the most part, from selected, short, stratigraphic intervals.

Location and Accessibility

The fossils and rock samples for the study were collected from

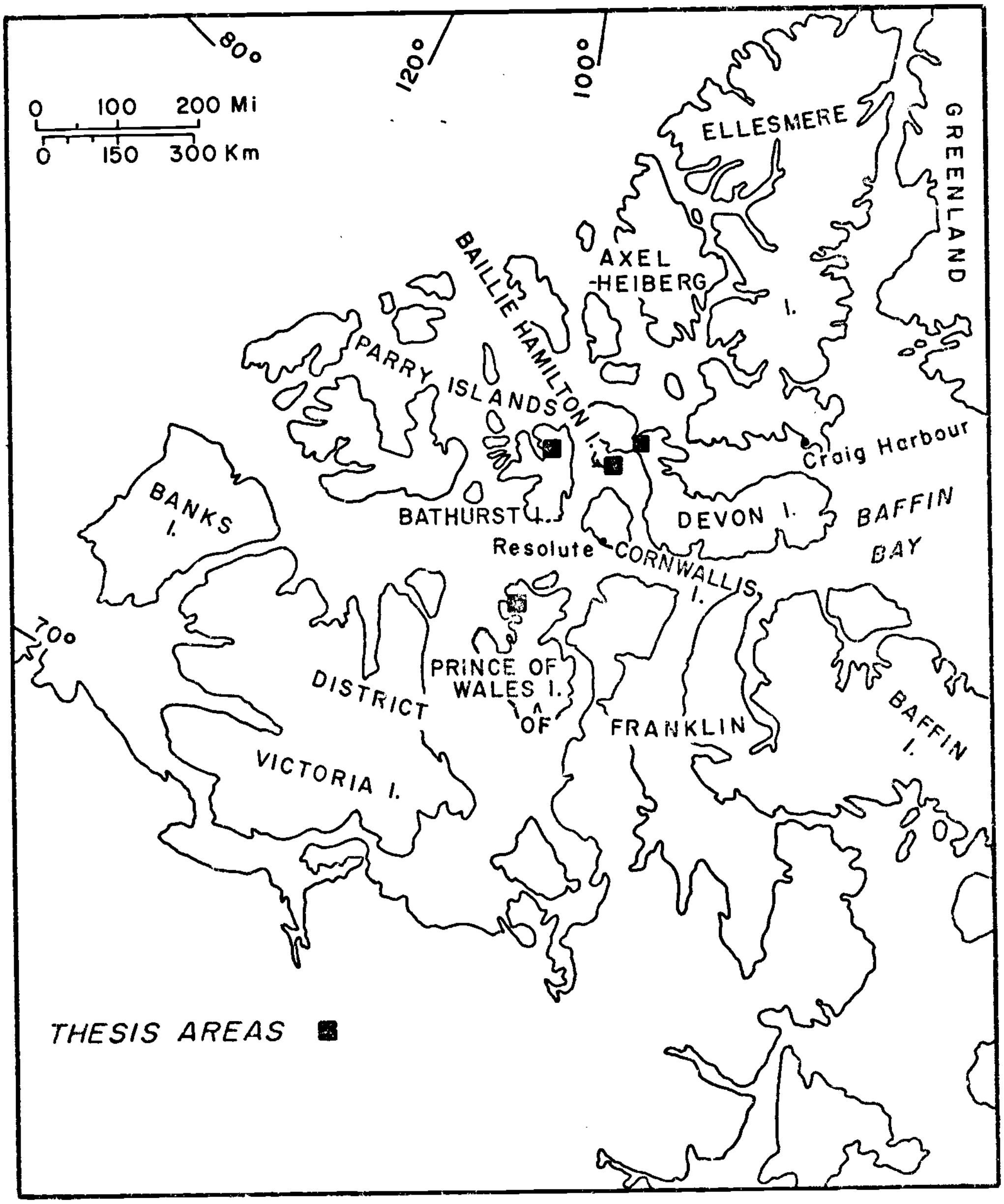
Prince of Wales, Bathurst, Baillie Hamilton, Cornwallis, and Devon Islands, District of Franklin, N.W.T., Canada (Figs. 1, 2, 3, 4).

The Arctic Islands have a rather severe and unpredictable climate which allows for a short field season in the summer months. Field work generally cannot commence until mid or late June, and is usually terminated in mid August, due to snow and fog. The winter darkness from November until March, coupled with the cold, makes surface work impractical.

The thesis area is accessible only by ship and aircraft. The main year round weather station is located at Resolute on southern Cornwallis Island. Chartered airlines fly there two to three times per week in the summer months from either Calgary or Montreal. From Resolute, travel is limited to fixed wing aircraft such as Beavers, Super Cubs, Otters, Twin Otters, and helicopters, as the thesis area contains no man-made runways.

Purpose and Methods of Investigation

The primary purpose of the thesis was to collect from measured sections (Figs. 2, 3, 4) large paleontologic and lithologic samples which would further our knowledge of the brachiopod faunas and of the geology of the area. Dunham's (1962) limestone classification was used in the field for measuring the 13 sections discussed in this paper.


80°
120°
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0 100 200 Mi
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ELLESMERE
GREENLAND
AXEL HEIBERG
I.
BAILLIE HAMILTON I.
PARRY ISLANDS
Craig Harbour
BANKS I.
BATHURST I.
DEVON I.
BAFFIN BAY
Resolute
CORNWALLIS I.
70°
PRINCE OF WALES I.
DISTRICT OF FRANKLIN
BAFFIN I.
VICTORIA I.
THESIS AREAS

FIG. I

Fig. 2. Map of part of western Prince of Wales Island illustrating section localities. Line of section is indicated by .

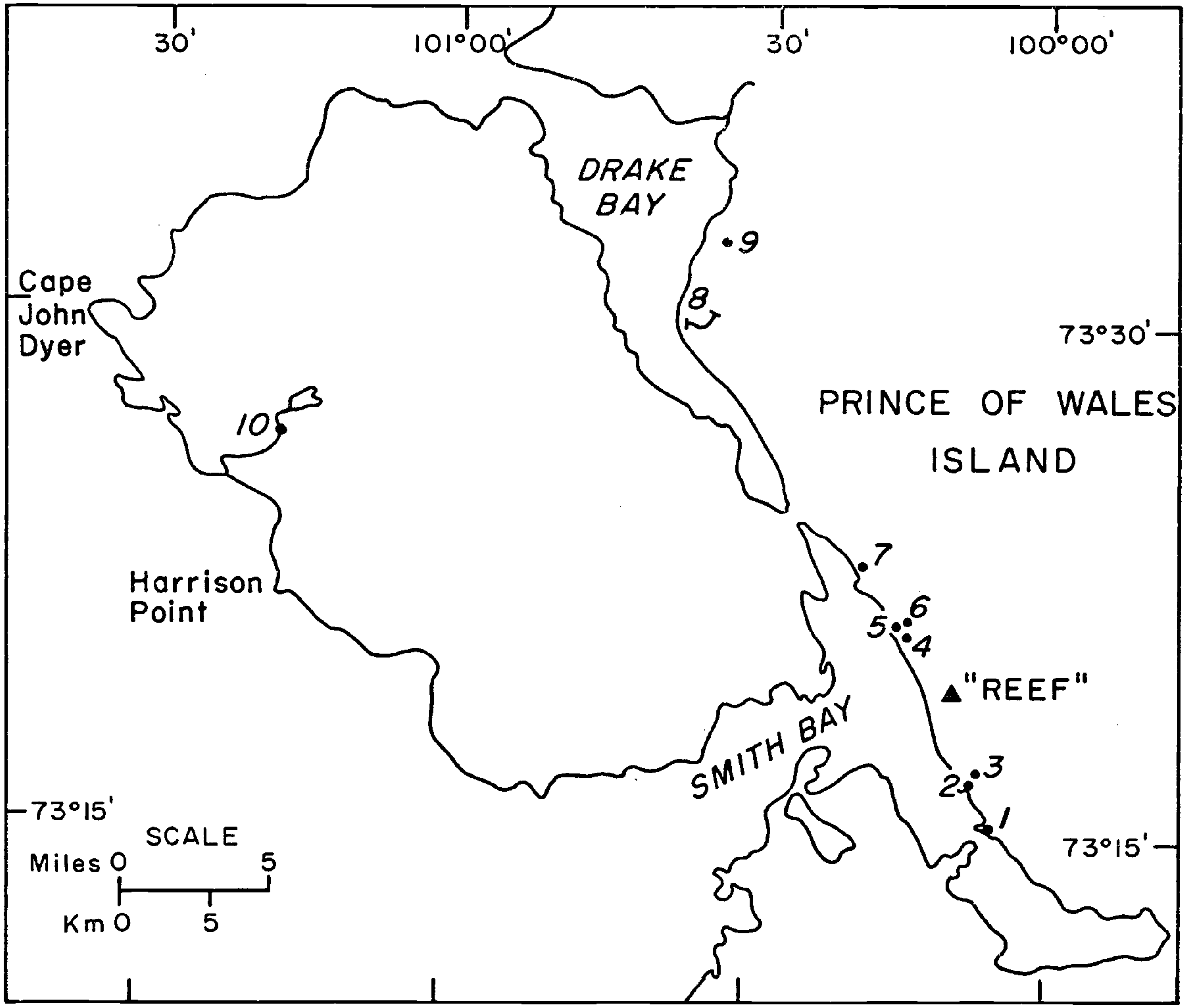

30'
101°00'
30'
100°00'
DRAKE
BAY
9
8
Cape
John
Dyer
73°30'
PRINCE OF WALES
ISLAND
10
7
Harrison
Point
6
5
4
"REEF"
SMITH BAY
3
2
1
73°15'
SCALE
Miles 0
5
Km 0
5
73°15'

FIG. 2

Fig. 3. Map of Baillie Hamilton Island illustrating section localities. Line of section is indicated by .

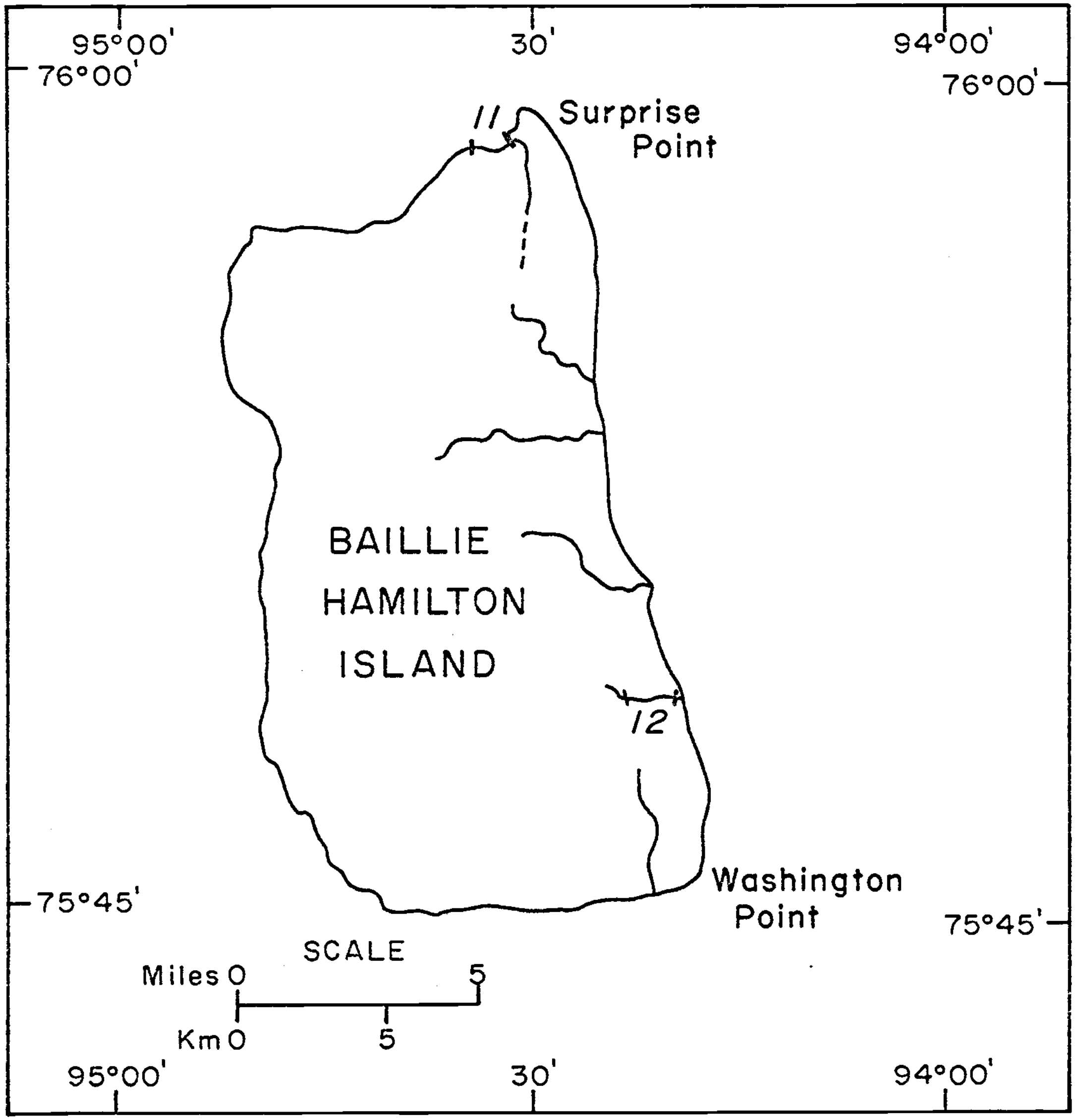

95°00'
30'
94°00'
76°00'
76°00'
11
Surprise
Point
BAILLIE
HAMILTON
ISLAND
12
Washington
Point
75°45'
75°45'
SCALE
Miles 0
5
Km 0
5
95°00'
30'
94°00'

FIG. 3

∞

Fig. 4. Map of part of Bathurst Island illustrating section locality. Line of section is indicated by .

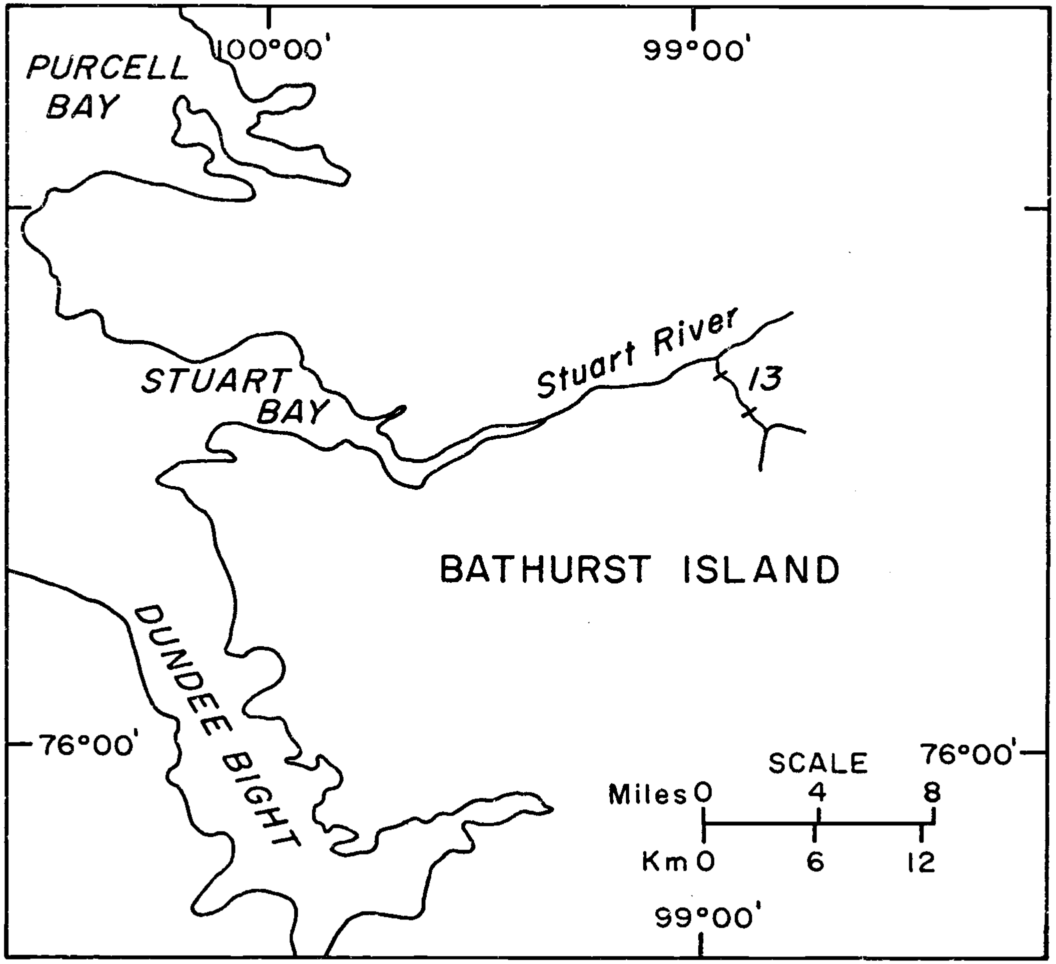

PURCELL BAY
100°00'
99°00'
STUART BAY
Stuart River
13
BATHURST ISLAND
DUNDEE BIGHT
76°00'
SCALE
Miles 0 4 8
Km 0 6 12
76°00'
99°00'

FIG. 4

The writer's prime concern was to study the paleontology and community relationships of the brachiopod faunas found in rocks of Lochkovian age, in order to utilize them for correlation purposes in the Arctic Islands and in other regions.

Bulk samples were collected in order to extract the maximum amount of paleontologic and lithologic information possible. This was done in order that other specialists could study other contained faunas such as trilobites, conodonts, fishes, graptolites, and corals found in each collection. This proves invaluable in determining zones of the various faunal groups and the relationships to each other. Too often a section is measured and samples collected with only one fossil group in mind. Therefore, the section generally has to be remeasured and more samples have to be collected if study of another fossil group is to be undertaken. Although personally biased to those exquisite creatures, brachiopods, the writer has made a sincere attempt to collect as many other fossil groups as possible.

A secondary purpose of the study was to examine in some detail the stratigraphy and petrologic aspects of the rocks.

In the laboratory, oriented blocks were slabbed to provide material for fabric and thin section analysis. The remainder of the rock was then immersed in concentrated HCl to free silicified fossils. Calcareous fossils were removed from the matrix with the aid of a hydraulic rock splitter. The calcareous fossils were prepared utilizing standard paleontologic techniques such as calcining with the aid of a Bunsen burner, followed by preparation of artificial internal molds with the aid of a bevel-edged needle, and by preparing acetate peels of serial sections.

Geologic Setting

The thesis area covers the southern area of the eastern Arctic Archipelago and exhibits facies varying from those of the shallow water stable carbonate platform to those of the deep water basins (Fig. 5). The rocks dealt with in this paper can be broadly characterized by two facies which trend in a NE-SW direction. Across depositional strike, in a SE-NW direction, they are the Arctic Platform shelf facies and the basinal facies. The Arctic Platform consists of flat lying or gently dipping shallow water carbonates and clastics. The basinal rocks to the northwest represent deeper water carbonate environments as well as basinal graptolitic mudstones, shales, and sandstones. The rocks here have undergone some tectonism as they have been folded and faulted during the Ellesmerian Orogeny (Thorsteinsson, 1970).

The Franklinian Geosyncline consists of approximately 40,000 feet of rocks and existed from late Precambrian to Late Devonian time. Its destruction was brought about by the Devonian Ellesmerian Orogeny. This orogeny was only a part of the active tectonism that

Fig. 5. Geological provinces of the Arctic Archipelago (after Thorsteinsson, 1970).

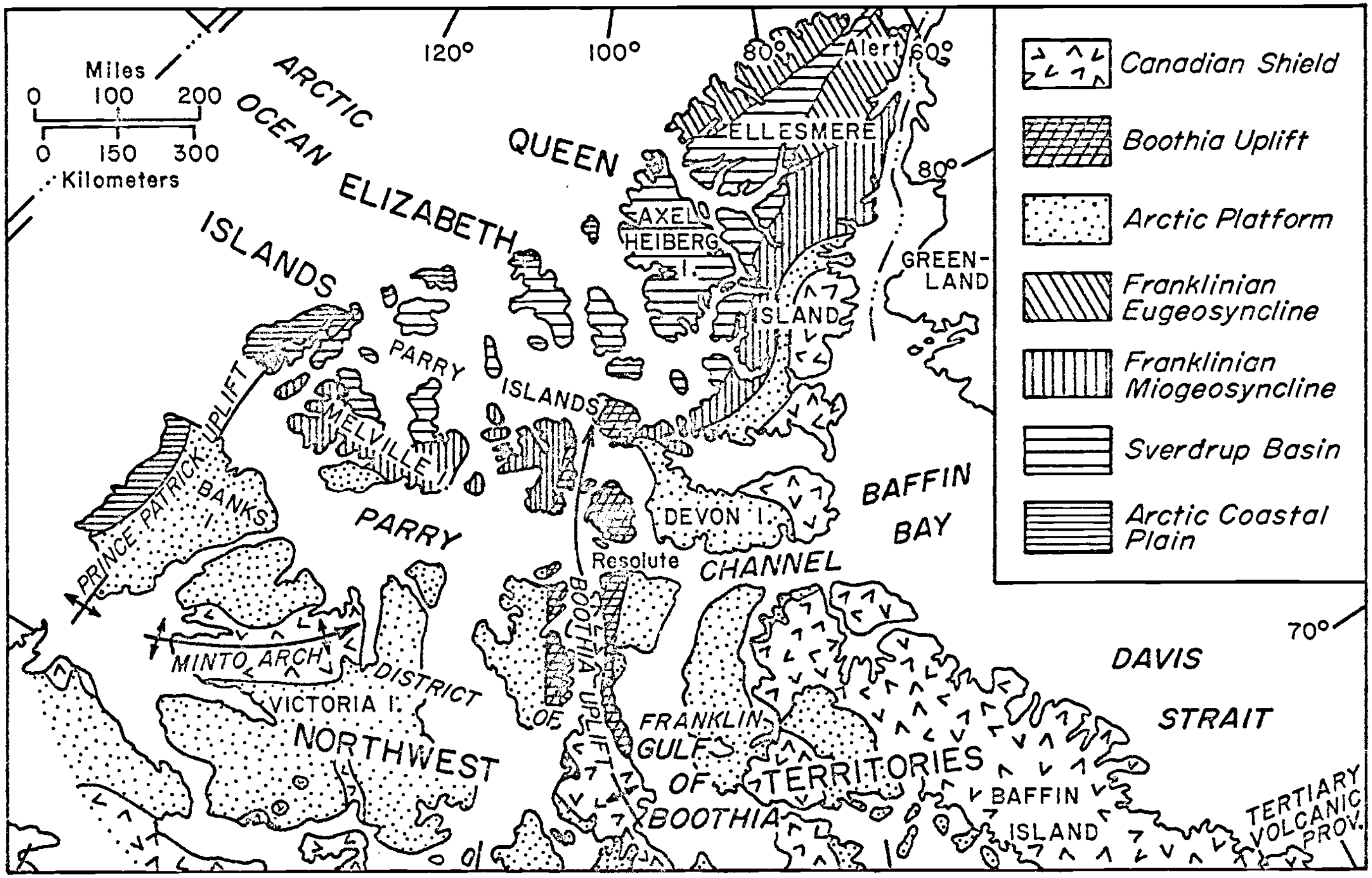

Miles
0 100 200
0 150 300
Kilometers
120°
100°
80°
Alert
60°
80°
70°
ARCTIC OCEAN
QUEEN ELIZABETH ISLANDS
ELLESMERE
AXEL HEIBERG I.
ISLAND
GREEN-LAND
PARRY ISLANDS
MELVILLE I.
PRINCE PATRICK UPLIFT
BANKS I.
PARRY CHANNEL
Resolute
DEVON I.
BAFFIN BAY
BOOTHIA UPLIFT
MINTO ARCH
VICTORIA I.
DISTRICT OF FRANKLIN
NORTHWEST TERRITORIES
GULF OF BOOTHIA
BAFFIN ISLAND
DAVIS STRAIT
TERTIARY VOLCANIC PROV.
Canadian Shield
Boothia Uplift
Arctic Platform
Franklinian Eugeosyncline
Franklinian Miogeosyncline
Sverdrup Basin
Arctic Coastal Plain

FIG. 5

affected the western edges of North America as well as the Arctic Islands at this time. It is thought to have occurred, in part, at about the same time as the Antler Orogeny of Nevada (Johnson, 1971).

BIOSTRATIGRAPHY

The formations dealt with in this paper range in age from Late Silurian to late Early Devonian. For reasons of clarity, the geologic setting of each formation will be discussed one island at a time. No new formational nomenclature has been invoked because the nomenclature will appear in subsequent manuscripts by R. Thorsteinsson and H.P. Trettin of the Geological Survey of Canada.

Prince of Wales Island

The Read Bay Formation (Thorsteinsson, 1958) is well exposed on the eastern margins of Prince of Wales Island in a belt subparallel to the Boothia Uplift. It consists mainly of thin bedded, lumpy, argillaceous limestone with uncommon thicker bedded units. This formation is approximately 500 meters thick in a section measured in a large creek north of Kennedy Bay. The formation ranges in age from probable mid Silurian to Late Silurian (Pridolian). The most notable of the brachiopods present are *Atrypella scheii* and *Atrypella phoca* (Smith, 1976; Smith and Johnson, manuscript). *Atrypella phoca*, the stratigraphically higher species, is separated from *Atrypella scheii* by 250 meters of strata. Clearly, these species are of differing ages, but precise ages at the moment are not known. It is thought that *Atrypella scheii* is late Ludlovian in age and *A. phoca* late Ludlovian to Pridolian.

The Read Bay Formation is overlain by the Peel Sound Formation (Thorsteinsson and Tozer, 1963). At the section near Kennedy Bay, the contact with underlying Read Bay Formation, taken at the first conglomerate bed, is conformable and gradational. Here the basal member of the Peel Sound Formation consists of interbedded siltstone, sandstone, limestone, and conglomerate. The upper member consists of conglomerates, the lower beds of which exhibit carbonate clasts; the upper beds exhibit a mixture of sedimentary and igneous (crystalline) clasts. The base of the formation is probably Late Silurian in age. In another section of the Peel Sound Formation, A. phoca occurs in the basal limestone beds. However, the Pridolian age indicated is tentative and needs to be confirmed by additional lines of evidence, perhaps by conodonts. The age of the top of the formation is not now known as diagnostic faunas have yet to be collected. The top of the formation has been eroded, but near Kennedy Bay the formation is at least 480 meters thick.

Miall (1970) has mapped the Peel Sound Formation and has shown that it consists of a series of roughly parallel north-south bands. The bands are composed of conglomerate in the east, grading westwards to a silty carbonate unit.

On western Prince of Wales Island strata equivalent to the Read Bay and Peel Sound Formations are present. A single collection of brachiopods from the southwestern part of the Island

(GSC loc. C-8245) contains Atrypella foxi Jones, Gypidula sp., and Stegerhynchus cf. angaciensis Chernyshev. Conodonts include Ozarkodina n. sp. A (Klapper and Murphy, 1975) and Icriodus n. sp. which may be the forerunner of Icriodus woschmidti Ziegler (T. T. Uyeno, written communication, 1975). The lithology at this locality is very similar to that of the Read Bay Formation on eastern Prince of Wales Island. The collection is of Late Silurian age, probably Pridolian.

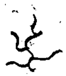
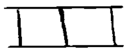
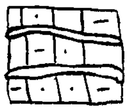
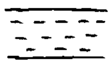
Farther to the north, sections measured by the writer (Fig. 2) are equivalent, in part, to the Peel Sound Formation. The strata on western Prince of Wales Island have a regional, variable, northerly dip of only a few degrees. The only exposures present (commonly 100%) are in the creek valleys as most of the area is very flat and covered by rubble or grass. Commonly the creeks are separated by a few miles and with a fluctuating dip (a few degrees), it is difficult to ascertain the exact covered thicknesses between sections and the possible existence of overlapping of some sections. Section 1 is believed to be the oldest and section 9 the youngest. There is some stratigraphic overlap between some of the sections which will be discussed later. An attempt has been made to assemble all available paleontologic information in order to establish the ages of the sections with reference to sections from other parts of the world as well as with reference to each other.

Section 1 (Fig. 6) is composed of thin- to medium-bedded, very porous, vuggy, dolomite containing abundant algal stromatolites and large, poorly preserved gastropods (Plate 37, Fig. 5). This section yielded no diagnostic faunas and consequently it is thought to be Late Silurian to Early Devonian in age based on stratigraphic position. Farther upsection from section 1, an isolated collection (GSC loc. C-26806) contains a fauna that is early Lochkovian in age. The diagnostic fossils are Cyrtina sp., Icriodus woschmidti hesperius, and Ozarkodina remscheidensis remscheidensis (see Appendices for additional fauna). Fig. 29 shows the conodont faunas and their localities.

Section 2 (Fig. 7) is composed of thin-bedded argillaceous lime mudstone containing rare angular quartz silt. This section is also early Lochkovian in age as defined by its diagnostic brachiopod fauna (Appendix 1) as well as the presence of Warburgella rugulosa canadensis Ormiston.

Section 3 (Fig. 8) consists of thin- to medium-bedded lime mudstone with common brachiopods, colonial corals (Plate 38, Fig. 6), and common to abundant angular quartz silt. It is also early Lochkovian in age, based on the presence of Iridistrophia johnsoni and on stratigraphic position as it is very close to section 2, with perhaps 5 meters of strata missing. The brachiopod fauna in this section (Fig. 38) is very similar to that found in the lower part of the

Table 1. Explanation of symbols on stratigraphic sections.

Stromatolites	
Gastropods	
Solitary corals	
Colonial corals	
Brachiopods	
Inarticulate brachiopods	
Trilobites	
Ostracodes	
Orthocone cephalopods	
Fish	
Pelecypods	
Graptolites	
Bryozoans	
Ceratiocerids	
Crinoids	
Dolomite	
Limestone	
Lumpy bedded argillaceous limestone	
Sandstone-siltstone	
Shale	

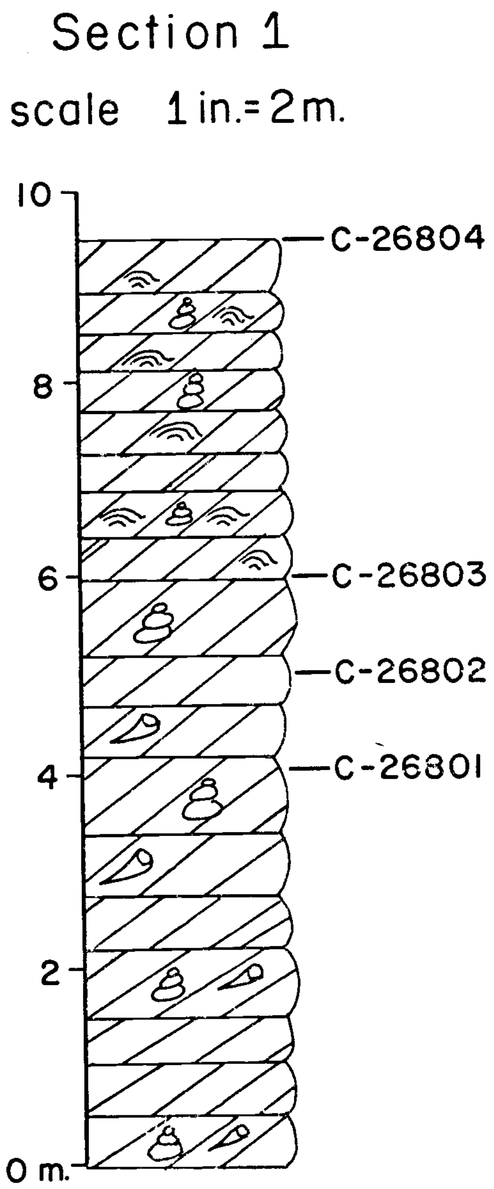

Section 1
scale 1 in.=2m.
10
8
6
4
2
0 m.
C-26804
C-26803
C-26802
C-26801

FIG. 6

Section 2

scale 1 in.= 2 m.

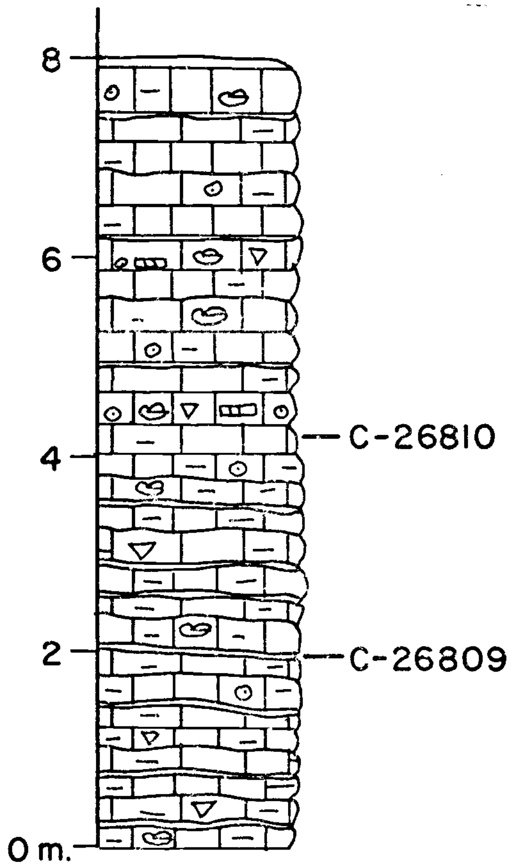


FIG. 7

unnamed carbonate unit on Baillie Hamilton Island. The strata from sections 2 and 3 exhibit an upward-shallowing trend because the surrounding hills of stratigraphically higher rocks are capped by vuggy dolomite containing colonial and solitary corals, as well as bryozoans, which is thought to represent a shallower, rougher water environment.

"Reef"

The "reef" herein described is a small scale carbonate buildup or bioherm. It would probably fall within the category of a framework reef of Heckel (1974). It is approximately 10-15 meters high and 5 meters wide (Fig. 9). The bioherm is composed of lime boundstone, containing common to abundant stromatoporoids, favositid corals, common crinoidal debris, and rare brachiopods (Plate 38, Fig. 2). The stromatoporoids seem to be an encrusting form that appear to bind together other fossils to make a possible wave resistant structure. Carbonate mud may later have filtered into protected, sheltered areas of porous reef core. Some of the immediate flanks of the reef are partially dolomitized and consist of unfossiliferous lime mudstone with abundant angular quartz silt. Some of these flank beds dip away from the core at an angle of 10 to 20 degrees, others less. Across the creek from where the reef is exposed (approximately 5 meters) is a series of beds that are a

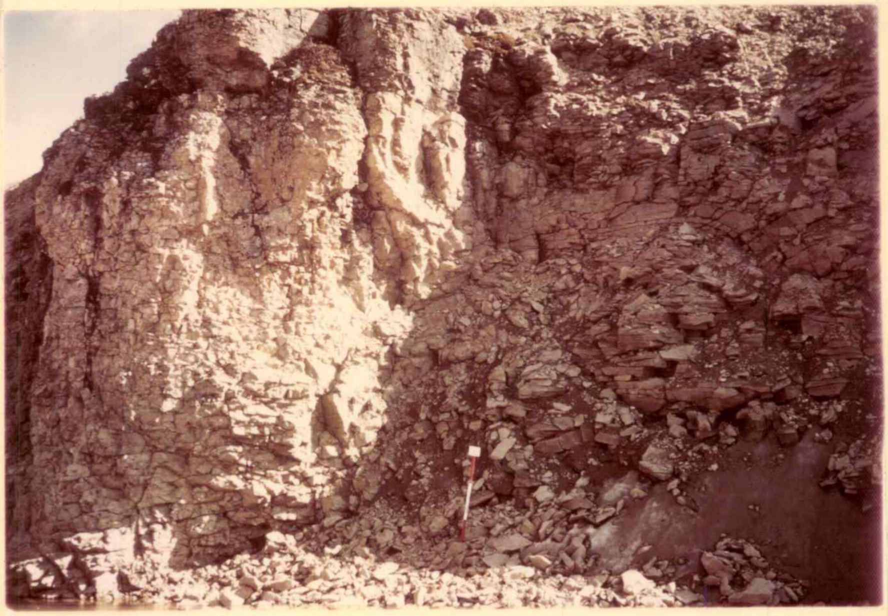


Fig. 9. View of reef core (in sunlight) and flanking beds, western Prince of Wales Island. Pogo stick is 1.5 meters in length.

wackestone-packstone of crinoidal debris and disarticulated brachiopod valves as well as fragments of colonial (favositid) corals and stromatoporoids. This may represent talus at the bioherm base. In a shoreward position from the reef (to the east, approximately 100 meters), are beds with common to abundant angular quartz silt, crinoidal debris, brachiopods and, in some places, abundant fish. The environments at and adjacent to the bioherm are interpreted as relatively high energy ones due to the disarticulated and broken brachiopod shells, crinoidal debris, and rare limestone intraclasts as well as colonial corals and stromatoporoids.

The brachiopod, trilobite, and conodont faunas present near the reef (Appendix 1) are early Lochkovian in age and thought to be the same age as the Gypidula-Atrypa-Schizophoria Community present in conodont faunas 1 and 2 on Baillie Hamilton Island (Fig. 47). Warburgella rugulosa is present in one of the collections (GSC loc. C-26845) flanking the bioherm.

Section 4 consists of thin-bedded, argillaceous lime mudstone (Fig. 10) with common to abundant brachiopods (a high percentage of articulated valves) and a few colonial tabulate corals as well as ostracodes (Beyrichia [Beyrichia] arctigena Martinsson, Kozlowskiella sp.), conodonts, crinoids, and gastropods in mud support (Plate 38, Fig. 1). The brachiopod assemblage (Fig. 39) is indicative of an early, but not earliest, Lochkovian age. This section also contains

Warburgella rugulosa canadensis Ormiston. There are believed to be approximately 150 meters of strata between the "Reef" and section 4.

Section 5 consists of thin-bedded, argillaceous lime mudstone with angular quartz silt in the lower part (Fig. 11) and may overlap slightly with section 4. It contains few to common brachiopods, crinoids and, in places, in the upper part abundant fish as well as less angular quartz silt. The brachiopod fauna in this section is not very complete, but is of Lochkovian age. Also present in this section are *Warburgella rugulosa canadensis* and *Monograptus uniformis*.

Section 6 contains, in the lower part, thin-bedded, highly argillaceous lime mudstone with angular quartz silt (Fig. 12). The upper part contains cleaner, well washed, thin- to medium-bedded lime packstone to grainstone with common to abundant oncolites, many of which have a valve fragment of *Schizophoria* as the center (Plate 38, Figs. 5, 7). The oncolites suggest an environment of clean, shallow water of higher energy than the underlying units, which do not possess oncolites. The changes upsection in this section suggest a shallowing, higher energy environment. The surrounding hills a few meters above the tip of section 6 are composed of finely crystalline vuggy dolomite somewhat similar to those dolomites stratigraphically above section 3. The age of this section is early Lochkovian. The brachiopod fauna (Fig. 41) is not very diagnostic, but beds on strike (GSC loc. C-26855) contain *Warburgella rugulosa canadensis*. This section also contains

Section 5

scale 1 in. = 2 m.

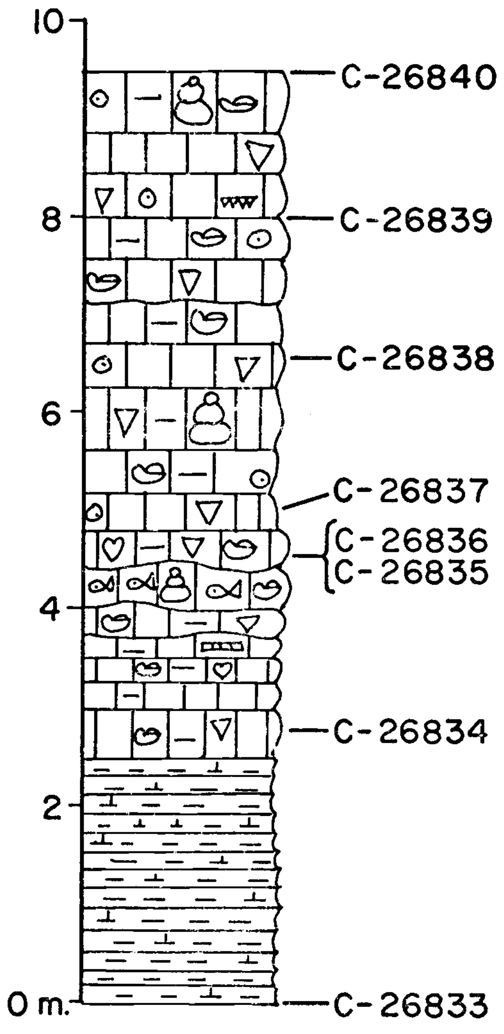


FIG. 11

Ozarkodina remscheidensis repetitor which Uyeno (written comm., 1976) regards as indicating a Lochkovian, but not earliest Lochkovian, age. There are approximately 10 meters of strata between sections 5 and 6.

Section 7 is composed of heavily argillaceous, carbonaceous lime mudstone with abundant angular quartz silt and abundant fecal pellets (Fig. 13). In addition to the brachiopod fauna (Fig. 42), it contains gastropods, pelecypods, ostracodes and rare crinoids (Plate 37, Fig. 6). The brachiopod fauna is not diagnostic in this section, but also present are Warburgella rugulosa canadensis and Icriodus eolatericrescens. Uyeno (written comm., 1976) regards the latter form as indicative of a Lochkovian, but not earliest Lochkovian age. There may be several hundred meters of strata between sections 7 and 8.

Section 8 contains varied and interesting lithologies (Fig. 15). The basal beds are highly argillaceous thin-bedded fossiliferous lime mudstone. These intertongue and exhibit channeling with thin- to medium-bedded well cemented calcareous siltstones (Fig. 14) with angular quartz. The siltstones are devoid of megafauna except for a few beds that contain rare disarticulated brachiopods and poorly preserved fish remains. These channels may have been formed on tidal flats, or shallow subtidal areas.

Section 7
scale 1in.=2m.

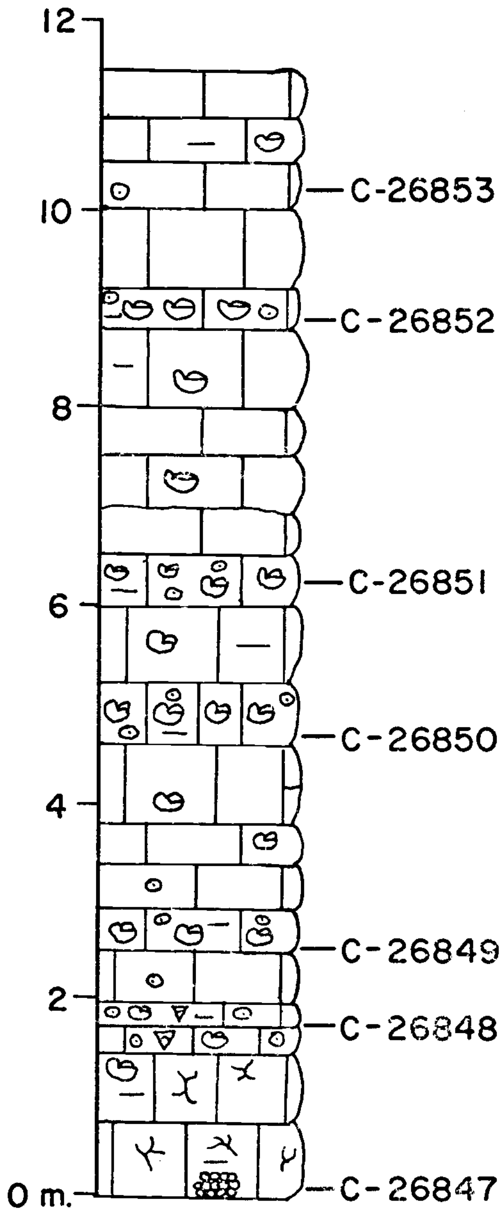


FIG. 13

Fig. 14. View of channeling and lensing in light colored resistant well cemented calcareous siltstone units (A) and less resistant argillaceous lime mudstone units (B). Section 8, western Prince of Wales Island. Note hammer for scale.

Higher upsection, these two units are interbedded in places, and in others the argillaceous lime mudstone units are channel infillings within the medium-bedded, blocky calcareous siltstone (Figs. 16, 17). The channel infillings are crescentic in cross-section and are composed of thin, lumpy bedded argillaceous lime mudstone with a varied fauna of brachiopods, crinoids, solitary tetracorals and gastropods. The siltstone units do not contain any megafaunas.

A few meters stratigraphically above the aforementioned units is a unit of thin-bedded, platy, silty lime mudstone with common argillaceous seams. Some beds contain silicified faunas composed of brachiopods, colonial and solitary corals, and sponge spicules. The next overlying unit is a poorly exposed one containing interbeds of siltstone and lime mudstone. Large colonial favositid corals are present in this unit. The overlying unit is a thin-bedded lime mudstone with argillaceous seams and is almost totally devoid of megafauna. This is interpreted as representing a quiet water, subtidal environment. The last unit in this section is a coarsely crystalline, vuggy, medium-bedded dolomite with common coral, stromatoporoid fragments, and algal (?) debris.

This section is thought to exhibit a broad shallowing trend from its basal beds which are thought to have been deposited in a quiet water, subtidal environment. The topmost beds are thought to have been deposited in a high energy, shallow environment, due to the presence of fragments of colonial corals and stromatoporoids.

Fig. 16. View of relationship between laminated calcareous siltstone units (A), and fossiliferous, lumpy bedded, argillaceous lime mudstone units (B), section 8, upsection from Fig. 15, western Prince of Wales Island. Note hammer for scale.

Fig. 17. View of relationship between laminated calcareous siltstone units (A) and fossiliferous, lumpy bedded, argillaceous lime mudstone units (B). Hammer rests on beds of lumpy bedded argillaceous lime mudstone. Section 8, western Prince of Wales Island.

The age of this section is in part, at least, late Lochkovian. The brachiopod fauna (Fig. 43) is one correlative with the Quadrithyris Zone (Johnson, 1975a). The diagnostic conodonts in this section are *Ozarkodina* n. sp. D of Klapper (see Klapper in Lenz and Pedder, 1972, p. 15), *O. stygia* and *O. johnsoni* assignable to fauna 3 of Klapper (in Klapper and others, 1971).

Section 9 is an extraordinary one in that within approximately one-quarter of a mile, it undergoes a marked facies change (Fig. 18). In the eastern part of the section, the units have a high content of angular quartz silt and are dolomitized, whereas in the western part, they are limestones with less angular quartz silt.

In the western part of the section, there are marked channeling and erosional surfaces within the limestone units (Figs. 19, 20). A few feet from the base of the section is a unit that exhibits channeling as well as large, cabbage head stromatoporoids that are present in what appears to be a penecontemporaneous limestone conglomerate infilling a channel. The stromatoporoids are not in growth position as they are seen at varying orientations within the calcite matrix. The overlying unit is a thinly-bedded, lenticular, silty lime mudstone unit containing rare scattered brachiopods in mud support. This unit also exhibits channeling (Fig. 19).

The brachiopod fauna in this section (Fig. 44) is not well preserved, but similarities with the fauna in the lower part of section 8

Fig. 19. View of western part (calcareous) of section 9, well bedded lime mudstone, western Prince of Wales Island. Note evidence of erosional surfaces and channeling near and above hammer, lower left of photo. Note colonial corals and stromatoporoids directly above and left of hammer.

Fig. 20. Closeup view of Fig. 19. Note the diverging erosional surfaces, with limestone conglomerates, and colonial corals above and to left and right of hammer. Section 9, western Prince of Wales Island.

indicate a late Lochkovian age. The presence of Cortezorthis sp. (GSC loc. C-26903) is notable as it marks the first appearance of this genus within the measured sections. GSC loc. C-26903 contains conodonts similar to those in section 8 and indicates an age of late Lochkovian.

Section 10 consists of thin-bedded, silty argillaceous lime mudstone, with uncommon intervening argillaceous seams (Fig. 21; Plate 38, Fig. 4). The fauna of this section is very prolific and varied (Fig. 45). The brachiopods present have some similarity with those from section 8. However, the key genera assignable to the Quadrithyris Zone are not present. The trilobite Basidechenella laticaudata Ormiston is common in this section. Ormiston (1976, oral comm.) feels that this species could indicate an age of conodont fauna 3. Conodont identifications from this section are not yet completed. Until additional evidence is obtained, a tentative age of early late Lochkovian (conodont fauna 3) will be assigned this section. As mentioned previously, the brachiopods exhibit more affinities with those of section 8 than they do with those of section 7. Ormiston (written comm., 1975) regards section 7 to be definitely older than section 10, based on trilobite evidence. Section 10 is older than section 8.

All of the previously mentioned sections from Prince of Wales Island are older than the Drake Bay Beds (Ormiston, 1969). The

Section 10

scale 1in.= 2m.

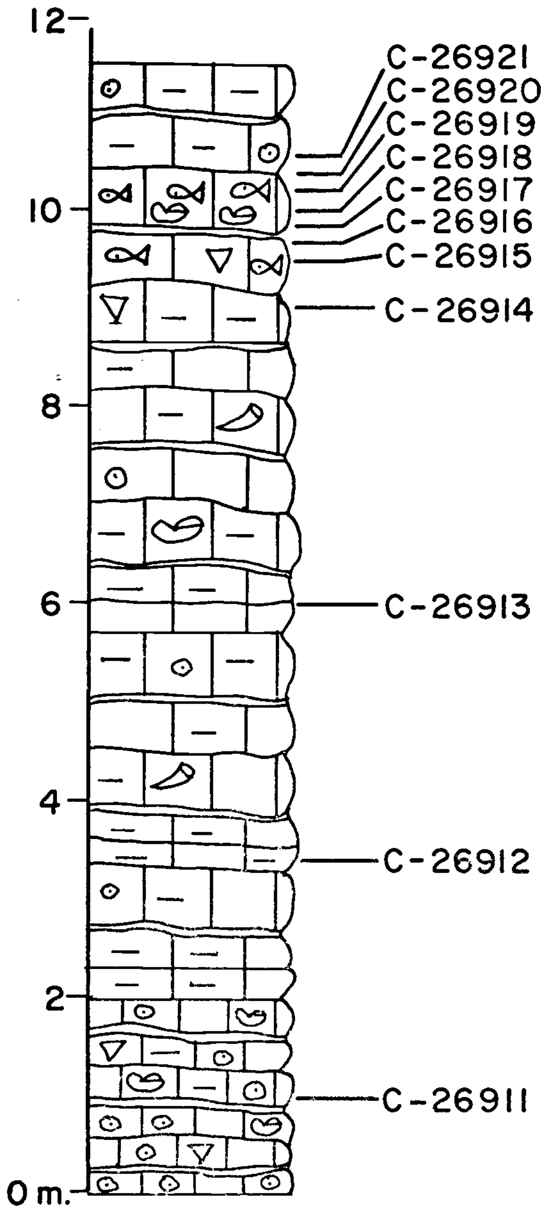


FIG. 21

fauna present in the latter unit is Pragian in age and approximately correlative with collections (GSC locs. C-67144, C-67145) which occur above the reefs within the Stuart Bay Formation of Bathurst Island (Johnson, 1975a, Text Fig. 3).

There are undoubtedly some strata missing between the topmost beds of section 9 and the Drake Bay Beds, but it is probably in the tens of meters, inasmuch as the age difference between the two sections is not great.

Baillie Hamilton Island

Cape Phillips Formation

The Cape Phillips Formation (Thorsteinsson, 1958) is a deeper water, basinal graptolitic facies in part correlative with the Read Bay Formation and older shelf carbonate units. It ranges in age from Ordovician to Early Devonian, and is composed of black graptolitic calcareous shale, as well as minor siltstone and limestone beds. Many of the beds possess dark grey to black laminations (Plate 36, Figs. 1, 2) as well as uncommon ceratiocerids and rare trilobite fragments. The abundant dark organic matter, fine grain size, and pelagic fossils suggest a deep marine, partially restricted stagnant basin below wave base. This formation is present in the areas of sections 11 and 12 of this paper (Figs. 23, 25) as well as many

Fig. 22. View of outcrop and thin to medium wavy bedding at approximately 240 meters above base of section 11, unnamed carbonate unit, Baillie Hamilton Island. Note hammer for scale.

others (Thorsteinsson, 1970). It is overlain by a series of transitional beds that are composed of mudstone, siltstone, and limestone interbeds. Some of these beds contain a diverse brachiopod fauna that consists of very small species. It is overlain by an unnamed carbonate unit (at least 500 meters thick) which can be broken into three members. The lower member is composed of thin-bedded argillaceous lime mudstone containing common argillaceous seams (Fig. 25) and contains a varied brachiopod fauna (Fig. 47) as well as corals, gastropods, and, in the upper parts, oncolites. The brachiopods in the lower part are in the form of geopetals with some disarticulated valves. The upper part exhibits oncolites with disarticulated brachiopod valves as the center. This lower member is overlain by a second member (Plate 36, Figs. 3-6) consisting of thin- to medium-bedded silty lime mudstone containing common to abundant colonial (favositid) corals as well as bryozoans (Plate 36, Fig. 1).

The third and upper member is a thin- to very thin-bedded silty, argillaceous lime mudstone containing in places small scale planar cross laminations (Fig. 24), lime mud intraclasts (Fig. 26), sedimentary drape (Fig. 27), as well as what appear to be small scale ripple marks and common to abundant leperditid ostracodes (Plate 37, Figs. 2-4). The ostracodes, ripples, and intraclasts suggest an intertidal to supratidal restricted environment in which weak tidal

Fig. 24. View of bedding and small scale planar cross-lamintation, lower member, unnamed carbonate unit, approximately 165 meters above base of section 12, Baillie Hamilton Island. Note pencil for scale.

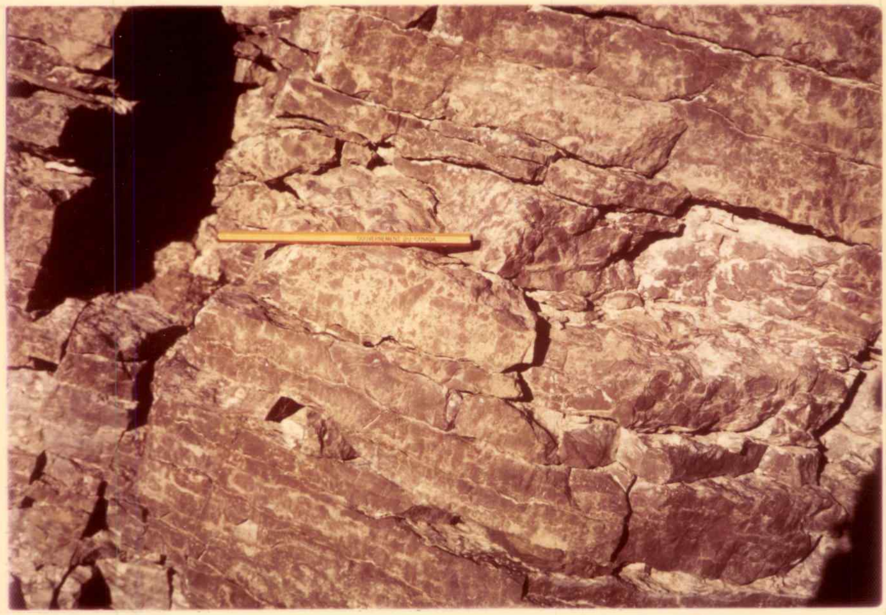


Fig. 26. View of carbonate intraclast ripups and thin, wavy bedding in upper member of unnamed carbonate unit, approximately 575 meters above base of section 12, Baillie Hamilton Island. Note pencil for scale.

Fig. 27. View of thin bedding, sedimentary drape and slab to right of pencil with abundant ostracodes, upper member of unnamed carbonate unit, approximately 635 meters above base of section 12, Baillie Hamilton Island. Note pencil for scale.

currents broke up intertidal muds. Such features are common in intertidal-supratidal carbonate bank environments as interpreted by Laporte (1969) in the Hamilton Group of New York.

The age of this carbonate unit is early Lochkovian, corresponding to Klapper's (in Klapper _et_ _al_., 1971) faunas 1 and 2. Fauna 2 contains the very widespread _Gypidula_ _pelagica_ fauna. The upper member of the unit contains few fossils of any type, consequently it cannot be dated precisely. As there is no evidence for an erosional break in the strata, it might be assumed that the upper member is not much younger than the lower ones, i.e., probably conodont fauna 2. _Warburgella_ _rugulosa_ _canadensis_ also occurs in the lower members of the carbonate unit. _Monograptus_ _uniformis_ occurs a few meters above the base of the carbonate unit in section 12 (R. Thorsteinsson, oral comm., 1975).

Devon Island

The Devon Island Formation (Thorsteinsson and Tozer, 1963; Morrow, 1973) consists of approximately 200 meters (in places) of thinly bedded, laminated, calcareous mudstone. It contains graptolites as well as a highly diverse fauna of very small brachiopods (Fig. 48). _Monograptus_ _uniformis_ has been reported from beds within the lower part of the formation (Morrow, 1973). The Devon Island Formation ranges from late Silurian to early Lochkovian in age as evidenced by the graptolites and brachiopods present.

Bathurst Island

The Bathurst Island Formation (McLaren, 1963) consists of approximately 1000 meters of interbedded calcareous siltstone, sandstone (Fig. 28) and mudstone containing common graptolites, ceratiocerids, and rare brachiopods. It conformably overlies the Cape Phillips Formation and is overlain by the Stuart Bay Formation, disconformably in places and conformably in others. The Bathurst Island Formation is a diachronous unit, and is Lochkovian-Pragian in age (Kerr, 1974).

The Stuart Bay Formation (McLaren, 1963) consists of approximately 400 meters of interbedded siltstone, sandstone, mudstone, and, near the top, limestone. The lower parts of the formation are graptolitic and the upper parts more calcareous, containing limestone units with two-holed crinoids and *Bifida* sp. In the Arctic, the latter are indicative of a Zlichovian age. This formation is also known to be diachronous (Kerr, 1974) and ranges in age from Lochkovian to Zlichovian. Graptolite, conodont, and spore identifications from the rocks in section 13 have not been completed. Until such time as the faunas become known, little will be gained by discussing these rocks from a biostratigraphic point of view.

Strata equivalent to the Lochkovian are abnormally thick in the Arctic Islands. This is thought to be a direct function of clastics being shed by the Boothia Uplift and subsequent subsidence of the areas surrounding it. The carbonates from Prince of Wales and Baillie Hamilton Islands contain variable amounts of argillaceous and silty material. Lochkovian strata on Prince of Wales Island are thought to be approximately 1000 to 1500 meters thick based on a compilation of measured sections, plus projected thicknesses of strata represented by covered intervals.

Lower Lochkovian strata on Baillie Hamilton Island are at least 500 meters thick. The top of the beds has been eroded, so this figure is only a minimum estimate.

Equivalent strata from the graptolitic facies (section 13) are thought to be approximately 1.5 times greater. However, graptolite and conodont identifications from this area have not been completed, so an accurate estimate of thicknesses is not practical at this time.

CORRELATION

Correlation of the various formations and units discussed previously has been attempted, utilizing as much diverse paleontologic information as possible.

As noted by Johnson (1973, 1975a), use of the Bohemian zonal scheme is more practical than the northwest European one when discussing and correlating strata in western and Arctic North America. An additional valuable practice is to utilize Klapper's (*in* Klapper *et al.*, 1971) conodont faunas, wherever applicable, for the Devonian of western and Arctic North America. Correlation with reference to a numbered conodont fauna reduces confusion as it replaces many faunal names that have been discussed in various areas.

The base of the Devonian (base of the Lochkovian) has been set (Chlupáč, 1972) at the first occurrence of *Monograptus uniformis*. *Icriodus woschmidti* and *Warburgella rugulosa* are also known to occur near the Siluro-Devonian boundary (Fig. 31). An additional valuable indicator is the first appearance of *Cyrtina*. This genus is not verified from the Silurian anywhere in the world.

The first three genera are known to occur in the Arctic Islands, but, as is to be expected, they do not always occur together. *W. rugulosa canadensis* has a long range in terms of stratigraphic thickness as it ranges through 157 meters of strata at Cape

Washington, Baillie Hamilton Island, at least that much strata on Prince of Wales Island, and more than 110 meters in Poland (A. R. Ormiston, written comm., 1975). The ranges of *Monograptus uniformis* and *Icriodus woschmidti* in the Canadian Arctic are imperfectly known.

The lower Lochkovian (faunas 1 and 2) in the eastern Arctic Archipelago includes several groups of brachiopod communities. The first is the *Notoparmella-Arctispira* Community, the *Iridistrophia-Mesodouvillina-Schizophoria* Community and equivalents. These communities (Figs. 46, 48) are approximately the age of fauna 1 of Klapper. *Monograptus uniformis* lies stratigraphically below the *Notoparmella-Arctispira* Community on Baillie Hamilton Island. The same stratigraphic sequence is believed to be evident on Devon Island, but, at this time the relationship is not certain. *Warburgella rugulosa canadensis* occurs within beds of the *I-M-S* Community in section 11.

Iridistrophia johnsoni n. sp., *Schizophoria fossula* n. sp., and *Ancillotoechia gutta*, Johnson, Boucot, and Murphy (1973) are common in beds of early Lochkovian age in the Arctic Islands, as they are present in strata on Prince of Wales Island and Baillie Hamilton Island. These beds are correlative with the lower F fauna from the northern Roberts Mountains of Nevada (Johnson, Boucot, and Murphy, 1973).

The *Gypidula*-*Atrypa*-*Schizophoria* Community and its equivalents are approximately the age of fauna 2. Beds of this age in the carbonate facies of the Arctic Islands are characterized by the presence of *Gypidula pelagica*, *Atrypa nieczlawiensis*, and *Schizophoria fossula* n. sp. The lower Lochkovian graptolitic facies equivalents are represented by the upper Cape Phillips Formation and lower Bathurst Island Formation. This assemblage of shells containing *Gypidula pelagica* is widely known in western and Arctic North America (Fig. 31). It is correlative with the upper F fauna of the northern Roberts Mountains, Nevada (Johnson, Boucot, and Murphy, 1973). The fauna also has correlatives in the Yukon Territory with the *Gypidula* cf. *pelagica* unit of Lenz (1968a) and beds with the same fauna from the Delorme Formation (Perry, 1974) (Fig. 30).

The Borszczow Formation of Polish Podolia contains a very similar fauna (Kozlowski, 1929) and is correlative with the *Gypidula*-*Atrypa*-*Schizophoria* Community and its equivalents. Notable are common occurrences in the Canadian Arctic and Podolia of *Gypidula pelagica*, *Atrypa nieczlawiensis*, *Grayina magnifica*, *Iridistrophia*, and *Linguopugnoides* (Kozlowski, 1929; Nikiforova, 1954).

Some of the faunas from the lower Lochkovian from the Arctic Islands are remarkably similar to those from Bohemia (Havlíček, 1959, 1961, 1967; Chlupáč, 1972). Among the common forms are *Icriodus woschmidti*, *Monograptus uniformis*, *Warburgella rugulosa*, Gypidula pelagica, Atrypa nieczlawiensis, Leptaena, Mesodouvillina, Iridistrophia, Barbaestrophia, Strophonella, and Howellella.

The rhynchonellid brachiopods from the two areas do not display the same degree of similarity as do the strophomenids (Chlupáč, 1972), but this is probably caused more by local environmental controls than to anything else. Additionally, the lower Lochkovian faunas from Bohemia are well known whereas their Arctic counterparts are only just beginning to be understood.

The Arctic Island lower Lochkovian faunas exhibit some affinities with those from the Maradana Shale of New South Wales, Australia (Savage, 1974). Savage (1973, Fig. 1) correlated the fauna from these beds with the Gypidula pelagica Zone of Central Nevada and the Gypidula cf. pelagica unit of Royal Creek, Yukon Territory.

Examination of the list of species from the Maradana Shale (Savage, 1974, p. 10-11) reveals some similarities with lower Lochkovian species from the Canadian Arctic Islands. However, some of the Australian genera including Machaeraria, Ogilviella, Spirigerina, and Muriferella are present in collections (Johnson, 1975a; this paper) which are younger than early Lochkovian. Machaeraria and Spirigerina do not occur in the Devonian of the Canadian Arctic stratigraphically below section 10, western Prince of Wales Island. This section is thought to be near the age of conodont fauna 3 of Klapper (Klapper et al., 1971). Species in section 10 have a good deal of overlap with those of section 8, which is late Lochkovian (Quadrithyris Zone) in age. In addition, Savage (1974) lists Quadrithyris in the Maradana Shale. Johnson (oral comm., 1976) reports that Quadrithyris does not extend below the Quadrithyris Zone of Nevada. In light of the foregoing evidence, it seems probable that the Maradana Shale fauna is slightly younger than the Gypidula pelagica Zone.

Correlation of lower Lochkovian strata in the Arctic Islands and Morocco is very weak, but equivalent strata would seem to be the Oudai-Hara inferieur and superieur (Drot, 1975). This publication deals only with orthids and dalmanellids and of these only a few are represented in the Arctic Island faunas. However, these Moroccan beds contain a succession of species of Acastella. The uppermost occurrence of A. jacquemonti is approximately equivalent to the upper range of Warburgella (Drot, 1974, Tableau 1). A. tiro occurs above the latter species in Morocco and A. cf. A. tiro is also known from Polish Podolia (Johnson, 1975a, Text Fig. 2).

Correlation with deposits in Belgium is also very weak, as the fauna in these beds (Boucot, 1960) has little affinity with those in the Canadian Arctic. Consequently, the correlation is indirect. Johnson (1975a, Text Fig. 2) illustrates a correlation between the various beds and other units in other areas.

Faunas from Lievin, France (Barrois, Pruvost, and Dubois, 1922) exhibit some similarities to the Arctic, but, as with the Belgian faunas, correlation is essentially indirect. Approximately correlative strata are the Schistes de Muno et de Mondrepuits. The Rhenish faunas illustrated by Dahmer (1951) from the Huinghauser Schichten are more clearly correlative with the Arctic Islands. Notable here are similar species of Mesodouvillina, Iridistrophia, Howellella, Isorthis, Leptaena, Atrypa, Cyrtina, "Tadschikia"?, and Warburgella rugulosa. The presence of Iridistrophia euzona is interesting as Iridistrophia of this type seems to be an indicator of early Lochkovian time in Bohemia, Nevada, Podolia, and the Arctic Islands.

Late Lochkovian time is equivalent to the Quadrithyris Zone of Johnson (1970). This zone has been correlated with similar strata in the Arctic Islands (Johnson, 1975a). It is also equivalent to the Spirigerina Unit of Lenz (1968a) from the Royal Creek area of Yukon Territory. Perry (1974) reports the same fauna from beds in the Delorme Formation, N.W.T. In addition to similar brachiopod faunas, other faunal elements are useful in recognizing this zone. Pedavis pesavis (Bischoff and Sannemann) and Monograptus hercynicus occur in Quadrithyris Zone age strata (Fig. 31).

As discussed by Johnson (1975a), Gypidulids offer the best means for correlation utilizing brachiopods within the Canadian Arctic

Islands. Collections made by the present writer in Quadrithyris age beds in the Arctic have strengthened Johnson's (1975a) correlation with the discovery of P. cf. P. kayseri (Peetz) from Prince of Wales Island. Previously this species was known only from Cornwallis Island. Additional specimens of Carinagypa careopleura have been collected from Prince of Wales Island. More work and more collections from Quadrithyris Zone age beds representing other communities need to be made before additional faunal elements become useful for correlation within the Arctic Islands.

The graptolitic facies equivalent of the Quadrithyris Zone in the Arctic is represented by strata of part of the Bathurst Island Formation.

Faunas from the Mandagery Park Formation, New South Wales (Savage, 1971) are correlative with the Quadrithyris Zone of western and Arctic North America. As mentioned earlier, the faunas from the Maradana Shale may be partially correlative to the Quadrithyris Zone.

The Arctic Island Lochkovian faunas are included in the Old World Realm of Boucot (1975). These faunas are distinct from those of the Eastern Americas and Malvinokaffric Realms. The Arctic Island faunas exhibit very strong affinities with those of Bohemia. Faunas from Nevada, the Yukon Territory, and Polish Podolia are similar, but not to the extent as are those from Bohemia. As mentioned previously, there is some similarity between the faunas from the Arctic and those from Australia, but the latter are regarded as a separate region within the Old World Realm (Boucot, 1975). The lack of strong correlation between the Arctic and the Yukon may be partially explained by the deeper water communities represented by the Yukon faunas.

Brachiopods are known to be sensitive to environmental parameters; therefore, it should not be surprising that ranges of individual taxa are variable. Ranges of taxa discussed in this paper have been plotted (Fig. 32) in an attempt to illustrate the ranges observed in one geographic area, the Canadian Arctic Archipelago. Comparison of these ranges with those of Perry (1974) from the Delorme Formation, N.W.T., shows some similarities and differences. This emphasizes the point that brachiopods are best correlated using assemblages rather than dealing with ranges of individual taxa, unless there is evidence based on evolving lineages.

PALEOGEOGRAPHY

The shelf-basinal boundary in western and Arctic North American remained remarkably stable from Ordovician to Early Devonian time (Johnson, 1971). This boundary is not believed to have varied much in the Arctic until Late Silurian time. At this time, the Boothia Uplift (Kerr and Christie, 1965), a northerly, elongate, crystalline extension of the Canadian Shield, began upward movements in the Arctic at right angles to the sedimentary depositional strike (Fig. 5). The resultant uplift of an area that had been previously the site of carbonate deposition (Read Bay Formation) resulted in the beginning of the process of stripping of the carbonate layer overlying the Boothia Uplift. This is reflected in the deposition of conglomerates of the Peel Sound Formation on Prince of Wales and Somerset Islands surrounding the Boothia Uplift. On eastern Prince of Wales Island, Atrypella phoca has been encountered in the basal beds of the Peel Sound Formation, thus indicating Late Silurian age. Figure 33 is a schematic lithofacies map illustrating known and inferred lithofacies distribution, compiled from published work and that of the writer.

During Late Silurian, the northern half of Cornwallis, Baillie Hamilton, Bathurst, and parts of Devon Island were accumulating graptolitic shales of the Cape Phillips Formation.

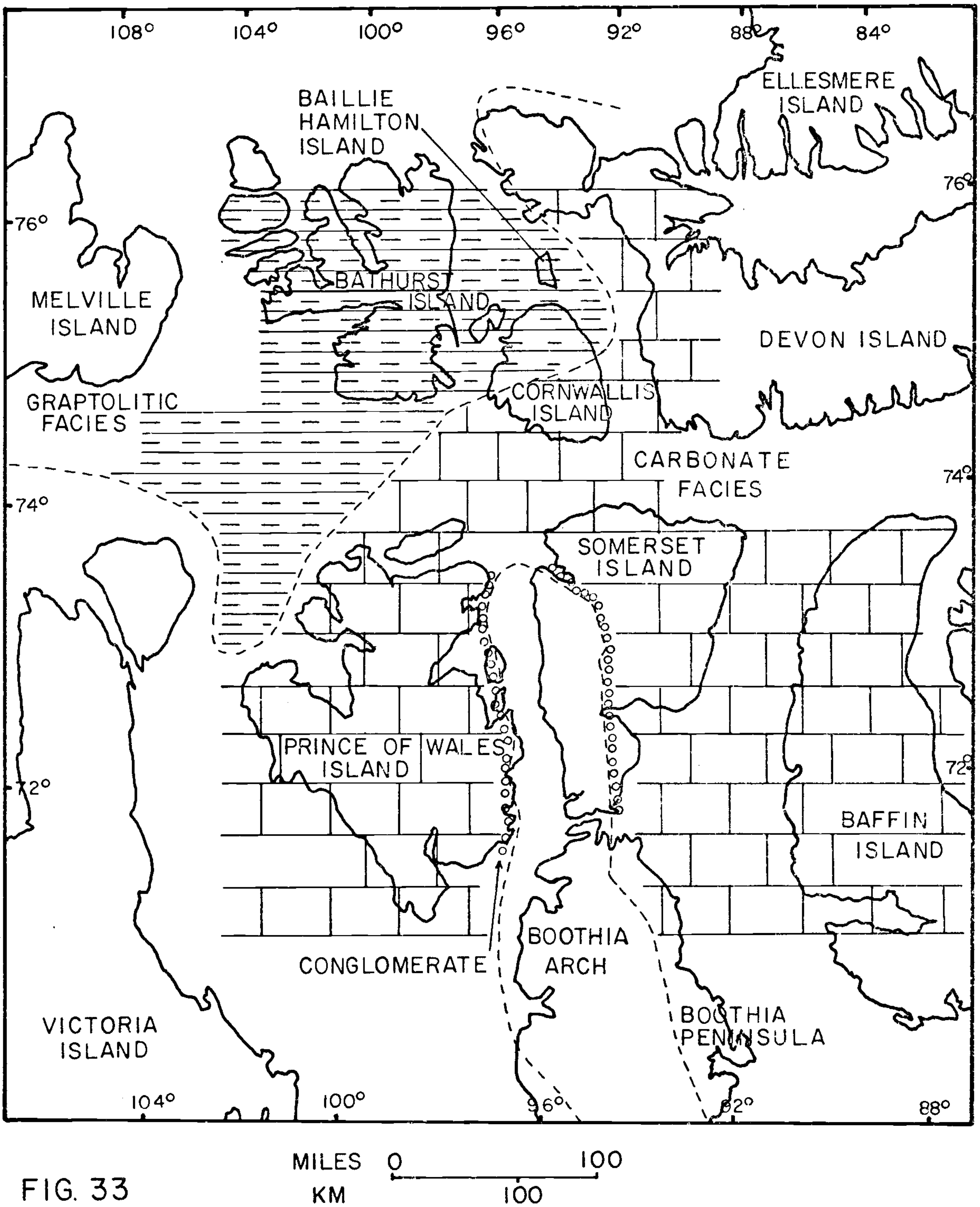


FIG. 33

SCHEMATIC LITHOFACIES MAP DURING LATE SILURIAN TIME

With increased uplift, erosion continued and lithic conglomerates began to be spread laterally from the Boothia Uplift. The outcrop distribution of these conglomerates have been mapped by Miall (1970). Figure 34 is a schematic map of sedimentary facies during Gypidula pelagica or early Lochkovian time, illustrating known and inferred lithofacies distribution, compiled from published work and that of the writer. The shale-carbonate boundary is believed to have existed off the northwestern edge of Prince of Wales Island. The bioherm was present during this time, and it seems a rough water, high energy environment might be situated near but not necessarily at the shelf-basin boundary.

To the north, Cornwallis Island was accumulating conglomerates of the Snowblind Bay Formation. Baillie Hamilton Island was accumulating silty shallow shelf carbonate platform lime muds in which the Gypidula-Atrypa-Schizophoria Community was flourishing. The Boothia Uplift in this area had the effect of extending the shelf-basin boundary to the west. Areas that were formerly accumulating graptolitic shales (Baillie Hamilton Island) were then accumulating normal marine shallow water, argillaceous shelf lime mudstones.

Other areas were accumulating limestone conglomerates at about the same time. Morrow (1973) demonstrates several facies of the Sutherland River Formation on Devon Island. The western-most

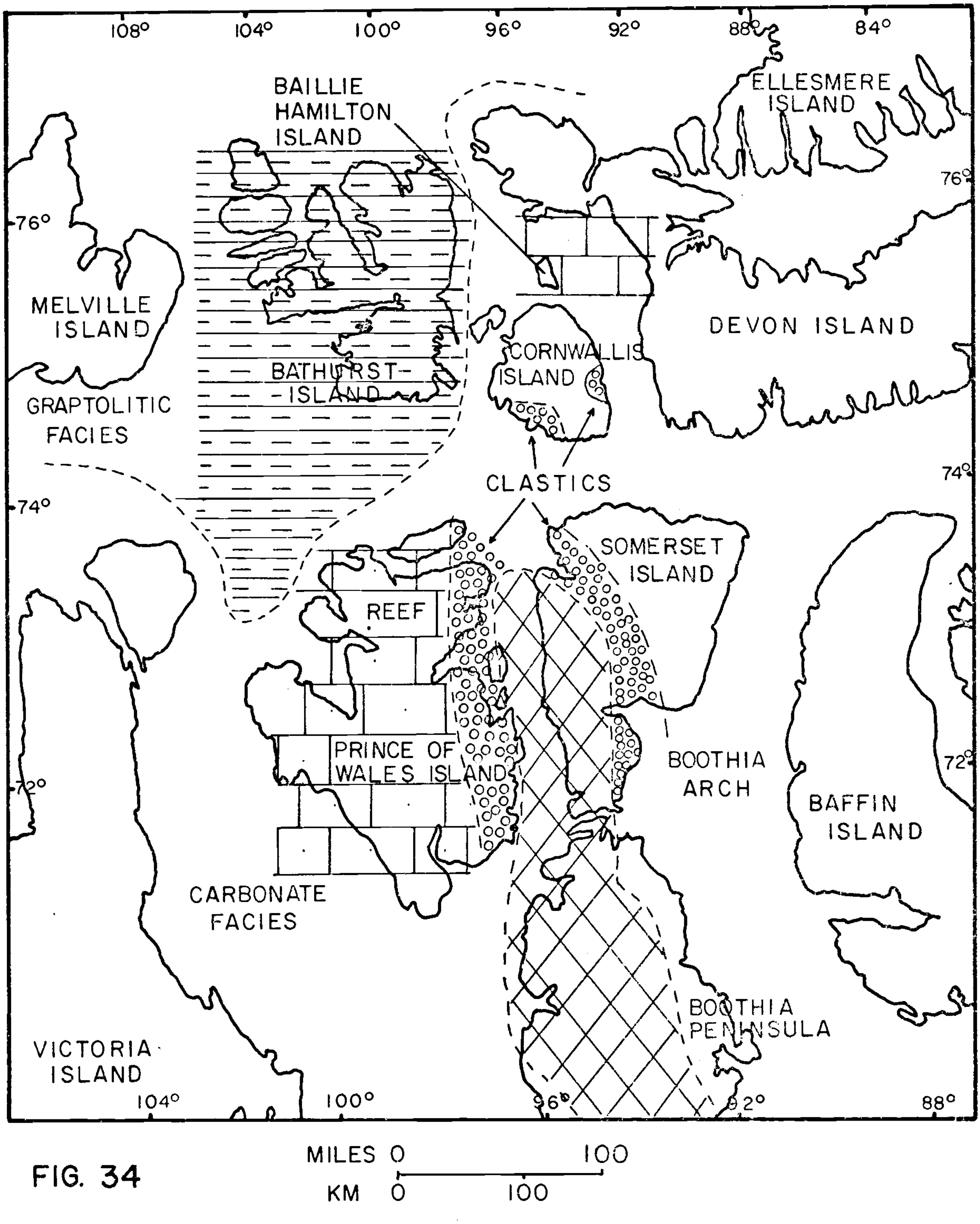


FIG. 34

SCHEMATIC LITHOFACIES MAP DURING EARLY LOCHKOVIAN TIME facies was conglomeratic and the easternmost was a silty carbonate facies.

Younger sedimentary rocks have been removed by erosion from Baillie Hamilton Island, as is evidenced by the eroded top of the unnamed carbonate unit which is of early Lochkovian age. Lochkovian age strata on Prince of Wales Island illustrate at least three broad shallowing sequences.

The Late Silurian-Early Devonian uplift brought about by the Boothia Uplift disrupted the shallow, lagoonal, sedimentary facies that had been present during most of the Silurian which is represented mainly by the Read Bay Formation. This results in the destruction of the environmental niche occupied by Atrypella and this fossil is not known from younger rocks anywhere in the Arctic Islands.

This disruption of the lagoonal facies was followed by several demonstrable deepening-shallowing trends on western Prince of Wales Island. Sections 3, 6, and 8 are all believed to exhibit a broad overall shallowing trend. Each begins with what is interpreted to be a normal marine, subtidal low energy environment as represented by the rocks and contained faunas and ends with shallow water higher energy limestones and dolomites.

The fauna from GSC loc. C-26806 (Appendix 1) is approximately equivalent in position to the Notoparmella-Arctispira Community. This locality lies stratigraphically below sections 2 and 3.

These latter two sections illustrate a shallowing trend and section 3 is thought to be equivalent in position to that of the *Iridistrophia-Mesodouvillina-Schizophoria* Community present on Baillie Hamilton Island. Above section 3, there is a rubble (covered) interval followed upsection by resistant dolomites that cap the surrounding hills. This dolomite is thin- to medium-bedded, very porous, and contains fragments of corals as well as what appear to be ghosts of other fossils. This dolomite unit is thought to represent a shallow subtidal high energy environment as evidenced by the fragmentary nature of the contained fossils.

Sections 6 and 8 exhibit similar trends although the communities present in these sections are not the same as in sections 2 and 3. (See Community discussion for additional information.)

Strata representing late Lochkovian time in the Arctic Islands are not widespread, and any inferences regarding paleogeography during this time interval must be regarded as preliminary.

Late Lochkovian age strata on Prince of Wales Island are represented by the beds of section 8 and possibly section 9. The lower part of section 8 is believed to represent a subtidal, quiet water environment. Influxes of terrigenous clays and silts probably derived from the Boothia Uplift were common at this time.

Late Lochkovian age strata on eastern Bathurst Island are represented by shallow water, *Quadrithyris* Zone age carbonates and reefs (Kerr, 1974; Johnson, 1975a). Equivalent strata on western Bathurst Island include calcareous shales, mudstones, and sandstones of the Bathurst Island and Stuart Bay Formations (Kerr, 1974; this paper, section 13). Quadrithyris Zone equivalents on Cornwallis Island (Johnson, 1975a) are represented by an isolated outcrop of limestone. The relationship of this outcrop to surrounding strata is not yet known.

The faunas from late Lochkovian age strata are poorly known from the rest of the Arctic Islands, but equivalent sedimentary strata are present in the geosynclinal facies on northwestern Ellesmere Island (Trettin, 1976).

COMMUNITIES

As recently noted by Lesperance and Sheehan (1975), literature dealing with Silurian and Devonian marine communities has been prolific within the last few years. Among these papers are Bowen, Rhoads, and McAlester (1975), Thayer (1975), Boucot (1970, 1975), Boucot and Johnson (1967), and Ziegler (1965). These papers define and enumerate basic parameters governing Paleozoic marine communities as well as discussing problems arising from an attempt to establish community names and boundaries. This paper will not attempt to duplicate this material and the reader is referred to them for background purposes.

As far as establishing what a marine community is, there seems to be widespread agreement among paleontologists that a community can be recognized by means of a recurrent association of taxa occurring in fossil collections (Speden, 1966, p. 411).

In addition, there are several parameters and assumptions outlined that have a direct bearing on recognizing and utilizing fossil marine communities; these will be briefly outlined in point form:

1. Communities are the results of a complex web of environmental parameters. At times, some parameters have more influence than others.
2. Life and death assemblages. Considerable weight has been

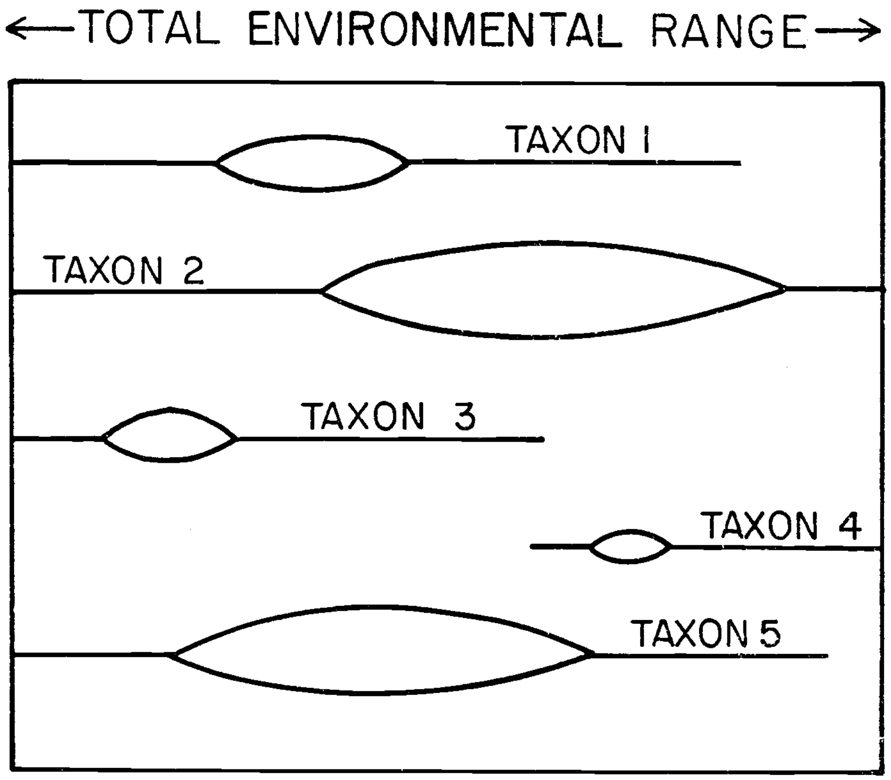
given to the presence of disarticulated and broken shells as representing a possible death assemblage. Very rarely would one expect to see a group of organisms preserved in life positions. Many post-mortem factors could alter the organisms (i.e., disarticulation, burrowing, reorientation) to a lesser or greater extent, resulting in what might be termed a death assemblage. This term generally implies that the organisms did not live together. Often such is not the case, as recent data (Turney and Perkins, 1972; Boucot, 1975, p. 40) indicate that post-mortem transport may not be important. In other words, shells may be rolled about after death, but net transport of these shells from the original habitat could be very limited. This would be true particularly of the more globose forms. Generally, a quick inspection of the strata containing an assemblage of shells would enable workers to deduce if there had been any strong current activity present, i.e., intraclasts, sedimentary structures, or coarse-grained sediments or lack of clay matrix.

3. The number of preserved organisms represents only a fraction of the taxa that once thrived in an environment.

4. There is a great discrepancy between number and diversity of silicified versus non-silicified shells extracted from rocks. Some silicified collections possess two and nearly three times

the diversity of taxa as do their calcareous counterparts. This is particularly true of small shelled collections. The minute shells are often difficult to see and harder to extract from the matrix if they are not silicified. Any abrupt or marked drop in diversity from one collection to another should be viewed with suspicion if one is silicified and the other not.

5. Each taxon present in a collection will have a range or environment in which it can thrive. Some part of this environment will represent optimum conditions for a particular taxon and other parts marginal conditions. The total ranges of taxa might be represented diagrammatically (Fig. 35). The bulges represent optimum conditions for a particular taxon and would be represented in the rock record as a peak zone. That is, the fauna at that particular spot would be dominated by that particular taxon.
6. Even where distance between samples collected from a measured section is small, it should not be surprising that percentages of certain individual taxa will fluctuate tremendously and percentages of certain other taxa will fluctuate only slightly.
7. Community boundaries should be expected to be gradual in a vertical rock column if there is no lithologic break. If sampling is sufficient and detailed enough in a measured section of changing lithology, a trend should be noticed, as elements of one community become less common or disappear and new



←TOTAL ENVIRONMENTAL RANGE→
TAXON I
TAXON 2
TAXON 3
TAXON 4
TAXON 5

FIG. 35

elements appear as a different community begins to be established.

Data Collection and Organization

The community data presented in this paper come from measured sections described previously. The thicknesses of the sections range from tens of meters to 600 meters.

Wherever possible, large bulk collections were made (slabs) in order to get a reasonable estimate of the shells preserved at a particular horizon. This not only avoids smashing specimens by breaking the rock into smaller pieces, but also aids in sampling all types of fossils present, rather than just brachiopods. Each oriented slab was then sliced to preserve a portion for fabric and petrographic analysis.

When the brachiopods were extracted from the matrix, the total number of valves of each taxon was counted and computed as a percentage of the total valves of all taxa per sample. The resulting data were then plotted on charts which facilitates viewing of fluctuating percentages, peak zones, and community boundaries. The relative abundance and types of other fossil groups were noted also for each sample as well as the dominant lithologic characters of the rocks.

Most sections from Prince of Wales Island exhibit only one community each. This is caused in large part by the small stratigraphic thickness of the sections. This is advantageous mainly because it can be assumed with some certainty that the changes in faunal numbers are the result of environmental causes rather than evolutionary ones.

One of the most important advantages of viewing communities from measured sections is that one can see fluctuating percentages and peak zones of particular taxa. Collection of isolated samples representing peak zones of different taxa has probably resulted in the past in the establishment of two or more communities when in fact there was only one present. The communities discussed do not span considerable time ranges, and, as a result, the variations within them are not likely to be the result of evolution. Environmental fluctuations are responsible for the variations in community structure.

The community development and succession on Baillie Hamilton and Devon Islands seem directly attributable to the tectonic activity of the Boothia Uplift. This uplift is a northerly extension of the Pre-cambrian Crystalline basement which became a positive feature in Early Devonian time (Kerr and Christie, 1965). This rise of the Boothia Uplift led to a pregressive shallowing in these areas which is reflected in the sediments deposited as well as in the community succession.

The sections measured on Baillie Hamilton Island begin in the deep water, euxinic, graptolitic black shale beds of the Cape Phillips

Formation. These are overlain by a series of beds composed of interbedded mudstone, silty mudstone, and limestone. These "transition" beds are overlain by a series of thin-bedded argillaceous limestones correlative at least in part with the Devon Island Formation from Devon Island.

The faunas arranged in order, upsection, deepest to shallowest are Graptolites Community, Notoparmella-Arctispira Community, Iridistrophia-Mesodouvillina-Schizophoria Community, Gypidula-Atrypa-Schizophoria Community, Coral Community, and Ostracode Community.

Two immediate and obvious trends are visible in this pattern of brachiopod community succession: going upsection, from deeper to shallower, diversity decreases and size of shells increases (Fig. 46).

This pattern lends itself to characterization in terms of energy. It is in essence a Low-High-Low pattern. This pattern is somewhat similar to Anderson's (1971) second model which deals with a prograding shoreline. He recognizes a High-Low energy pattern with his model. The energy pattern discussed here is characterized by a low energy mud environment with graptolites, followed by a higher energy subtidal shelf environment with brachiopods and corals, followed by a low energy, somewhat restricted, intertidal-supratidal possibly lagoonal environment with ostracodes.

Community Characterization

It is relatively easy to agree on a word definition as to what a community should be. However, putting this in practice in a form useful to one's colleagues is more easily said than done.

This has been attempted, however, in the describing and delimiting of the various communities encountered in the course of this work. Communities must be defined in some sort of qualitative and quantitative manner. This description should be sufficiently narrow in order to separate one community from another. In addition, the description should be sufficiently broad to allow for variations between collections. Failure to do this results in far too many communities being established, as in the extreme case that each bed examined for its fossil content becomes a different community as a result of variations in abundance.

Low to moderately diverse communities lend themselves to characterization by a few genera present in all samples which always constitute the bulk of the shells (numerically) from one collection to another. Larger shells (Gypidula, Atrypa, Schizophoria) usually fall into this category. Highly diverse communities do not lend themselves to this approach as few if any taxa account for the bulk of the total number of specimens. Small shelled communities (i.e., Notoparmella-Arctispira) fall into this category.

In conclusion, an attempt has been made to define communities as they appear in the rock record, giving them a "real" character in hope that others will be able to recognize the same community in other areas. In many cases, community boundaries are gradational and necessarily need to be established at the discretion of the worker directly involved.

Notoparmella-Arctispira Community

This community is characterized by its high diversity, and generally numerically low numbers of individual taxa of small brachiopods (Fig. 48). It is equivalent to Johnson's (1974) community of small species. It is a deep water community thought to be immediately shoreward of the pelagic Graptolite Community. Many of the species are present from collection to collection, but others are present or absent with no apparent regularity (Fig. 48). Salopina, Coelospira, and Skenidioides are good examples of this phenomenon. To characterize this community on the basis of presence of genera common in every collection would be a mistake since one would then be forced to designate each collection diagrammed on Fig. 48 as a separate community.

This community is found in thinly bedded, silty, laminated, argillaceous lime mudstone. It is commonly found in association with rare inarticulate brachiopods, ostracodes, and ceratiocerids. It is best developed in beds of the Devon Island Formation on Devon Island. Here the formation consists of silty, calcareous, laminated, black mudstone.

Although collections are small and few, this community is probably represented at the bases of sections 11 and 12 (this paper) as well as being well developed in the Devon Island Formation.

Iridistrophia-Mesodouvilina-Schizophoria Community

This community is characterized by a mixture of large and small shells (Fig. 46) and bears some similarity to Johnson's (1974) mixed community of his G-A-S Biofacies. These three constituents are present in every collection of more than 50 shells and account for at least 35% of the total number of taxa. It is developed in section 11 (Fig. 46) from collection C-26939 to C-26945 (see Plate 38, Fig. 3). Notable here is the presence of large, numerous and diverse strophomenids. At the base of this grouping of collections, a few holdovers from the Notoparmella-Arctispira Community are evident, but these disappear upwards as the community becomes established.

This community is found in thin- to medium-bedded, argillaceous lime mudstone to packstone. Some gastropods are present in every collection. Trilobites and crinoidal and coralline debris are not as evident, but common to abundant in some collections, as are some forms of tabulate corals encrusting both valves of articulated, large specimens and Mesodouvillina.

Gypidula-Atrypa-Schizophoria Community

This community is very similar to if not actually Johnson's (1974) community of large species of his G-A-S Biofacies.

This community is characterized predominantly by large shells, of which Gypidula-Atrypa-Schizophoria are present in every collection of more than 50 specimens and account for at least 40% of the total number of specimens. It is developed in section 12 (Fig. 47) from collection C-26968 to C-26989. It is also poorly developed in section 11 from collections C-26947 to C-26950 (see Plate 36, Figs. 3-6).

This community occurs in thin-bedded, argillaceous, silty lime mudstones, with periodic influxes of terrigenous clays represented by argillaceous seams. In addition to the brachiopods, there are common colonial corals (favositids), and a few trilobites, gastropods, encrusting algae (oncolites) near the boundary with the Coral Community, cephalopods, bryozoans, and gastropods.

Coral Community

This community is characterized by abundant, large tabulate corals of the favositid type with minor brachiopods, bryozoans, gastropods, solitary tetra corals and stromatoporoids (see Plate 37,

Fig. 1). It is best developed in section 12 (Fig. 25) (C-26992 to C-26999) above the G-A-S Community. It occurs in thin- to medium-bedded, very silty, slightly argillaceous lime mudstone-wacke stone. The bedding varies from lenticular to undulatory with argillaceous seams and common silt. The colonial corals appear to be in growth position. Tiny skeletal debris is commonly present with the corals and appears to be composed of brachiopods and bryozoans.

Ostracode Community

This community is characterized by common to very abundant small ostracodes (Leperditiids), often present in swarms on bedding planes. It is developed in section 12 (Fig. 25) from collections C-27000 to C-27008 above the Coral Community. It occurs in very thin- to thin-bedded, silty, slightly argillaceous lime mudstone (see Plate 36, Fig. 7). Gastropods are rare as is skeletal debris. Local small scale planar cross-laminations as well as ripup phenomena are present. Solution cracks, possible small ripple marks and slight dolomitization point to a very shallow, restricted, low energy, supratidal to intertidal possibly lagoonal, environment.

Community Model

As mentioned earlier, sections 11 and 12 exhibit a shallowing trend reflected not only in the rocks, but also in the faunas. Fig. 36 is an interpretation of the position of the communities previously discussed from Baillie Hamilton and Devon Islands as they appear to be relative to the shoreline. The Ostracode Community, although shallow and possibly restricted, is not thought to be directly adjacent to the shoreline. Accordingly, a strip has been left blank (Fig. 36).

Because of the lack of a continuous section from Prince of Wales Island and the several demonstrable broad deepening and shallowing sequences, the communities recognized will be discussed section by section.

Section 1

This section is dominated in the upper part by algal stromatolites and large gastropods. The entire section has been dolomitized and is thought to represent a restricted intertidal to supratidal low energy shallow water environment. The poorly preserved gastropods are believed to be grazers that fed on the algea. The lack of normal marine faunas (i.e., common corals and brachiopods) indicates this environment was a shallow water restricted one.

Section 2

This section is characterized by thin-bedded argillaceous lime

Fig. 36. Relative positions of communities from Baillie Hamilton and Devon Islands as they appear to be in relation to the shoreline.

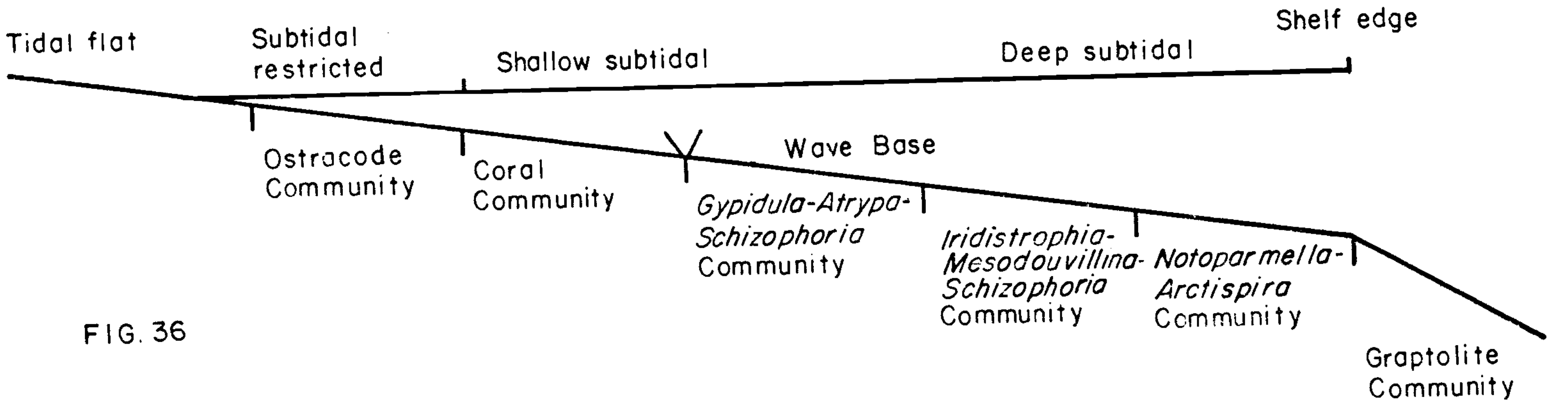

Tidal flat
Subtidal restricted
Shallow subtidal
Deep subtidal
Shelf edge
Ostracode Community
Coral Community
Wave Base
Gypidula-Atrypa-Schizophoria Community
Iridistrophia-Mesodouvillina-Schizophoria Community
Notoparmella-Arctispira Community
Graptolite Community

FIG. 36

mudstone. Trilobites Warburgella rugulosa canadensis are common to abundant here as are many brachiopods in common with section 3. It is a quiet water, low energy environment, thought to have occupied a position below wave base as evidenced by the high content of argillaceous material and lack of any geopetals or sedimentary structures. It is thought to represent a slightly deeper or quieter environment than section 3.

Section 3

This section is characterized by thin-bedded, silty, argillaceous lime mudstone. The brachiopod fauna is highly diverse (Fig. 38) and contains common Schizophoria, Iridistrophia, and Mesodouvillina. Also present, in addition to other brachiopod taxa, are common corals, gastropods, and rare pelecypods. Argillaceous and silty material are common in the beds of this section (see Plate 38, Fig. 6). The fact that the fossils in this section are calcareous aids in interpreting the lack of smaller shelled taxa. It might be assumed that they are present, but of such minute size that detection is almost impossible. Only well preserved silicified collections present a relatively accurate picture of total number and diversity of taxa present in a sample.

The taxa in this section (Fig. 38) bear a striking resemblance to those found in the Iridistrophia-Mesodouvillina-Schizophoria

Community developed in section 11 (Fig. 46). The lack of additional smaller taxa makes positive assignment to this community questionable. However, as mentioned earlier, this is a result in a very large part of preservation, and probably caused to some degree by the excessive amount of argillaceous material.

"Reef"

The taxa associated with the "reef" are predominantly large shelled and can be assigned to the G-A-S Community. Differences occur between these collections and those on Baillie Hamilton, but preservational and slightly different environmental factors could explain the variation (see Plate 38, Fig. 2). In addition to the brachiopods (Appendix 1) present at the flanks, corals, *Platyceras*, and fish are present as well as rare to common crinoids. The "reef" is here interpreted as a rough water, subtidal environment equivalent to the G-A-S Community as evidenced by the boundstone in the reef core, talus at some of the flanks as well as the disarticulation and poor preservation of the faunas found there.

Section 4

Hebetoechia Community. The *Hebetoechia* Community is a low diversity community characterized by an abundance of *Hebetoechia*, *Schizophoria*, and *Mesodouvillina* with occasional occurrences of

Cyrtina (Fig. 39). Corals, trilobites, crinoids, fish, gastropods, rare pelecypods, orthocone cephalopods, conodonts, scolecodonts, ostracodes, and inarticulate brachiopods are found associated with the brachiopods (see Plate 38, Fig. 1). Notable here is the absence of Howellella, a common constituent of most collections discussed. The fossils occur in a thin, lumpy bedded, argillaceous, silty lime mudstone. This community may have flourished slightly seaward of the position occupied by the bioherm (this paper). However, it represents a relatively quieter water environment, free from effects of waves and tides as evidenced by the large number of articulated valves as well as common to abundant argillaceous material.

Section 5

Section 5 contained too few collections to assign it to a community which would be justified in any sense of the word. It contains some elements of the Hebetoechia Community as well as fish (Fig. 40).

Section 6

Schizophoria-Howellella Community. This community is characterized by an almost total dominance of Schizophoria and Howellella with very rare occurrence of Hebetoechia and Mesodouvillina (Fig. 41). It is a low diversity, high density community characterized by fluctuating percentages of the dominant members. Also present are trilobites, crinoids,

SECTION 5

NUMBER OF TAXA / % OF TOTAL FAUNA — GSC LOCALITY	C-26833	C-26834	C-26835	C-26836	C-26837*	C-26840
Orbiculoidea sp.	26 / 100	3 / 60	1 / 17			
Schizophoria fossula transversiforma n. sp. n. subsp.			2 / 33		67 / 64	
Mesodouvillina musculusvarius n. sp.				1 / 100	16 / 15	
Hebetoechia ornatrix ? Havlíček		2 / 40	3 / 50		6 / 6	
Howellella sp.					1 / 1	1 / 100
Cyrtina sp.					14 / 13	
TOTAL NUMBER OF SPECIMENS	26	5	6	1	104	1

FIG. 40

gastropods, corals, and, in the upper collections, common to very abundant calcareous algal material.

Typical lithology for this community is thin-bedded silty, argillaceous lime mudstone. This community appears to have occupied a shallower, rougher water position than the Hebetoechia Community, as evidenced by the disarticulation of the valves (Plate 38, Fig. 7), common crinoidal, coral and algal material.

Section 7

Mesodouvillina-Ancillotoechia Community. This community is a low diversity high density one (Fig. 42) characterized by the presence of Mesodouvillina-Ancillotoechia, accounting for at least 60% of the total fauna in each sample. The samples collected in this section were all calcareous which may account for the low diversity present, but they lack any of the taxa from section 3, which is one containing Ancillotoechia and Mesodouvillina. Other members of the fauna are rare crinoids, bryozoans, colonial corals, trilobites, ostracodes, gastropods, and pelecypods.

The characteristic lithology is very silty, thin-bedded, argillaceous, carbonaceous, lime mudstone containing argillaceous seams and common dark gray-black laminations.

This community is thought to have occupied a somewhat restricted (euxinic), shallow water environment. The lack of such

SECTION 7

NUMBER OF TAXA / % OF TOTAL FAUNA — GSC LOCALITY	C-26848	C-26849	C-26850	C-26851	C-26852	C-26853
Schizophoria fossula transversiforma n. sp. n. subsp.	11 / 16	155 / 20	18 / 8	40 / 16	3 / 4	
Mesodouvillina musculusvarius n. sp.	37 / 55	88 / 11	120 / 56	205 / 81	3 / 4	4 / 36
Ancillotoechia plicaminor n. sp.	10 / 15	425 / 55	31 / 14	7 / 3	75 / 91	4 / 36
Protathyris sp.	9 / 13	110 / 14	45 / 21		1 / 1	3 / 27
TOTAL NUMBER OF SPECIMENS	67	778	214	252	82	11

FIG. 42

common taxa as Howellella, Atrypa, and Gypidula suggests an abnormal environment. It is believed to have occupied a shallower, more restricted position than the Schizophoria-Howellella environment. The high concentration of argillaceous and carbonaceous matter would have restricted the growth of large numbers of the normal marine faunas, i.e., corals, bryozoans, and crinoids.

Section 8

Plicogypa-Atrypa Community. This community is a moderately diverse one characterized by the presence of the two main constituents in each collection, the two accounting for not less than 30% of the total fauna (Fig. 43). In collections of more than 50 specimens they generally compose more than 60% of the total fauna, but one collection (C-26881) exhibits a far lower percentage. The community is developed in places from GSC locality C-26873 to C-26883 (Fig. 43). Common notable additional members of the fauna are fish, gastropods, and pelecypods. Rare constituents are ostracodes and solitary corals.

Notable here is the absence of crinoids, colonial corals, calcareous algea, or bryozoa which are generally associated with brachiopods of this type (Gypidulids and Atrypids). The community is found in very highly argillaceous silty, thin-bedded, lime mudstone. This community is thought to have thrived in a quiet, possibly protected, water environment as is evidenced by the lack of previously described organisms commonly associated with the normal marine faunas. Most of the brachiopod taxa are the type that did not possess a functional pedicle and presumably lived unattached on the soft muds of the sea bottom.

The collections stratigraphically above the Plicogypa-Atrypa Community are few and far between and do not yield sufficient data to place them in a community with any certainty. However, judging from the taxa present, they seem to have inhabited a shallower water, more normal marine environment than that of the Plicogypa-Atrypa Community.

Section 9

Collections here are few, and preservation is poor. However, the collections show some similarities to the Plicogypa-Atrypa Community.

Section 10

Ancillotoechia-Cyrtina Community. This medium diversity community (Fig. 45) is characterized by the presence of Ancillotoechia and Cyrtina in every collection (C-26913 to C-26921). Together the two make up not less than 40% of the total fauna.

The community occurs in thin-bedded, silty, argillaceous lime mudstone containing argillaceous seams (Plate 38, Fig. 4). Notable here are the variations of Ancillotoechia and Cyrtina of the percentage of total fauna from collection to collection (Fig. 45). Notable other faunal constituents are trilobites, gastropods, pelecypods, Auloporid corals, colonial corals, abundant fish in the upper collections, rare to common crinoids, and orthocone cephalopods.

This community represents a subtidal biotope. The tremendous number of taxa preserved suggest that this community flourished in an environment conducive to life of all kinds. It is thought to occupy a normal shallow marine subtidal environment. The community probably thrived in an environment of quieter water than did the G-A-S Community.

This community is especially interesting from the standpoint of the large number of fossil fish preserved, occurring in the same beds as the trilobites, brachiopods, and other normal marine fauna. The fish are embodied in a large, nearly completed monograph by R. Thorsteinsson.

As the communities previously discussed span a considerable amount of time, it is necessary to separate them into two shorter time spans. The two groups correspond to conodont faunas 1 and 2, and 3 and 4 of Klapper (in Klapper et al., 1971). This is necessary in order to place them in models depicting their relative positions from shore without having large time differences between them. Figure 37 is an attempt to plot early Lochkovian age communities relative to themselves and relative to shoreline. It is necessary to point out here that water depth and energy of environment may not be the only ecological controls of the brachiopod communities discussed in this paper. Further work may establish the importance of other ecological controls.

SYSTEMATIC PALEONTOLOGY

Phylum Brachiopoda

Class Inarticulata

Order Lingulida

Superfamily Lingulacea Menke, 1828

Genus Lingula Bruguiere, 1797

Type Species: Lingula anatina Lamarck 1801

Lingula sp.

Material and Occurrence: Calcareous specimens from GSC locs. C-26810, section 2, C-26829, section 4, C-26855, unnamed units, Prince of Wales Island; C-26965, C-26986, unnamed carbonate units, Baillie Hamilton Island. Early Lochkovian.

Discussion: Lingula was encountered in only five collections and was poorly preserved, not allowing specific assignment. In the five collections it represented less than 1% of the total fauna which attests to its scarcity and poor preservation.

Order Acrotretida

Suborder Acrotretoidea

Superfamily Discinacea Gray, 1840

Subfamily Orbiculoidinae Schuchert and LeVene, 1929

Genus Orbiculoidea d'Orbigny, 1847

Type Species: Orbicula forbesi Davidson, 1848, p. 334

Orbiculoidea sp.

Material and Occurrence: Calcareous specimens from GSC locs. C-26913, C-26917, section 3, C-26829, section 4, C-26833, section 5, C-26846, reef, unnamed units, Prince of Wales Island; C-26949, section 11, C-26986, C-26989, section 12, unnamed carbonate unit, Baillie Hamilton Island.

Discussion: Orbiculoidea sp. was found in few collections and preservation was too poor to allow specific assignment. In most collections it accounted for less than 1% of the total fauna.

Suborder Craniioidea

Superfamily Craniacea Menke, 1828

Family Craniidae Menke, 1828

Genus Crania Retzius, 1871

Type Species: Anomia craniolaris Linne, 1758

Crania sp.

(Plate 1, Figs. 1, 2)

Material and Occurrence: One silicified specimen (GSC 46941), GSC loc. C-26911, unnamed units, section 10, Prince of Wales Island.

Discussion: Only one silicified dorsal valve was encountered, but it is enough to document the occurrence of the genus. The specimen is small, subcircular in outline with an excentric apex. Ornament consists of high, narrow costellae separated by wide, flat interspaces. Strong growth lines are present at right angles to the costae, but do not interrupt them. The interior contains two pairs of slightly raised adductor scars, one pair being kidney shaped and set close together while the other is subcircular to suboval and farther apart than the first two.

This specimen is similar to Crania rowleyi Gurley (Rodriguez and Gutschick, 1967; Plate 41, Figs. 6-9). However, the latter species has more numerous costae and narrower interspaces.

Class Articulata

Order Orthida

Suborder Orthoidea

Superfamily Orthacea Woodward, 1852

Family Skenidiidae Kozlowski, 1929

Genus Skenidioides Schuchert and Cooper, 1931

Type Species: Skenidioides billingsei Schuchert and Cooper, 1931

Skenidioides robertsensis Johnson, Boucot, and Murphy, 1973

(Plate 1, Figs. 23-41)

Skenidioides robertsensis Johnson, Boucot, and Murphy, 1973
Plate 10, Figs. 1-13

Material and Occurrence: Silicified specimens from GSC locs.

C-26806, unnamed unit, Prince of Wales Island; C-33700, C-33701, C-33702, Devon Island Formation, Devon Island. Early Lochkovian.

Diagnosis: Shells small, transverse, of spiriferoid form.

Description: Shells very small, transverse, of spiriferoid form, strongly ventribiconvex in lateral profile. Ventral interarea broad, smooth, triangular, catacline to gently apsacline, crossed by faint growth lines parallel to hinge. Dorsal interarea broad, low, triangular, anacline. Delthyrium open, deltidial angle 20° to 30°. Maximum width at hinge. Cardinal angles obtuse. Ventral fold very weak forming a low, medial arch. Dorsal sulcus shallow. Anterior commissure possesses weak deflection representing fold and sulcus. Ornament consists of strongly rounded, radial costae separated by deep interspaces. Costae increase anteriorly by implantation and bifurcation. Growth lines variable, commonly best developed in anterior regions of both valves.

Hinge teeth small, short, stubby, sub-oval in cross-section. Inner margin of delthyrium connected to U-shaped septalium which rests on a low ridge or buildup of shell material. Pallial trunks developed lateral to medial buildup. Anterior one-third of shell contains crenulations reflecting costae.

Sockets small, sub-oval, gently divergent, floored by shallow socket plates. Socket plate edges join a U-shaped cruralium which rests above the floor of the valve. Cruralium bisected by thin, ridge-like median septum extending two-thirds to three-quarters shell length, increases greatly in height anterior to cruralium. Cardinal process small, oval shaped. Brachiophores extend antero-ventrally and are blade-like distally. Interior crenulated on thin shelled specimens. Small, sub-oval, variably developed adductor impressions developed laterally to cruralium.

Skenidioides sp.
(Plate 1, Figs. 3-22)

Material and Occurrence: Silicified specimens from GSC locs. C-26883, C-26886, section 8, C-26914, C-26915, C-26917, C-26921, section 10, unnamed units, Prince of Wales Island. Late Lochkovian.

Diagnosis: Shells transverse, with auriculation of lateral margins.

Description: Shells very small, transverse, of spiriferoid form, strongly ventribiconvex in lateral profile. Ventral umbo prominent. Ventral interarea high, broad, smooth, triangular, apsacline, crossed by faint growth lines. Dorsal interarea broad, low, triangular, anacline. Maximum width at hinge. Cardinal angles obtuse to acute, pointed. Delthyrium open, deltidial angle 20^{o} to 30^{o}. Ventral interarea increased by auriculation at lateral margins. Ventral fold low, forming medial arch. Dorsal sulcus shallow. Anterior commissure has weak deflection representing fold and sulcus.

Ornament consists of subangular, high, radial costae separated by deep U-shaped interspaces. Costae increase by implantation and bifurcation anteriorly on both valves. Strong growth lines present in anterior two-thirds of shell.

Hinge teeth small, short, stubby, sub-oval in cross-section. Inner margin of delthyrium connected to broad U-shaped septalium resting on low median ridge or buildup of shell material. Pallial trunks developed lateral to median ridge. Peripheral crenulations reflect costae.

Sockets small, sub-oval, gently divergent, floored by shallow socket plates. Socket plate edges join a triangular U-shaped cruralium bisected throughout its length by a thin blade-like median septum. Septum extends two-thirds to three-quarters shell length, increasing in height markedly anterior to cruralium. Cardinal process small, oval shaped. Brachiophores extend anteroventrally and are blade-like distally. Small, sub-oval, variably developed adductor impressions developed lateral to cruralium. Costae reflected on thin shell specimens.

Comparison: Skenidioides sp. differs from S. robertsensis in having a more prominent ventral umbo, greater convexity in saggital section of ventral valve; higher, fewer, more angular costae and possessing auriculation of the ventral valve along its lateral margins. It differs from S. lewisi (Kozlowski, 1929; Plate 1, Figs. 20, 21) in being more transverse and having the ventral margins expanded by auriculation. S. polonicum Gurich (Biernat, 1959; Plate 1, Figs. 1-9) is less transverse, coarsely costate, has a strongly apsacline ventral interarea and a cruralium which is deeper and less triangular in outline, and lacks auriculation of the ventral valve.

Subfamily Isorthinae Schuchert and Cooper, 1931

Genus Isorthis Kozlowski, 1929

Type Species: Dalmanella (Isorthis) szajnochai Kozlowski, 1929 (Plate 2, Figs. 24-41)

Isorthis bistria n. sp.
(Plate 1, Figs. 42-49; Plate 2, Figs. 1-6)

Derivatio nominis: L. bi, two; stria, groove

Material and Occurrence: Holotype (GSC 46953), paratypes (GSC 46954, 46955, 46956, 46957, 46958, 46959, 46960), plus additional material from GSC loc. C-26957, transitional unit, Baillie Hamilton Island. Late Silurian to Early Lochkovian.

Diagnosis: Shells subcircular to slightly transverse in outline with peripheral crenulations of two distinct lengths.

Description: Shells medium sized, subcircular to slightly transverse in outline. Ventribiconvex, ventral valve deep and subcarinate; dorsal moderately to strongly convex, with steeply convex anterior margins, approaching geniculation. Maximum width at midlength.

Ventral umbo prominent, beak gently incurved. Ventral interarea flat, high, broad, triangular, apsacline, beak gently incurved. Delthyrium open, deltidial angle 30° to 40°. Cardinal angles obtuse. Ventral fold weakly developed. Dorsal sulcus very shallow, broad, extending anteriorly from beak. Lateral and anterior margins smoothly curved. Ornament consists of narrow, high, rounded, radial costellae near beak, curved on flanks with U-shaped interspaces of about equal width as costellae. Costae of nearly equal size increase anteriorly by bifurcation particularly in anterior one-third of shell. Rare, strong growth lines developed near anterior margins.

Hinge teeth stubby, triangular in cross-section, supported by thick anteriorly diverging dental lamellae, welded to shell wall producing shallow umbonal impressions. Deeply incised, elongate diductor field extends slightly less than half shell length, bounded by lamellae and parallel, rounded, slightly raised bounding ridges. Diductors separated medially by moderately broad, rounded ridge, variable in height, which generally flattens out before entering umbonal cavity. Becomes wider, flatter anteriorly, extending slightly beyond muscle bounding ridges. Anterior to median ridge, a moderately deep depression shallows anteriorly. Very strong, widely separated peripheral crenulations with weaker, shorter ones between them present on lateral margins.

Sockets deep, triangular, anteriorly divergent, floored by fulcral pads. Anteriorly divergent brachiophores diverge at about 60°. Cardinal process oval. Large muscle field oval to suboval in outline and extends half valve length. Bounded by well defined, narrow, rounded lateral ridges. Suboval, pointed posterior adductors separated from anteriors by very faint transverse ridge at 90° to bounding ridges. Muscle field bisected by long, narrow medial ridge extending slightly anterior to muscle bounding ridges. Very strong, widely separated peripheral crenulations with weaker, shorter ones between them present on lateral margins.

Comparison: Walmsley and Boucot (1975) recognize five subgenera of *Isorthis*. One of the criteria used to distinguish *Isorthis* from *Protocortezorthis* is the width of the medium ridge dividing the ventral diductor field. However, the specimens the writer possesses exhibit a wide range in the width of the ridge and therefore, he finds the character unsuitable. Rather, the dorsal muscle field seems to be more useful because in *Isorthis* it is oval elongate and nearly continuous, whereas in *Protocortezorthis*, is it slightly rhomboidal to subrectangular. The dorsal muscle field is bisected by a generally higher, narrower ridge in *Isorthis* than in *Protocortezorthis*. The classification set up by Walmsley and Boucot (1975) does not account for wide variations seen in the shells discussed and will therefore not be followed in this paper. *Isorthis bistria* n. sp. (this paper) differs from _I. festiva_ Philip, 1962 (Savage, 1971; Plate 69, Figs. 33-48) in being more circular in outline, more biconvex, and having a much less pronounced dorsal sulcus as well as lacking the distinctive peripheral radial crenulations. _I. orbicularis_ figured by Walmsley (1965, Plate. 63, Figs. 1-15; Plate 64, Figs. 1-14; Plate 65, Figs. 30-31) is similar in outline, but has a deeper dorsal sulcus, a less convex dorsal valve, a subcircular muscle field and lacks the distinctive radial crenulations.

Genus _Tyersella_ Philip

Type Species: _Tyersella typica_ Philip, 1962
(Plate 30, Figs. 12-19; Fig. 10)

Tyersella sp.
(Plate 6, Figs. 13-24)

Material and Occurrence: Silicified specimens from GSC loc. C-26939, unnamed carbonate unit, Baillie Hamilton Island. Early Lochkovian.

Diagnosis: Strongly ventribiconvex _Tyersella_ with well defined ventral diductor scars divided by a well developed median ridge.

Description: Shells small to medium sized, suboval to slightly elongate in outline, ventribiconvex in lateral profile. Ventral inter-area moderately high and broad, curved, triangular, apsacline. Ventral umbo slightly raised. Delthyrium open, delthyrial angle 30°

to 40°. Beak slightly incurved. Dorsal interarea poorly developed, moderately low, broad, flat, triangular to band-like, anacline. Cardinal angles broadly rounded, obtuse. Dorsal valve bears a very faint, shallow sulcus beginning near beak and widening anteriorly. Commissure exhibits a weak deflection resulting from shallow sulcus. Ornament consists of numerous, very fine, rounded costellae which increase anteriorly by bifurcation and implantation. Larger specimens exhibit parvicostellation accentuated in midregions anteriorly. Costellae on posterolateral flanks strongly curved due to short interarea. Some specimens exhibit few, poorly developed, concentric growth lines.

Hinge teeth short, blunt, triangular in cross-section, supported by thick, divergent dental lamellae fused to shell wall. Crural fossettes present on anteromedial surfaces. Dental lamellae continuous with long, straight muscle-bounding ridges. Ridges vary from straight, subparallel to gently curved producing a bilobate outline. Muscle field bisected by well developed, flat-topped to rounded ridge which increases in height anteriorly, then flattens out. Ridge may or may not extend beyond muscle bounding ridges. Apex is filled with small plug of shell material forming pedicle callist. Adductor scars visible on most specimens, situated medially inside diductor scars and are lyre shaped, bisected by median ridge much reduced in height from anterior regions. Diductor scars elongate, suboval, bilobed in some specimens and bisected by higher portion of median ridge. Muscle scars extend half length of shell. Peripheral radial septa present on lateral margins.

Sockets fairly deep, cylindrical, widely divergent, not floored by socket plates, but impressed in shell material, bounded medially by brachiophore bases. Bases continuous with thick, well developed, widely divergent brachiophores. Posterior ends of brachiophores close together, leaving small, cramped notothyrial cavity. Cardinal process small, blade-like, resting on buildup of shell material. Adductor scars subquadrate in outline. Posterior set small, triangular due to brachiophore bases, anterior set suboval, separated from posterior set by moderately to well developed ridge at about 90° to muscle bounding ridge. Entire adductor field bisected by well developed subrounded median ridge extending slightly beyond anterior edge of muscle field. In posterior regions it joins with buildup of shell material upon which rests the cardinal process. Peripheral radial septa present on lateral margins.

Comparison: This species differs from _T. jubar_ (Johnson, Boucot, and Murphy, 1973, Plate 15, Figs. 1-23; Plate 16, Figs. 1-15) in being more elongate in outline, in having a larger, more developed ventral muscle field and a less convex dorsal valve. This species differs from _T. typica_ (Philip, 1962, Plate 30, Figs. 12-19) in being smaller, more transverse and possessing a less deeply impressed dorsal muscle field. This species is probably new, and although it is tempting to propose a new name, it seems appropriate to await further, more abundant collections which will illustrate intraspecific variation.

Suborder Dalmanelloidea

Superfamily Dalmanellacea Schuchert, 1913

Family Dalmanellidae Schuchert, 1913

Subfamily Cortezorthinae Johnson and Talent, 1967b

Genus *Protocortezorthis* Johnson and Talent, 1967b

Type Species: *Orthis fornicatimcurvata* Fuchs, 1919
(p. 58, Plate 5, Figs. 1-6)

Protocortezorthis quadriforma n. sp.
(Plate 2, Figs. 7-36)

Derivatio nominis: L; *quattuor*, four; *forma*, shape

Material and Occurrence: Holotype (GSC 49677), paratypes (GSC 46978, 46979, 46980, 46981), GSC loc. C-26913, plus additional silicified material from GSC locs. C-26912, C-26913, C-26914, C-26915, C-26917, C-26918, C-26919, C-26920, C-26921, unnamed units, section 10, Prince of Wales Island. Early-Late ? Lochkovian.

Diagnosis: Subquadrate, ventribiconvex *Protocortezorthis* with broadly oval to subquadrate dorsal muscle field bisected by broad ridge.

Description: Shells medium to large sized, subquadrate in outline, moderately to strongly ventribiconvex in lateral profile. Ventral valve strongly convex. Dorsal valve weakly to moderately convex. Ventral umbo prominent. Ventral and dorsal beaks slightly incurved. Ventral interarea flat, high, moderately broad, triangular, apsacline. Dorsal interarea flat, low, broad, triangular, anacline. Delthyrium open, delthyrial angle 30° to 40°. Cardinal angles obtuse. Ventral fold weak. Dorsal sulcus broad, shallow, extending from beak throughout shell length. Anterior commissure weakly deflected. Ornament consists of radial costellae near beak, curved on lateral margin, increasing posteriorly by bifurcation. Rare, strong, anterior growth lines present. Costellae appear bundled, secondaries separated by stronger primaries, becoming faint in postero-lateral margins.

Hinge teeth stout, subtriangular in cross-section, with crural fossettes on anteromedial surfaces; supported by thick, short, diverging dental lamellae extending one-quarter to one-fifth shell length, fused to shell wall producing shallow umbonal cavities. Muscle field extends nearly half shell length. Deeply incised, elongate diductor muscle scars bounded by dental lamellae and low, narrow, parallel, laterally directed muscle bounding ridges. Diductors separated medially by adductor ridge of varying height and width. Ridge enters umbonal cavity and flattens out. It flattens anteriorly and may bifurcate. Anterior of ridge a deep depression shallows anteriorly. Peripheral crenulations of equal length present on lateral margins of shell. Radial striae reflecting costae present throughout valve.

Sockets triangular, anteriorly divergent, deep, floored by fulcral plates or pads. Anteriorly directed brachiophores diverge at about 60°. Fibrous cardinal process oval shaped. Large muscle field suboval to subquadrate in outline extending approximately half shell length. Bounded by moderately to well defined lateral ridges. Suboval, pointed posterior adductors separated from anteriors by faint ridges at 90° to lateral bounding ridges. Muscle field bisected by broad, rounded medial ridge, variable in height, extending slightly anterior of muscle field. Peripheral crenulations of equal length present on lateral margins of shell.

Comparison: The median ridge dividing the ventral muscle field is of variable height and thickness. It ranges from relatively narrow (low or high) to very wide (low to moderate). The ridge dividing the dorsal muscle field is always broad and rounded, varying from low to moderate height. This species is similar to I. (Protocortezorthis) slitensis (Walmsley and Boucot, 1975, Plate 3, Figs. 9-11) but is more quadrate in outline and has a much broader ventral median ridge dividing the muscles which does not extend far into the umbonal cavity. It is also similar to I. (Protocortezorthis) festiva Philip, 1962 (Walmsley and Boucot, 1975, p. 69) but the latter is subcircular in outline and possesses a shallower sulcus.

Protocortezorthis carinatus n. sp.
(Plate 3, Figs. 1-32)

Protocortezorthis aff. P. fornicatimcurvata Lenz, 1973
(Plate 1, Figs. 7-9)

Protocortezorthis cf. P. fornicatimcurvata Johnson, 1975a
(Plate 1, Figs. 5-9, 12-15)

Derivatio nominis: L; carina, keel.

Material and Occurrence: Holotype (GSC 46990), paratypes (GSC 46982, 46983, 46984, 46985, 46986, 46987, 46988, 46989, 46991, 46992, 46993, from GSC loc. C-26883, plus additional material from GSC locs. C-26873, C-26874, C-26881, C-26888, C-26890, C-26892, C-26905, C-26906, C-26907, C-26908, unnamed units, sections 8 and 9, Prince of Wales Island; C-11467, unnamed unit, Cornwallis Island; C-33666, unnamed unit, Devon Island. Late Lochkovian, Quadrithyris Zone.

Diagnosis: Shells small, subquadrate in outline with subcarinate to carinate ventral valve and moderate to deep dorsal sulcus.

Description: Shells small to medium sized, quadrate in outline, ventribiconvex in lateral profile. Ventral valve subcarinate to carinate from umbo to anterior margin. Dorsal valve gently to moderately convex, but never more than half height of ventral valve.

Maximum width at mid length, hinge straight, wide. Ventral umbo prominent, both beaks gently incurved. Ventral interarea flat, low, moderately broad, triangular, apsacline. Dorsal interarea flat, very low, moderately broad, triangular, anacline. Delthyrium open, deltidial angle 30° to 40°. Cardinal angles obtuse. Ventral fold strong, subcarinate to anterior margin. Dorsal sulcus moderately to strongly developed, beginning directly anterior to umbo, flaring anteriorly. Lateral and anterior margins smoothly curved. Anterior commissure moderately to sharply deflected in the form of a U. Ornament consists of angular, radial costellae near beak, curved on lateral margins increasing anteriorly by bifurcation. Costellae broad, triangular in cross-section, separated from each other by broad V-shaped interspaces of equal width as costellae. Costellae of two sizes, larger primaries separated by smaller, less angular secondaries formed by bifurcation.

Hinge teeth short, stubby, triangular in cross-section supported by short, thick dental lamellae fused to shell wall producing faint umbonal depressions. Faint crural fossettes on anteromedial surfaces. Deeply incised, elongate, diductor muscle scars extend about half shell length, bounded by dental lamellae and parallel, narrow, rounded, moderately high bounding ridges. Diductors separated by moderately narrow, rounded median ridge which tapers anteriorly and disappears slightly anterior to muscle field. Faint suboval adductor impressions bisected by median ridge between posterior portion of diductor field. Radial striations reflecting costellae present throughout anterior of valve. Very short, peripheral crenulations, of equal length visible on anterior margin.

Sockets deep, triangular, anteriorly divergent, floored by fulcral pads, brachiophores diverge anteriorly at about 60°; lamellose, variably sized cardinal process suboval to bulbous. In some specimens it fills notothyrial cavity, in others it does not. Large suboval muscle field extends half shell length, bounded by moderately to well defined ridges. Suboval, pointed posterior adductors separated from suboval anteriors by faint, transverse ridge at 90° to bounding ridges. Muscle field bisected by broad, low, rounded, median septum extending slightly anterior to muscle field, in some specimens, swelling posteriorly to form crude notothyrial platform. Peripheral crenulations present on lateral margins of shell. Radial striations present throughout, reflecting costellae.

Comparison: This species differs from P. fornicatimcurvata (Johnson and Talent, 1967b, Plate 21, Figs. 14-22) in that it possesses straighter, less curved dental lamellae, has a wider, shorter median ridge dividing the ventral muscle field and has a more carinate ventral valve. It is similar to P. orbicularis (J. de C. Sowerby, 1839), in Walmsley (1965, Plate 63, Figs. 1-15, Plate 64, Figs. 1-14, Plate 65, Figs. 30, 31) but is more transverse in outline and has a more oval dorsal muscle field as well as a more carinate ventral valve. It differs from *P. quadriforma* n. sp. (this paper) in having a more carinate ventral valve, deeper dorsal sulcus, and broader, more angular costellae.

Genus *Cortezorthis* Johnson and Talent, 1967

Type Species: *Cortezorthis maclareni* Johnson and Talent, 1967b, (Plate 19, Figs. 1-20)

Cortezorthis sp.

(Plate 3, Figs. 33, 34, 38, 39)

Material and Occurrence: One calcareous specimen from GSC loc. C-26903, unnamed unit, section 9, Prince of Wales Island. Late Lochkovian, *Quadrithyris* Zone.

Discussion: Only one articulated specimen was found and the posterior portion of the dorsal valve is damaged, making specific assignment impossible. However, preservation is sufficient to show the diagnostic features of *Cortezorthis*. The specimen is medium sized, slightly transverse to subpentagonal in outline and ventribiconvex in lateral profile. The ventral valve is subcarinate and the dorsal valve moderately convex. The ventral muscle field is bisected by a long, narrow median ridge. The dorsal muscle field is subquadrate in outline and bisected by a long, narrow, triangular median septum which increases in height anteriorly and extends to the anterior commissure. The ventral fold and dorsal sulcus are poorly developed, and represented by a low, broad deflection in the anterior commissure. Peripheral radial septa are present in both valves and are most prominent in anteromedial areas.

This species can readily be distinguished from other, younger species from the Canadian Arctic (Johnson and Talent, 1967b). C. maclareni has a much deeper dorsal sulcus and more carinate ventral fold. C. bathurstensis lacks peripheral radial septa. It is very similar to if not actually C. norfordi n. sp. (Lenz, in prep.) from the Road River Formation, N.W.T. D.G. Perry (1974) reports the same species from the Delorme Formation, Mount Sekwi area, N.W.T. The range of this species is upper Lochkovian to lower Pragian, which agrees well with C. sp. (this paper). Cortezorthis sp. seems to be a morphological intermediate between C. windmillensis Johnson and Talent and C. maclareni.

Family Rhipidomellidae Schuchert, 1913

Subfamily Rhipidomellinae Schuchert, 1913

Genus Dalejina Havlíček, 1953

Type Species: Dalejina hanusi Havlíček, 1953
(Plate 1, Figs. 10, 12-14)

Delejina devonensis n. sp.
(Plate 3, Figs. 35-37, 40-50)

Derivatio nominis: After Devon Island, the type locality.

Material and Occurrence: Holotype (GSC 46996) paratypes (GSC 46995, 46997, 46998) GSC loc. C-33702, plus additional material from GSC locs. C-33695, C-33700, C-33701, Devon Island Formation, Devon Island. Early Lochkovian.

Diagnosis: Shells, subcircular to slightly transverse in outline, faint ventral diductor bisecting ridge, well developed dorsal muscle field.

Description: Shells small, subcircular to slightly transverse in outline, ventribiconvex in lateral profile. Ventral interarea curved, low, narrow, triangular, apsacline. Delthyrium open, deltidial angle approximately 60°, beak slightly incurved. Dorsal interarea narrow, low, orthocline. Hinge line short. Ventral valve slightly carinate posteriorly, dorsal valve convex and indented slightly at midline. Cardinal angles rounded, obtuse. Ventral valve flattens anteriorly, dorsal valve evenly rounded, producing a smooth curve in lateral profile. Maximum width at midlength. Anterior commissure rectimarginate. Subrounded, radial costellae increase in number by bifurcation and implanatation anteriorly. Costellae on posterolateral flanks arcuate and concave posteriorly. Ventral valve has pair of costellae at midline and dorsal valve has only one. Few, variably developed growth lines present in anterior regions.

Hinge teeth short, triangular in cross-section, supported by short, plate-like dental lamellae fused to shell wall. Crural fossettes present on anteromedial surfaces. Diductor impressions bilobed, indistinct, not bounded by bounding ridges, separated by very faint, short ridge. Adductors not impressed, Long peripheral, radial crenulations on lateral margins, best developed anteriorly, consisting of flat-topped ridges bearing faint radial grooves separated by narrow grooves.

Sockets moderately deep, divergent, supported by fulcral pads, not plates. Brachiophores short, thick, divergent. Bases curved, forming inner socket ridges. Cardinal process suboval to rhomboidal, with a short shaft, stubby, set in narrow notothyrial cavity. Adductor scars faint, quadripartite, bisected by rounded median ridge highest near posterior adductors forming crude notothyrial platform and flattening anteriorly in region of anterior adductors. In larger specimens, ridge has expanded to make shaft obsolete. Posterior adductors narrow, pinched due to brachiophore bases, anterior adductors faint and fade into dorsal interior. Long, peripheral radial septa present on lateral margins.

Comparison: This species differs from D. subfrequens (Johnson, Boucot and Murphy, 1973, Plate 13, Figs. 1-24) in the absence of the long, well defined median ridge bisecting the ventral diductors. It differs from D. frequens (Kozlowski, 1929, Plate 3, Figs. 4-22) in being more circular in outline and possessing a more inflated ventral valve as well as a shorter hinge. It is somewhat similar to D. sp. A of Johnson (1970, 1973).

Superfamily Enteletacea Waagen

Family Schizophoriidae Schuchert and LeVene

Subfamily Schizophoriinae Schuchert and LeVene

Genus Schizophoria King

Type Species: Conchyliothus (Anomites) resupinatus Martin, 1809
(Plate 49, Figs. 13, 14)

Remarks: The various species of Schizophoria are a very difficult group to work with due to their plasticity of form. Variations within collections are extreme and only large collections are useful in delineating the range of variation within a fossil population. Previous workers (e.g. Kozlowski, 1929; and many others) have illustrated very few specimens when dealing with a particular species, a fact which hinders knowledge as to the variation of morphological characters present. An attempt has been made to distinguish different species from the available collections utilizing such parameters as shell shape, size, and presence or absence of a fold and sulcus. These determinations may prove to be invalid with further work as the various forms are probably controlled by environmental parameters which may vary from place to place. Thin-shelled forms are found in quieter environments and thicker-shelled ones in rougher water ones. These variations may produce forms which are utilizable for correlation in a very restricted area. Perry (1974) has discussed this problem in dealing with *Schizophoria* spp. from the Delorme Formation, N.W.T., in which he finds plasticity among the various species he recognizes.

Schizophoria fossula fossula n. sp., n. subsp.
(Plate 4, Figs. 29-39, Plate 5, Figs. 1-17, Plate 6, Figs. 8-12)

Derivatio nominis: L.; *fossula*, small trench.

Material and Occurrence: Holotype (GSC 47020), paratypes (GSC 47021, 47022, 47023, 27024), GSC loc. C-26942, plus additional material from GSC locs. C-26939, C-26940, C-26942, C-26943, C-26945, C-26948, C-26949, C-26950, C-26951, C-26952, section 11; unnamed carbonate unit, C-26973, C-26974, C-26979, C-26982, C-26984, C-26985, C-26986, C-26987, C-26988, C-26989, C-26990, C-26991, section 12; unnamed carbonate unit, Baillie Hamilton Island. Early Lochkovian.

Diagnosis: Shells, subpentagonal in outline, possessing a fold and sulcus in large specimens, with very strongly inflated ventral umbo, very high ventral interarea and narrow delthyrium.

Description: Shells medium sized, subpentagonal in outline, ventribiconvex in lateral profile in immature forms, dorsibiconvex in adults. Ventral umbo very prominent, inflated, beak pointed, incurved. Dorsal umbo prominent, not as inflated as ventral. Ventral palintrope short, curved in form of an inverted V. Ventral interarea curved, very high, triangular, short, apsacline. Dorsal palintrope moderately high, broad, rounded. Dorsal interarea well developed, curved, high, moderately broad, triangular, anacline. Cardinal angles strongly rounded, obtuse. High, narrow, triangular delthyrium open; deltidial angle approximately 20° to 25°. Hinge line straight, slightly more than half shell width. Maximum width slightly anterior of midlength. Ventral fold best developed on mature specimens, shallow, broad, beginning in anterior one-third of valve. In some specimens developed into a tongue. Dorsal fold generally poorly developed in anterior third of shell, occasionally well developed. Commissure smooth on flanks, deflected dorsally in fairly broad, rectangular shape. Ornament consists of very fine, rounded, radial, hollow costellae separated by narrow interspaces, increasing anteriorly by bifurcation and implantation. Costellae more noticeable in regions of fold and sulcus. Interior of valve exhibits striations reflecting costellae. Variably developed concentric growth lines visible on anterior regions.

Hinge teeth short, stubby, triangular in cross-section, supported by very widely diverging plate-like dental lamellae. Crural fossettes present on anteromedial surfaces. Moderately to well defined muscle bounding ridges continue from lamellae and recurve to midline anteriorly. Diductor impressions well defined, suboval, elonate, wide, divided medially by an extremely variable ridge. Ridge varies from faint to well developed, thin to moderately broad, generally ends at anterior of muscle field, may or may not increase in height anteriorly, then taper off. Inner surface exhibits fine striations reflecting costellae.

Sockets shallow, slightly divergent, posteriorly covered by interarea on large specimens, floored by thin, curved fulcral plates joining brachiophore supports. Brachiophores stubby, prism-like, extending anteroventrally, supported by high, thin, plate-like, widely diverging brachiophore supporting plates continuing anteriorly to form thin, rather high, muscle bounding ridges. Cardinal process trilobate, anterior lobe directed ventrally, main lobe rhomboidal in outline, flanked by two lateral strut-like lobes. Cardinal process rests on thin shaft which may or may not merge with very faint to almost imperceptible rounded ridge bisecting adductors. Ridge does not extend beyond muscle bounding ridges. Muscle field undifferentiated, in large, well preserved specimens, adductors recurve forming bilobate field. Inner surface exhibits faint striations reflecting costellae.

Comparison: This subspecies differs from _S. fossula transversiforma_ n. sp., n. subsp. (this paper) in being much less transverse in outline, more pentagonal, in having a more inflated ventral umbo, a higher, narrower delthyrium and a wider, more oval ventral muscle field. It differs from _S. protonevadaensis_ n. sp. (this paper) in being smaller, far less transverse, less biconvex, and having a much more inflated ventral umbo and narrow delthyrium.

Schizophoria fossula transversiforma n. sp., n. subsp.
(Plate 4, Figs. 1-28)

Derivatio nominis: L.; *fossula*, small trench; *transversus*, transverse; *forma*, form.

Material and Occurrence: Holotype (GSC 47002), paratypes (GSC 47001, 47003, 47004, 47005, 47006, 47007, 47008, 47009, 47010, 47011, 47012), GSC loc. C-26831, plus additional material from GSC locs. C-26811, C-26812, C-26813, C-26814, C-26817, section 3; C-26823, C-26825, C-26829, C-26830, C-26831, C-26832, section 4; C-26837, section 5; C-26841. Reef; C-26858, C-26859, C-26860, C-26861, C-26863, C-26865, C-26866, C-26869, section 6; C-26848, C-26849, C-26850, C-26851, C-26852, section 7; unnamed units, Prince of Wales Island. Early Lochkovian.

Diagnosis: *Schizophoria*, with slightly transverse outline, low, wide, open delthyrium. Ventral sulcus and dorsal fold present.

Description: Shells medium sized, slightly transverse to subpentagonal in outline, ventribiconvex in immature forms, dorsibiconvex in adults. Ventral umbo moderately prominent, beak pointed, incurved. Dorsal umbo moderately prominent, beak pointed, slightly incurved. Ventral palintrope broad, curved in form of inverted V.

Ventral interarea curved, moderately high, triangular, moderately broad, apsacline. Dorsal palintrope low, broad, rounded. Dorsal interarea well developed, curved, low, broad, triangular, anacline. Cardinal angles obtuse, rounded. Delthyrium open, deltidial angle approximately 40°. Hinge fairly wide, straight. Maximum width anterior to midlength. Ventral sulcus best developed on mature specimens. Shallow, broad, beginning in anterior third of shell. Dorsal fold weakly developed, broad, low, best seen in anterior regions. Commissure smooth on flanks, deflected dorsally in broad, rectangular form. Ornament consists of very fine, rounded, hollow, radial costellae separated by fairly deep rounded interspaces, increasing anteriorly by bifurcation and implantation. Costellae more noticeable on large specimens in regions of fold and sulcus. Inner surface of both valves exhibits radial striations reflecting costellae. Variably developed, concentric growth lines visible in anterior regions.

Hinge teeth short, stubby, triangular in cross-section, supported by long, widely divergent to subparallel plate-like dental lamellae. Crural fossettes on anteromedial surfaces. Moderately to well defined muscle-bounding ridges continue anteriorly from lamellae and may or may not recurve to midline anteriorly. Diductor impressions well defined, elongate, suboval, divided medially by an extremely variable ridge serving as adductor track. Ridge varies from very faint to well developed, thin to broad, may or may not extend anterior of muscle field, may or may not increase in height anteriorly, then taper off abruptly, may or may not bifurcate anteriorly. Inner surface exhibits fine striations reflecting costellae.

Sockets shallow, divergent, posteriorly covered by interarea on large specimens, floored by thin, curved fulcral plates joining brachiophore supports. Brachiophores stubby and prism-like, extend anteroventrally. Brachiophore supporting plates continue anteriorly to form thin, high, muscle bounding ridges. Cardinal process trilobate on well preserved specimens. Anterior lobe directed ventrally. Main lobe rhomboidal in outline, flanked by two lateral strut-like lobes. Cardinal process rests on thin shaft which may or may not merge with faint, rounded ridge or myophragm bisecting adductors. Myophragm imperceptible to moderately well developed, not extending beyond muscle bounding ridges. Muscle field undifferentiated, in large, well preserved specimens, adductors recurve forming bilobate anterior field. Inner surface exhibits faint striations reflecting costellae.

Comparison: Due to the plasticity of form exhibited by this species, it is necessary to have large collections representing nearly all growth stages before any meaningful concepts can be formulated. Mature specimens of this species possess a distinct fold and sulcus whereas immature forms do not; therefore, it is very difficult if not impossible to assign a specific name to a collection containing only immature forms. The deeper, quieter water forms tend to be smaller with large individuals rare whereas shallower water assemblages contain a full range of sizes allowing a realistic look at intraspecific variation.

This species differs from S. fragilis (Kozlowski, 1929, Plate 3, Figs. 1, 2) in that the ventral muscle dividing ridge is more variable and the outline of the shells is much less transverse. However, Kozlowski illustrated only two specimens which allows no information as to the variability inherent in S. fragilis. This species differs from S. paraprima (Johnson, Boucot, and Murphy, 1973, Plate 10, Figs. 19-34, Plate 11, Figs. 1-11) in being more transverse and in having a much broader ventral muscle-bisecting ridge as well as a distinct fold and sulcus. It differs from S. parafragilis Johnson (1970, Plate 8, Figs. 1-12) in having more widely divergent brachiophore supporting plates and an undifferentiated dorsal muscle field. It differs from S. fossula fossula n. sp., n. subsp. (this paper) in being more transverse, in having a less inflated ventral umbo, a lower ventral interarea and a wider delthyrium. It differs from S. protonevadaensis n. sp. (this paper) in being far less transverse, smaller, and less convex.

Schizophoria protonevadaensis n. sp.

(Plate 5, Figs. 5-18; Plate 6, Figs. 1-7)

Derivatio nominis: Gr.; proteros, earlier.

Material and Occurrence: Holotype (GSC 47038), paratypes (GSC 47039, 47040), GSC loc. C-26881, plus additional material from GSC locs. C-26913, C-26914, C-26915, C-26919, section 10, C-26873, C-26881, section 8, unnamed units, Prince of Wales Island. Early ? to Late Lochkovian.

Diagnosis: Shells transverse to subquadrate in outline, strongly dorsibiconvex in lateral profile, ventral valve moderately convex.

Description: Shells medium sized, strongly to moderately transverse to subquadrate in outline, subequally to dorsibiconvex in mature specimens, ventribiconvex in immature specimens. Cardinal angles strongly rounded, obtuse. Maximum width at midlength, hinge straight, three-quarters of shell width. Ventral umbo prominent, beak pointed, slightly incurved. Dorsal umbo slightly flattened, beak pointed, slightly incurved. Ventral palintrope moderately broad, curved, fairly low. Ventral interarea curved, moderately broad, low, triangular, apsacline. Dorsal interarea broad, slightly curved, low, triangular, anacline. Fold and sulcus poorly developed, generally low and broad, best seen as shallow deflection in commissure. Ornament consists of rounded, radial, hollow costellae increasing anteriorly by bifurcation and implantation. Rare, well developed, concentric growth lines present on anterior margins.

Hinge teeth small, stubby, triangular in cross-section, supported by well developed blade-like dental lamellae. Shallow crural fossettes on anteromedial surfaces. Moderately to well developed subparallel muscle bounding ridges continue from lamellae and may or may not recurve slightly to midline. Diductors moderately well defined, elongate, bilobate. Field separated by rounded ridge of variable height, may or may not extend beyond muscle field, may or may not increase in height anteriorly, then taper off, may or may not bifurcate anteriorly. Internal surface exhibits fine striations reflecting costellae.

Sockets moderately deep, divergent, covered posteriorly in large specimens by interarea, floored by thin, curved fulcral plates. Brachiophores thin, prism-like, directed anteroventrally. Thin, divergent, blade-like brachiophore supporting plates continue anteriorly becoming muscle bounding ridges. Cardinal process trilobate, main lobe rhomboidal, projects ventrally, flanked by two strut-like lobes. Cardinal process rests on thin shaft which may or may not continue to form low ridge bisecting adductor field. Process nearly fills posterior portion of notothyrial cavity. Muscle field undifferentiated, bisected by an almost imperceptible to moderately well developed rounded ridge or myophragm generally extending beyond muscle bounding ridges. On well preserved specimens anterior adductors well defined and lobate. Interior of shell exhibits fine striations reflecting costellae.

Comparison: This species differs from S. fragilis Kozlowski in being more transverse in outline and having a dorsal ridge separating the muscle field. It differs from S. parafragilis Johnson in having an undifferentiated dorsal muscle field as well as being larger. It bears some resemblance to Schizophoria sp. (Lenz, 1973, Plate 1, Figs. 1-4). It differs from S. fossula n. sp. (this paper) in being far more transverse, larger, having a less well developed fold and sulcus and much reduced interareas. It differs from S. nevadaensis Merriam (Johnson, 1970, Plate 9, Figs. 1-18) in possessing a more inflated ventral valve and ventral umbo as well as less widely divergent brachiophore supporting plates.

Subfamily Drabovinae Havlíček

Genus Salopina Boucot, 1960

Type Species: Orthis lunata Sowerby, 1839, p. 611

Salopina submurifer Johnson, Boucot, and Murphy, 1973 (Plate 6, Figs. 25-49)

Salopina? sp. Boucot et al., 1960 (Plate 1, Figs. 1-5)

Salopina cf. S. crassaformis Johnson and Talent, 1967a (Plate 9, Figs. 15-27)

Salopina submurifer Johnson, Boucot, and Murphy, 1973 (Plate 11, Figs. 15-23; Plate 12, Figs. 1-19)

Salopina submurifer Johnson, 1973 (Plate 1, Figs. 5-11)

Material and Occurrence: Silicified specimens from GSC locs. C-26806, unnamed unit, C-26911, C-26915, unnamed unit, section 10, Prince of Wales Island; C-26939, unnamed carbonate unit, Baillie Hamilton Island; C-33700, C-33701, C-33702, C-33704, Devon Island Formation, Devon Island. Early Lochkovian.

Diagnosis: Salopina with elongate, suboval, dorsal adductor impressions bounded by subparallel ridges and bisected by long, subrounded median ridge.

Description: Shells very small, subquadrate to slightly transverse in outline, strongly ventribiconvex in lateral profile. Ventral palintrope long, curved; beak short, pointed. Ventral interarea curved, moderately low, fairly broad, triangular, apsacline. Dorsal interarea flat, low, triangular, anacline; dorsal beak slightly incurved. Delthyrium open, delthyrial angle 30° to 40°. Cardinal angles rounded, obtuse. Maximum width at midlength or slightly posterior to it. Ventral valve strongly arched in transverse profile, subcarinate. Dorsal valve weakly to moderately convex. Ventral fold low, broad; dorsal sulcus shallow, widening anteriorly. Commissure smooth on flanks with broad, moderately developed deflections in anterior regions. Ornament consists of numerous, well defined, subrounded costellae increasing anteriorly by bifurcation and implantation. Rare, variably developed, concentric growth lines developed in anterior regions.

Hinge teeth short, subtriangular in cross-section, supported by short, plate-like dental lamellae, widely divergent, enclosing muscle field. Apical muscle field short with undifferentiated adductors and diductors, no bisecting ridge present. Anterior margin of muscle field marked by moderately to well developed ridge joined to anterior edges of dental lamellae. Strong, peripheral crenulations present with subrounded ridges and deep U-shaped grooves.

Sockets small, subtriangular to suboval in outline, separated by U-shaped fulcral plates or rarely pads partially covered in posterior regions by interarea. Stout, prism-like brachiophores directed ventrally and slightly anteriorly, tapering to fine points. Brachiophores supported by gently divergent plates extending to floor of valve. Cardinal process rhomboidal to suboval in outline, nearly filling notothyrial cavity. Anterior ends of brachiophore supporting plates either connect with long, subparallel muscle bounding ridges outlining dorsal adductor field or lie slightly within them. Adductors undivided. Muscle field bisected by long, subrounded median ridge that extends anterior of muscle field and in some specimens to anterior margin. Ridge is variable in height and width. Peripheral radial crenulations present.

Comparison: This species differs from the closely allied Muriferella Johnson and Talent (1967a) in having a dorsal muscle bisecting ridge instead of a low blade-like median septum. It is similar to

S. crassiformis Kozlowski (1929), but is more quadrate in outline and has a less convex dorsal valve as well as a slightly different dorsal muscle field. However, only one dorsal interior was illustrated and the difference might be intraspecific variation.

Order Pentamerida

Suborder Syntrophioidea

Superfamily Camerellacea Hall and Clarke

Family Camerellidae Hall and Clarke

Genus *Anastrophia* Hall, 1867

Subgenus *Grayina* Boucot, 1975

Type Species: *Anastrophia magnifica* Kozlowski, 1929
(Text Fig. 42, Plate 4, Figs. 14-16)

Grayina magnifica (Kozlowski)
(Plate 7, Figs. 1, 2)

Synonomy: See Johnson, Boucot, and Murphy (1973).

Material and Occurrence: Poorly preserved calcareous specimens from GSC locs. C-26841, C-26845, Reef, Prince of Wales Island. Early Lochkovian.

Discussion: The material from Prince of Wales Island is not well preserved nor abundant. However, the available specimens serve to document the occurrence of the subgenus. The shells are transversely suboval to slightly shield shaped in outline, and moderately to strongly dorsibiconvex. The dorsal umbo is inflated and the ventral somewhat flattened. The hinge is straight and about two-thirds of shell width. Maximum width is at midlength. The ventral sulcus is fairly broad and shallow, extending approximately two-thirds of shell length, then developed into a tongue. The dorsal fold is also low and somewhat broad. The specimens collected exhibit an asymmetrical fold and sulcus. The shells possess moderately strong, subangular costae, separated by deep U-shaped interspaces. Some bifurcating or branching of costae occurs in the region of the fold and sulcus. In the ventral valve, a V-shaped spondylium is supported by a low median septum that extends anteriorly from the spondylium. In the dorsal valve, there is a pair of long, subparallel, outer plates extending approximately one-third of the length of the valve.

Suborder Pentameroidea

Superfamily Pentameracea M'Coy

Family Gypidulidae Schuchert and LeVene

Subfamily Gypidulinae Schuchert and LeVene

Genus *Gypidula* Hall

Type Species: *G. typicalis* Amsden, 1953, p. 140

Gypidula pelagica (Barrande)
(Plate 7, Figs. 26-32)

Synonomy: See Johnson, Boucot, and Murphy (1973).

Material and Occurrence: Calcareous specimens from GSC locs. C-26841, C-26845, Reef; Prince of Wales Island.

Discussion: This species was encountered in two collections, but the specimens were often disarticulated, broken, or crushed. However, the distinguishing features of this species were recognizable. Some variation in the number and strength of plications was noted as well as the overall shape, but these may have been enhanced by post-mortem distortion.

This species is characterized by its nearly smooth exterior and by the well defined ventral, rectangular fold and tongue-like extension of the dorsal sulcus. Some of the specimens exhibit a faint ventral median furrow of variable length. On some specimens, it extends to the anterior while on others it becomes indistinct in the anterior one-third of the shell.

As noted by Johnson, Boucot, and Murphy (1973), G. pelagica has utility as a tool for correlation as it is commonly abundant, is confined to a short time span and is very widespread geographically. The gypidulids are particularly useful for correlation within the Canadian Arctic Archipelago (Johnson, 1975; this paper) which aids in a better understanding of the geological history of the area.

Gypidula pelagica pyraforma n. subsp.
(Plate 8, Figs. 1-20; Plate 9, Figs. 1-16)

Derivatio nominis: L.; pyra, pyre; forma, shape.

Material and Occurrence: Holotype (GSC 47075), paratypes (GSC 47076, 47077), GSC loc. C-26986, plus additional calcareous and silicified specimens from GSC locs. C-26942, C-26943, C-26945, section 11; unnamed carbonate unit, C-26968, C-26973, C-26974, C-26985, C-26986, C-26987, C-26988, C-26989, section 12, unnamed carbonate unit, Baillie Hamilton Island. Early Lochkovian.

Diagnosis: Shells narrow, subpyriform in outline, with trapezoidal fold and sulcus and prominent ventral umbo in mature specimens.

Description: Shells medium sized, narrowly pyriform in outline, strongly ventribiconvex in lateral profile. Ventral valve strongly curved and inflated at umbo, from midlength to anterior, curve less pronounced. Ventral beak strongly incurved, almost touching dorsal beak. Dorsal valve moderately curved with inflated umbo; curve more gradual from midlength to anterior. Ventral palintrope short, curved. Ventral interarea curved, high, triangular, steeply apsacline. Dorsal interarea moderately broad, high, anacline. Delthyrium high, narrow, triangular, open. Cardinal angles obtuse, rounded. Maximum width slightly anterior to midlength. Hinge of moderate length. Rectangular ventral fold seen on larger specimens, not visible on smaller ones. Fold developed on anterior one-third of shell where it is elevated above posterolateral flanks, best seen in deflection of commissure. Broad, shallow, flat bottomed dorsal sulcus best developed in anterior one-third of shell, extending anteriorly into tongue accommodated by ventral fold. Ornament consists of faint costae, four to five on fold and sulcus, best seen on large specimens. Flanks smooth. Shells exhibit faint, concentric growth lines.

Hinge teeth short, subtriangular in cross-section, set close together. Spondylium rhomboidal in outline, narrow, deep, V-shaped in cross-section. Supported by thin median septum extending to midlength or slightly farther.

Sockets poorly developed, shallow, elongate, diverging at approximately 90° joining curved, flared, triangular inner plates which merge smoothly with thin, long, subparallel outer plates which diverge and recurve slightly near junction with shell wall.

Comparison: This subspecies differs from *G. pelagica lux* (Johnson, Boucot, and Murphy, 1973); it is more elongate in outline, possesses a more inflated ventral umbo and has a less well developed fold. A specimen illustrated by Kozlowski (1929, Plate 6, Figs. 1-3) is not as elongate and possesses a much stronger deflection in the anterior commissure. *G. pelagica* illustrated by Nikiforova (1937, Plate 4, Figs. 15, 16) is more transverse and possesses a very strong deflection in the anterior commissure.

<u>Gypidula</u> <u>dyerensis</u> n. sp.

(Plate 9, Figs. 17-24, Plate 10, Figs. 1-12,
Plate 11, Figs. 1-6)

<u>Derivatio</u> <u>nominis</u>: After Cape John Dyer, Prince of Wales Island, from near where the specimens were collected.

Material and Occurrence: Holotype (GSC 47095), paratypes (GSC 47098, 47099, 47100, 47101, 47103, 47104), GSC loc. C-26913, plus additional material from GSC locs. C-26910, C-26911, C-26913, C-26914, C-26915, C-26916, C-26917, C-26918, C-26920, unnamed unit, section 10, Prince of Wales Island. Early-Late ? Lochkovian.

Diagnosis: Large <u>Gypidula</u>, broadly triangular in outline, with subrounded, moderately broad costellae, separated by broad U-shaped interspaces.

Description: Shells triangular to broadly triangular in outline, ventribiconvex in lateral profile. Ventral valve strongly curved near umbo, less curved from midlength to anterior. Ventral umbo moderately inflated, beak strongly incurved and rests on dorsal umbo. Dorsal valve convex at umbo, less curved from midlength to anterior. Ventral palintrope short, curved. Ventral interarea smooth, high, triangular, steeply apsacline. Delthyrium narrow, triangular, open. Dorsal interarea low, broad, anacline. Maximum width at midlength or slightly anterior to it. Cardinal angles, rounded, obtuse. Hinge short, curved. High, rectangular fold best developed on large specimens, not raised much above anterolateral flanks. On smaller specimens, reflected in bending of commissure. Dorsal sulcus shallow, moderately broad, flat bottomed, extends into tongue. Commissure smooth, not deflected by costae. Ornament consists of subrounded, moderately broad costae separated from each other by broad U-shaped interspaces. Costae most noticeable on fold and sulcus, also present on flanks, increasing anteriorly by bifurcation.

Hinge teeth short, subtriangular to subrounded in cross-section. Spondylium rhomboidal in outline, narrow, deep, supported by thin median septum extending approximately half length of shell. Shell interior smooth except for faint impress of costae.

Sockets shallow, elongate, widely divergent, joining curved, flared, triangular inner plates which merge with long, thin, slightly divergent outer plates connected to floor of valve. Outer plates curve laterally at junction with inner plates, then recurve toward each other near floor of shell. Shell interior smooth except for faint impressions of costae.

Comparison: This species is very similar to G. sp. 1 Lenz (1968), but is thin-shelled, less transverse, and possesses more numerous, broader, rounder costae which are only faintly impressed on the interior of the shell. It bears some resemblance to G. gyrifera Maligina and Sapelnikov (1973, Plate 25, Figs. 1-3), but does not possess as many costae and has a stronger fold and sulcus. The anterior commissure of G. gyrifera illustrated is almost flat which differs strongly with the species described herein.

Subgenus Plicogypa Rzhonsnitskaya, 1975

Type Species: Pentamerus kayseri Peetz, 1901
Plicogypa cf. P. kayseri (Von Peetz, 1901)
(Plate 7, Figs. 3-5)

Pentamerus kayseri Von Peetz, 1901, p. 377
(Plate 3, Figs. 8a-c)

Gypidula kayseri Alekseeva et al., 1970 (Plate 3, Fig. 14)

?Gypidula kayseri (Peetz) Maligina and Sapelnikov, 1973
(Plate 24, Figs. 4-8)

Gypidula cf. G. kayseri Johnson, 1975a (Plate 3, Figs. 1-5)

Material and Occurrence: Calcareous specimens from GSC locs. C-26874, section 8, C-26903, section 9, unnamed units, Prince of Wales Island. Late Lochkovian, Quadrithyris Zone.

Discussion: Only three specimens were found from two collections on Prince of Wales Island. This species is a relatively strongly biconvex gypidulid with a ventral fold divided by a shallow, elongate, median furrow. On either side of the fold there is one well developed plication. The dorsal valve exhibits a deep sulcus extending nearly the entire length of the shell. It is bounded by two strong plications. The outer plates are thin, subparallel and extend slightly more than one-third of shell length. The specimens collected were immature and slightly more transverse than those illustrated by Johnson (1975). However, this may be due to the size of the shells as mature specimens may be more elongate.

Plicogypa thorsteinssoni (Johnson)
(Plate 7, Figs. 6-25; Fig. 49)

Gypidula thorsteinssoni Johnson, 1975a
(Plate 3, Figs. 6-25, Plate 4, Figs. 1-25, Text Fig. 5)

Material and Occurrence: Calcareous specimens from GSC locs. C-26873, C-26874, C-26876, C-26880, C-26881, C-26883, C-26887, section 8, C-26903, C-26906, C-26908, section 9, unnamed unit, Prince of Wales Island. Late Lochkovian, *Quadrithyris* Zone.

Diagnosis: Small to medium sized shells with smooth flanks and a biplicate ventral fold.

Discussion: Johnson (1975a) has adequately described this very interesting species. Large collections exhibit some variations in shell shape and the strength and development of the biplicate ventral fold, but these are minor and are to be expected in most collections of this size (several hundred specimens). To date, this species has been found to be confined to the *Quadrithyris* Zone (Late Lochkovian) in the Canadian Arctic Archipelago.

Fig. 49. Drawings of acetate peels from serial sections of Plicogypa thorsteinssoni (Johnson) (X4), GSC 47068, GSC loc. C-26883, Prince of Wales Island.

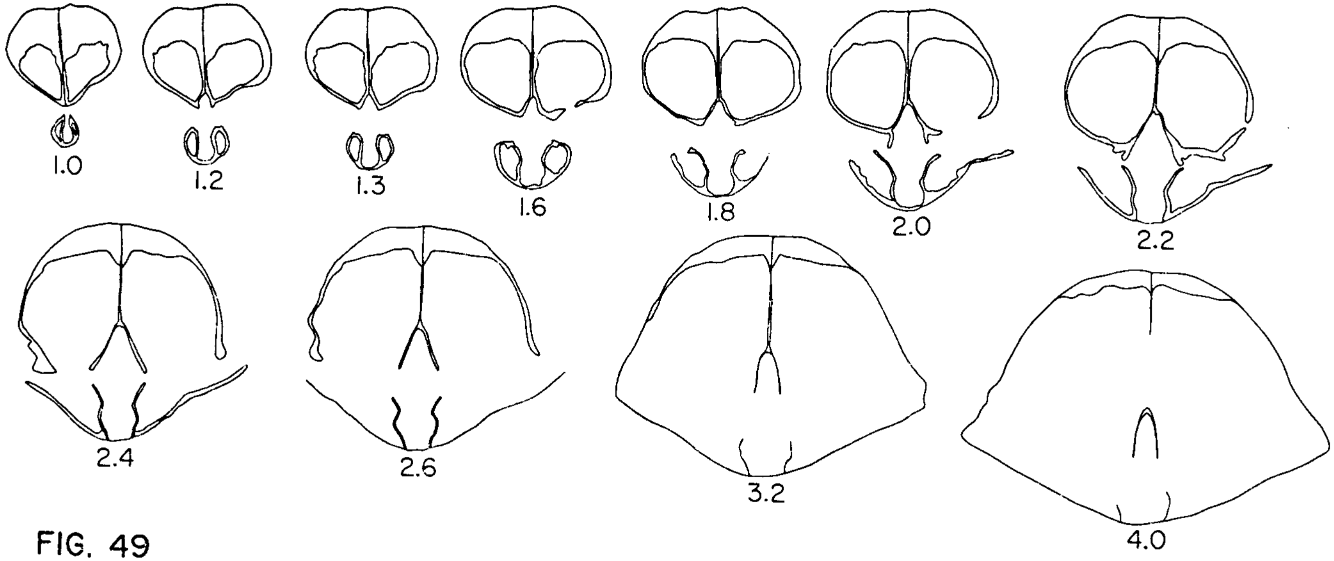


FIG. 49

Genus Carinagypa Johnson and Ludvigsen, 1972

Type Species: Gypidula loweryi Merriam, 1940, p. 81
(Plate 7, Fig. 9)

Carinagypa careopleura Johnson
(Plate 11, Figs. 7-16; Fig. 50)

Carinagypa careopleura Johnson, 1975a
(Plate 5, Figs. 1-9, Text Fig. 4)

Material and Occurrence: Calcareous and silicified specimens from GSC loc. C-26888, section 8, unnamed unit, Prince of Wales Island. Late Lochkovian, Quadrithyris Zone.

Discussion: This species was encountered in only one collection from Prince of Wales Island. It is characterized by its smooth flanks and almost total absence of a ventral fold. The ventral valve has a spondylium with a short septum. The dorsal valve has well defined, discrete outer plates with well developed, inward projecting carinae (easily seen on acetate peels of serial sections). To date, this species is not known from outside the Quadrithyris Zone in the Canadian Arctic Archipelago.

Order Strophomenida

Suborder Strophomenoidea

Superfamily Strophomenacea King, 1846

Family Leptaenidae Hall and Clarke, 1894

Genus Leptaena Dalman, 1828

Fig. 50. Drawings of acetate peels from serial sections of *Carinagypa careopleura* Johnson (X10), GSC 47112, GSC loc. C-26888, Prince of Wales Island.

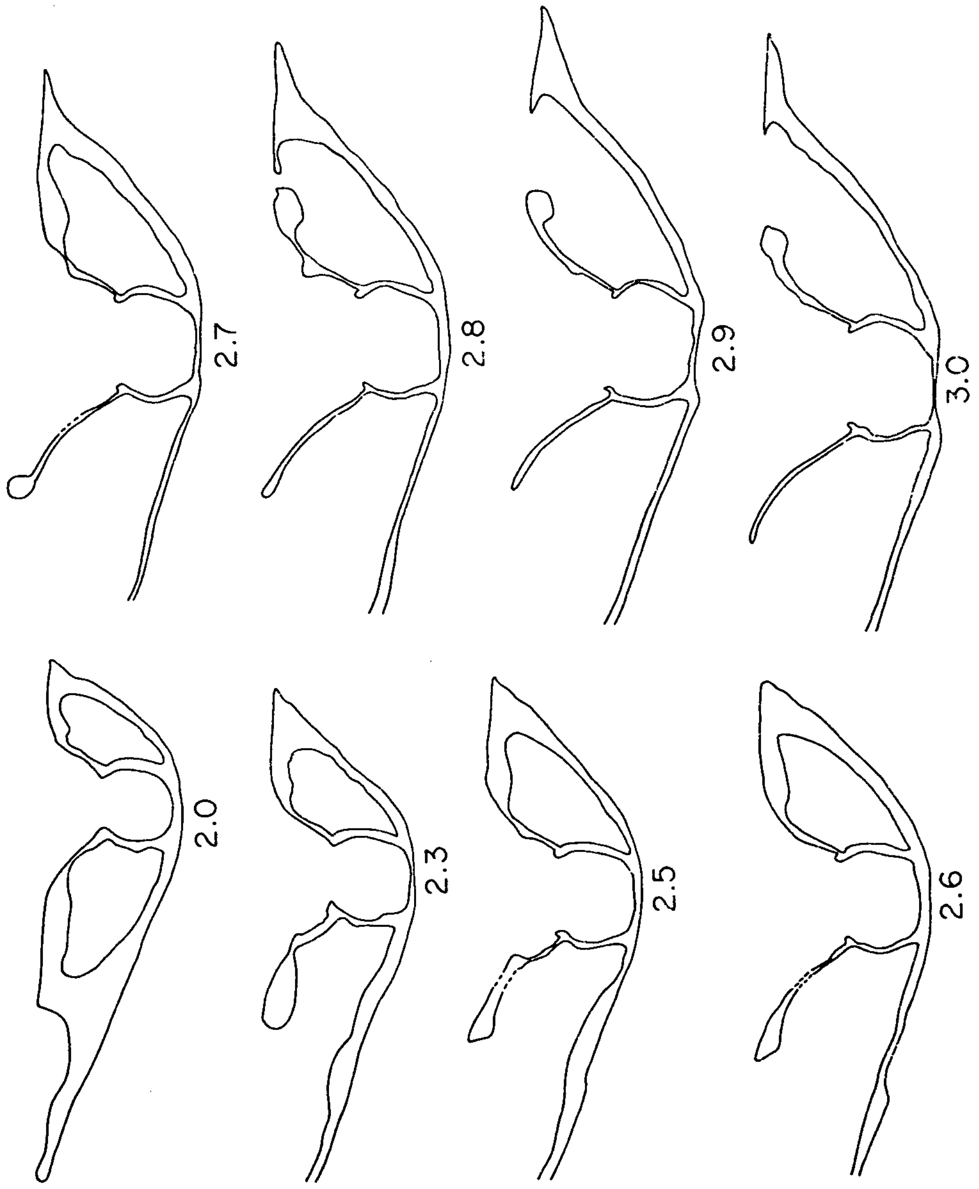


FIG. 50

Type Species: Leptaena rugosa Dalman, 1828 (Plate 1, Fig. 1)

Leptaena nassichuki n. sp.
(Plate 11, Figs. 18, 21, 24; Plate 12, Figs. 1-8, 11, 12)

Derivatio nominis: For W.W. Nassichuk, Geological Survey of Canada.

Material and Occurrence: Holotype (GSC 47116), paratypes (GSC 47115, 47117, 47118), GSC loc. C-26940, plus additional material from GSC locs. C-26845, Reef, Prince of Wales Island; C-26939, C-26940, C-26942, C-26943, C-26945, section 11, unnamed carbonate unit, Baillie Hamilton Island. Early Lochkovian.

Diagnosis: Leptaena with dorsal muscle field bisected by long, thin median ridge, flanked by two, subparallel secondary ridges.

Description: Shells medium sized, transverse to subrectangular in outline, plano-convex in lateral profile. Auriculation of lateral edges developed. Visceral disc subplanar. Hinge long, straight, place of maximum width. Delthyrium broad, obtuse, partially covered by small, convex pseudodeltidium at apex, foramen filled with plug of shell material. Cardinal angles obtuse to acute, pointed due to auriculation. Ventral interarea broad, flat, low, triangular, apsacline. Dorsal interarea broad, flat, low, anacline. Cardinal process partially covered posteriorly by thin, convex, strap-like chilidium, cleft medially. Ornament consists of fairly strong, subrounded, concentric rugae separated by U-shaped interspaces. Not all rugae continuous, local fusion of two ridges into one, ruga low on umbo, higher anteriorly; crossed by numerous, well developed, subrounded, radial costellae. On dorsal valve there are 11-14 rugae on disc and 7-11 on ventral disc, much reduced in height in areas of geniculation.

Hinge teeth blunt, triangular in cross-section, crenulated, supported by thick dental lamellae partially fused to shell wall. Lamellae continue to form well developed, high, flank-like muscle bounding ridges, slightly corrugated which curve together, but do not touch. Diductors scars subcircular in outline. Adductors thin, elongate-oval, situated medially between diductors, bisected by a low, continuous myophragm. Near anterior of muscle field, myophragm swells to form triangular platform, then thins and extends slightly beyond muscle bounding ridges. Interior pustulate throughout and exhibits reflection of rugae posterior to geniculation.

Sockets moderately deep, widely divergent, impressed in shell material. Cardinal process consists of two narrowly divergent, flat-topped lobes or plates. Adductor muscle field subtriangular in outline. Diaphragm moderately to well developed. Subcircular posterior adductors bounded by muscle bounding ridges, well developed posteriorly, reduced in height anteriorly. Suboval anterior adductors bisected by thin, blade-like median ridge that extends three-quarters shell length. Ridge rounder, flatter in posterior and flanked by two subparallel ridges extending as far as main ridge. Valve interior pustulose throughout, reflection of rugae seen posterior to geniculation.

Comparison: This species is similar in form to L. amelia Havlíček, 1967 (Plate 15, Figs. 3, 6, 7; Plate 19, Figs. 1-6, 10, 11; Text Figs. 42, F.G.) but has coarser rugae and possesses a well developed dorsal median ridge as well as flanking accessory ridges. It is similar to L. sp. A (Johnson, 1970, Plate 16, Figs. 1-4), but has finer rugae and a better developed dorsal median ridge.

Leptaena sp.

(Plate 11, Figs. 19, 20, 22, 23)

Material and Occurrence: One silicified ventral valve from GSC loc. C-26913, unnamed unit, section 10, Prince of Wales Island. Early-Late ? Lochkovian.

Diagnosis: Large sized, subrectangular in outline with a ventral sulcus that extends into a tongue.

Discussion: Only one ventral valve was encountered and it possesses most of the characters of Leptaena. However, the interior is filled with debris and the full extent of the diductor field is not known. The shell is transverse, subrectangular in outline, and the ventral valve moderately convex. The ventral interarea is broad, flat, low, apsacline. The delthyrium is broad, widely divergent and open except for a small posterior convex pseudodeltidium. The foramen is large, circular and apical. The deltidial angles are obtuse. Cardinal angles acute, somewhat rounded with maximum width at hinge. The hinge is long and straight. A broad, moderately deep sulcus is confined to the trail extending into a rounded tongue. Ornament consists of rather fine, concentric rugae with a local fusion of two into one. The rugae are not present anterior to geniculation. The single specimen has 15 visible rugae crossed by very fine, radial costellae best developed on posterolateral flanks. The hinge teeth are blunt, massive, subtriangular in cross-section. They are probably supported by dental lamellae. However, they are made obsolete by infilling of shell material. The raised diductor bounding ridges appear to be subcircular, but debris obscures the anterior portion. The muscle field is bisected by a thin, rounded myophragm extending anteriorly from the foramen. Impressions of vascula media are visible on the internal surface. Minute pustules are visible on the anterior margins.

Comparison: This species is peculiar in that it possesses a sulcus in the ventral valve and a foramen. It is similar to <u>Leptaenopyxis</u> <u>bouei</u> (Barrande) (Havlíček, 1967, Plate 18, Figs. 1-8, 11-14), but possesses a sulcus in the ventral valve. This interesting specimen will have to await further collections until its true affinities can be ascertained.

Superfamily Davidsoniacea King

Family Chilidiopsididae Boucot

Genus Iridistrophia Havlicek

Type Species: Orthis umbella Barrande, 1848, p. 206
(Plate 19, Fig. 1)

Iridistrophia johnsoni n. sp.
(Plate 12, Figs. 9, 10, 13-35; Plate 13, Figs. 1-21)

Derivatio nominis: For J.G. Johnson

Iridistrophia cf. umbella (Barrande) Johnson, Boucot, and Murphy, 1973 (Plate 21, Figs. 1-8)

Material and Occurrence: Holotype (GSC 47125), paratypes (GSC 47120, 47121, 47122, 47126), GSC loc. C-26940, plus additional calcareous and silicified specimens from GSC locs. C-26813, C-26814, C-26816, section 3; C-26821, Reef; unnamed units, Prince of Wales Island; C-26939, C-26940, C-26942, C-26943, C-26945, C-26949, C-26950, C-26952, section 11; C-26968, C-26973, C-26974, C-26979, C-26982, C-26985, C-26986, C-26988, C-26989, section 12, unnamed carbonate unit, Baillie Hamilton Island. Early Lochkovian.

Diagnosis: Shells medium to large sized, coarsely costate, subcircular in outline, with obtuse, strongly rounded cardinal angles.

Description: Medium to large sized, subcircular to subquadrate in outline, resupinate in lateral profile. Immature specimens have convex ventral valve. Ventral umbo inflated. Dorsal valve weakly to moderately convex. Ventral interarea high, broad, flat, triangular, apsacline, crossed by faint growth lines parallel to hinge. Dorsal interarea well developed, low, broad, flat, band-like, anacline. Cardinal angles obtuse, strongly rounded. Maximum width at mid-length. Hinge straight, two-thirds of valve width. Delthyrium broad, widely divergent, partially covered by two triangular deltidial plates. Well developed, convex, pseudodeltidum situated between plates, covering posterior three-quarters of delthyrium. Ventral valve exhibits broad, very shallow depression. Cardinal process partially covered by thin band-like chilidium. Ornament consists of numerous, radial, subrounded costellae that increase anteriorly by implantation, separated by U-shaped interspaces of equal depth as height of costellae. Costellae radial in midregions, near posterolateral flanks become progressively more convex. Costellae increase in height away from umbo, highest on posterolateral flanks. Costellae crossed by minute growth lines that appear as ridges. Ridges not seen on interspaces.

Hinge teeth stout, elongate, suboval in cross-section, supported by thin, well developed, plate-like, widely divergent dental lamellae confined to umbo. Muscle scars generally not seen, but the diductor field of one specimen is subrhomboidal in outline. Interior grooved over almost entire surface, strongest at margins. On lateral margins, flat topped ridges are themselves grooved.

Sockets deep, widely divergent, bounded by well developed socket ridges and posterolateral shell area, floored by socket plates. Posterior ends of socket plates strongly twisted to midline joining cardinal process lobes. Prominent, small node between main lobes of cardinal process projects anterodorsally. Muscle scars not seen. Interior grooved over almost entire surface, strongest at margins. Flat-topped ridges are themselves grooved.

Comparison: This species differs from I. umbella (Havlíček, 1967, Plate 41, Figs. 7-16; Plate 42, Figs. 3, 5, 8) in being more rounded in posterolateral margins as well as in possessing weaker costellae. I. iris (Havlíček, 1967, Plate 45, Figs. 5-8, 13) is more quadrate in outline and does not possess rounded posterolateral margins. It differs from I. praeumbracula (Kozlowski, 1929, Plate 5, Figs. 3-6) in possessing much more rounded cardinal angles as well as more curved costae in the posterior portions of the valves. It differs from I. thorsteinssoni n. sp. (this paper) in being more rounded posterolaterally, and it has coarser costellae, shorter dental lamellae, as well as a shorter hinge. It differs from I. euzona (Fuchs) figured by Dahmer (1951, Plate 10, Fig. 7; Plate 11, Figs. 24, 25) in possessing much coarser costellae.

Iridistrophia thorsteinssoni n. sp.
(Plate 14, Figs. 1-12, 14, 15, 18, 22, 27)

Derivatio nominis: For R. Thorsteinsson, Geological Survey of Canada, whose work has been basic to all studies of Arctic geology.

Material and Occurrence: Holotype (GSC 47141), paratypes (GSC 47142, 47143, 47144, 47145, 47146), GSC loc. C-26917, plus additional silicified specimens from GSC locs. C-26911, C-26913, C-26914, C-26915, C-26916, C-26917, C-26918, C-26919, C-26920, C-26921, section 10, unnamed unit, Prince of Wales Island. Early ?-Late Lochkovian.

Diagnosis: Medium sized, finely costellate, subrectangular in outline with wide hinge and long, widely divergent dental lamellae.

Description: Shells medium sized, subrectangular in outline, resupinate in lateral profile. Immature specimens are biconvex. Dorsal valve weakly to moderately convex. Ventral interarea very wide, flat, moderately high, triangular, apsacline, crossed by faint growth lines parallel to hinge. Ventral umbo slightly inflated. Dorsal interarea not developed. Maximum width between midlength and hinge. Hinge long, straight, nine-tenths shell width. Cardinal angles obtuse, very slightly rounded. Delthyrium broad, widely divergent, covered posteriorly by convex pseudodeltidium. Ornament consists of fine, radial, subrounded costellae that increase anteriorly by bifurcation and implantation. Some dorsal valves give impression of weak development of parvicostellation. Costellae radial throughout entire area of shell, ones paralleling hinge are only weakly curved. Costellae crossed by minute growth lines that appear as minute ridges on them; ridges do not appear to cross interspaces.

Hinge teeth long, suboval in cross-section, supported by well developed, blade-like, widely divergent, long dental lamellae. Muscle scars not seen. Interior nearly completely covered by grooves, best developed on lateral margins.

Sockets deep, widely divergent, bounded by socket ridges and posterior shell wall, floored by socket plates. Socket ridges curved posteriorly to midline joining bilobed cardinal process. Lobes small, bisected by an elongate groove producing a quadrilobate process. Small node situated medially to cardinal process lobes, facing anterodorsally. Muscle scars not visible. Inner surface covered by grooves best developed on lateral margins.

Comparison: This species differs from I. johnsoni n. sp. in being more quadrate in outline, in having finer costellae, wider hinge, longer dental lamellae and poorly defined to absent dorsal interarea. It differs from I. umbella (Havlíček, 1967, Plate 41, Figs. 7-16, Plate 42, Figs. 3, 5, 8) in having finer costellae, and being more quadrate in outline. It differs from L euzona (Fuchs) figured by Dahmer (1951, Plage 10, Fig. 7, Plate 11, Figs. 24, 25) in having coarser costellae and much less rounded cardinal margins. It differs from I. praeumbracula (Kozlowski, 1929, Plate 5, Figs. 3-6) in possessing finer costellae as well as more obtuse cardinal angles.

Genus Eoschuchertella Gratsianova, 1974

Type Species: Eoschuchertella popovi Gratsianova, 1974
(Plate 13, Figs. 1-9)

Eoschuchertella sp.
(Plate 13, Figs. 22-35)

Material and Occurrence: Silicified specimens from GSC loc. C-26650, unnamed unit, plus additional material from same loc. Prince of Wales Island. Early Lochkovian.

Diagnosis: Medium sized, transversely suboval with wide, high, flat ventral interarea, small cardinal process lobes, grooves covering inner surface of both valves.

Description: Shells small to medium sized, transversely suboval in outline, plano-convex to gently biconvex in lateral profile. Ventral umbo inflated. Ventral interarea broad, flat, high, triangular, apsacline, crossed by numerous fine growth lines. Delthyrium covered by well developed, strongly convex pseudodeltidium. Cardinal process lobes covered posteriorly by thin, strap-like chilidium. Dorsal interarea not developed. Maximum width between midlength and hinge. Hinge long, straight, nine-tenths of shell width. Cardinal angles obtuse, slightly rounded.

Ornament consists of subrounded, radial costellae separated by deep U-shaped interspaces slightly narrower than costellae. Costellae increase anteriorly by intercalation, and increase in height anteriorly. Costellae crossed by growth lines, present as minute ridges on costellae.

Hinge teeth small, short, suboval in cross-section. Dental lamellae weakly developed to nonexistent. Muscle scars not impressed. Entire inner surface covered by grooves, strongest on lateral margins.

Sockets moderately deep, bounded by socket ridges and posterior shell wall, floored by socket plates. Socket ridges curve strongly to midline joining base of bilobed cardinal process. Each lobe cleft medially producing a quadrilobate process. Lobes project posteroventrally. Small node situated medially between main lobes of process. Entire surface covered by grooves, strongest on lateral margins.

Comparison: This species resembles "Schuchertella" sp. A (Johnson, 1970, Plate 18, Figs. 1-7), but has a higher ventral interarea, more distinct cardinal process lobes and a flatter dorsal valve.

Superfamily Stropheodontacea Caster

Family Leptostrophiidae Caster

Genus Barbaestrophia Havlíček, 1965

Type Species: Strophomena praestans Barrande, 1879
(Plate 51, Fig. 4)

Barbaestrophia bieleri n. sp.
(Plate 14, Figs. 13, 16, 17, 19-21, 23-26, 28, 29)

Derivatio nominis: To honor Captain Guy Bieler, Le Régiment de Maisonneuve.

Material and Occurrence: Holotype (GSC 47148), paratypes (GSC 47147, 47149, 47150, 47151), GSC loc. C-26940, plus additional material from GSC locs. C-26940, C-26942, C-26945, section 11, unnamed carbonate unit, Baillie Hamilton Island. Early Lochkovian.

Diagnosis: Shells small to medium sized with one, rarely two pair of spines on hinge; ventral interarea well developed, cardinal process flanked by two well developed socket plates.

Description: Shells small to medium sized, subquadrate in outline, plano-convex in lateral profile. Ventral valve gently convex. Ventral interarea broad, flat, moderately high, triangular, apsacline. One, rarely two pair of spines present on hinge, curving posterolaterally. Spines on extreme lateral margins developed as continuation of shell material. Others joined with interarea. Hinge long, straight, nine-tenths shell width. Maximum width at midlength. Cardinal angles obtuse, rounded. Delthyrium open, moderately broad, deltidial angle approximately 60°. Ornament consists of weak, subrounded radial costellae, widely separated, increasing anteriorly by bifurcation and implantation. Flat, poorly preserved pseudodeltidium covers posterior interarea. Dorsal costellae finer, more numerous, closer together than ventral.

Denticles well developed, present along one-half of hinge length. Muscle bounding ridges well developed, raised, straight; top of ridges covered with fairly large pustules. Ventral process narrow, rectangular, continuous with myophragm. Large diductor field triangular in outline, bisected by prominent, thin myophragm. Adductor scars elongate-oval, located in posteromedial area of diductor field. Interior nearly completely covered by grooves and minute pustules.

Denticles on dorsal valve well developed, present on at least two-thirds of hinge. Cardinal process bilobed, each lobe grooved producing a quadrilobate process, lobes project posteroventrally. On well preserved specimens, a third, small, flat-topped posteriorly widening lobe present, situated medially between two main lobes. Cardinal process flanked by two well developed socket plates parallel to hinge extending half width of valve. Slightly curved, widely divergent muscle bounding ridges well developed. Deeply incised posterior adductors suboval in outline, not as pinched as posterior set. Field bisected by subrounded, moderately well developed ridge. Interior nearly covered by faint grooves and minute pustules.

Comparison: This species differs from B. praestans (Barrande) (Havlíček, 1967, Plate 31, Figs. 7-9, Text Fig. 60c) in being smaller, having shorter, less well developed spines and generally only one pair as opposed to two. Havlíček (1967) does not discuss the dorsal valve of Barbaestrophia.

Family Stropheodontidae

Genus Strophonella Hall

Type Species: Stropheodonta semifasciata Hall, 1863

Strophonella cf. S. plasi Havlíček, 1967
(Plate 15, Figs. 30-34)

Material and Occurrence: Silicified specimens from GSC locs. C-26939, C-26940, C-26942, section 11, unnamed carbonate unit, Baillie Hamilton Island. Early Lochkovian.

Diagnosis: Medium sized shells, subquadrate in outline with well developed cardinal process lobes longer than wide.

Description: Shells subquadrate to semisubcircular in outline, resupinate in lateral profile. Ventral interarea well developed, broad, moderately high, flat, triangular, apsacline. Delthyrium broad, margins widely divergent, no evidence of pseudodeltidium. Dorsal interarea low, broad, flat, triangular, anacline. Dorsal valve exhibits shallow depression in posteromedial regions, anteriorly this disappears and shell is nearly geniculate. Maximum width between midlength and hinge. Hinge long, straight, nine-tenths shell width. Cardinal angles gently rounded, acute to slightly obtuse. Parvicostellate ornament consists of faint, subrounded, widely separated, radial costellae crossed by numerous, faint, concentric growth lines. Costellae increase anteriorly by bifurcation.

Denticles present on about half shell width. Flabellate diductor scar subquadrate in outline, posterior portion highest above valve floor, extends half length of valve. Adductor scar very faint, elongate-oval. Ventral process broad, triangular, low, continuous with faint myophragm bisecting diductors. Interior nearly covered with pustules. Periphery of shell grooved.

Denticles present on half width of shell. Short, very widely divergent socket plates lateral to cardinal process lobes appear to be resting on plate-like bases subparallel to hinge. Cardinal process lobes well developed, near posterior ends, curve slightly to midline. Process projects posteroventrally, not extending beyond hinge. Lobes pyriform in lateral profile. Each lobe bears a faint groove in anteroventral area. Muscle bounding ridges weakly developed, diverging anterolaterally. Adductors moderately large, suboval in outline. Muscle field bisected by median ridge, low, rounded, triangular in posterior, thin, narrow, in anterior regions. Surface covered by pustules, density increases markedly in anterior one-half of shell. Anterior rim of shell grooved.

Comparison: This species is similar to S. bohemica (Barrande) (Havlíček, 1967, Plate 39, Figs. 7, 8, 12, 13) but is more quadrate in outline and does not possess auricular projections. It is very similar to S. plasi, but the dorsal valve of the latter seems subtriangular in outline. However, only three specimens of S. cf. S. plasi have been found and these are not sufficient for a proper understanding of intraspecific variation.

Family Douvillinidae Caster

Genus Mesodouvillina Williams

Type Species: Stropheodonta (Brachyprion) subinterstrialis seretensis Kozlowski, 1929 (Plate 4, Figs. 1-7)

Discussion: Mesodouvillina is among the most abundant of the stropheodontids dealt with in this paper. They are quite variable in shape, ornamentation, convexity and shape of the ventral muscle field. An attempt has been made to separate them into distinguishable species and at the same time to note variations present within these species. Later workers may choose to subdivide Mesodouvillina into subgenera and the specific designations used herein will be altered. However, the writer feels it advisable here only to separate the various forms into different species of Mesodouvillina.

<u>Mesodouvillina</u> sp. 1

(Plate 15, Figs. 7-18)

Material and Occurrence: Silicified specimens from GSC loc. C-26806, unnamed unit, Prince of Wales Island. Early Lochkovian.

Diagnosis: Small, moderately to strongly concavo-convex, subquadrate in outline, parvicostellate on both valves.

Description: Shells small, subquadrate to subsemicircular in outline, moderately to strongly concavo-convex in lateral profile. Ventral interarea broad, low, flat, triangular, apsacline. Dorsal interarea broad, very low, flat, triangular, hypercline. Maximum width between midlength and hinge. Hinge long, straight, nine-tenths shell width. Delthyrium covered by plates parallel with interarea. Cardinal angles slightly rounded, obtuse to slightly acute. Ornament parvicostellate on both valves. Primary costellae on ventral valve well defined, those on dorsal valve reduced resulting in smaller contrast between two types. Difference on ventral valve more striking. Costellae low, subrounded, numerous, close together. Interrupted rugae variably developed on well preserved specimens.

Denticles present for about half width of hinge. Narrow, subtriangular ventral process flared at base, grooved in anterior. Diductor field large, suboval to bilobate. Muscle bounding ridges moderately well developed, recurving slightly in anterior toward midline. Low, rounded myophragm bisects field. Adductor scars elongate, suboval to pyriform, situated medially between diductors and abutting ventral process. Interior nearly covered with minute pustules. Lateral margins strongly grooved.

Denticles present on half to two-thirds hinge width. Cardinal process lobes disjunct, project posteroventrally, each lobe grooved producing quadrilobate process, suboval in outline. Process overhangs hinge, flanked laterally by close, short, widely divergent socket plates. Rhomboidal adductor scar bounded by moderately well developed bounding ridges. Posterior adductor scars subtriangular in outline. Muscle field bisected by low, rounded myophragm, flanked by two gently divergent ridges which may be site of anterior adductors. Ridges decrease in height anteriorly and are covered by well developed elongate, cylindrical tubercles. Most of shell surface covered by minute pustules, shell grooved on lateral margins.

Comparison: This species differs from M. cf. M. varistriatus (Johnson, 1970, Plate 23, Figs. 1-15) in having a rhomboidal dorsal adductor bounding ridge, in being more quadrate in outline, in having more curved ventral diductor bounding ridges. It differs from M. costatula (Barrande) (Havlíček, 1967, Plate 34, Figs. 7, 9-12) in having less well developed costellae, suboval ventral adductor scars. M. ivanensis is quite similar, but possesses a low, flat ventral interarea and has a different dorsal adductor field.

<u>Mesodouvillina</u> sp. 2
(Plate 16, Figs. 11-22, 26)

Material and Occurrence: Silicified specimens from GSC locs. C-26913, C-26914, C-26915, C-26916, C-26917, C-26919, C-26920, C-26921, unnamed unit, section 10, Prince of Wales Island. Early-Late ? Lochkovian.

Diagnosis: Shells small to medium sized, slightly transverse in outline, nearly plano-convex in lateral profile with faint, subrounded costellae, separated by very wide interspaces.

Description: Shells small to medium sized, slightly transverse to suboval in outline, nearly plano-convex in lateral profile. Ventral interarea flat, moderately low, broad, triangular, apsacline. Dorsal interarea very low, broad, triangular, flat, hypercline. Delthyrium covered with small, convex, pseudodeltidium which seems to be confined to posterior portion. Maximum width at hinge. Hinge long, straight. Cardinal angles rounded, obtuse. Ornament consists of very fine, low, rounded costellae increasing anteriorly by implantation, separated by very wide interspaces. Secondaries very faint to imperceptible.

Denticles present on half shell width. Process thin, subtriangular in outline. Diductor bounding ridges strong, straight to slightly curved, prominent in posterior areas, weaker anteriorly. Diductor field subtriangular to nearly bilobate in some specimens.

Adductors small, elongate-oval, situated medially between diductors and anterior to process. Thin, variably developed, subrounded ridge bisects diductor field. Not seen to extend anterior to muscle field. Interior nearly covered with many, minute pustules. Lateral margins weakly grooved.

Denticles present on one-half shell width. Cardinal process bilobed, disjunct, moderately divergent, pyroform in outline resting on low buildup of shell material projecting posteroventrally, extending slightly beyond hinge. Closely flanked by two well developed, high, long, widely divergent socket plates. Adductor muscle bounding ridges poorly developed, thin, marked by pustules. Anterior adductors suboval to subtriangular in outline. Field bisected by weak, variably developed rounded median ridge extending slightly more than one-third shell length. Flanked by two low, poorly developed, gently divergent ridges. Anteriorly, ridges pass into concentrations of pustules which are probably site for anterior adductors. Surface covered by many minute pustules. Flanks grooved.

Comparison: Of the species in this paper, this species is most similar to <u>M</u>. <u>musculusvarius</u> n. sp. However, the latter is larger, has more numerous, larger costellae and a rhomboidal ventral diductor field and is much more concavo-convex. <u>M</u>. <u>costatula</u> (figured by Havlíček, 1967, Plate 34, Figs. 7, 9-12) is more concavo-convex and possesses more numerous, coarser costellae.

Mesodouvillina musculusvarius n. sp.
(Plate 15, Figs. 19-26, Plate 16, Figs. 1-10)

Derivatio nominis: L.; *musculus*, muscle; *varius*, variable.

Material and Occurrence: Holotype (GSC 47165), paratypes (GSC 47162, 47163, 47164, 47166, 47167, 47168, 47169, 47170), GSC loc. C-26851, plus additional material from GSC locs. C-26822, C-26823, C-26824, C-26825, C-26829, C-26830, section 4; C-26835, C-26837, section 5; C-26860, C-26861, section 6; C-26848, C-26849, C-26850, C-26851, C-26852, C-26853, section 7, unnamed units, Prince of Wales Island. Early Lochkovian.

Diagnosis: Shells large with very large, rhomboidal ventral diductor field, bounded by well developed, variable, divergent, straight ridges.

Description: Shells large, subquadrate to subsemicircular in outline, moderately to strongly concavo-convex. Ventral interarea broad, flat, moderately high, triangular, apsacline. Delthyrium broad, divergent, covered by plates continuous with interarea. Dorsal interarea very low, broad, flat, triangular, hypercline. Maximum width at midlength. Hinge straight, long, about four-fifths shell width. Cardinal angles gently rounded, obtuse. Ornament parvicostellate on both valves, secondaries increase in amplitude producing a nearly equicostellate pattern. Costellae low, rounded, separated from each other by narrow interspaces. Faint, interrupted rugae variably developed.

Denticles well developed, extending half to two-thirds shell width. Process thin, triangular, touching plate covering delthyrium. Diductor scars very large, rhomboidal in outline. Muscle bounding ridges straight, occasionally crenulate in anterior portions. Ridges vary from weakly divergent to very strongly divergent. Well developed adductors elongate, suboval, adjacent to ventral process, half length of diductors, bisected medially by narrow, well developed myophragm which continues to anterior of diductors, rarely farther. Interior nearly covered by fine pustules, anterior margin grooved.

Denticles well developed, present on half to two-thirds shell width. Cardinal process bilobed, well developed resting on buildup of shell material. Process lobes pyriform in cross-section, grooved anterodorsally and posteroventrally producing a quadrilobate process. Well developed, short, widely divergent socket plates adjacent to process lobes resting on buildup of shell material. Subrhomboidal adductor field well developed posteriorly, but anteriorly, muscle bounding ridges almost imperceptible. Field separated by thin, subrounded myophragm continuous with shell buildup, beginning anterior to process, extending about two-thirds shell length. Adductors suboval in outline. Two gently divergent ridges flank myophragm. These may be sites of anterior adductors. Shell covered with many, minute pustules. Grooves visible on anterior half of specimen.

Comparison: This species is similar to M. subinterstrialis (Kozlowski, 1929, Plate 4, Figs. 1-7, Text Figs. 28, 29) but has a different shaped dorsal muscle field. The specimens the writer possesses exhibit a striking range in ventral muscle field and angle of divergence of the bounding ridges. Kozlowski illustrates only one specimen so that positive assignment to this species is not possible. It is different from M. sp. 1 (this paper) in being larger, having a different ventral diductor scar, different ornament and different dorsal adductor bounding ridges. It differs from M. triculta (Fuchs) figured by Dahmer (1951, Plate 10, Fig. 5) in possessing finer costellae as well as much smaller cardinal process lobes.

Mesodouvillina tuberosa n. sp.

(Plate 16, Figs. 23-25; Plate 17, Figs. 1-20)

Derivatio nominis: L.; tuberosus, full of protuberances.

Material and Occurrence: Holotype (GSC 47178), paratypes (GSC 47177, 47180, 47182, 47183, 47184, 47185), GSC loc. C-26990, plus additional material from GSC locs. C-26990, C-26991, unnamed carbonate unit, section 12, Baillie Hamilton Island. Early Lochkovian.

Diagnosis: Shells moderately to strongly concavo-convex in lateral profile, with abundant, well developed tubercles on dorsal interior.

Description: Shells small to medium sized, transversely subquadrate in outline with well developed auricular projections on lateral margins; moderately to strongly concavo-convex in lateral profile. Ventral interarea broad, flat, high, triangular, apsacline. Dorsal interarea flat, very low, broad, subtriangular, hypercline. Delthyrium divergent, covered by plate subparallel to interarea. Maximum width at hinge. Cardinal angles sharp, acute. Ornament parvicostellate, but on ventral valve secondaries increase in height anteriorly thereby reducing strong parvicostellation. Dorsal costellae lower, less distinct than ventral. Rare, well developed growth lines present anteriorly. Costellae low, rounded, separated by U-shaped interspaces, increasing anteriorly by implantation.

Denticles present on half to two-thirds shell width. Process thin, elongate with flared base producing a subtriangular outline. Muscle bounding ridges curved, well developed posteriorly, flattening anteriorly. Diductor field large, nearly half shell length, suboval to subcircular in outline. Adductors deeply incised, situated medially between diductors. Moderately to well developed subrounded ridge bisects diductor field. Ridge flattens posteriorly, may or may not thicken anteriorly. Interior nearly covered with many, minute pustules; grooved on lateral margins.

Denticles present on half to two-thirds shell width. Cardinal process lobes disjunct, moderately to strongly divergent, pyriform in outline, extending beyond hinge, weakly grooved posteriorly producing a quadrilobate process; process flanked by two, closely set, short, well developed, widely divergent socket plates. Muscle bounding ridges thin, quite low, forming a subtriangular posterior adductor field. Field bisected by thin, low, variably developed ridge exhibiting height variations throughout its length. In posterior region, ridge flanked by two gently diverging, subrounded ridges. Anteriorly, these ridges pass into dense accumulations of high, narrow, hollow, cylindrical tubercles arranged in an elongate-oval pattern, bisected by median ridge. Accumulations of tubercles may have been site of anterior adductors. Shell surface nearly covered by many, minute pustules. Lateral edges exhibit sharp break in convexity approaching geniculation in some specimens and are slightly grooved.

Comparison: This species differs from M. sp. 1 (this paper) in having less well developed parvicostellate ornamentation, well developed auriculation of the lateral edges, a subtriangular posterior adductor field and accumulations of tubercles in regions of anterior adductors. M. equicosta n. sp. (this paper) is larger, less convex, has coarser costellae and a more rhomboidal dorsal adductor scar. It differs from M. cf. varistriatus figured by Johnson (1970, Plate 23, Figs. 1-15) in having more numerous finer costellae, well developed auricular projections and a stronger ventral diductor bisecting ridge.

The raised tubercles in the region of the anterior adductors are anomalously well developed, being four to five times higher than wide. They are in the region of muscle attachment, and one is led to consider that they aided in this function. However, if this were the case, the added strength of the muscles produced by the greater amount of surface area for attachment would have been tremendous, far more it seems than would be warranted for a shell of this size. Williams (1965, p. 123) mentioned brace plates in his discussion of morphology of stropheodontids and these would seem as plausible muscle attachment regions. However, the structures of *M. tuberosa* n. sp. are not plates in any sense of the word as the regions of concentration of tubercles do not coincide with elevations of the shell floor.

Mesodouvillina equicosta n. sp.

(Plate 17, Figs. 21, 22; Plate 18, Figs. 1-22)

Derivatio nominis: L.; *aequus*, equal; *costa*, rib.

Material and Occurrence: Holotype (GSC 47187), paratypes (GSC 47188, 47189, 47190, 47191, 47192, 47193, 47194, 47195, 47196, 47197), GSC loc. C-26940, plus additional material from GSC locs. C-26938, C-26939, C-26940, C-26942, C-26943, C-26945, C-26950, C-26952, unnamed carbonate unit, section 11, Baillie Hamilton Island. Early Lochkovian.

Diagnosis: Medium to large sized shells, slightly transverse in outline to subquadrate, with moderately developed auricular projections, narrow, high, subrounded costellae, weakly concavo-convex in lateral profile, with subcircular ventral diductor field.

Description: Shells medium to large sized, slightly transverse to subquadrate in outline with moderately developed auricular projections, weakly concavo-convex in lateral profile. Ventral interarea moderately high, flat, broad, triangular, apsacline. Dorsal interarea broad, very low, triangular, flat, hypercline. Delthyrium covered by thin, gently convex pseudodeltidium. Maximum width at hinge. Hinge long, straight. Cardinal angles acute. Ornament parvicostellate, but anteriorly secondaries increase in height producing an equicostellate pattern. Costellae high, narrow, rounded separated by U-shaped interspaces and increase by implantation.

Denticles present for about one-half to two-thirds shell width. Ventral process thin, subtriangular in outline with flared base. Diductor muscle bounding ridges strongly curved, high at posterior end of field, much reduced in anterior. Diductor field suboval to subcircular. Adductors elongate-oval, abutting anterior of ventral process. Diductor field bisected by very weak, low, subrounded myophragm which does not extend to anterior of muscle field. Surface nearly covered with many, minute pustules, particularly anterolaterally.

Denticles extend for one-half to two-thirds shell width. Bilobed, strongly divergent, disjunct cardinal process pyriform in outline, rests on buildup of shell material. Lobes very strongly grooved, producing a quadrilobate process closely flanked by two stout, long, fairly high, widely divergent socket plates. Anterior muscle bounding scars low, narrow, very gently curved. Adductor field subrhomboidal in outline, bisected by thin, low, subrounded median ridges continuous with process base and extending nearly half valve length. Anterior adductors subtriangular to suboval in outline. Median ridge flanked by two slightly divergent ridges which fade anterior to posterior of muscle bounding ridge. Continuous with elongate-oval concentration of moderately thin, cylindrical, hollow tubercles which might be considered as site for anterior adductors. In some specimens, tubercles are present on low, rounded ridges. Shell surface nearly covered with many, minute pustules becoming small near anterior margins. Grooved on lateral edges, best seen on anterolateral surface.

Comparison: This species is similar internally to _M. tuberosa_ n. sp., but is larger, has different ornamentation, and is not as nearly concavo-convex in lateral profile. _M. musculusvarius_ n. sp. is larger, has a rhomboidal ventral diductor field and much finer costellae. _M. subinterstrialis_ Kozlowski (1929, Plate 4, Figs. 1-4, Text Figs. 28A, B) has much weaker costellae, and has a very large rhomboidal ventral diductor field. _M. costatula_ (Havlíček, 1967,

Plate 34, Figs. 7, 9-12, Text Fig. 69) has finer costellae, a rhomboidal ventral diductor field and a disc and trail.

Genus Cymostrophia Caster, 1939

Type Species: Strophomena stephani Barrande, 1848, p. 230
(Plate 20, Fig. 7)

Cymostrophia cf. C. golem Haclíček

(Plate 18, Figs. 23-28)

"Brachyprion" mirabilis Johnson, 1975a
(Plate 5, Figs. 16, 17)
cf. C. golem Havlíček, 1967
(Plate 24, Figs. 5, 6, 8, 9, 11-15)

Material and Occurrence: Calcareous specimens from GSC locs. C-26872, C-26881, C-26883, C-26892, unnamed unit, section 8, Prince of Wales Island. Late Lochkovian, Quadrithyris Zone.

Discussion: Very few specimens were encountered and these were poorly preserved or fragmentary. No suitable dorsal valve was recovered and consequently, for the present, the interior is unknown. The shells are large sized and strongly geniculate, with the lateral edges forming auricular projections. The ornament is parvicostellate with well developed primaries which increase in height anteriorly making some specimens appear plicate. Interrupted rugose ornament is very well developed. The ventral diductor tracks are deep and curve slightly toward midline. The diductor field is subtriangular to nearly bilobate. The adductors are elongate-oval in outline and situated medially between the diductors. Adductor field bisected by a thin groove which becomes a thin ridge bisecting diductors and extends beyond the muscle field.

This species is very similar to C. golem (Havlíček, 1967, Plate 24, Figs. 5, 6, 8, 9, 11-15), but until additional material becomes available, this problem cannot be solved.

Cymostrophia sp.
(Plate 19, Figs. 1-13, 15, 16)

"Brachyprion" mirabilis Johnson, 1975a
(Plate 5, Figs. 10-17)

Material and Occurrence: Silicified specimens from GSC locs. C-26913, C-26914, C-26915, C-26916, C-26917, C-26919, C-26920, unnamed unit, section 10, Prince of Wales Island. Early-Late? Lochkovian.

Diagnosis: Shells small to medium sized, very strongly concavo-convex, with well developed interrupted rugae and very strong primary costellae which approach the size of costae.

Description: Shells small to medium sized, transversely suboval to subtriangular in outline with well developed auricular projections, strongly concavo-convex in lateral profile. Ventral interarea low, broad, triangular, flat, orthocline to anacline. Dorsal interarea very low, flat, hypercline. Delthyrium covered by plates parallel with hinge. Hinge long, straight, site of maximum width. Cardinal angles acute. Ornament parvicostellate. Primaries increase in height anteriorly and extend slightly beyond valve margin, appearing spinose. Secondary costellae very fine, very close together, narrow, low. Posterior portions of mature specimens covered with well developed interrupted rugae. Dorsal primary costellae much reduced in height compared to ventral counterparts.

Very fine denticles developed on about half shell width. Ventral process very small, thin, rectangular in outline. Base flares anteriorly producing a subtriangular outline. Muscle bounding ridges narrow, low, slightly curved, recurving anteriorly toward midline. Diductor field suboval to bilobate in some specimens. Adductors paired, elongate, oval abutting ventral process base. More deeply impressed in posterior regions. Muscle field bisected by weakly developed, rounded myophragm that may or may not extend to muscle field anterior. Interior nearly covered by minute, numerous pustules. Grooved over entire surface, impressions of rugae present in posterior regions.

Very fine denticles present on about half shell width. Cardinal process bilobed, disjunct, moderately divergent, projecting postero-ventrally, overhanging hinge, medially grooved producing a quadri-lobate process, resting on low buildup of shell material. Flanked by two closely set, short, widely divergent socket plates. Adductor bounding ridges very faint, producing a subrhomboidal field. Posterior adductors suboval in outline. Very faint, broad, flat ridge continuous from base of process bisects the field. Flanked by two gently divergent, poorly developed ridges that are composed of moderately well developed cylindrical tubercles in the anterior area which are probably the site for the anterior adductors. Surface nearly covered by numerous, minute pustules; grooved anteriorly.

Comparison: This species is similar in outline to some of the species of Mesodouvillina illustrated in this paper, but is far more concavo-convex to nearly geniculate. Very few dorsal valves were available for study and the one illustrated does not possess as well developed interrupted rugae as is present on the dorsal valves of articulated specimens. Therefore, there is some doubt that the dorsal valve used in the comparison and description for this species actually belongs to it. Until additional material is available, the affinities of this species will be in doubt.

Genus Brachyprion Shaler

Type Species: Strophomena leda Billings, 1860, p. 55 (Figs. 2, 3)

"Brachyprion" cf. "B." mirabilis Johnson
(Plate 15, Figs. 1-5)

Shaleria sp. Boucot et al., 1960
(Plate 11, Figs. 23-26; Plate 12, Figs. 1-8)

cf. "Brachyprion" mirabilis Johnson, 1970
(Plate 22, Figs. 1-12)

Material and Occurrence: Silicified specimens from GSC locs. C-33700, C-33701, C-33702, Devon Island Formation, Devon Island. Early Lochkovian.

Discussion: This species is poorly represented both in numbers as well as state of preservation. Nearly all the valves are fragmentary and poorly preserved. However, the distinguishing features of "*Brachyprion*" are present. The cardinal process lobes are disjunct and project ventrally, not extending beyond the hinge line. The socket plates are widely divergent and set far apart. The ornament is parvicostellate with variably developed interrupted rugae as well. This species differs from "*B.*" *mirabilis* Johnson (1970, Plate 22, Figs. 1-12) in having smaller, thinner, cardinal process lobes as well as less deeply incised ventral adductor scars. Until additional material is available to determine intraspecific variation, positive specific assignment of this species is not practicable.

Suborder Chonetoidea

Superfamily Chonetacea Bronn, 1862

Family Chonetidae Bronn, 1862

Subfamily Strophochonetes Muir-wood, 1962

Genus *Asymmetrochonetes* new genus Smith

Type Species: *Asymmetrochonetes spinalonga* new genus, new species.

Diagnosis: Shells small transversely suboval in outline, concavo-convex in lateral profile with one or two, rarely three, long, hollow spines on right side of the hinge only, very rarely on left side only. Dorsal medium septum nearly imperceptible to absent. Anderidia well developed. Cardinal process bilobed proximally, quadrilobed distally.

Comparison: This genus differs from Strophochonetes Muir-wood in lacking a median capilla on the ventral valve and in lacking spines on both sides of the ventral hinge. It is similar to forms illustrated as "Strophochonetes" (Johnson, 1970, Plate 30, Fig. 6), but these forms possess spines on both the left and right margin of the hinge. It differs from Septachonetes Chatterton (1973, Plate 14, Figs. 18-25; Plate 17, Figs. 1, 2) in lacking secondary lateral septa. This genus is somewhat larger than Septachonetes Chatterton in that Chatterton reports specimens rarely being wider than 5 mm, whereas specimens of Asymmetrochonetes reach nearly 7 mm or slightly larger in width.

Species Assigned

Asymmetrochonetes spinalonga new genus, new species

S. (Strophochonetes) maramilia Garcia-Alcalde and Racheboeuf, 1975
(Fig. 3, a-e)

Asymmetrochonetes spinalonga n. gen., n. sp.
(Plate 19, Figs. 14, 17-35)

Derivatio nominis: Gr.; asymmetros, without symmetry; L.; spina, spine; longus, long.

Material and Occurrence: Holotype (GSC 47207), paratypes (GSC 47206, 47208, 47209, 47210, 47211, 47212, 47213, 47214, 47215), GSC loc. C-26915, plus additional silicified specimens from GSC locs. C-26914, C-26915, C-26916, C-26917, C-26918, C-26919, C-26920, C-26921, unnamed unit, section 10, Prince of Wales Island. Early-Late ? Lochkovian.

Diagnosis: Asymmetrochonetes with long, well developed spines and lacking a well developed dorsal median septum.

Description: Shells very small, transversely suboval in outline, concavo-convex in lateral profile, on some specimens auricular projections are present. Ventral interarea low, broad, flat, triangular, steeply apsacline to catacline. Ventral umbo gently inflated. Dorsal interarea low, flat, anacline. Delthyrium moderately broad, divergent, covered apically by very thin, convex, pseudodeltidium. Maximum width at midlength. Hinge line straight, nine-tenths shell width. Cardinal angles acute to slightly rounded, obtuse. Ornament consists of fine, radial, subrounded, low, broad, closely spaced costellae that increase anteriorly by bifurcation and implantation on both valves. Long, slender, hollow spines present on ventral valve, meet hinge at approximately 90°; posteriorly curving toward midline forming an angle of about 60° with hinge. Generally one or two spines on right hand margin of hinge, rarely three. Angle between spines and commissural plane varies from 20° to 60°, ventrally inclined.

Teeth very short, elongate-oval in outline, parallel hinge in lateral profile. Short, high, thin, median septum present, confined to umbo. Diductor field weakly impressed, subrhomboidal in outline. Surface nearly covered with minute pustules and grooves from costellae.

Socket ridges well developed, short, widely divergent, merge at base of bilobed proximally, distally quadrilobed cardinal process. Lobes project posteriorly, short, diverging slightly. Alveolus shallow. Anderidia moderately well developed, diverging at an angle of about 60°. Median ridge or septum very weakly developed to imperceptible. Surface nearly covered with grooves reflecting costellae, best developed anteriorly. Pustules arranged in rows on top of ridges.

Comparison and Discussion: This genus is not unique in that the spines present on the ventral hinge are present on one side only. Of 517 specimens with the hinge well preserved, all but one had spines on the right hand margin of the hinge. One specimen has a spine on the left hand margin and none on the right. In most other chonetids, the spines are arranged in pairs on both sides of the hinge. Other workers have illustrated forms with spines on one side of the hinge only which demonstrates the occurrence of this feature in other parts of the world (Chatterton, 1973; Garcia-Alcalde and Racheboeuf, 1975). _A. spinalonga_ differs from _A. marimilia_ (Garcia-Alcalde and

Racheboeuf, 1975, Fig. 3, a-e) in being smaller and not possessing a well developed dorsal median ridge.

Order Rhynchonellida

Superfamily Rhynchonellacea Gray, 1848

Family Rhynchotrematida Schuchert, 1913

Subfamily Orthorhynchulinae Cooper, 1956

Genus *Machaeraria* Cooper, 1955

Type Species: *Rhynchonella formosa* Hall, 1857, p. 76

Machaeraria obesa n. sp.
(Plate 20, Figs. 1-24)

Derivatio nominis: L.; *obesus*, fat.

Material and Occurrence: Holotype (GSC 47219), paratypes (GSC 47218, 47223), GSC loc. C-26915, plus additional calcareous and silicified material from GSC locs. C-26873, C-26874, C-26880, C-26881, section 8, C-26906, section 9, C-26911, C-26915, C-26916, C-26917, C-26919, C-26920, unnamed units, section 10, Prince of Wales Island. Early-Late? Lochkovian.

Diagnosis: Shells subpentagonal to transversely oval in outline, strongly biconvex in lateral profile. Costae bifurcate in fold and sulcus of mature specimens.

Description: Shells small to medium sized, subpentagonal to transversely suboval in outline, strongly dorsibiconvex in lateral profile. Delthyrium triangular, divergent, covered partially by disjunct continuation of shell margins in posterior portions leaving a narrow foramen extending to posterior of valve. Foramen varies from hypothyrid to submesothyrid. Ventral umbo slightly inflated. Ventral beak suberect. Dorsal umbo slightly inflated, beak incurved. Hinge line short, curved. Maximum width anterior to midlength. Ventral sulcus well developed, deep, nearly flat bottomed, extends from umbo to anterior margin, containing one to three, less commonly four costae. Dorsal fold well developed, raised above shell margin, high with smooth sides, extending from umbo to anterior margin and has two to five costae. Lateral costae in sulcus of some specimens become obsolete anteriorly. Ornament on flanks consists of radial, subrounded to angular costae separated by broad U to V-shaped interspaces, increasing from near umbo by implantation and rarely by bifurcation. Costae bifurcate in sulcus of large specimens. Costae more angular anteriorly in larger, more mature specimens; crossed by very fine, closely spaced, concentric growth lines.

Hinge teeth well developed, set widely apart, elongate-oval in outline, close to shell wall, widely divergent, supported by short, plate-like, widely divergent dental lamellae. Diductor muscle bounding ridges poorly defined, continuous from lamellae, converge to mideline, then diverge, extending nearly half shell length. Diductor scar subtriangular in outline. Adductors weakly impressed, elongate-oval, anterior to umbo. Interior surface corrugated due to costae.

Sockets elongate-oval in outline, cylindroidal, moderately deep, widely divergent, impressed in shell wall. Sockets bounded medially by outer hinge plates, triangular in outline, curved, sloping dorsomedially. Notothyrium deep, narrow, triangular, contains long, septaform cardinal process. Crura arise from anterior of hinge plates, anteroventrally directed, crescentic in cross-section, upper surfaces convex. Muscle field not impressed. Shell surface corrugated due to impress of costae.

Comparison: This species differs from _M._ cf. _M._ _formosa_ (Hall) (Savage, 1971, Plate 70, Figs. 35-39) in being much more dorsibiconvex, more transverse in outline and having a more pronounced dorsal fold. _M._ _kurjensis_ (Gratsianova, 1967, Plate 6, Fig. 9) is far less dorsibiconvex and is subtriangular in outline as well as possessing smooth umbos. It is similar to _M._ _formosa_ (Hall) (Cooper, 1955, Plate 13, Figs. 13-29), but is far more dorsibiconvex as well as having a deeper sulcus and larger, more elevated fold and being more transverse in outline.

Family Trigonirhynchiidae Schmidt

Genus _Ancillotoechia_ Havlíček

Type Species: _Rhynchonella_ _ancillans_ Barrande 1879
(Taf. 36 als. Fig. 2, 12-17)

Discussion: Ancillotoechia bears a very striking resemblance to Hemitoechia Nikiforova (1970), but differs internally in possessing a plate across the dorsal septalium. Specimens of Hemitoechia were obtained from Dr. Nikiforova and one was serial sectioned. It is illustrated here (Fig. 51) for comparison. Hemitoechia possesses a pair of crural flanges on the inner edges of the septalium. However, these do not unite to form a plate.

Ancillotoechia gutta gutta Johnson, Boucot, and Murphy
(Plate 20, Figs. 25-38; Plate 21, Figs. 1, 5, 8-12)

Ancillotoechia gutta gutta Johnson, Boucot, and Murphy, 1973
(Plate 22, Figs. 1-19)

Material and Occurrence: Calcareous and silicified specimens from GSC locs. C-26806, C-26810, unnamed unit, section 2, C-26813, unnamed unit, section 3, Prince of Wales Island. Early Lochkovian.

Diagnosis: Shells subtriangular to pyriform in outline, moderately dorsibiconvex in lateral profile, with well developed fold and sulcus.

Discussion: A. gutta gutta has been well described by Johnson, Boucot, and Murphy (1973) and the writer feels no need to duplicate it here. However, a noticeable difference was detected in specimens from Prince of Wales Island. As is true at the subspecific level of taxonomy, noticeable differences are very minor and some characters overlap from one form to another.

Fig. 51. Drawings of acetate peels from serial sections of *Hemitoechia distincta* Nikiforova, GSC 27230. (X5).

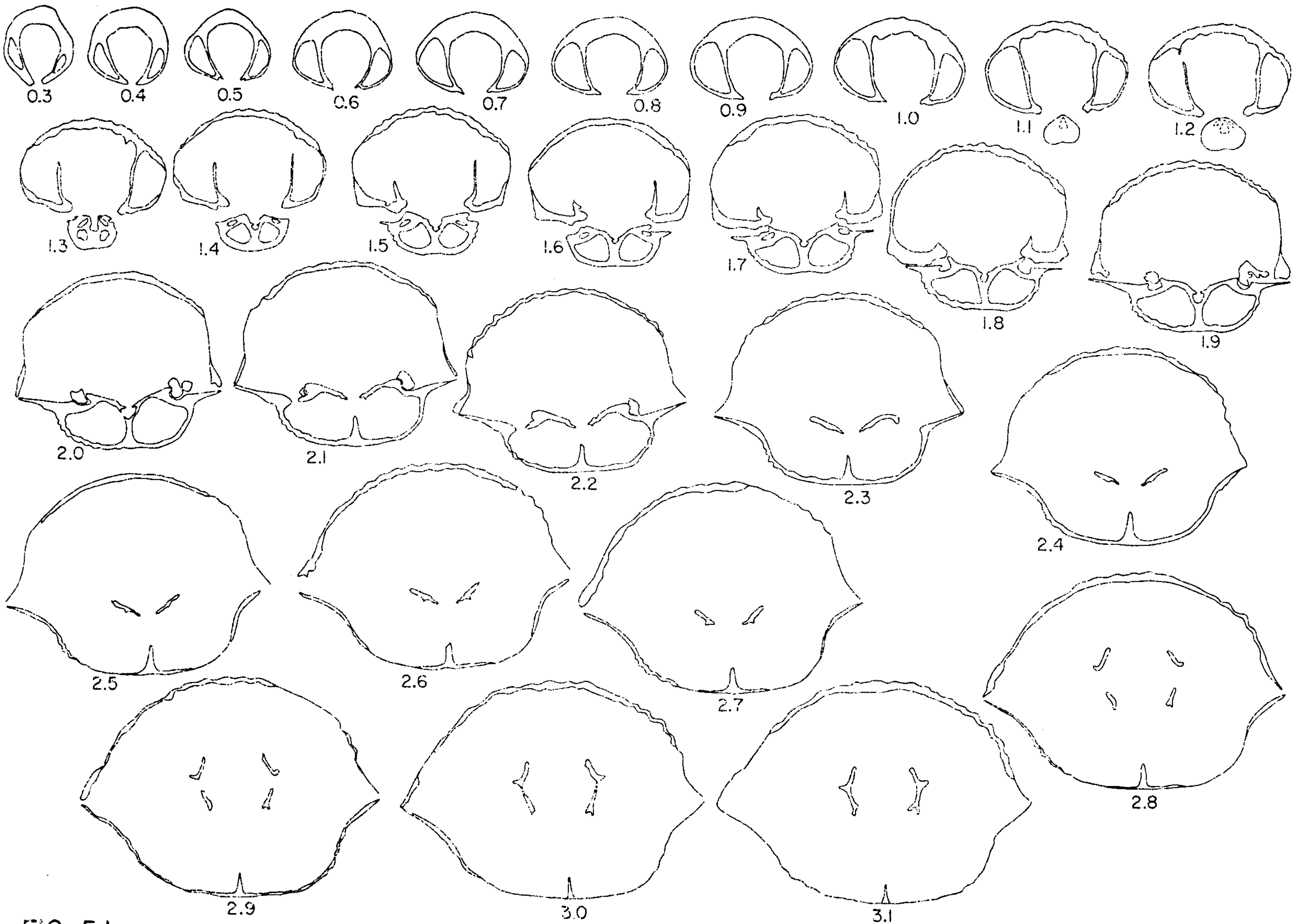

0.3
0.4
0.5
0.6
0.7
0.8
0.9
1.0
1.1
1.2
1.3
1.4
1.5
1.6
1.7
1.8
1.9
2.0
2.1
2.2
2.3
2.4
2.5
2.6
2.7
2.8
2.9
3.0
3.1

FIG. 51

This subspecies is characterized by its subtriangular to pyriform outline. Immature specimens are sharply triangular in outline and ventribiconvex. Mature specimens are moderately dorsibiconvex in lateral profile. The ventral sulcus is well developed in anterior regions and contains three costae and the dorsal fold four. The dorsal umbo is slightly flattened. The fold is moderately to strongly raised above the shell margins and is best developed in anterior regions. The ventral beak is narrow, pointed and suberect to gently incurved over the dorsal umbo. Costae on each flank range from four to eight on larger specimens.

Comparison: This subspecies differs from *A. gutta rotunda* n. subsp. in being more triangular in outline, having more costae, being more oval in lateral profile and having a better developed ventral sulcus and dorsal fold as well as more angular costae. It is also slightly larger than *A. gutta rotunda* n. subsp.

Ancillotoechia gutta rotunda n. subsp.
(Plate 21, Figs. 6, 7, 13-35)

Derivatio nominis: L.; *rotundus*, rounded.

Material and Occurrence: Holotype (GSC 47237), paratypes (GSC 47233, 47234, 47235, 47236), GSC loc. C-26952, plus additional material from GSC locs. C-26939, C-26940, C-26942, C-26943, C-26945, C-26952, section 11, C-26973, C-26974, C-26985, C-26986, C-26987, C-26988, C-26989, C-26990, section 12, unnamed carbonate unit, Baillie Hamilton Island. Early Lochkovian.

Discussion: This subspecies is characterized by its subtriangular to suboval outline. It is variably dorsibiconvex to slightly ventribiconvex in lateral profile. The dorsal umbo is rounded and gently inflated. Immature specimens are subtriangular in outline and ventribiconvex in lateral profile. Some specimens are nearly equibiconvex and appear globose. The ventral sulcus is very shallow and contains three to four costae. The dorsal fold is also poorly developed and does protrude much above shell margin and contains four to five costae. The flanks contain four to seven costae on larger specimens.

Comparison: This subspecies differs from *A. gutta gutta* in being more biconvex in lateral profile, more oval shaped and possessing a much weaker ventral sulcus and dorsal fold as well as more rounded costae.

Ancillotoechia magnaplica n. sp.

(Plate 21, Figs. 49, 56, 63, 70;
Plate 22, Figs. 1-31, 36)

Derivatio nominis: L.; *magnus*, large; *plica*, fold.

Material and Occurrence: Holotype (GSC 47250), paratypes (GSC 47253, 47254, 47255, 47256, 47257), GSC loc. C-26913, plus additional silicified specimens from GSC locs. C-26911, C-26913, C-26914, C-26915, C-26916, C-26917, C-26918, C-26919, C-26920, C-26921, unnamed unit, section 10, Prince of Wales Island. Early-Late ? Lochkovian.

Diagnosis: Medium sized shells, dorsibiconvex in lateral profile, subtriangular to transversely suboval in outline, costae very sharp, angular, fold and sulcus well developed, umbos faintly costate to nearly smooth, ventral umbo pinched.

Description: Shells medium sized, subtriangular to transversely suboval in outline, outline varies considerably, dorsibiconvex in lateral profile. Immature specimens subtriangular in outline and ventribiconvex. Delthyrium open, high, narrow. Hinge short, curved. Ventral umbo inflated. Beak sharply pointed to pinched, suberect to gently incurved. Dorsal umbo gently inflated, beak incurved. Maximum width slightly anterior to midlength. Shallow, ventral sulcus moderately developed in anterior half of shell, extending into tongue-like process. Sulcus uniplicate, sharply serrate. In some specimens, flanks slightly recurved. Sulcus of most specimens contains three costae. Dorsal fold moderately well developed in anterior half of shell. Fold of most specimens contains four costae. Ornament on flanks consists of subrounded to angular costae which become faint to nearly imperceptible at umbo. Commissure has zig-zag crenulate margin of interlocking costae, accentuated in fold and sulcus. Flanks have five to eight well developed costae. Rare, well developed growth ridges present on some specimens.

Hinge teeth small, suboval in outline, widely divergent, supported by thin, widely divergent, plate-like dental lamellae situated close to shell wall. Muscle bounding ridges extend from anterior edges of lamellae and are moderately divergent. Diductor field subtriangular to gently bilobed. Adductors faint, elongate-oval. Surface corrugated due to impress of costae.

Sockets shallow, very narrow, broadly divergent, bounded by shell wall and high socket ridges. V-shaped septalium covered by inner hinge plates, open apically. Septalium supported by well developed, blade-like median septum extending half shall length. Crura extend as anterior extensions of outer hinge plates, are thin, crescentic in cross-section, curving anteroventrally. Surface corrugated due to impress of costae.

Comparison: This species differs from A. gutta gutta Johnson, Boucot, and Murphy (1973, Plate 22, Figs. 1-19) in being larger, more variable in outline, in having a more pronounced fold and sulcus and in having nearly smooth umbos in some specimens. It is similar to A. nucula (Sowerby) (Kozlowski, 1929, Plate 6, Figs. 17-27) but has more angular costae, smoother umbos and a much more developed fold and sulcus. A. ancillans (Havlíček, 1961, Plate 6, Figs. 8-11) has fewer, coarser, more rounded costae and is more pear-shaped in outline. It differs from *A. plicaminor* n. sp. in being larger, having more coarse, angular costae and a better developed fold and sulcus.

Ancillotoechia plicaminor n. sp.
(Plate 21, Figs. 36-41, 43-48, 50-55, 57-62, 64-69; Figs. 52, 53)

Derivatio nominis: L.; *plica*, fold; *minor*, smaller.

Material and Occurrence: Holotype (GSC 47239), paratypes (GSC 47238, 47240, 47241, 47242, 47243), GSC loc. C-26852, plus additional material from GSC locs. C-26848, C-26850, C-26851, C-26852, C-26853, unnamed unit, section 7, Prince of Wales Island. Early Lochkovian.

Diagnosis: Shells small, subrhomboidal to subpentagonal in outline, dorsibiconvex to nearly biconvex in lateral profile. Fold generally part of even curvature of outline of shell in anterior view, umbos nearly smooth.

Description: Shells small, subrhomboidal to subpentagonal in outline, dorsibiconvex to nearly biconvex in lateral profile. Hinge short, curved. Maximum width at midlength. Ventral umbo inflated. Ventral beak narrow, suberect to gently incurved. Dorsal umbo broad, inflated, beak incurved. Delthyrium open, divergent, moderately high and broad. Ventral sulcus shallow, very poorly developed to nonexistent, generally part of even curvature of valve,

Fig. 52. Drawings of acetate peels from serial sections of *Ancillotoechia plicaminor* n. sp. (X6), GSC 47244, GSC loc. C-26852, Prince of Wales Island.

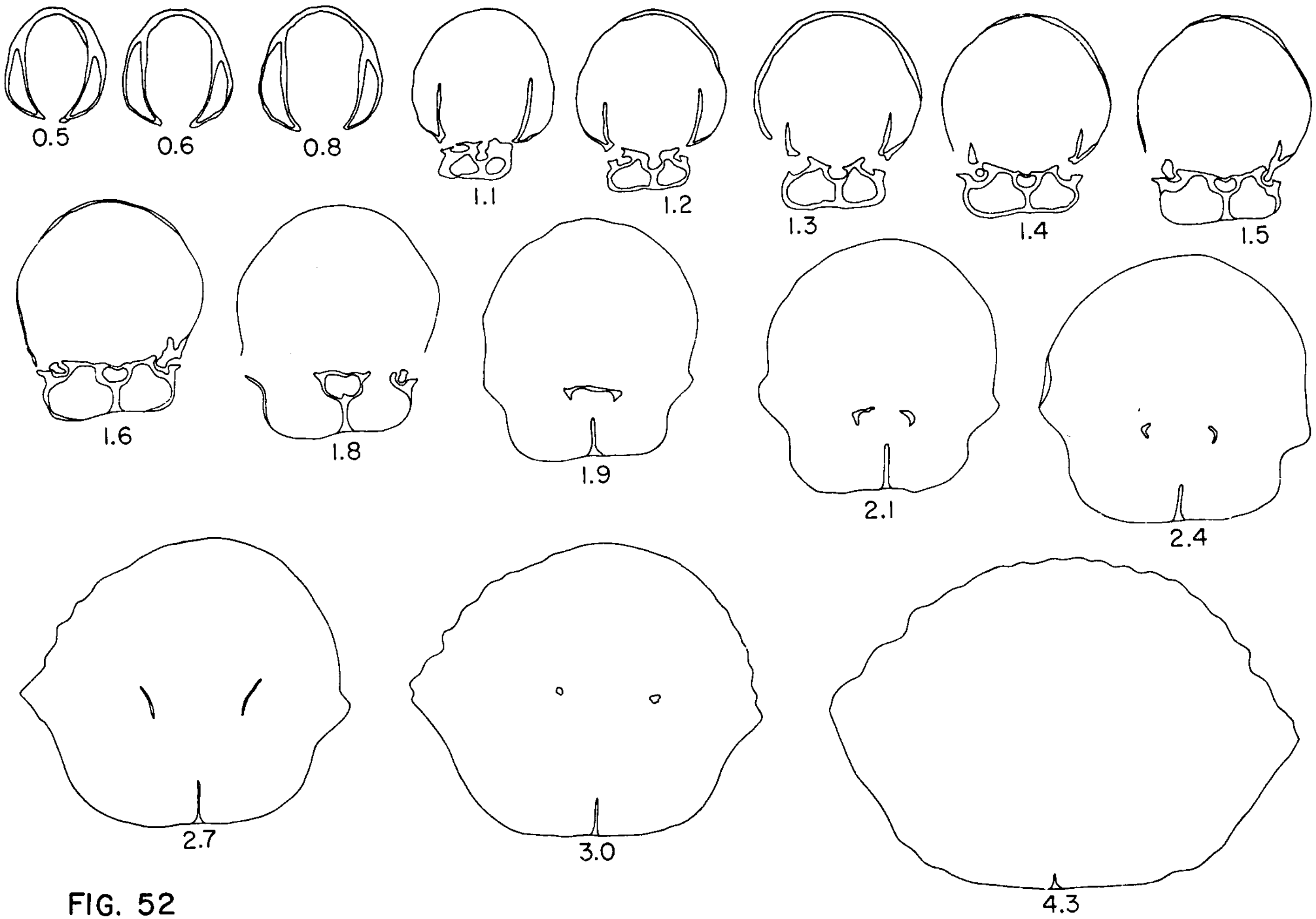


FIG. 52

Fig. 53. Drawings of acetate peels from serial sections of *Ancillotoechia plicaminor* n. sp. (X7), GSC 47245, GSC loc. C-26852, Prince of Wales Island.

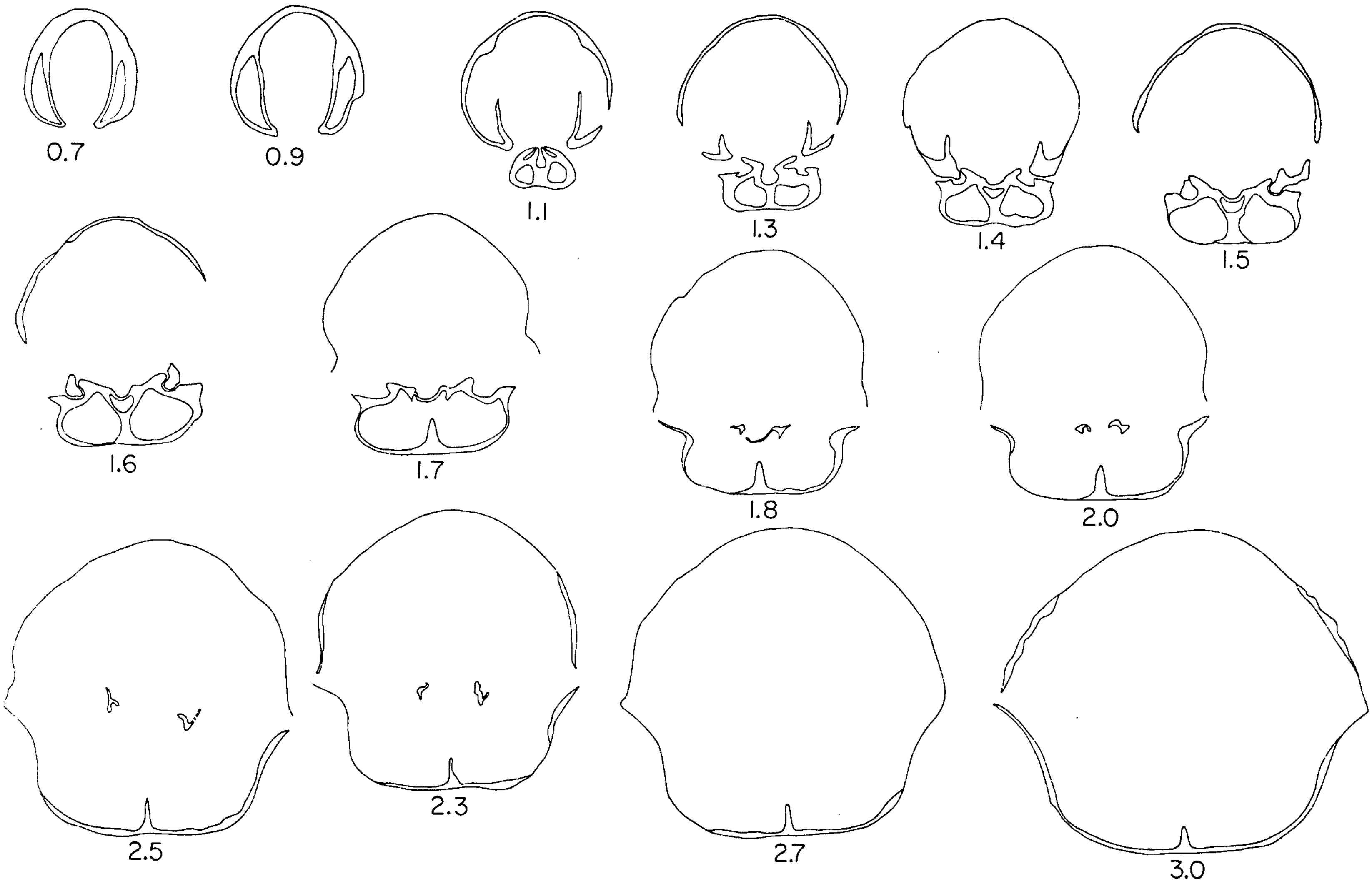


FIG. 53

contains three to five costae. Dorsal fold weakly differentiated from flanks, best seen in anterior one-quarter of shell, contains four to six costae. Flanks contain five to eight costae. Ornament consists of subangular to subrounded costae separated by moderately deep U to V-shaped interspaces. Costae crossed by very faint, closely spaced, concentric growth lines.

Hinge teeth short, elongate-oval in outline, separated by well developed, short, divergent, plate-like dental lamellae. Muscle field not impressed. Inner surface corrugated due to impress of costae.

Sockets fairly broad, divergent, bounded by shell wall and socket ridges. V-shaped septalium supported by well developed, blade-like median septum extending one-third shell length. Septalium covered by inner hinge plates, convex dorsally, open apically. Crura extend from outer hinge plates, are crescentic in cross-section and extend anteroventrally. Surface corrugated due to impress of costae.

Comparison: This species differs from _A. gutta gutta_ (Johnson, Boucot, and Murphy, 1973, Plate 22, Figs. 1-19) in being more convex, in having a much less well developed fold and sulcus and flattened, nearly smooth dorsal umbo. _A. nucula_ (Sowerby) (Kozlowski, 1929, Plate 6, Figs. 17-27) has a more inflated ventral umbo, and is more transverse to suboval in outline as well as having a better developed fold and sulcus.

Family Uncinulidae Rzonsnitskaya, 1956

Subfamily Uncinulinae Rzonsnitskaya, 1956

Genus Uncinulus Bayle

Type Species: Hemithyris subwilsoni d'Orbigny, 1850

"Uncinulus" sp.
(Plate 22, Figs. 32-35, 37-43;
Figs. 54, 55)

Material and Occurrence: Calcareous and silicified specimens from GSC locs. C-26806, unnamed unit, C-26810, C-26811, C-26812, C-26813, C-26814, C-26816, C-26817, unnamed unit, section 3, Prince of Wales Island. Early Lochkovian.

Discussion: These shells are a problem in that they resemble Uncinulus s. s. in outline and ornament, but do not possess a comb-like cardinal process nor a plate covering the dorsal septalium. They may belong to a new genus, but until other material from other parts of the world has been examined, it seems advisable to place this form tentatively with the uncinulids.

Diagnosis: Shells broadly triangular in outline, slightly dorsibiconvex in lateral profile. Hinge plates not conjunct. Septalium infilled with callus-like deposit.

Fig. 54. Drawings of acetate peels from serial sections of "Uncinulus" sp. (X3.5), GSC 47258, GSC loc. C-26813, Prince of Wales Island.

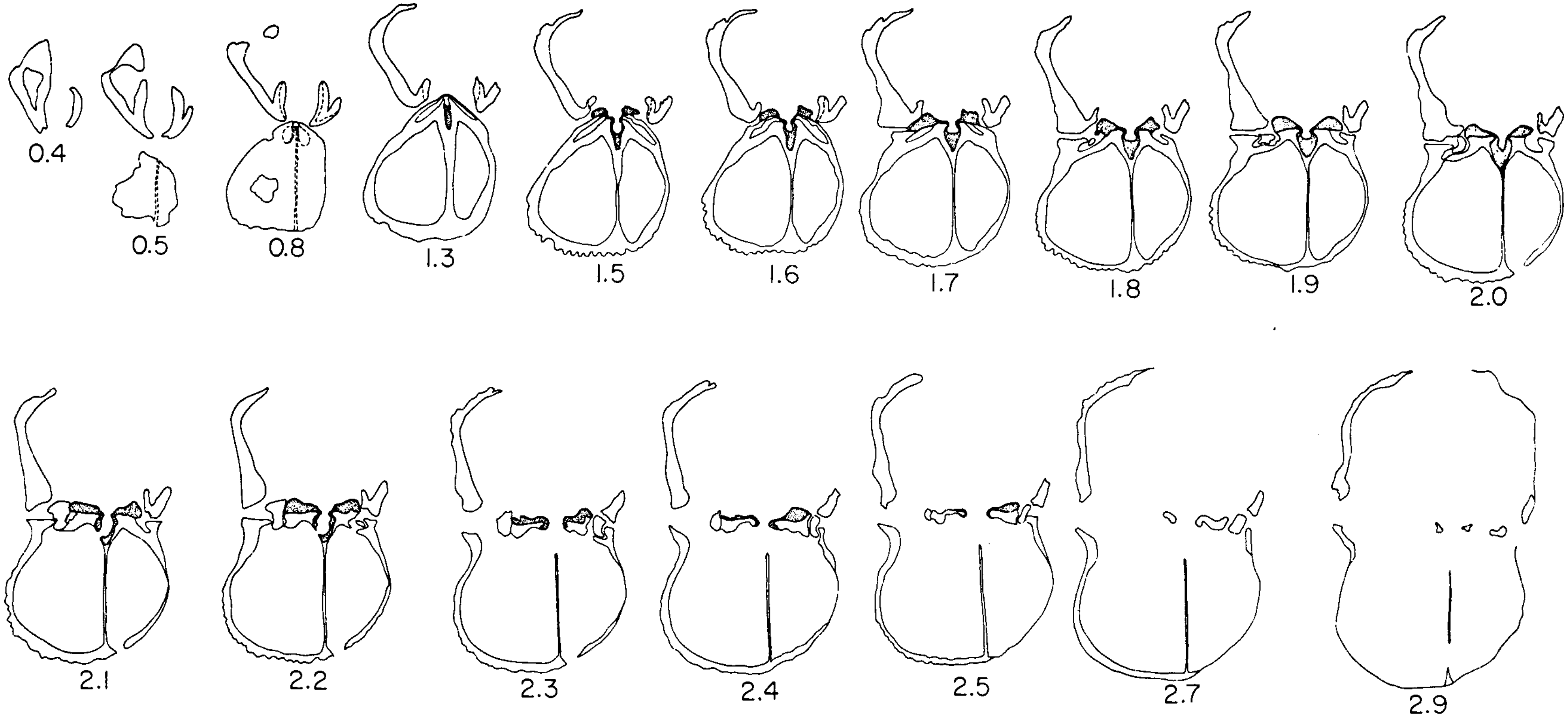


FIG. 54

Fig. 55. Drawings of acetate peels from serial sections of "*Uncinulus*" sp. (X3), GSC 47259, GSC loc. C-26817, Prince of Wales Island.

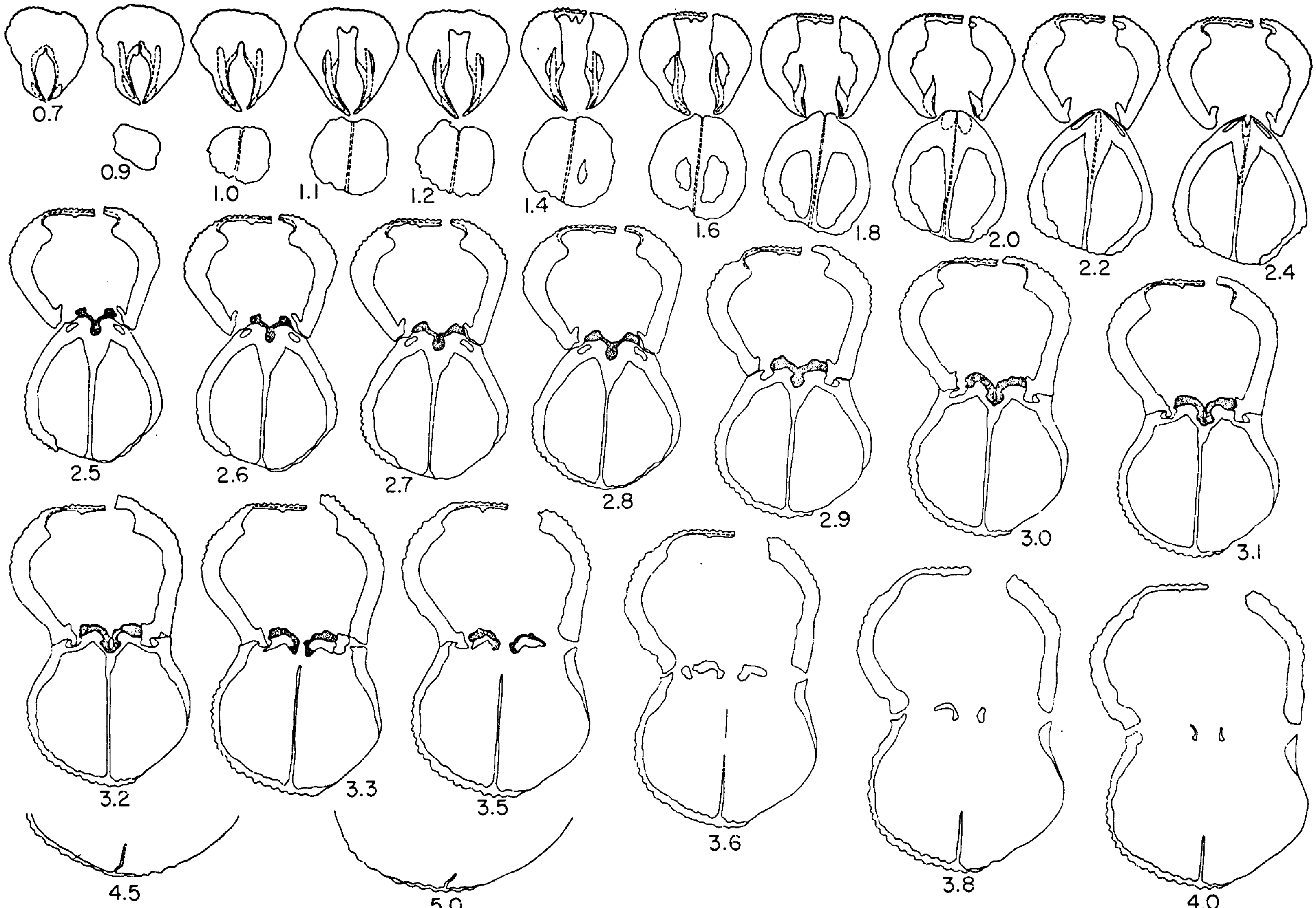

0.7
0.9
1.0
1.1
1.2
1.4
1.6
1.8
2.0
2.2
2.4
2.5
2.6
2.7
2.8
2.9
3.0
3.1
3.2
3.3
3.5
3.6
3.8
4.0
4.5
5.0

FIG. 55

Description: Shells of moderate size, subpentagonal in immature stages, broadly triangular in adults. Slightly dorsibiconvex in lateral profile. Ventral umbo inflated, beak incurved, almost resting on dorsal valve. Dorsal umbo gently inflated, beak incurved. Hinge short, curved. Maximum width slightly anterior to midlength. Shallow ventral sulcus begins near umbo, widely divergent, ending in well developed, wide, nearly flat-topped tongue. Low dorsal fold begins near umbo, broadly divergent, best seen in anterior one-third of shell as well as rectangular deflection of commissure. Ornament consists of numerous, low, rounded, broad costae separated by narrow U-shaped interspaces. Costae on flanks of fold and sulcus in anterior one-quarter of shell become more angular, elevated. Costae in fold and sulcus flatten out and are longitudinally grooved reflecting spines. Lateral costae also grooved.

Hinge teeth stout, oval in cross-section, divergent supported by short, divergent, plate-like dental lamellae partially fused to shell wall. Pedical collar well developed. Diductor field deeply impressed, subtriangular in outline, bisected by well developed, elongate myophragm. Weakly impressed adductor field appears elliptical in outline. Interior weakly impressed due to impress of costae.

Sockets well developed, deep, U-shaped in cross-section, floored by socket plates. V-shaped septalium supported by well developed, posteriorly thickened (almost bulbous), plate-like median septum extending nearly half shell length. Septalium infilled with callus-like deposits forming large, mound-like buildups on outer hinge plates, creating an incipient cardinal process. Covering plate absent. Thickened, well developed crura extend anteroventrally. Muscle field not impressed. Shell crenulated anteriorly due to impress of costae.

Comparison: This genus is similar to "Tadschikia" (this paper) in that is possesses a similar ornament and internal features. However, it differs in having a broader, more transverse outline, being less dorsibiconvex and not possessing a plate covering the dorsal septalium. It is somewhat similar to Plethorhynchus dunensis Dreverm figured by Barrois, Pruvost, and Dubois (1922, Plate 14, Figs. 11-18), but does not possess as well developed a fold and sulcus.

Subfamily Hebetoechiinae Havlíček, 1960

Genus Hebetoechia Havlíček, 1959

Type Species: Terebratula hebe Barrande, 1847
(Taf 19, Fig. 11)

Hebetoechia ornatrix Havlíček
(Plate 22, Figs. 44-60; Plate 23, Figs. 1-4, 14-41;
Figs. 56, 57)

Hebetoechia ornatrix Havlíček, 1961
(Plate 8, Figs. 2, 3; Text Fig. 45)

Material and Occurrence: Calcareous and silicified specimens from

Fig. 56. Drawings of acetate peels from serial sections of *Hebetoechia ornatrix* Havlíček (X7), GSC 47263, GSC loc. C-26822, Prince of Wales Island.

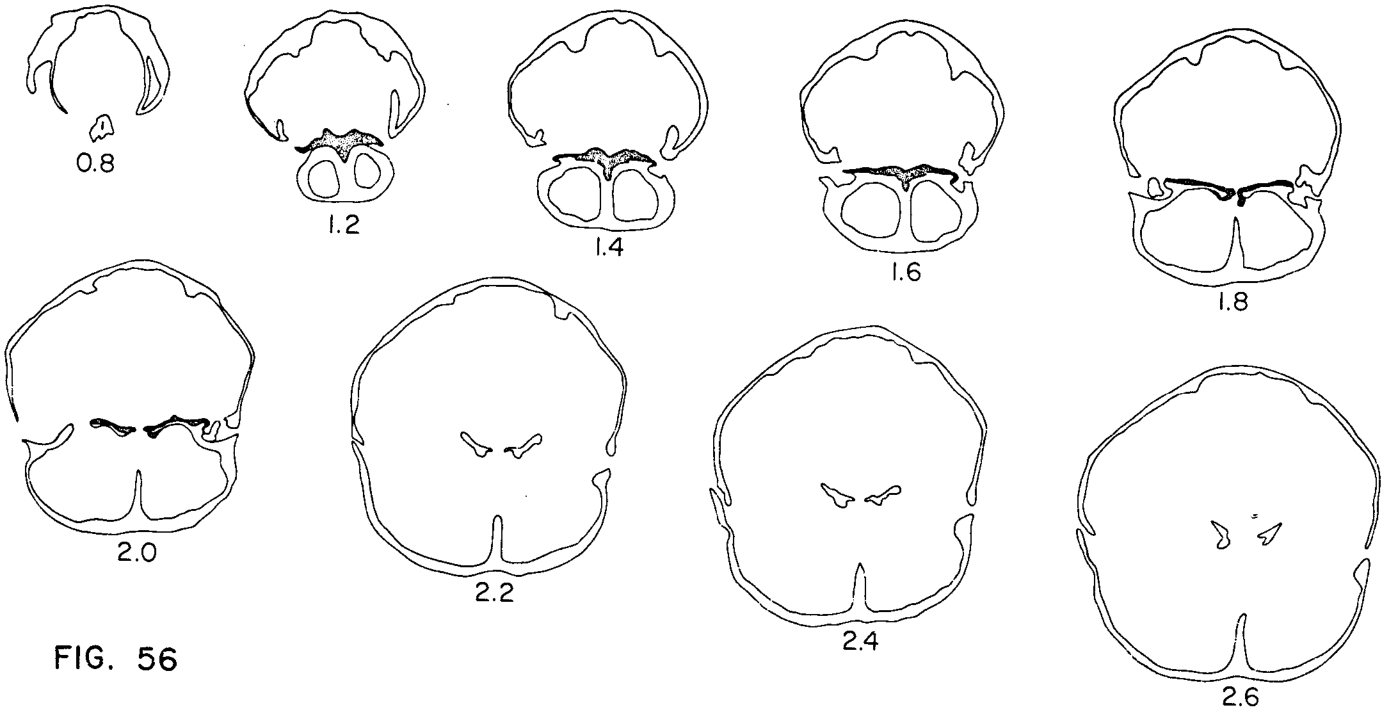


FIG. 56

Fig. 57. Drawings of acetate peels from serial sections of *Hebetoechia ornatrix* Havlíček (X10), GSC 47264, GSC loc. C-26829, Prince of Wales Island.

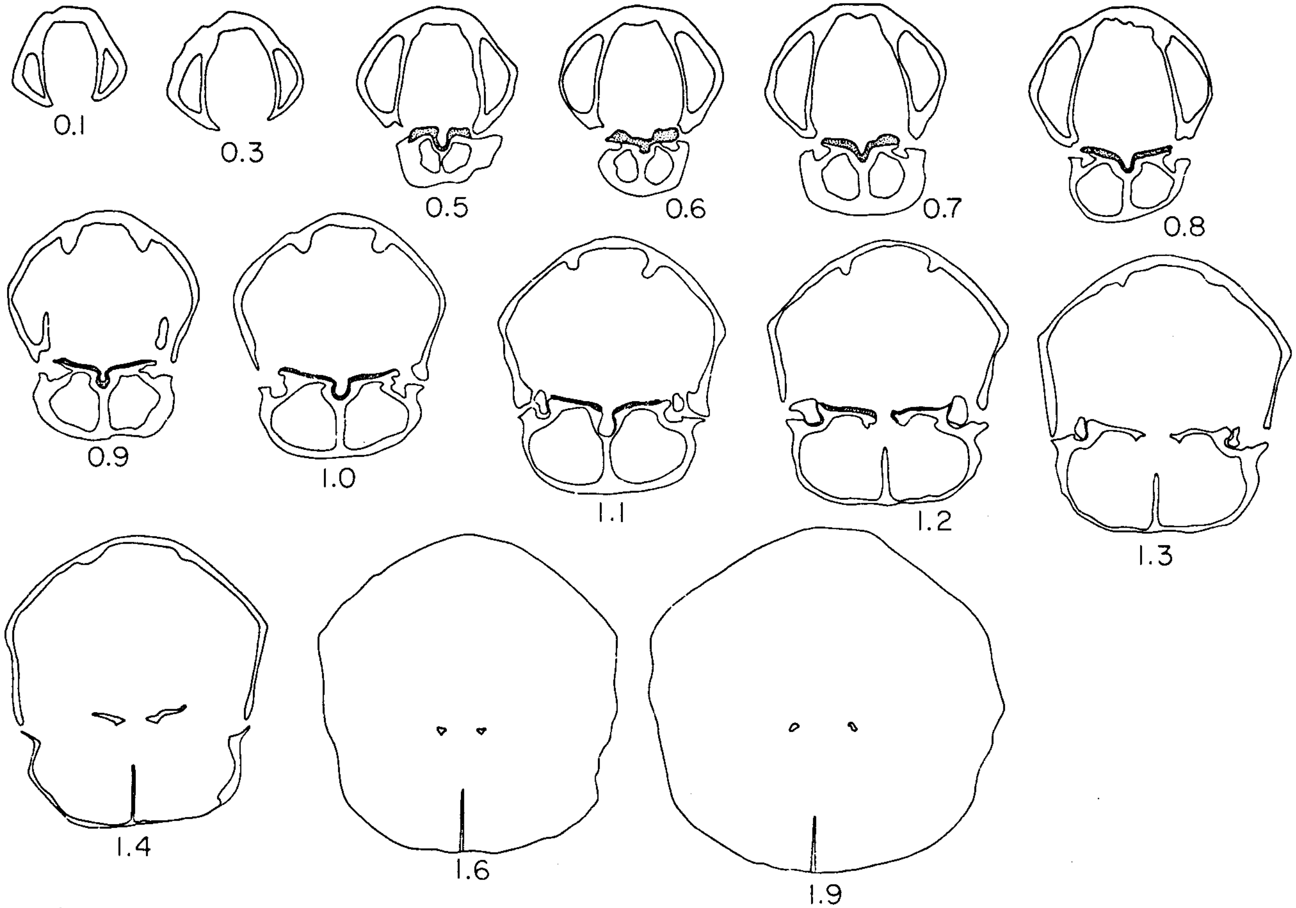


FIG. 57

GSC locs. C-26822, C-26823, C-26824, C-26825, C-26828, C-26829, C-26830, C-26831, unnamed unit, section 4, Prince of Wales Island. Early Lochkovian.

Diagnosis. Shells subpentagonal in outline, dorsibiconvex in lateral profile with robust dorsal valve. Ventral sulcus contains four to eight costae and the dorsal fold five to nine.

Description: Shells small to medium sized, subpentagonal in outline, dorsibiconvex in lateral profile with robust dorsal valve. Ventral umbo gently inflated. Beak pointed, incurved over dorsal valve. Dorsal umbo inflated, beak incurved. Delthyrium moderately high, open, divergent. Hinge short, curved. Maximum width at midlength. Ventral sulcus poorly developed, shallow, broad, flat-bottomed, best developed in anterior third of shell forming tongue-like process, contains four to eight costae. Dorsal fold poorly developed, broad, flat-topped, best developed in anterior third of shell, contains five to nine costae; flanks contain six to ten costae; fold best seen on anterior commissure as rectangular deflection. Fold protrudes slightly above even curvature of shell. Ornament consists of moderately to strongly rounded, broad costae, wider than high, separated by narrow interspaces, increasing anteriorly by implantation. Umbos smooth. Costae in ventral tongue grooved and flat. Costae crossed by very fine, concentric, very closely spaced growth lines.

Hinge teeth small, delicate, elongate-oval in outline, widely divergent, supported by short, divergent, plate-like dental lamellae set close to shell wall and confined to umbo. Thin, low muscle bounding ridges continue anteriorly from lamellae and are divergent, forming a subrhomboidal to gently bilobate diductor field. Adductor field small, cordate, posterior to umbo. Inner surface corrugated due to impress of costae.

Sockets short, subtriangular in outline, U-shaped in cross-section. Supported by well developed socket plates, widely divergent, covered posteriorly by shell wall and hinge plates. Outer hinge plates triangular in outline curving anterodorsally. Moderately to broadly divergent V-shaped septalium supported by thin, blade-like median septum that may or may not thicken anteriorly. Notothyrial cavity very high, narrow. Septalium infilled with buildup of callus-like deposits, cleft medially, variable in thickness, also present on hinge plates, forming incipient cardinal process. These deposits may be very low, rounded, ranging to moderately high and bulbous. Crura extend from inner edge of outer hinge plates, are moderately divergent, crescentic in cross-section and project anteroventrally. Muscle scars not seen. Inner surface corrugated anteriorly due to costae.

Comparison: This species differs from _H. hebe_ (Havlíček, 1961, Plate 27, Figs. 8-14, Text Fig. 44) in being larger, more robust, and possessing more costae. Havlíček (1961) illustrates the nature of the septalium infilling which appears different from species to species. However, this feature is now known to vary considerably in a single collection of shells and, therefore, the writer feels it is of little use as a specific character. H. compta (Havlíček, 1961, Plate 19, Figs. 6-9) is larger, less robust and possesses more costae.

Genus Tadschikia Nikiforova, 1937

Type Species: Wilsonella (Tadschikia) wilsoniaformis Nikiforova, 1937
(Plate 6, Figs. 6a-e, 7a-d, 8a-c, 9, 10)

"Tadschikia" crassiforma crassiforma n. sp., n. subsp.
(Plate 23, Figs. 5-13, Plate 24, Figs. 1-15, Plate 25, Figs. 3, 8; Fig. 59)

Derivatio nominis: L.; crassus, fat; forma, form.

Material and Occurrence: Holotype (GSC 47287), paratypes (GSC 47288, 47289), GSC loc. C-26989, plus additional material from GSC locs. C-26973, C-26974, C-26984, C-26987, C-26988, C-26989, section 12, unnamed carbonate unit, Baillie Hamilton Island. Early Lochkovian.

Discussion: "Tadschikia" is a problem in that it does not coincide completely with known uncinulid genera. It possesses a plate covering the dorsal septalium, but does not possess a comb-like cardinal process. Rather, the septalial infilling consists of two

Fig. 58. Drawings of acetate peels from serial sections of *Sphaerirhynchia* sp. (X4), GSC 47280.

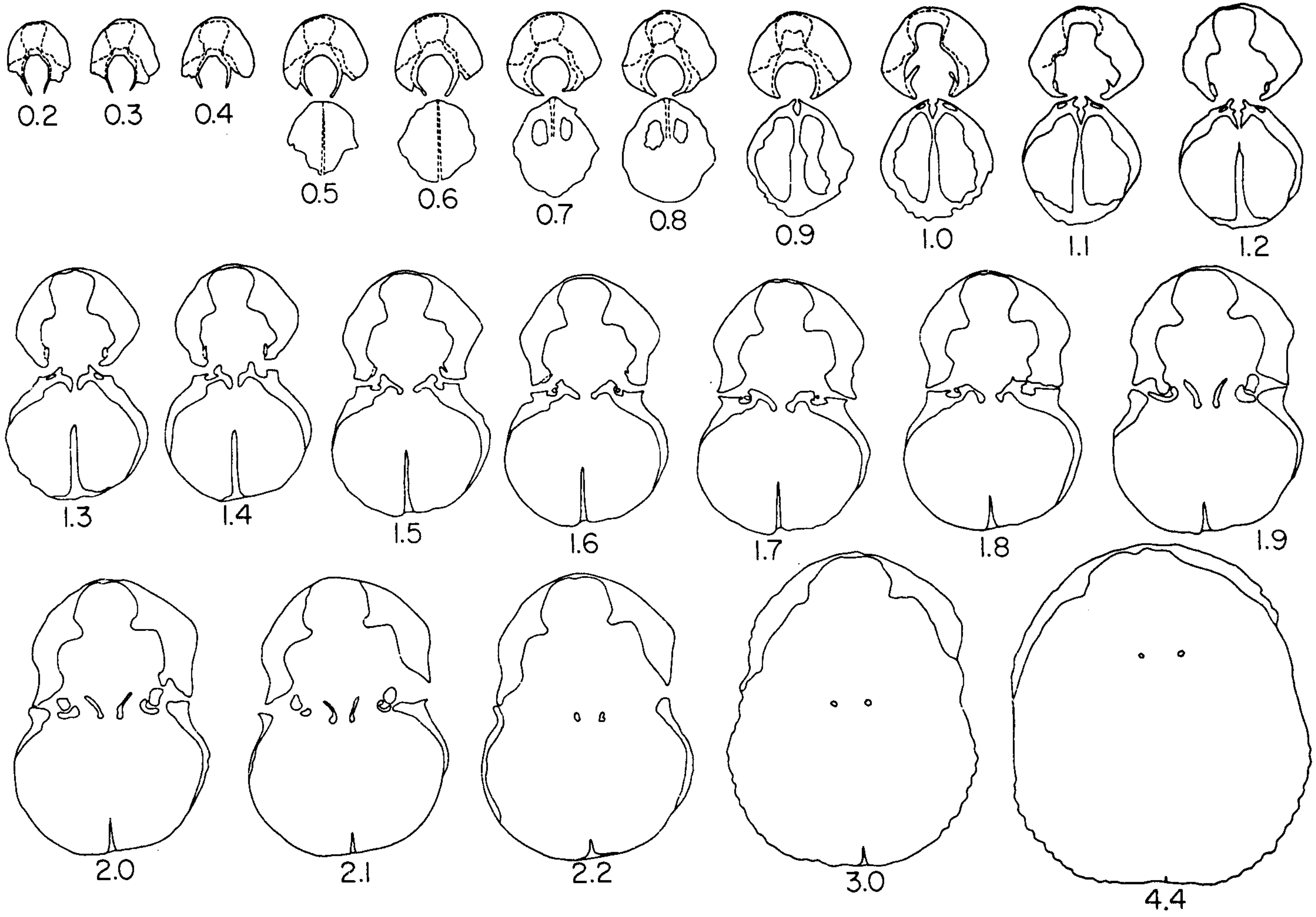


FIG. 58

Fig. 59. Drawings of acetate peels from serial sections of "Tadschikica" crassiforma crassiforma n. sp., n. subsp. (X6), GSC 47281, GSC loc. C-26989, Baillie Hamilton Island.

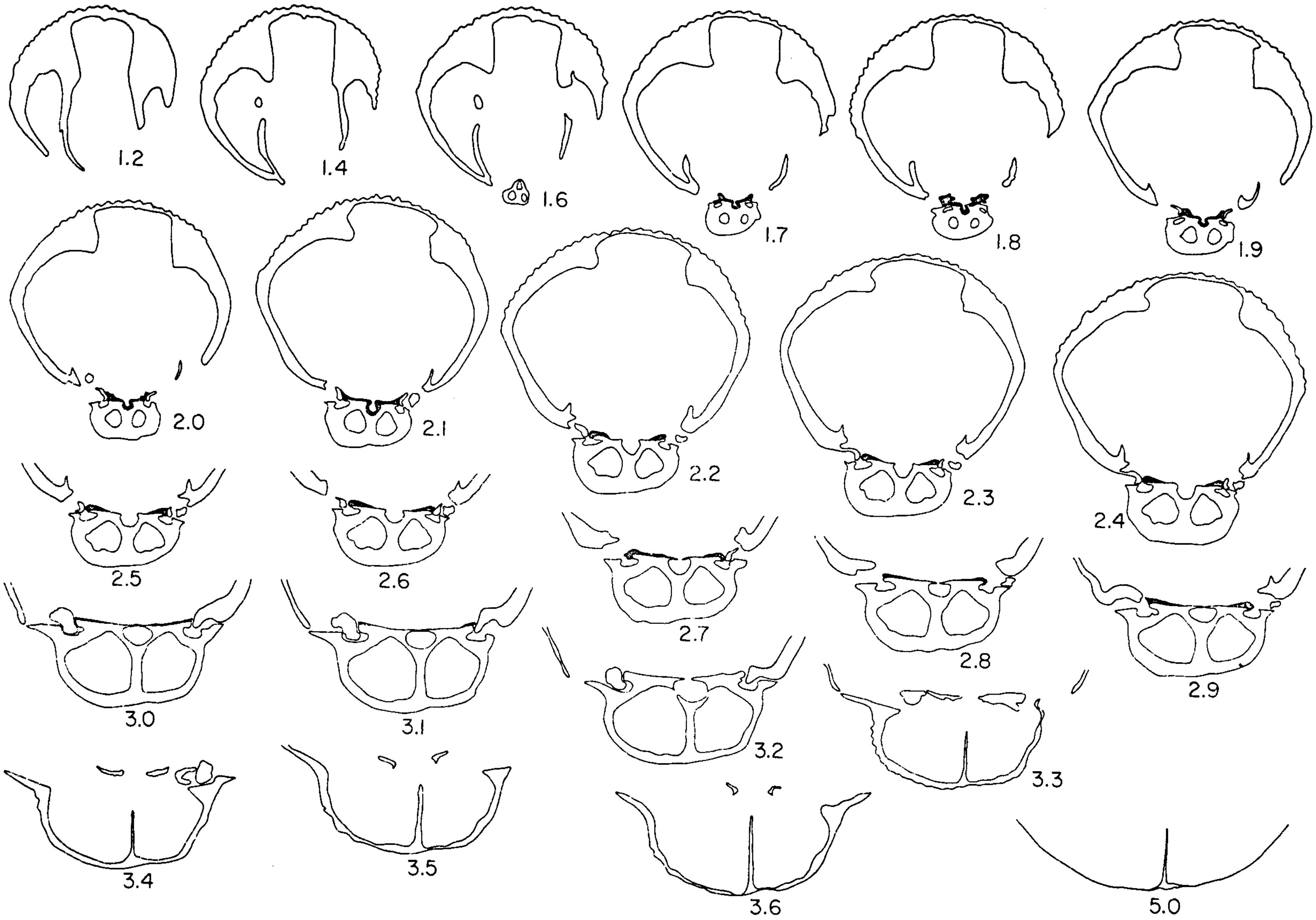


FIG. 59

mound-like lobes with a depression separating them. The nature of this infilling needs more investigation before this genus can be assigned with any certainty.

It is very similar to Sphaerirhynchia gibbosa (Johnson, Boucot, and Murphy, 1973, Plate 23, Figs. 1-11). However, the specimens illustrated possess a plate covering the dorsal septalium, a feature which true Sphaerirhynchia does not have. A. J. Boucot kindly gave the writer a specimen of Sphaerirhynchia from the Ludlow of England which was subsequently serial sectioned. The acetate peels of this specimen are illustrated here (Fig. 58) for comparison. It is similar to Plethorhynchus dunensis Dreverm. (Barrois, Pruvost, and Dubois, 1922, Plate 14, Figs. 11-18), but does not possess a well developed fold and sulcus. Pictures of P. dunensis Dreverm. do not confirm or deny existence of a plate in the dorsal valve.

Until the writer has had the opportunity to examine additional material and benefit from the knowledge of his colleagues, this form will be provisionally assigned as "Tadschikia" sp.

Diagnosis: Shells globose, subpentagonal to pyriform in outline, in posterior profile, shells subquadrate in outline, septalium covered by plate.

Description: Shells medium sized, globose, subpentagonal to pyriform in outline, strongly dorsibiconvex in lateral profile, in posterior profile, shells nearly square. Ventral umbo inflated, beak strongly incurved, nearly touching dorsal umbo. Dorsal umbo smooth to faintly costate, nearly flat, beak incurved. Delthyrium open, fairly high, moderately divergent. Hinge short, curved. Maximum width anterior to midline. Ventral sulcus poorly developed, broad, flat-bottomed, best seen in anterior one-third to one-quarter of shell, contains five to ten costae in large specimens. Sulcus extends into well developed tongue. Dorsal fold also poorly developed, best seen in anterior third of shell, fairly wide, low, flat-topped, containing 6 to 11 costae in large specimens. Best seen as rectangular deflection in anterior commissure. Flanks contain 13 to 15 costae on large specimens. Ornament consists of moderately to strongly rounded costae separated by narrow V-shaped interspaces. In ventral tongue, costae flat and grooved. Costae crossed by fairly well developed, concentric growth lines, best seen in anterior regions.

Hinge teeth fairly short, elongate in outline, widely divergent, supported by well developed, anteriorly divergent, plate-like dental lamellae, set close to shell wall. Umbonal cavity well developed. Well developed, high, muscle bounding ridges continue anteriorly from lamellae, divergent. Diductor field subtriangular to gently bilobate, deeply incised. Adductor field elongate, cordate in outline, anterior to umbonal cavity. Muscle field separated by thin, poorly developed myophragm. Interior crenulate due to impress of costae.

Sockets narrow, short, subtriangular in outline, U-shaped in cross-section, widely divergent, covered posteriorly by shell material; supported by socket plates. Septalium V-shaped, very thick, supported by well developed, blade-like median septum extending nearly half shell length. Septum thickens markedly near septalium and becomes nearly bulbous. Socket ridges connect to triangular outer hinge plates which are thickened and slope anteromedially. Two raised, knob-like areas present on anteromedial surfaces. Septalium covered by well developed plate, open apically. Area of thickened shell material on outer hinge plates may have served as incipient cardinal process. Crura thin, blade-like, delicate, gently divergent, crescentic in cross-section, project anteroventrally. Muscle scars not seen. Surface crenulated due to impress of costae.

Comparison: This subspecies differs from "T." crassiforma producta n. sp., n. subsp. in being more quadrate in anterior view and far more dorsibiconvex in lateral profile.

"Tadschikia" crassiforma producta n. sp., n. subsp.
(Plate 24, Figs. 16-34, Plate 25, Figs. 1, 2)

Derivatio nominis: L.; crassus, fat; forma, form; productus, drawn out.

Material and Occurrence: Holotype (GSC 47292), paratypes (GSC 47290, 47291), GSC loc. C-26949, plus additional material from

GSC locs. C-26949, C-26952, section 11, unnamed carbonate unit, Baillie Hamilton Island. Early Lochkovian.

Diagnosis: Shells rectangular in posterior profile, possessing well developed plate covering septalium.

Description: Shells medium sized, pyriform to subpyramidal in outline, strongly to moderately dorsibiconvex in lateral profile, in posterior profile, shells elongate, rectangular, drawn out. Ventral umbo slightly inflated, beak incurved. Dorsal umbo nearly flat, beak incurved. Delthyrium open, moderately high triangular, divergent. Maximum width at midlength. Ventral sulcus not developed, shell passes into tongue-like projection. Dorsal fold not developed, best seen as rectangular deflection in anterior commissure. Ornament consists of numerous, moderately to strongly rounded costae separated by narrow V-shaped interspaces, crossed by rare, concentric growth lines. Costae more rounded anteriorly, flattening out in tongue. Costae grooved on anterior and lateral areas of shells reflecting spines.

Hinge teeth stubby, elongate-oval in outline, widely separated, widely divergent. Supported by widely divergent, plate-like dental lamellae fused to shell wall in anterior regions, umbonal cavity well developed, pedicle collar present. Diductor field deeply incised, subpentagonal in outline, tending toward bilobation in anterior regions, extending half shell length, separated from umbonal cavity by thickened shell deposits. Adductor field elongate-oval, bisected by thin, blade-like myophragm not extending full length of field. Interior crenulated due to impress of costae.

Sockets moderately deep, elongate in outline, U-shaped in cross-section, widely divergent, floored by socket plates. V-shaped septalium supported by blade-like median septum, thickening posteriorly, extending nearly half shell length. Socket ridges connected to triangular outer socket plates which increase in height anteriorly and then curve anteromedially. Septalium covered by well developed, thick plate, open apically. Crural bases join anterior portion of outer socket plates. Muscle scars not seen. Surface faintly crenulated due to impress of costae.

Comparison: This subspecies differs from "Tadschikia" crassiforma crassiforma n. sp., n. subsp. in being far more rectangular, drawn out in posterior profile. The dorsal outer socket plates are much better developed in this species and it exhibits no evidence of shell buildup forming an incipient cardinal process. The septalium is not infilled with secondary material.

Family Uncertain

Genus Linguopugnoides Havlíček

Type Species: Rhynchonella nympha Barr. varietas carens Barrande, 1879 (Taf. 122, Fig. 4, 5)

Linguopugnoides uyenoi n. sp.
(Plate 25, Figs. 4-7, 9-42; Fig. 60)

Derivatio nominis: For T.T. Uyeno, Geological Survey of Canada.

Material and Occurrence: Holotype (GSC 47301), paratypes (GSC 47299, 47300, 47301, 47302, 47303, 47304, 47305, 47306), GSC loc. C-26883, plus additional material from GSC locs. C-26881, C-26883, section 8, C-26903, C-26906, unnamed units, section 9, Prince of Wales Island. Late Lochkovian, *Quadrithyris* Zone.

Diagnosis: Medium sized *Linguopugnoides*, subpentagonal to transversely suboval in outline, dorsibiconvex in lateral profile, costae varying from subangular to nearly flat.

Description: Shells subpentagonal to transversely suboval in outline, dorsibiconvex in lateral profile. Dorsal valve of most specimens twice as deep as ventral. Ventral umbo gently inflated, beak slightly incurved. Ventral valve moderately convex, not flat. Delthyrium moderately broad, triangular, open. Dorsal beak incurved. Ventral sulcus begins about midlength, broad, moderately deep, widely divergent, flat-bottomed, contains three to four costae, extends into a tongue. Dorsal fold best developed in anterior half of shell, moderately high, broad, flat-topped, contains four to five costae, rectangular in outline. Maximum width at midlength. Ornament consists of subangular to rounded, radial costae present on anterior two-thirds of shell, separated by wide interspaces. Umbos smooth.

Fig. 60. Drawings of acetate peels from serial sections of *Linguopugnoides uyenoi* n. sp. (X4), GSC 47298, GSC loc. C-26883, Prince of Wales Island.

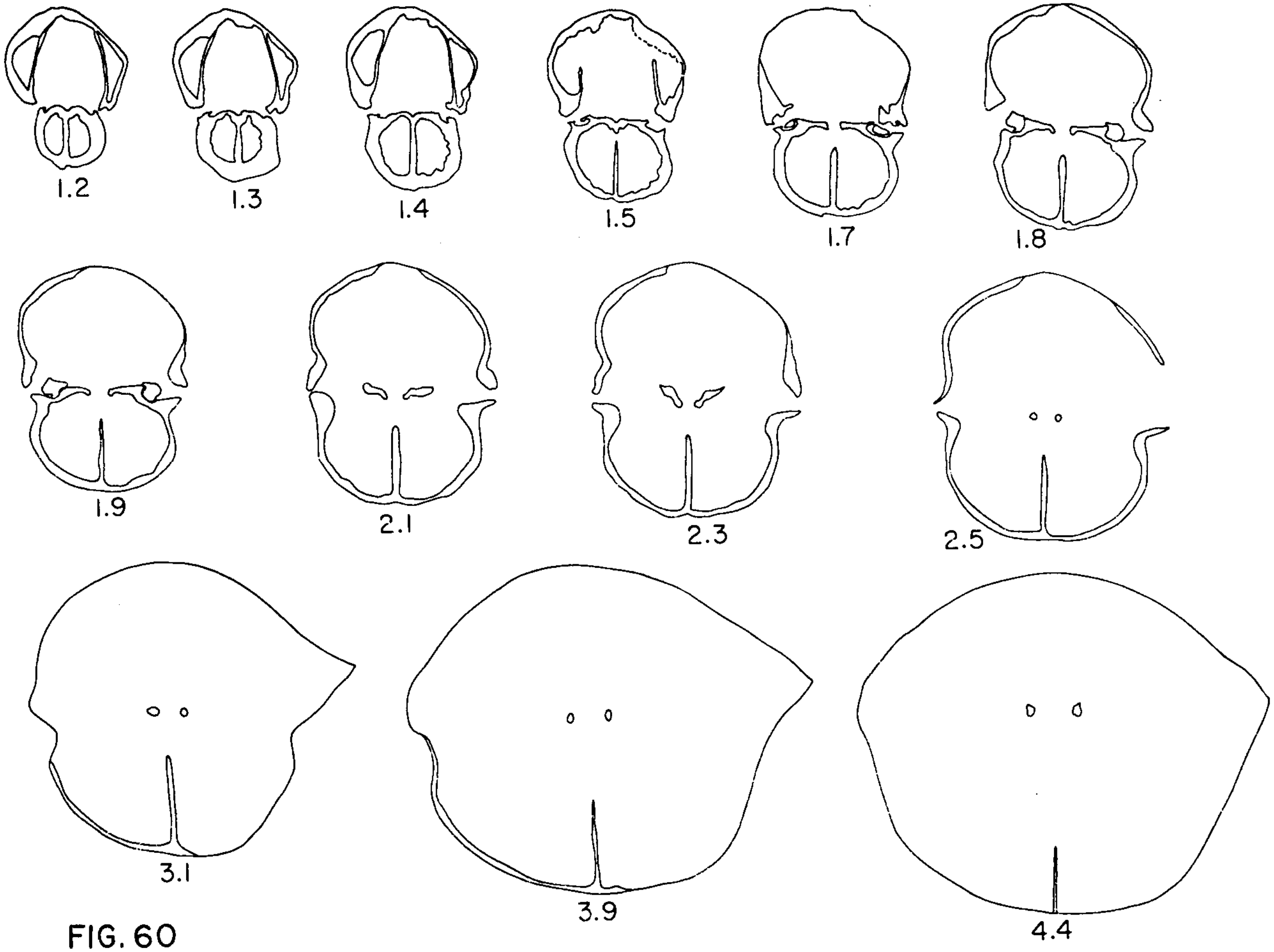


FIG. 60

Costae increase in angularity anteriorly. On some specimens, costae in tongue of sulcus are low, very rounded. Very fine, numerous, concentric growth lines cross costae. Costae in sulcus limited to three to four, in fold, four to five, on each flank three to five.

Hinge teeth stubby, elongate-oval in cross-section, supported by well developed, short, plate-like, divergent dental lamellae. Diductor field narrow, elongate, one-third shell length, subtriangular in outline and moderately impressed, bisected throughout its length by thin myophragm. Adductor field not seen. Interior grooved due to impress of costae.

Sockets moderately broad, divergent, elongate-oval in cross-section, supported by socket plates. V-shaped septalium supported by well developed median septum. Septalium uncovered. Outer socket ridges connected to crural bases. Crura thin, delicate, directed anteriorly, then anteroventrally. Muscle scars not seen. Shell interior grooved due to impress of costae.

Comparison: This species differs from L. carens (Barrande) (Havlíček, 1961, Plate 11, Figs. 1, 2, Text Fig. 34) in having a much more inflated ventral valve; fewer, less angular costae as well as a much more impressed ventral diductor scar.

Order Spiriferida

Suborder Atrypoidea

Superfamily Atrypacea Gill

Family Atrypidae Gill

Subfamily Atrypinae Gill

Genus _Atrypa_ Dalman

Type Species: _Anomia reticularis_ Linne, 1758

Atrypa nieczlawiensis Kozlowski
(Plate 26, Figs. 1-42)

Atrypa reticularis var. _nieczlawiensis_ Kozlowski, 1929
(Plate 8, Figs. 14-17)

Atrypa nieczlawiensis Johnson, Boucot, and Murphy, 1973
(Plate 24, Figs. 14-27)

Material and Occurrence: Calcareous and silicified specimens from GSC locs. C-26811, C-26812, C-26813, C-26816, section 3, C-26841, C-26854, Reef, unnamed units, Prince of Wales Island; C-26939, C-26940, C-26942, C-26943, C-26945, C-26947, C-26948, C-26949, C-26952, section 11; C-26968, C-26973, C-26974, C-26984, C-26985, C-26986, C-26987, C-26988, C-26989, section 12, unnamed carbonate unit, Baillie Hamilton Island. Early Lochkovian. This widely occurring species seems to be a marker for early Lochkovian time in the Canadian Arctic Islands and elsewhere in the world. It is known from the Borszczow Beds of Polish Podolia (Kozlowski, 1929). Johnson, Boucot, and Murphy (1973) also describe it from their F fauna from the Roberts Mountain Formation of central Nevada. This species is characterized by its characteristic ornament. Variations in shell outline and valve convexity do exist within populations and an effort has been made to illustrate some of these (Plate 26, this paper). Specimens of _A. westfalica_ (Dahmer, 1951, Plate 11, Figs. 19-21) are very similar to _A. nieczlawiensis_.

Atrypa sp. 1

(Plate 27, Figs. 1-6, 12)

Material and Occurrence: Silicified specimens from GSC locs. C-26911, C-26913, C-26914, C-26915, C-26916, C-26917, C-26918, C-26919, C-26920, unnamed unit, section 10, Prince of Wales Island. Early-Late ? Lochkovian.

Discussion: This species is present in nearly every collection from section 10, and is a noteworthy element of the total fauna. Due to the plethora of similar species of _Atrypa_ present in the literature, no attempt will be made to assign this form a specific designation. However, this species can be distinguished from _A. nieczlawiensis_ Kozlowski (1929) in that it possesses a more triangular outline and a slightly stronger deflection in the anterior commissure.

Atrypa sp. 2
(Plate 27, Figs. 7-11, 13-17)

Material and Occurrence: Calcareous specimens from GSC locs. C-26873, C-26874, section 8, unnamed units, Prince of Wales Island. Late Lochkovian, *Quadrithyris* Zone.

Discussion: As with the previously mentioned species of *Atrypa*, no attempt will be made to assign it a specific designation. It is characterized by its broadly triangular outline and well developed deflection in the anterior commissure. The latter feature seems to have some correlation with the amount of argillaceous material in the matrix. The more argillaceous sediments contain *Atrypa* specimens with a stronger deflection in the anterior commissure.

Genus *Spirigerina* d'Orbigny

Type Species: *Terebratula marginalis* Dalman, 1828

Spirigerina sp.
(Plate 27, Figs. 19-30, 36)

Material and Occurrence: Silicified specimens from GSC loc. C-26911, section 10, unnamed unit, Prince of Wales Island. Early-Late ? Lochkovian.

Diagnosis: *Spirigerina* with numerous, fine costae which decrease in height on the anterior margins of the valves.

Description: Shells transversely suboval to subquadrate in outline, strongly dorsibiconvex in lateral profile. Ventral umbo gently inflated, beak suberect. Delthyrium partially covered by deltidial plates. Foramen well developed, subhypothyrid. Hinge short, curved. Maximum width at midlength. Ventral sulcus poorly developed, best seen in anterior quarter of shell, moderately broad, flat bottomed, extends into long, well developed tongue. Dorsal fold also poorly developed, best seen in anterior quarter of shell and deflection of commissure. Ornament consists of numerous, rounded to subrounded costae, increasing anteriorly by bifurcation, particularly in anterior half of shell, separated by moderately broad U-shaped interspaces. Costae decrease in height and become nearly flat at lateral and anterior shell margins. Rare, widely spaced, concentric growth lines cross costae.

Hinge teeth well developed, suboval in outline, widely spaced, subparallel to hinge, not supported by dental lamellae. Muscle scars not visible, but on some specimens there is a subtriangular depression.

Sockets elongate-oval in outline, divergent, U-shaped in cross-section, floored by socket plates. Crural bases connected to inner socket ridges. Notothyrium open, triangular. Adductor field not subdivided, subrhomboidal in outline, bounded posteriorly by two faint, widely divergent ridges. Field bisected by narrow median groove. Posterior to flanking ridges, field becomes bulbous, consisting of two oval lobes bisected by median groove. Shell surface faintly crenulated on thinner shelled specimens due to impress of costae.

Comparison: This species differs from S. supramarginalis (Khalfin, 1948, Plate 2, Figs. 10, Plate 4, Figs. 4-7) in having more numerous, less well developed costae. S. marginaliformis Alekseeva (1960, Plate 7, Fig. 1) has fewer and better developed costae. Neither of the latter two species exhibits the flattening of the costae near the anterior shell margins. Perry (1974) reports that he finds this species in the Delorme Formation of the N.W.T. There, this species occurs stratigraphically between S. marginaliformis Alekseeva and S. supramarginalis (Khalfin).

Subfamily Septatrypinae Kozlowski, 1929

Genus Dubaria Termier, 1936

Type Species: Terebratula thetis Barrande, 1847, p. 349
(Plate 14, Fig. 5)

Dubaria thetis (Barrande)
(Plate 27, Figs. 31-35, 37-41,
43-47; Fig. 61)

Dubaria cf. D. thetis Johnson, 1975a
(Plate 10, Figs. 1-5)

Synonomy in Johnson (1975a).

Material and Occurrence: Calcareous specimens from GSC locs. C-26876, C-26878, section 8, unnamed unit, Prince of Wales Island. Late Lochkovian, Quadrithyris Zone.

Fig. 61. Drawings of acetate peels from serial sections of Dubaria thetis (Barrande) (X6), GSC 47333, GSC loc. C-26878, Prince of Wales Island.

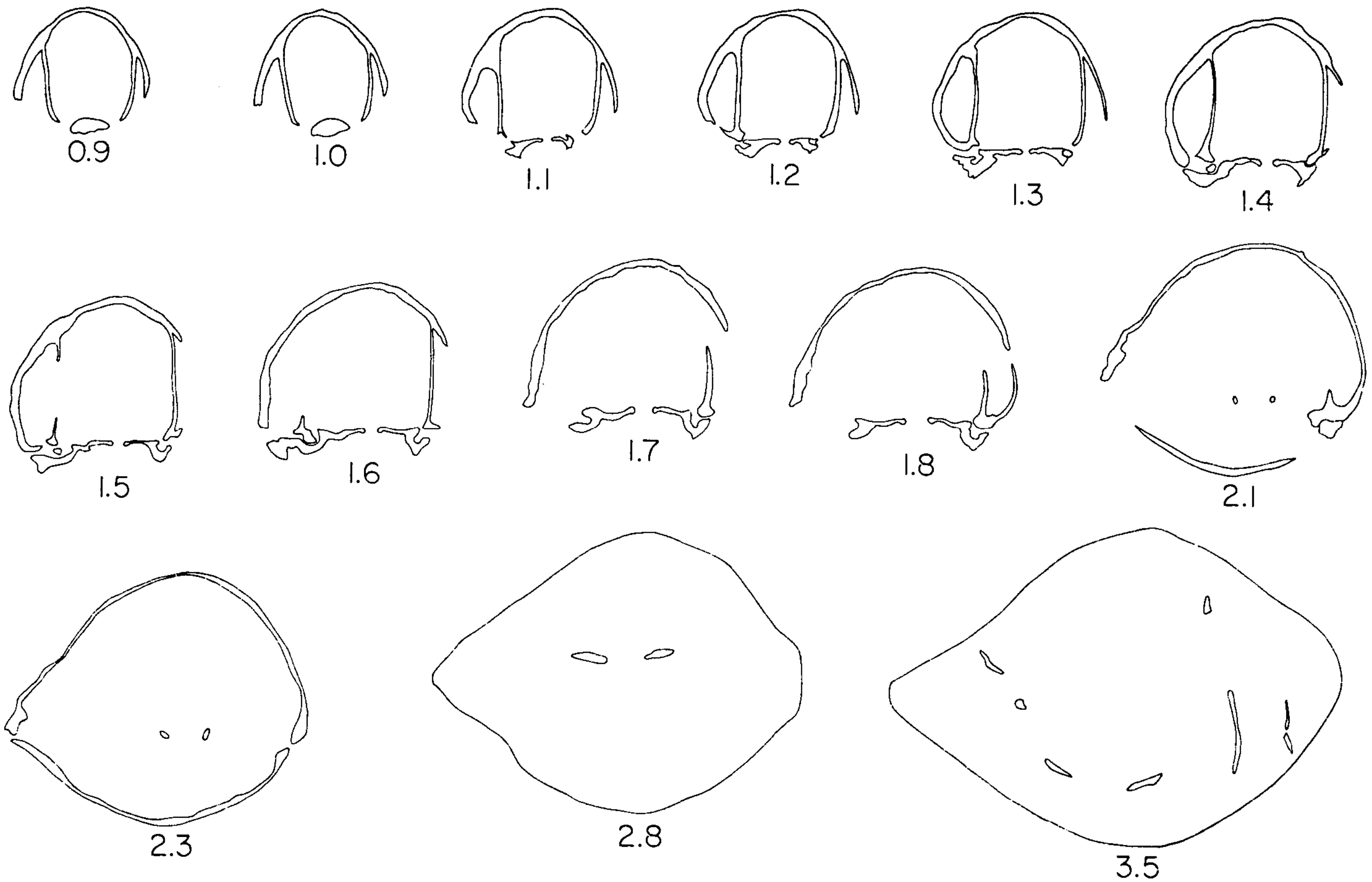


FIG. 61

Diagnosis: Small, smooth shells with variable deflection in anterior commissure and with distinct outer hinge plates which lie along a horizontal line in serial section.

Description: Shells small, smooth, subpentagonal in outline, nearly equally dorsibiconvex in lateral profile. Delthyrium low, triangular, open. Ventral umbo gently inflated, beak slightly incurved. Hinge short, curved. Maximum width at midlength or slightly anterior to it. Sulcus best developed in anterior half of shell, widely divergent, shallow, flat-bottomed extending into a broad tongue. Dorsal fold poorly developed, best seen in anterior sixth of shell; marked by a broad deflection in anterior commissure. Width and height of deflection varies. Ornament consists of rare, faint, concentric growth lines. Outer shell texture is fibrous.

Hinge teeth well developed, elongate in cross-section, supported by well developed, widely spaced, plate-like dental lamellae. Muscle field not seen.

Sockets well developed, U-shaped in cross-section, supported by socket plates. Inner socket ridges connected to thin, well developed outer hinge plates, horizontal in cross-section. Outer hinge plates connected to crural bases, which are connected to crura. Spiralia not well preserved. Muscle field not seen.

Comparison: Johnson (1975a) mentioned that specimens he examined from the Canadian Arctic were similar in appearance to D. thetis

(Barrande) but did not possess well developed outer hinge plates as illustrated by Siehl (1962, Plate 28). However, the sections of the specimen Johnson (1975a) illustrates came from Bathurst Island while the specimens illustrated in his plates came from Prince of Wales Island. The specimens that the writer possesses come from Prince of Wales Island as well. It may well be that the Bathurst Island specimens are a different species.

Superfamily Carinatinacea Rzhonsnitskaya

Family Notanopliidae Gill

Genus Notoparmella Johnson

Type Species: Notoparmella gilli Johnson, 1973
(Plate 4, Figs. 1-17)

Notoparmella gilli Johnson
(Plate 28, Figs. 50-54, Plate 29, Figs. 1-3, 6-19)

Coelospira sp. Boucot et al., 1960
(Plate 3, Figs. 15-20)

Notoparmella gilli Johnson, 1973b
(Plate 4, Figs. 1-17)

Material and Occurrence: Calcareous and silicified specimens from GSC locs. C-26914, C-26915, section 10, C-26841, Reef, Prince of Wales Island; C-26968, C-26969, C-26973, C-26974, section 11, unnamed carbonate unit, Baillie Hamilton Island; C-33700, C-33701, C-33702, C-33704, C-33705, Devon Island Formation, Devon Island. Early-Late ? Lochkovian.

Diagnosis: Notoparmella lacking or possessing extremely faint costae.

Discussion: Johnson (1973) has discussed and illustrated this species; consequently it will not be duplicated herein. This species is characterized by its almost completely smooth exterior. Some of the valves exhibit a fibrous texture, resembling spinules, on the outer surface (Plate 28, Figs. 50-54, this paper) not unlike that of some forms of Nucleospira.

Notoparmella costalata n. sp.
(Plate 28, Figs. 33-49, 55; Plate 29, Figs. 4, 5)

Derivatio nominis: L.; costa, rib; lata, broad.

Material and Occurrence: Holotype (GSC 47350), paratypes (GSC 47348, 47349, 47350, 47351, 47352, 47353, 47366, 47367), GSC loc. C-26939, plus additional material from GSC locs. C-26936, C-26937, C-26938, C-26939, section 11, unnamed carbonate unit, Baillie Hamilton Island. Early Lochkovian.

Diagnosis: Small, thin shelled Notoparmella with distinct, low, broad costae.

Description: Shells small shield shaped in outline, ventribiconvex in lateral profile. Delthyrium low, triangular, open. No interarea. Hinge straight, equal to approximately half maximum width. Maximum width at midlength. Ventral fold poorly developed, best seen in deflection of anterior commissure, possesses a U-shaped median furrow or groove. Dorsal sulcus well developed, beginning anterior to beak, flaring widely, anterior margin indistinct. Sulcus has a median costa originating near posterior portion of sulcus and extending to anterior commissure. Ornament consists of broad, rounded costae, increasing anteriorly by implantation, separated by broad U-shaped interspaces. On extreme lateral margins, costae much reduced in width, more numerous. On well preserved specimens, costae crossed by numerous, faint, closely spaced, concentric growth lines.

Hinge teeth elongate-oval in outline, widely divergent, subparallel to hinge; dental lamellae absent. Diductor field faintly impressed, subtriangular to subrhomboidal in outline, extending about one-third valve length. Interior crenulated due to impress of costae.

Sockets shallow, widely divergent, U-shaped in cross-section, floored by socket plates or embedded in shell wall. Distal ends of inner socket ridges meet at apex of notothyrium forming an inverted V. Some specimens exhibit shell buildup on socket plates, forming a nearly straight, transverse ridge. Poorly to moderately developed myophragm separates elongate-oval adductor impressions. Interior crenulated due to impress of costae.

Comparison: This species differs from N. gilli Johnson (1973, Plate 4, Figs. 1-17) in being smaller, thinner shelled, and possessing rounded costae as well as less well developed muscle scars.

Family Carinatinidae Rzhonsnitskaya

Subfamily Carinatininae Rzhonsnitskaya

Arctispira n. gen. Smith

Type Species: Arctispira canadensis n. sp.

Diagnosis: Shells very small, subpentagonal in outline, slightly ventribiconvex in lateral profile. Ventral interarea high, narrow, triangular, flat, apsacline. Delthyrium high, narrow, triangular, open. Ventral fold well developed, divided by median groove. Dorsal sulcus well developed, broad, contains a median costa. Shell covered by well developed, radial, rounded costae separated by U-shaped interspaces. Costae increase anterior by bifurcation and implantation. Internally, teeth broadly divergent, supported by plate-like, divergent dental lamellae. Sockets widely divergent, U-shaped in cross-section, musculature faintly impressed.

Discussion: This genus differs from Sibirispira (Alekseeva, 1968, Plate 1, Figs. a-e) in having coarser costae, a well developed ventral fold and dorsal sulcus and a much less inflated ventral valve. It differs from Ogilviella Lenz (1968b, Plate 31, Figs. 1-35) in being much more ventribiconvex, having a better developed dorsal sulcus, being more pentagonal in outline and possessing more widely spaced costae.

Species Assigned

"Sibirispira" sp. Johnson, Boucot, and Murphy, 1973
(Plate 25, Figs. 8-11)

Arctispira canadensis n. gen., n. sp.
(Plate 27, Figs. 42, 48, Plate 28, Figs. 1-32)

Derivatio nominis: After the Canadian Arctic from where it occurs.

Material and Occurrence: Holotype (GSC 47339), paratypes (GSC 47338, 47340, 47341, 47342, 47343, 47344, 47345, 47346, 47347), GSC loc. C-26939, plus additional material from GSC locs. C-26939, C-26940, section 11, unnamed carbonate unit, Baillie Hamilton Island; C-33695, C-33700, C-33701, C-33702, C-33704, C-33705, Devon Island Formation, Devon Island. Early Lochkovian.

Diagnosis: Same as for genus.

Description: Shells very small, subpentagonal in outline, ventribiconvex in lateral profile, dorsal umbo gently inflated, ventral beak pointed. Ventral interarea high, narrow, flat, triangular, apsacline. Dorsal interarea lacking. Delthyrium high, narrow, triangular, open. Hinge straight, approximately two-thirds maximum width. Greatest width at midlength or slightly anterior to it. Ventral fold well developed, beginning anterior to umbo, flaring anteriorly, bisected by median groove. Dorsal sulcus well developed, begins anterior to umbo, flares widely, shallow, contains a large median costa and on larger specimens, smaller lateral costae. Ornament consists of well developed, radial, rounded costae, variable in number, separated by broad U-shaped interspaces, that increase anteriorly by bifurcation and implantation. Bifurcation best developed in anterior half of shell, near fold and sulcus.

Hinge teeth well developed, widely divergent, elongate-oval in outline, supported by plate-like dental lamellae. Low buildup of shell material in umbonal region may have served as diductor site. Adductor scars, elongate-oval in outline, anterior to diductor site. Shell interior crenulated due to impress of costae.

Sockets widely divergent, U-shaped in cross-section, floored by socket plates. Inner socket ridges recurve posterolaterally. Small node sometimes present between junction of inner socket ridges. Crural bases connected to inner socket ridges. Crura thin, blade-like, extend anteroventrally. Faint muscle field appears broadly transverse. Surface crenulated due to impress of costae.

Discussion: This species exhibits variation in the number and size of costae present from one collection to another. Internally, these specimens are indistinguishable from one another.

Suborder Dayioidea

Superfamily Dayiacea Waagen

Family Anoplothecidae Schuchert

Genus *Coelospira* Hall

Type Species: *Leptocoelia concava* Hall, 1857

Coelospira exilicosta exilicosta n. sp. n. subsp.
(Plate 30, Figs. 6-17)

Derivatio nominis: L.; *exilis*, weak; *costa*, rib.

Material and Occurrence: Holotype (GSC 47373), paratypes (GSC 47374, 47375, 47376, 47377, 47378, 47379, 47380), GSC loc. C-33704, plus additional material from GSC locs. C-33701, C-33702, C-33704, Devon Island Formation, Devon Island. Early Lochkovian

Diagnosis: Shells subpentagonal to pyriform in outline, rounded costae of flanks generally three in number. Dorsal myophragm anterior to cardinal process very well developed, extending nearly half shell length.

Description: Shells very small, subpentagonal to pyriform in outline, strongly ventribiconvex in lateral profile. Ventral umbo gently inflated, beak gently incurved. Delthyrium low, narrow, triangular, open. Hinge short, curved. Maximum width at mid-length. Ventral valve moderately to weakly arched, has a pair of median costae and a poorly developed median costa. Dorsal sulcus well developed, beginning anterior to beak, flares widely, shallow, contains a large median costa that either bifurcates or increases in width anteriorly, flanked by a pair of lesser costae defining margins of sulcus. Ornament consists of broadly spaced, radial, subrounded costae that increase rarely by bifurcation and implantation, generally ten costae on each valve, separated by U-shaped interspaces. Well developed growth lines cross costae in anterior third of shell.

Hinge teeth elongate-oval in outline, divergent, not supported by dental lamellae. Muscle field consists of elongate-oval lobes bisected by a thin myophragm, field extends almost half shell length. Muscle field rests on very weak platform. Interior crenulated due to impress of costae.

Sockets well developed, deep, divergent, floored by socket plates, U-shaped in cross-section. Inner socket ridges curve posterolaterally. Massive, triangular buildup of shell material between inner socket ridges forms base on which bulbous, elongate cardinal process rests. Anterior from buildup is a well developed myophragm, high, rounded, tapering to a point, extending nearly half shell length. Faint adductor field appears suboval in outline. Interior crenulated due to impress of costae.

Comparison: This subspecies differs from C. exilicosta orbita n. sp. n. subsp. (this paper) in being more pyriform in outline, in having fewer, more rounded, broader costae as well as a much more pronounced dorsal myophragm. It differs from C. virginia (Amsden, 1958a, Plate 7, Figs. 29-36; 1958b, Plate 5, Figs. 39, 40) in being more pyriform in outline and possessing narrower costae. It differs from C. saffordi (Amsden, 1949, Plate 10, Figs. 1-5) in having a poorly developed ventral median costa, and a well developed dorsal myophragm.

Coelospira exilicosta orbita n. sp. n. subsp.
(Plate 29, Figs. 20-31, Plate 30, Figs. 1-5)

Derivatio nominis: L.; exilis, weak; costa, rib; orbitus, round.
Material and Occurrence: Holotype (GSC 47368), paratypes (GSC 47369, 47370, 47371, 47372), GSC loc. C-26940, plus additional material from GSC locs. C-26938, C-26940, section 11, unnamed carbonate unit, Baillie Hamilton Island. Early Lochkovian.
Diagnosis: Shells subpentagonal to subcircular in outline. Costae numerous, up to 14 on a mature dorsal valve, narrow, subrounded. Ventral diductors confined on low platform. Ventral median costa poorly developed.
Description: Shells very small, subpentagonal to subcircular in outline, ventribiconvex in lateral profile. Ventral umbo only gently inflated. Ventral beak short, gently incurved. Interareas lacking. Delthyrium low, narrow, triangular, open. Hinge short, curved.

Maximum width at midlength. Ventral valve moderately arched, with a median costa weakly developed to thread-like. Dorsal sulcus well developed, beginning anterior to beak, flaring widely, shallow, possesses an enlarged median costa that either bifurcates or widens anteriorly, flanked by a pair of smaller costae defining sulcus margin. Ornament consists of numerous (12-14 on each valve), radial, sub-rounded costae that increase by bifurcation and implantation on both valves, separated by U-shaped interspaces. Concentric growth lines cross costae in anterior third of shell.

Hinge teeth elongate-oval in outline, widely divergent, not supported by dental lamellae. Muscle field consists of elongate-oval lobes, divided by thin myophragm, muscle field rests on very weakly developed platform.

Sockets deep, widely divergent, U-shaped in cross-section. Socket ridges well developed, recurve posterolaterally. Low, rounded buildup of shell material between socket ridges serves as base for knob-like cardinal process. Poorly developed myophragm extends anteriorly from buildup of shell material. Faint adductor field suboval in outline.

Comparison: This species differs from C. saffordi (Amsden, 1949, Plate 10, Figs. 1-5) in not possessing a strong platform in the ventral vale, in having more numerous, narrow costae and a poorly developed median costa. It differs from C. virginia (Amsden, 1958a,

Plate 7, Figs. 29-36) in having finer, narrower costae, being more rounded in outline, and not possessing a bilobate cardinal process. C. exilicosta orbita n. sp., n. subsp. possesses a dorsal myophragm extending from the buildup near the muscle attachment site; however, the published serial sections of C. virginia (Amsden, 1958a) do not extend far enough into the shell to demonstrate the presence or absence of this feature. This species differs from C. exilicosta exilicosta n. sp., n. subsp. (this paper) in being decidedly more circular to transversely oval in outline and having finer, more numerous costae.

Suborder Athyridoidea

Superfamily M'Coy

Family Nucleospiridae Davidson

Genus Nucleospira Hall

Type Species: Spirifer ventricosus Hall, 1857, p. 57

Nucleospira sp.

(Plate 30, Figs. 18-28, 34)

Material and Occurrence: Silicified specimens from GSC locs. C-26911, C-26913, C-26914, section 10, unnamed unit, Prince of Wales Island. Early-Late? Lochkovian.

Discussion: Nucleospira is present in very few collections and is not a major element of any fauna encountered. The lack of any definitive features makes assignment to a particular species impractcable, and consequently this was not attempted. The specimens are well preserved, allowing for documentation of the occurrence of the genus in the collections studied.

Family Athyrididae M'Coy

Subfamily Protathyridinae Boucot, Johnson, and Staton

Genus Protathyris Kozlowski

Type Species: P. praecursor Kozlowski, 1929
(Plate 12, Figs. 41-46)

Protathyris sp.
(Plate 30, Figs. 29-33, 36-40, 43-47; Fig. 62)

Material and Occurrence: Calcareous specimens from GSC locs. C-26848, C-26849, C-26850, C-26853, section 7, unnamed unit, Prince of Wales Island. Early Lochkovian.

Discussion: This species of Protathyris is small, rounded and lacks prominent growth lines. Due to the relatively featureless exterior of this form, no attempt has been made to assign it a specific name.

Suborder Spiriferoidea

Superfamily Cyrtinacea Frederiks

Family Cyrtinidae Frederiks

Genus Cyrtina Davidson

Type Species: Calceola heteroclita Defrance, 1824, p. 306

Fig. 62. Drawings of acetate peels from serial sections of *Protathyris* sp. (X6), GSC 47386, GSC loc. C-26850, Prince of Wales Island.

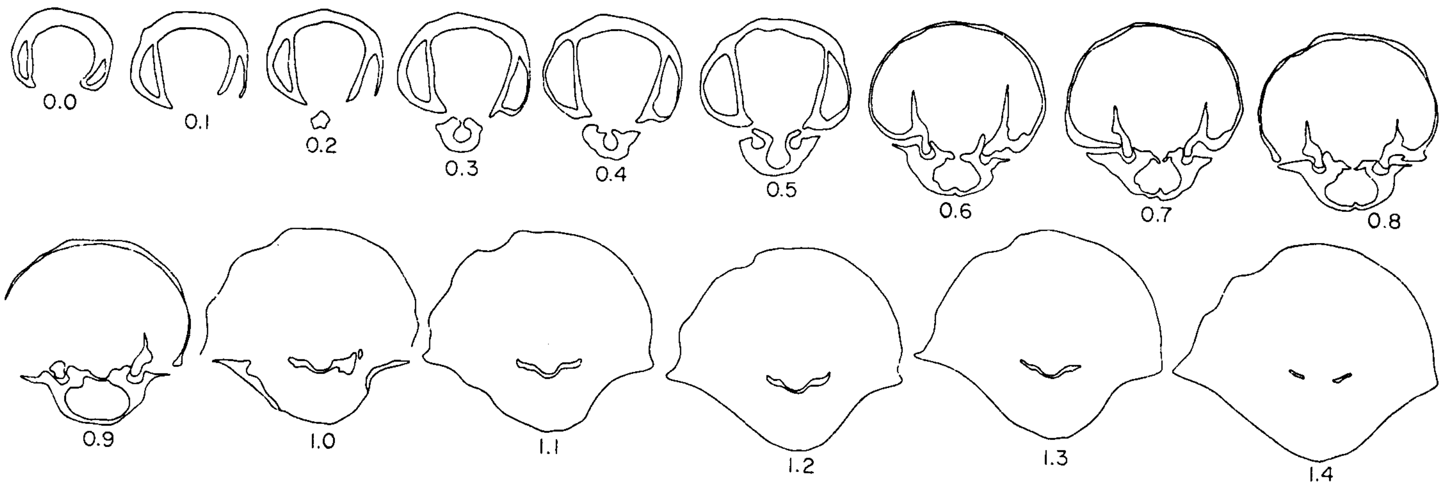


FIG. 62

<u>Cyrtina</u> <u>maclennani</u> n. sp.

(Plate 31, Figs. 1-27, 30-34, 37-41, 44-48)

<u>Derivatio</u> <u>nominis</u>: For A.D. McLennan.

Material and Occurrence: Holotype (GSC 47404), paratypes (GSC 47391, 47392, 47393, 47394, 47395, 47396, 47397, 47398, 47399, 47400, 47401, 47402, 47403, 47404, 47405, 47406, 47407, 47408), GSC loc. C-26915, plus additional material from GSC locs. C-26911, C-26913, C-26914, C-26915, C-26916, C-26917, C-26918, C-26919, C-26920, C-26921, section 10, unnamed unit, Prince of Wales Island. Early-Late ? Lochkovian.

Diagnosis: Shells with sockets floored by plates, dorsal valve possesses a prominent, elevated ridge around the lateral and anterior margins.

Description: Shells small, transversely suboval to subquadrate in outline, markedly ventribiconvex in lateral profile. Ventral peak pointed, incurved. Dorsal umbo weakly inflated. Ventral interarea high, wide, triangular, smooth, steeply apsacline to nearly catacline. Dorsal interarea thin, band-like, low, triangular, broad, anacline. Cardinal angles gently rounded, obtuse. Delthyrium very high, narrow, triangular, partially covered by convex deltidium, expanding in some specimens to form pedicle sheath, open near apex. Hinge wide, straight. Maximum width at midlength. Ventral sulcus begins at umbo, flares widely anteriorly, shallow, smooth, flanked by two costae of variable strength, extends into rounded tongue. Dorsal fold well developed, begins at umbo, flares anteriorly, broad, rounded, flanked by two pairs of costae. Ornament consists of few, low, rounded, costae generally of greater height and more numerous on dorsal valve. Strength of costae variable. Variably developed, closely spaced, concentric growth lines cross costae.

Hinge teeth set close together, elongate-oval in outline, divergent. Blade-like median septum extends approximately one-third shell length, supporting well developed spondylium. Septum extends through spondylium and bears a tichorinum of oval cross-section. Muscle scars not visible. Interior crenulated due to impress of costae.

Sockets close together, divergent, U-shaped in cross-section, supported by socket plates. Inner socket ridges recurve postero-laterally, connected to triangular crural bases. Crura long, thin, delicate, project anteriorly, then curve anteroventrally. Poorly preserved cardinal process is striate. Muscle field not evident. Interior crenulated due to impress of costae.

Comparison: This species differs from C. praecedens (Kozlowski, 1929, Plate 11, Figs. 8-23) in not exhibiting the large variation in number of costae as well as possessing fewer and less pronounced growth lines. Cyrtina maclennani n. sp. (this paper) possesses a very pronounced, elevated rim around the lateral margins of the dorsal valve as well as distinct socket plates. It differs from Cyrtina spp. 1 and 2 (this paper) in the presence of the dorsal rim as well as size, shape and ornament differences.

Cyrtina sp. 1
(Plate 31, Figs. 49-62)

Material and Occurrence: Specimens from GSC loc. C-26886, section 8, unnamed unit, Prince of Wales Island. Late Lochkovian, Quadrithyris Zone.

Diagnosis: Shells small, triangular in outline, costae well developed, lamellose ornamentation prominent.

Description: Shells transverse and triangular in outline, strongly ventribiconvex in lateral profile. Ventral beak pointed, incurved. Cardinal angles acute, pointed. Ventral interarea high, wide, curved, triangular, strongly apsacline to catacline. Dorsal interarea band-like, wide, low, triangular, anacline. Delthyrium high, narrow, triangular, covered by a triangular, convex deltidium, open at apex. Hinge wide, straight. Maximum width at hinge. Sulcus well developed, beginning near umbo, narrow, shallow, flanked by two costae, extends into tongue. Dorsal fold well developed, begins near umbo, flares anteriorly, high, rounded, flanked by two pairs of costae. Ornament consists of few, well developed, high, rounded costae crossed by very well developed, regularly spaced, concentric, lamellose growth lines.

Hinge teeth set closely together, divergent, oval-shaped. Spondylium supported by well developed, blade-like median septum extending approximately one-third shell length. Septum extends through spondylium and bears a tichorinum, oval to elliptical in cross-section. Interior crenulated due to impress of costae. Muscle scars not evident.

Sockets broad, divergent, U-shaped in cross-section, supported by socket plates. Inner socket ridges recurve posterolaterally and are thickened. Crura attached to anteromedial edges or crural bases. Cardinal process variable, rests on thickened deposit of shell material. On well preserved specimens, it is bilobed, with each lobe striated. A faint myophragm extends anteriorly from the cardinal process. Muscle scars not evident. Surface crenulated due to impress of costae.

Comparison: This species differs from *C. maclennani* n. sp. (this paper) in its lack of a rim around the dorsal valve and the presence of well developed lamellose growth lines as well as a triangular outline. This species is very similar to *C.* sp. A (Johnson, 1970, Plate 72, Figs. 10-13), but the latter has sockets set in thickened shell material rather than supported by socket plates.

Cyrtina sp. 2

(Plate 31, Figs. 28, 29, 35, 36, 42, 43;
Plate 32, Figs. 4, 5, 10)

Material and Occurrence: Silicified specimens from GSC loc. C-26903, section 9, unnamed unit, Prince of Wales Island. Late Lochkovian, *Quadrithyris* Zone.

Diagnosis: Shells moderately large, triangular in outline, possessing fine, poorly developed growth lines. Dorsal sockets are imbedded in shell material. Cardinal process multistriate.

Description: Shells moderately large, triangular in outline, strongly ventribiconvex in lateral profile. Ventral beak pointed, slightly incurved. Ventral interarea high, broad, triangular, flat, catacline, crossed by growth lines. Dorsal interarea low, band-like, anacline. Delthyrium high, narrow, triangular, covered by a convex deltidium, open apically. Hinge wide, straight, point of maximum width. Cardinal angles acute, pointed. Ventral sulcus well developed, begins near umbo, gently divergent, smooth, extends into tongue. Dorsal fold well developed, begins near beak, high, rounded, widens anteriorly, flanked by a pair of prominent, rounded costae. Ornament consists of few, well developed, high, rounded costae crossed by fine, concentric, irregularly spaced growth lines.

Teeth set close together, suboval in outline. Spondylium supported by blade-like median septum extending slightly more than one-third shell length. Septum extends above base of spondylium and bears an elliptical tichorinum. Muscle scars not evident. Interior crenulated due to impress of costae.

Sockets wide, deep, covered posteriorly by shell material, U-shaped in cross-section, divergent, excavated from shell wall. Well developed, thickened inner socket ridges curve gently postero-laterally. Crura extend anteriorly from crural bases. Cardinal process rests on buildup of shell material and is multistriate. Thin myophragm extends anteriorly from base of cardinal process. Muscle scars not evident. Surface crenulated due to impress of costae.

Comparison: This species differs from *C. maclennani* n. sp. (this paper) in lacking socket plates, in being larger, triangular, in possessing more pronounced costae. *C.* sp. 1 (this paper) has well developed lamellose ornamentation as well as socket plates.

Genus *Cyrtinaella* Frederiks, 1916

Type Species: *Cyrtina biplicata* Hall, 1857, p. 165

Cyrtinaella sp.

(Plate 30, Figs. 35, 41, 42, 48, 49)

Material and Occurrence: Silicified specimens from GSC loc. C-26886, section 8, unnamed unit, Prince of Wales Island. Late Lochkovian, *Quadrithyris* Zone.

Discussion: This genus was encountered in only one sample and preservation was not sufficient to allow specific assignment. However, the specimens at least allow documentation of the occurrence of the genus.

Superfamily Delthyridacea Phillips

Family Ambocoeliidae George, 1931

Genus *Ambocoelia* Hall

Type Species: *Orthis umbonata* Conrad, 1842, p. 264

Ambocoelia spp.

Material and Occurrence: Calcareous and silicified specimens from GSC locs. C-26876, C-26886, section 8, C-26911, C-26913, C-26914, C-26915, C-26916, C-26917, C-26918, C-26919, section 10, unnamed unit, Prince of Wales Island; C-26939, section 11, C-26979, section 12, unnamed carbonate unit, Baillie Hamilton Island; C-33695, C-33700, C-33702, Devon Island Formation, Devon Island. Early-Late Lochkovian.

Discussion: *Amboecoelia* was encountered in a number of collections but preservation was not always good. Due to the lack of significant distinguishing features, these fossils were given little treatment, and none were illustrated.

Family Delthyrididae Phillips

Subfamily Delthyridinae Phillips

Genus Howellella Kozlowski, 1946

Type Species: Delthyris elegans Muir-Wood, 1925
(= Terebratula crispa Hisinger, 1827, Plate 7, Fig. 4)

Howellella sp. 1

(Plate 32, Figs. 1-3, 6-9, 11-45;
Plate 33, Figs. 1-5)

Material and Occurrence: Silicified and calcareous specimens from GSC locs. C-26806, C-26807, unnamed unit, C-26808, C-26809, section 2, C-26810, C-26813, section 3, unnamed unit, Prince of Wales Island; C-26939, C-26940, C-26942, C-26943, C-26945, C-26947, C-26948, C-26949, C-26950, C-26952, section 11, unnamed carbonate unit, C-26968, C-26973, C-26974, C-26979, C-26982, C-26984, C-26985, C-26987, C-26988, C-26989, section 12, unnamed carbonate unit, Baillie Hamilton Island. Early Lochkovian.

Diagnosis: Shells transversely suboval to triangular in outline, costae subrounded, variable in number, well developed.

Description: Shells small, transversely suboval to triangular in outline, ventribiconvex in lateral profile, dorsal valve moderately convex. Ventral umbo inflated, beak pointed, incurved. Ventral interarea moderately high, broad, approximately two-thirds maximum width, triangular, flat, steeply apsacline. Dorsal interarea low, broad, band-like, flat, anacline. Delthyrium high, moderately broad, triangular, open. Hinge wide, straight. Cardinal angles rounded, obtuse. Maximum width at midlength. Ventral sulcus well developed, beginning near umbos, anteriorly divergent, U-shaped, smooth, extending into tongue. Dorsal fold well developed, beginning near umbo, flares anteriorly, nearly flat-topped. Ornament consists of rounded costae that increase anteriorly by implantation, separated by broad, U-shaped interspaces. Costae variable in number, three to five on each flank of ventral valve. Costae crossed by closely spaced, concentric growth lines, best seen near anterior margin of shell.

Hinge teeth small, pointed, divergent, supported by well developed, plate-like dental lamellae which extend approximately one-fifth shell length. Weakly impressed diductor field consists of two elongate-oval lobes, separated by faint myophragm. Shell interior crenulated due to impress of costae.

Sockets widely divergent, moderately deep, U-shaped in cross-section, floored by socket plates, posterior three-quarters covered by shell material. Inner socket ridges connected to well developed, triangular crural bases which slope to midline. Thin, delicate crura attached to anterior margin of crural plates. Cardinal process striate. Muscle field not evident. Interior crenulated due to impress of costae.

Comparison: This species differs from H. angustiplicatus Kozlowski (1929, Plate 10, Figs. 10-19), in that it possesses fewer costae and much shorter dental lamellae. It differs from H. sp. 2 (this paper) in possessing stronger, more numerous costae, a wider delthyrium and in being more transverse in outline.

Howellella sp. 2

(Plate 33, Figs. 37, 38; Plate 34, Figs. 1-17)

Material and Occurrence: Calcareous and silicified specimens from GSC locs. C-26855, C-26856, C-26859, C-26860, C-26861, C-26863, C-26865, C-26866, C-26869, section 6, unnamed unit, Prince of Wales Island. Early Lochkovian.

Diagnosis: Shells small, suboval in outline, delthyrium high, narrow. Ventral interarea high, short, less than half maximum shell width.

Description: Shells small, suboval in outline, ventribiconvex in lateral profile. Ventral umbo inflated, beak pointed, gently incurved. Ventral interarea moderately high, triangular, narrow, flat, apsacline. Dorsal interarea low, broad, smooth, band-like, anacline. Delthyrium high, narrow, triangular, open. Hinge wide, straight. Maximum width at midlength. Cardinal angles rounded, strongly obtuse. Ventral sulcus begins near umbo, gently divergent anteriorly, shallow, smooth, extends into poorly developed tongue.

Dorsal fold begins near umbo, flares anteriorly, nearly flat-topped. Ornament consists of few, low, rounded costae separated by broad, U-shaped interspaces. Costae best developed near fold and sulcus. Costae on flanks weak, generally two to three on flanks of each valve. On well preserved specimens, costae crossed by closely spaced, concentric growth lines, best developed in anterior regions.

Hinge teeth small, suboval in outline, divergent, supported by well developed, short, plate-like, gently divergent dental lamellae. Muscle field consists of two elongate lobes bisected by long, narrow myophragm. Interior crenulated due to impress of costae.

Sockets widely divergent, U-shaped in cross-section, supported by socket plates. Inner socket plates join triangular crural bases that slope toward midline. Thin, blade-like crura extend from antero-medial edges of crural plates. Muscle field not evident. Surface crenulated due to impress of costae.

Comparison: This species differs from H. angustiplicatus Kozlowski (1929, Plate 10, Figs. 10-19), in that it lacks a triangular outline and very long dental plates. It differs from H. sp. 1 (this paper) in that it has fewer, less prominent costae, has a shorter ventral interarea, narrower delthyrium and is more oval in outline.

Superfamily Reticulariacea Waagen, 1883

Family Reticulariidae Waagen, 1883

Genus Undispirifer Havlíček, 1957

Type Species: Spirifer undiferus Roemer, 1844

Undispirifer laeviplicatus (Kozlowski)
(Plate 33, Figs. 6-36; Plate 34, Figs. 19-37; Fig. 63)

Spirifer (Crispella) laeviplicatus Kozlowski, 1929
(Plate 10, Figs. 22-27)

Undispirifer? sp. Johnson, 1975a (Plate 10, Figs. 25-29)

Material and Occurrence: Calcareous and silicified specimens from GSC locs. C-26909, C-26913, C-26914, C-26915, C-26916, C-26917, C-26918, C-26919, C-26920, section 10, C-26876, C-26881, C-26883, C-26884, C-26888, section 8, C-26903, C-26906, section 9, unnamed units, Prince of Wales Island. Early-Late Lochkovian.

Diagnosis: Shells transversely-oval in outline with costae few in number, very low, rounded, may be indistinct, separated by wide, shallow, interspaces.

Description: Shells of moderate size, transversely-oval in outline, ventribiconvex in lateral profile, but not markedly so. Ventral umbo inflated, beak pointed, incurved. Dorsal umbo weakly inflated, beak incurved. Ventral interarea low, broad, triangular, flat, apsacline. Dorsal interarea very low, broad, triangular, flat, anacline. Delthyrium moderately high, narrow, triangular, open.

Fig. 63. Drawings of acetate peels from serial sections of *Undispirifer laeviplicatus* (Kozlowski) (X6), GSC 47443, GSC loc. C-26883, Prince of Wales Island.

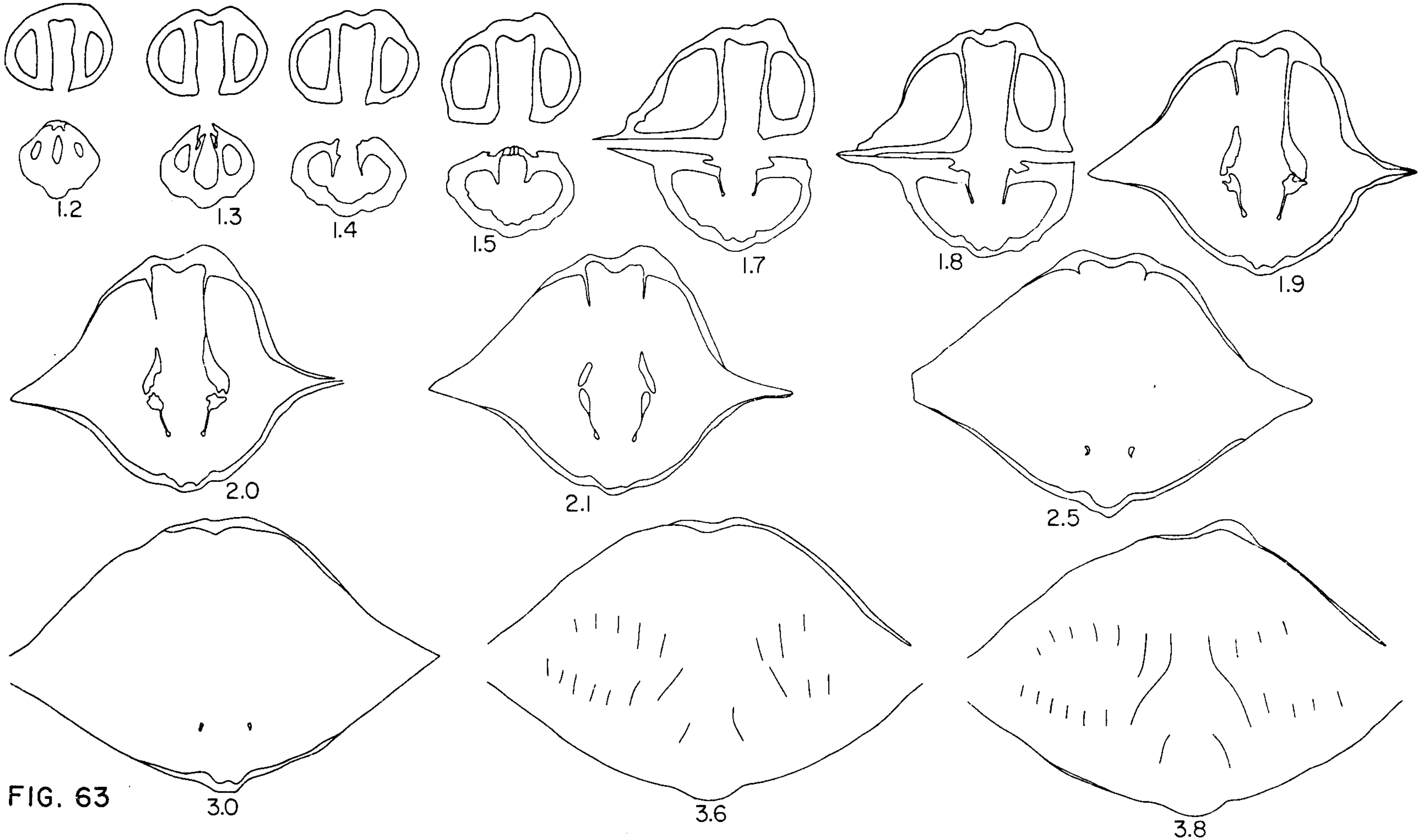


FIG. 63

Hinge wide, straight. Maximum width slightly anterior to midlength. Cardinal angles well rounded, obtuse. Ventral sulcus begins near umbo, flares anteriorly, shallow, smooth, developed into rounded tongue. Dorsal fold begins near umbo, flares anteriorly, low, rounded to subangular in some specimens in lateral profile. Ornament consists of weakly developed to almost imperceptible, broad, rounded costae separated by wide, shallow interspaces. Mature specimens generally possess eight to ten costae on the dorsal valve and eight to ten on the ventral valve. Costae crossed by well developed, closely spaced, concentric growth lines, best seen in anterior regions. Anterior edges of lamellae bear rows of small, elongate, radially arranged spine bases which do not appear to extend to the next lamellae.

Hinge teeth small, pointed, divergent, supported by well developed, plate-like dental lamellae, variable in thickness, which at first converge, then bend to diverge slightly the remainder of the distance to the valve floor, extending approximately one-quarter shell length. Diductor field consists of two, elongate-oval lobes extending anterior from lamellae slightly more than one-third shell length, separated by thin, rounded myophragm. Adductor site elongate-oval in outline situated within confines of lamellae. Surface crenulated due to impress of costae. On thin-shelled specimens, impress of growth lines are seen.

Sockets deep, widely divergent, U-shaped in cross-section, covered posteriorly by shell material, floored by socket plates. Triangular crural bases connected to inner socket ridges, sloping toward midline. Crural plates extend to floor of valve. Crura extend from anterior edges of crural bases. Cardinal process striate to multilobate. Thin myophragm extends anteriorly from cardinal process to slightly less than half shell length. Muscle field not evident. Surface crenulated due to impress of costae. Impress of growth lines visible on thin shelled specimens.

Comparison and Discussion: As noted by Johnson (1975a), inclusion of this form with Undispirifer extends the range of the genus into the lower Devonian. As is the case with most early representatives of a certain stock of brachiopods, there arise problems in its classification. Such is the case with the form just described, i.e., whether or not to include it in with Howellella or Undispirifer. The writer feels it advisable to follow the classification of Johnson (1973b) and include it in with Undispirifer as it has some characteristics in common with the reticularids.

Genus Acanthospirifer Menakova, 1964

Type Species: Acanthospirifer edelschteini Menakova, 1964
(Plate 7, Figs. 1-14; Plate 8, Figs. 1, 2, Text Fig. 13)

Acanthospirifer macdonaldi n. sp.
(Plate 35, Figs. 1-22)

Derivatio nominis: To honor Sir John A. MacDonald, first Prime Minister of Canada.

Material and Occurrence: Holotype (GSC 47481), paratypes (GSC 47477, 47478, 47479, 47480), GSC loc. C-26942, plus additional material from GSC locs. C-26939, C-26940, C-26942, C-26943, C-26945, C-26952, section 11, unnamed carbonate unit, Baillie Hamilton Island. Early Lochkovian.

Diagnosis: Shells transversely oval in outline, multicostate, costae high, rounded.

Description: Shells small, transversely oval in outline, ventribiconvex in lateral profile, dorsal valve moderately convex. Ventral umbo inflated, beak incurved. Dorsal umbo weakly inflated, beak slightly incurved. Ventral interarea high, broad, triangular, flat, apsacline. Dorsal interarea low, broad, triangular, flat, anacline. Delthyrium high, narrow, triangular, open. Hinge wide, straight. Maximum width at hinge or slightly anterior to it. Cardinal angles rounded, obtuse. Sulcus begins near umbo, gently divergent, shallow, contains one rounded costae, best developed near anterior margin of shell. Dorsal fold well developed, anteriorly divergent, high, nearly flat-topped, cleft medially by well developed groove that runs nearly entire length of fold. Ornament consists of well developed, high, subrounded costae separated by deep, U-shaped interspaces.

Hinge teeth short, pointed, divergent, supported by well developed dental lamellae, gently divergent, extending approximately one-third shell length. Diductor scars elongate-oval in outline, separated by thin, elongate myophragm which begins in umbonal cavity and extends nearly half shell length. Interior crenulated due to impress of costae.

Sockets narrow, deep, U-shaped in cross-section, widely divergent, floored by socket plates. Inner socket ridges connected to triangular crural bases which slope toward midline. Thin crural plates join crural bases to shell floor. Cardinal process striate. Muscle field not evident. Surface corrugated due to impress of costae.

Comparison: This species differs from *A. norfordi* n. sp. (this paper) in being smaller, more transverse in outline and possessing more numerous, rounded costae. It differs from *A. edelschteini* Menakova (1964, Plate 7, Figs. 1-14, Plate 8, Figs. 1, 2) in being more transverse in outline and possessing more numerous costae. In addition, the groove in the center of the dorsal fold is more accentuated in *A. macdonaldi* n. sp.

<u>Acanthospirifer</u> <u>norfordi</u> n. sp.

(Plate 35, Figs. 23-42; Fig. 64)

<u>Derivatio nominis</u>: For B.S. Norford, Geological Survey of Canada.

Material and Occurrence: Holotype (GSC 47484), paratypes (GSC 47483, 47485, 47486, 47487), GSC loc. C-26990, plus additional material from GSC locs. C-26987, C-26989, C-26990, section 12, unnamed carbonate unit, Baillie Hamilton Island. Early Lochkovian.

Diagnosis: Shells subtriangular to suboval in outline, costae subrounded to subangular, concentric growth lines present on anterior edges of shells.

Description: Shells of moderate size, subtriangular to suboval in outline. Ventribiconvex in lateral profile. Ventral umbo inflated, beak pointed, incurved. Ventral interarea high, broad, triangular, flat, steeply apsacline to catacline. Dorsal interarea low, broad, triangular, flat, anacline. Delthyrium high, narrow, triangular, open. Hinge wide, straight. Maximum width at midlength. Cardinal angles strongly rounded, obtuse. Sulcus begins near umbo, anteriorly divergent, broad, shallow, contains a weak, rounded costa best developed in anterior regions, extends into rounded tongue. Dorsal fold well developed, begins near umbo, anteriorly divergent, nearly flat-topped, cleft medially by a U-shaped groove. Ornament consists of subrounded to subangular costae separated by deep, V-shaped interspaces. In anterior third of shell, costae crossed by closely spaced, concentric growth lines.

Fig. 64. Drawings of acetate peels from serial sections of *Acanthospirifer norfordi* n. sp. (X4), GSC 47482, GSC loc. C-26987, Baillie Hamilton Island.

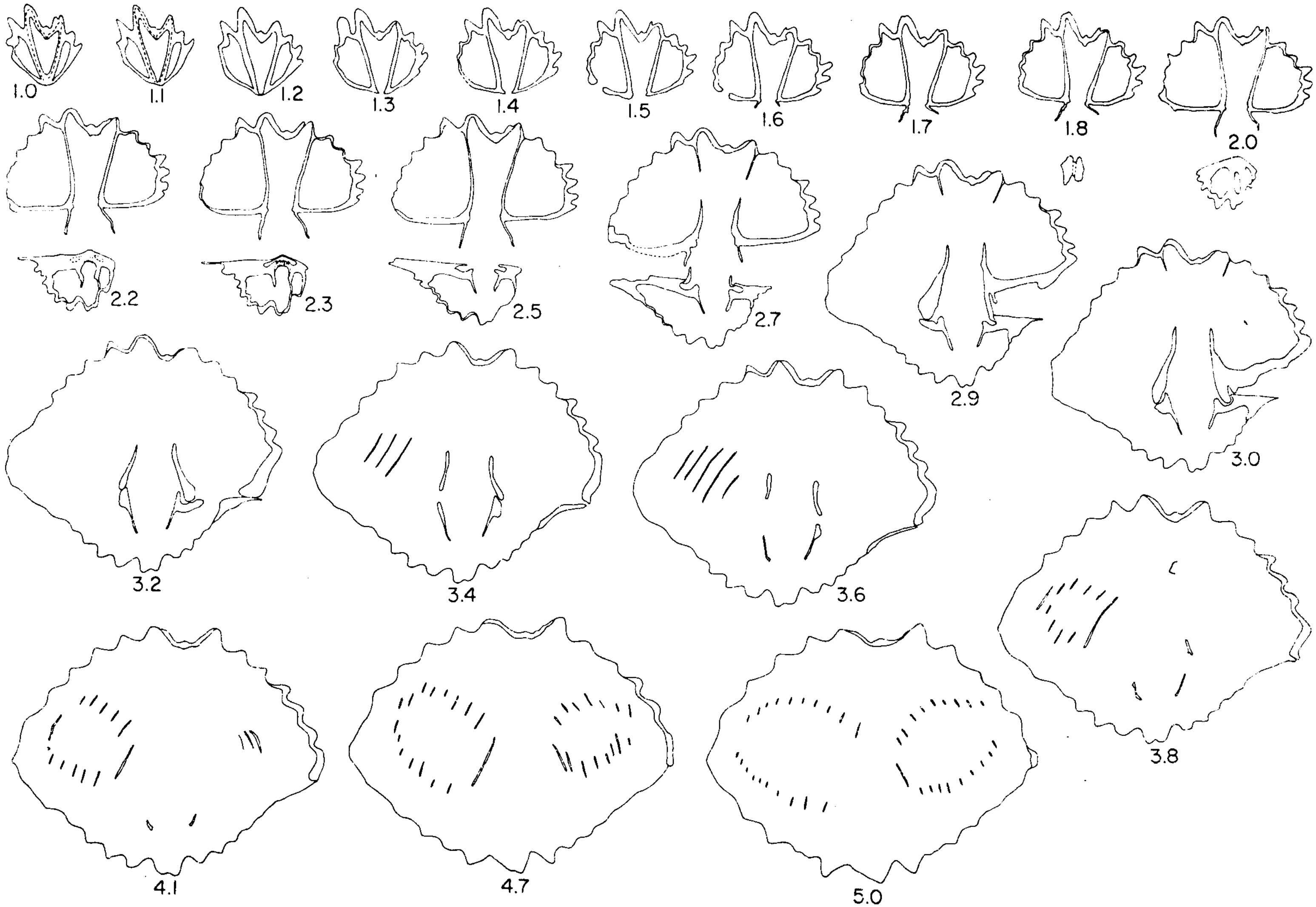


FIG. 64

Hinge teeth short, pointed, divergent, supported by well developed, divergent dental lamellae extending one-third shell length. Crural fossettes present on anteromedial surfaces. Diductor field elongate-oval in outline, separated by myophragm beginning in umbo and extending anterior to lamellae. Shell interior crenulated due to impress of costae.

Sockets deep, divergent, U-shaped in cross-section, floored by socket plates. Inner socket ridges connected to triangular crural bases which slope toward midline. Crural bases connected to crural plates joining floor of valve. Crura join primary lamellae which connect with spiralia. Spiralia consist, in large specimens, of up to ten whorls. Cardinal process striate. Muscle field not evident. Surface crenulated due to impress of costae.

Comparison: This species differs from A. edelschteini Menakova (1964, Plate 7, Figs. 1-14; Plate 8, Figs. 1, 2) in having more numerous, angular costae as well as a more developed costa in the ventral valve and groove in the dorsal valve. It differs from A. macdonaldi n. sp. (this paper) in being more triangular to suboval in outline, generally possessing fewer, more angular costae as well as concentric growth lines.

Acanthospirifer sp.

(Plate 34, Figs. 38-47)

Material and Occurrence: Calcareous specimens from GSC locs. C-26841, C-26845, Reef, Prince of Wales Island. Early Lochkovian.

Discussion: Specimens from these two localities are few in number and are not well preserved. They are sufficient, however, to document the occurrence of the genus. They are similar in some respects to the specimens from Baillie Hamilton Island (this paper), but exhibit some differences as well. Until more specimens are available, the amount of intraspecific variation will not be understood, and assigning them a specific name is impracticable. These specimens are somewhat similar to *A. edelschteini* Menakova (1964, Plate 7, Figs. 1-14; Plate 8, Figs. 1, 2) in that they seem to exhibit a wide variation in the number of costae.

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APPENDICES

APPENDIX 1

FAUNAL LISTS FROM ISOLATED OUTCROPS

Faunal Lists from Isolated Outcrops

GSC loc. C-26806, Prince of Wales Island

Skenidioides robertsensis Johnson, Boucot, and Murphy, 14p, 6b.

Schizophoria fossula n. sp., 33p, 31b, 15 art.

Salopina submurifer Johnson, Boucot, and Murphy 84p, 82 b, 32 art.

Gypidula sp. 1p, 2b.

Mesodouvillina sp. 1 78 p, 17b, 80 art.

"Uncinulus" sp. 2 art.

Ancillotoechia gutta gutta Johnson, Boucot, and Murphy 45 p, 71b, 380 art.

Ancillotoechia? sp. 1b.

Atrypa nieczlawiensis? Kozlowski 2p, 3 art.

Howellella sp. 1 280p, 201b, 77 art.

Cyrtina sp. 4 p, 1b.

Conocardium sp. 7 art.

gastropods 85

corals 4

Silicified fauna at this locality.

GSC loc. C-26808, Prince of Wales Island

Ancillotoechia sp. 1p, 2 art.

Howellella sp. 1 9p, 4b, 2 art.

trilobites 14

indet. gastropods

indet. pelecypod

GSC loc. C-26809, section 2, Prince of Wales Island

<u>Iridistrophia</u> sp. 3 p, 1b.

<u>Howellella</u> sp. 1, 5 p, 2 art.

trilobites

GSC loc. C-26810, section 2, Prince of Wales Island

<u>Schizophoria</u> sp. 1 p.

<u>Iridistrophia</u> sp. 2 p, 3b.

<u>Mesodouvillina</u> sp. 23 p.

"<u>Uncinulus</u>" sp. 1 p, 1b.

<u>Ancillotoechia</u> <u>gutta</u> Johnson, Boucot and Murphy 17 art.

<u>Atrypa</u> sp. 1b.

<u>Howellella</u> sp. 1, 25 p, 12b, 24 art.

<u>Ambocoelia</u>? sp. 1p, 2 art.

<u>Lingula</u>? sp. 1

indet. pelecypod

trilobite fragments 105

GSC loc. C-26841, Prince of Wales Island, Reef

<u>Schizophoria</u> <u>fossula</u> n. sp. 35 p, 37b, 3 art.

<u>Gypidula</u> <u>pelagica</u> (Barrande) 22p, 19b, 1 art.

<u>Grayina</u> <u>magnifica</u> (Kozlowski) 3 p, 3b.

<u>Leptaena</u> <u>nassichuki</u> n. sp. 1 p, 6b.

<u>Eoschuchertella</u> sp. 8p, 5b.

<u>Cymostrophia</u>? sp. 4 p.

<u>Ancillotoechia</u> <u>gutta</u>? Johnson, Boucot and Murphy 1p, 1 art.

<u>Machaeraria</u>? sp. 1 art.

"<u>Tadschikia</u>"? sp. 2p.

indet. rhynchonellids 7

<u>Atrypa</u> <u>nieczlawiensis</u> Kozlowski 18p, 25b, 13 art.

Spinatrypa sp. 3p, 2b, 3 art.

Coelospira sp. 1p.

Notoparmella gilli Johnson 1 art.

Protathyris sp. 3p, 4 art.

Howellella sp. 20 p, 10b, 1 art.

Acanthospirifer sp. 16p, 10b, 4 art.

indet. smooth brachiopods 6

Platyceras sp. 1

indet. ostracode 1

indet. tabulate coral 1

indet. fish and fish spines

GSC loc. C-26845, Prince of Wales Island, Reef

Schizophoria sp. 1p, 1b.

Gypidula pelagica (Barrande) 113p, 49b, 1 art.

Grayina magnifica (Kozlowski) 6p, 5b.

Leptaena nassichuki? n. sp. 7p, 11b.

Eoschuchertella sp. 10p, 1b.

Leptostrophia? sp. 1p.

Mesodouvillina sp. 2p.

Ancillotoechia gutta? Johnson, Boucot, and Murphy 4p, 1b.

indet. rhynchonellids 12

"Tadschikia"? sp. 1p, 3b, 1 art.

Atrypa nieczlawiensis Kozlowski 35p, 98b, 1 art.

Spinatrypa sp. 4b.

Notoparmella? sp. 2b.

Howellella sp. 27p, 31b.

Acanthospirifer sp. 5p, 1b.

indet. spirifer 1p.

indet. spirifer, strong ribs 2b.

indet. brachiopods 10

Orbiculoidea? 2

Platyceras sp. 1

indet. fish and fish spines

APPENDIX 2

DESCRIPTION OF MEASURED SECTIONS

Descriptions of Measured Sections

Isolated Outcrops

Prince of Wales Island, Smith Bay
Air Photograph A16189-84

Coordinates: +3.8X, -3.4Y

dolomite, very fine to fine crystalline, medium-thick bedded, wavy, pale yellow-orange weathering to a grayish-orange; well indurated, cliff former, pinpoint vugs partially infilled with sparite; rare, poorly preserved gastropods. GSC loc. C-26795

Coordinates: +4.9X, -3.9Y

dolomite, fine crystalline, thin-thick bedded, wavy, brownish-gray weathering to a medium dark-dark gray with yellow-orange patches, well indurated, pinpoint vugs, slightly fetid. GSC loc. C-26796

Coordinates: +6.1X, -4.5Y

dolomite, very fine crystalline, medium-thick bedded, wavy; dark greenish gray weathering to a medium gray with pale yellow-orange patches; well indurated, slightly fractured, partially silicified crinoids, gastropods, vuggy in places.
dip 10°N, caps hills in surrounding area. Unit is stratigraphically above samples 1a and 1b. GSC loc. C-26797

Coordinates: +4.0X, -0.3Y

dolomite, very fine-fine crystalline, thin to thick bedded, wavy, yellowish gray weathering to a medium gray with yellow-gray orange patches, quite porous, vugs partially infilled with sparite, quite fossiliferous, poorly preserved gastropods, brachiopods, bryozoans? and solitary corals, partially silicified.
this unit is a bluff former approximately 2.5 m thick similar to GSC loc. C-26797. GSC loc. C-26798

Coordinates: +2.6X, -0.3Y

dolomite, very fine crystalline, thin-medium bedded; brownish gray weathering to a medium gray with yellow orange patches; vuggy, well indurated, partially silicified, stands out as a cliff former 2 m thick;

gastropods, brachiopods, crinoids common; probably same unit as sample 1d. GSC loc. C-26799

Coordinates: +2.2X, +1.1Y

lime mudstone, thin bedded, platy, gray brown weathering to a medium gray; abundant fossils, gastropods, brachiopods, crinoids; unit is stratigraphically below dolomite unit that caps hills (GSC loc.C-26798) rubbly outcrop. GSC loc. C-26800

Coordinates: +4.7X, -2.1Y

dolomite, fine crystalline, thin-medium bedded, wavy; light olive gray brown weathering to medium gray to yellow-orange; quite fractured; tiny vugs partially infilled with sparite, rare gastropods; forms a small cliff in the creek; probably partially equivalent to upper part of section one. GSC loc. C-26805

Coordinates: +2.7X, -2.4Y

lime mudstone, thin bedded; medium dark gray weathering to a medium gray; very fossiliferous, brachiopods, gastropods, crinoids, pelecypods, trilobites, fish? this unit is below beds at GSC loc. C-26800. GSC loc. C-26806

Coordinates: +2.5X, -1.2Y

lime mudstone, thin bedded, wavy; medium gray weathering to a medium gray-pale yellow orange; fossiliferous, brachiopods, colonial corals, bryozoans; well indurated, some argillaceous laminations, bedding platy in places. GSC loc. C-26807

Coordinates: 2.4X, -0.8Y

lime mudstone as before with more shaly partings; bedding quite undulatory (lumpy; some trilobites here as well); same unit as GSC loc. C-26807. GSC loc. C-26808

Prince of Wales Island
Air Photograph A16189-85

Coordinates: -0.9X, -3.9Y

dolomite, fine crystalline, medium-thick bedded; medium yellow-brown weathering to a pale yellow-brown to medium dark gray; slightly fetid, well indurated, very porous; vugs are 1 1/2 cm diameter and

1 1/2 cm length; some partially infilled with sparite, unit forms small scarps and cliffs along the coast; slightly siliceous, rare crinoid columnals. GSC loc. C-26819 may be equivalent to GSC loc. C-26798

Coordinates: -0.3X, +3.1Y

argillaceous lime mudstone to shale, very thin-thin bedded; lenticular; medium dark gray weathering to a yellow-orange; poorly indurated, platy, poorly preserved fish, inarticulate brachiopods and pelecypods; unit is approximately 2 m thick; stratigraphically above reef horizon. GSC loc. C-26846

Prince of Wales Island
Air Photograph A16189-86

Coordinates: -5.4X, +4.1Y

lime mudstone, thin-medium bedded; medium gray weathering to a yellow-orange to a gray-brown; sparsely fossiliferous; rare poorly preserved brachiopods; well indurated, fractured; rubble is stained a yellow-orange here, very noticeable; this outcrop is upstream and stratigraphically above section 7. GSC loc. C-26854

Coordinates: -0.1X, -1.5Y

lime mudstone-packstone, small outcrop of abundant spiriferid brachiopods. GSC loc. C-26870 equivalent to similar horizon in section 6.

Section 1

Prince of Wales Island, Smith Bay
Air Photograph A16189-84

Coordinates: 2.6X, -3.5Y

Base at 0 meters
0-9.5

dolomite (limy), finely crystalline, thin-medium bedded, wavy, undulatory, badly fractured, light olive gray-gray brown weathering to pinkish gray-white to pale yellow-orange; quite fossiliferous, large (8 cm height) gastropods, solitary horn corals ?; some tiny vugs (2-3 mm) partially infilled with sparite.

at 4.0 m gastropod and coral? sample, GSC locs. C-26801, C-26802. at 6.0 m above base algal stromatolites become common, numerous gastropods; bedding becomes thinner and more fractured; GSC locs. C-26803, C-26804.
Top of section, no more exposure.

Section 2

Prince of Wales Island
Air Photograph A16189-84

Coordinates: 1.5X, 1.0Y

Base at 0 meters
0-4

lime mudstone, thin bedded, wavy, medium-dark gray, weathering to a pale yellow-orange; yellow-orange shale partings present; well indurated, platy; rare brachiopods, rare tiny trilobites (pygidiums); unit sparsely fossiliferous. GSC loc. C-26809 at 2.0 m

4-8

lime mudstone, thin bedded, nearly lenticular, blocky; medium dark gray weathering to a pale yellow-orange, less argillaceous material than previous unit; quite fossiliferous; fossils confined to small lenses within beds, rare fossils scattered in pods, trilobites, crinoids. GSC loc. C-26810 at 4.25 m

Isolated Outcrops

Prince of Wales Island, Smith Bay
Air Photograph A16189-85

Stratigraphically above section 3
Coordinates: -0.7X, -0.3Y

lime wackestone-packstone, medium-thick bedded, undulatory; brownish gray weathering to a light olive gray to gray brown; fetid, well indurated, very fossiliferous; common large crinoids, brachiopods, colonial corals, slightly argillaceous, fossils dispersed throughout beds as well as on top of bedding planes, appear to be lime mud intraclasts 1.5-4 cm in length. GSC loc. C-26818, unit is below reef.

Coordinates: 0.0X, 0.0Y, Downstream from Reef

dolomite-calcareous ? fine-very fine crystalline, thin-medium bedded, medium dark gray to olive gray weathering to a grayish yellow-orange, well indurated, quite fractured, numerous wispy dark gray-black laminations, blocky in places; rare inarticulate brachiopods, Lingula, slightly fetid, GSC loc. C-26820.

above previous unit about 1 m - lime mudstone, thin-medium bedded; medium dark gray weathering to a medium gray-yellow-gray; rare large brachiopods, Iridistrophia johnsoni n. sp., present. GSC loc. C-26821

Reef

lime wackestone-packstone, thin-medium bedded; medium gray weathering to a gray brown to gray orange; moderately indurated; brachiopods common, crinoids extremely abundant, rare trilobites, rare fish fragments, GSC loc. C-26841, 1/2 m above, GSC loc. C-26842. crinoidal horizon grades upward to a lime mudstone with argillaceous lenses fairly common; upper beds are more thinly bedded, platy, and weather to a pale yellow orange; approximately 10-15 m of beds here at toe of reef.

lime-mudstone-dolomite, medium-thick bedded, blocky; medium dark gray-olive gray weathering to a medium brown; well indurated, argillaceous, fractured, reef flank. GSC loc. C-26843

lime mudstone-wackestone; massive; medium dark gray-medium gray weathering to a light gray-yellow gray; well indurated, fossiliferous, common crinoids; few common colonial corals, favositid types; abundant stromatoporoids and algal? structures, reef core, GSC loc. C-26844

there are approximately 25 m of beds in this creek; upper units are lumpy bedded lime mudstone with gray green argillaceous seams with abundant crinoid remains.

Air Photograph A16189-85, Smith Bay
Coordinates: +0.6X, +0.3Y

upstream from reef, about 50-60 m. lime wackestone, thin bedded, wavy, medium gray weathering to a yellow-brown-pale yellow orange; well indurated; argillaceous extremely fossiliferous; abundant crinoids, common abundant fish, brachiopods, trilobites, bedding blocky in places. GSC loc. C-26845

Section 3

Prince of Wales Island, Smith Bay
Air Photograph A16189-84
Coordinates: +2.2X, +1.9Y

This section is stratigraphically above section 2. Approximately 5 m missing.

Base at 0 meters
0-0.5

lime mudstone, thin bedded, wavy-undulatory; dark yellow brown weathering to a yellow-orange; broken outcrop, quite fossiliferous, common colonial corals, abundant brachiopods, rhynchonellids, atrypids, spirifers; silty-sandy, well indurated, fractured.
at .25 m, GSC loc. C-26811

0.5-4.0
covered interval; limestone talus.

4.0-5.5
lime mudstone, thin-medium bedded, undulatory; medium gray-dark yellow-brown weathering to yellow-orange-brown; fractured, argillaceous, very fossiliferous, orthocone cephalopds, colonial corals, brachiopods, rare solution vugs (relict brachiopods ?), crinoids.
at 4 m GSC loc. C-26812, at 4.5 m GSC loc. C-26813, at 5.0 m GSC loc. C-26814

5.5-9.0
dolomite, fine crystalline, medium-thick bedded, fairly lenticular; medium yellow-brown weathering to a light yellow-orange to medium dark gray; well indurated, more resistant than underlying unit, sandy, rare fossils, cephalopod, unit slightly calcareous in places, some small vugs, fractured. at 6 m, GSC loc. C-26815

9.0-13.5
lime mudstone, thin-medium bedded, nearly lenticular; medium dark gray weathering to a dark gray-yellow-orange; moderately indurated, argillaceous, moderately fossiliferous; brachiopods, trilobites, colonial corals. at 9.5 m, GSC loc. C-26816, at 12 m different type of brachiopods mainly strophomenids, bedding slightly platy, at 12 m, GSC loc. C-26817

Section 4

Prince of Wales Island, Smith Bay
Air Photograph A16189-85
Coordinates: -1.4X, +5.9Y

0.0-1.0
lime mudstone, thin bedded, nearly lenticular; medium dark gray weathering to a greenish gray; argillaceous, sparsely fossiliferous, well indurated, fossils seen in small pockets, rest of bedding has rare fossils, few brachiopods, some in the form of geopetals, fractured. at base. GSC loc. C-26822

1.0-2.0
lime mudstone, thin bedded, slightly undulatory; dark yellow-brown to gray-brown weathering to a moderate yellow-brown; flaggy, argillaceous, yellow-orange-gray argillaceous seams throughout, quite fossiliferous; brachiopods, trilobites, crinoids on bedding planes, moderately indurated. at 1.5 m, GSC loc. C-26823

2.0-5.5
lime mudstone, thin-medium bedded; medium dark gray weathering to a yellow-orange, yellow-brown; few argillaceous seams, beds smooth, curved, common brachiopods, crinoids and rare fish, well indurated, fractured, argillaceous seams not as soft and poorly preserved as previous unit. at 2.75 m, GSC loc. C-26824, at 3 m, (fish) GSC loc. C-26825, at 5 m, GSC loc. C-26826, at 5.5 m, GSC loc. C-26827

5.5-10.5
c.f. unit below, but no more pronounced argillaceous seams. at 7 m, GSC loc. C-26828, trilobites and brachiopods common, at 9.5 m, a 10 cm thick brachiopod horizon, GSC loc. C-26829

10.5-11.5
wackestone-packstone, c.f. underlying unit, but very abundant crinoids, common brachiopods and orthocone cephalopods. at 10.5 m, GSC loc. C-26830, bedding surfaces are a dark brown color.

11.5-14.5
lime mudstone, c.f. unit 5.5-10.5, rare pelecypod, common brachiopods. at 13.5 m, GSC loc. C-26831, at 14.5 m, GSC loc. C-26832

14.5-18.0
covered interval, top of section, top of creek valley. this section may be equivalent to parts of section 5.

Section 5

Prince of Wales Island, Smith Bay
Air Photograph A16189-85
Coordinates: -2.7X, +8.0Y

0-2.5
argillaceous lime mudstone-shale, very thin-thin bedded, platy, olive black weathering to a light greenish gray; few argillaceous seams, poorly indurated, quite fractured, inarticulate brachiopods, few-common. at base, GSC loc. C-26833

2.5-3.5
lime mudstone, thin-medium bedded, fairly lenticular; medium dark gray weathering to a light olive gray, well indurated, slightly petroliferous, rare brachiopods, trilobites, faint laminations, slightly fractured. at 2.75 m GSC loc. C-26834

3.5-4.8
argillaceous lime mudstone, thin-medium bedded, undulatory, medium dark gray-olive gray weathering to a yellow-gray; badly fractured, well indurated; common brachiopods, trilobites, fish, cephalopods, pelecypods, gastropods. at 4.5 m, GSC loc. C-26835, at 4.5 m, GSC loc. C-26836

4.8-9.5
lime mudstone, thin-medium bedded, fairly lenticular; olive gray weathering to a yellow-orange; well indurated, blocky, rare yellow-orange argillaceous seams; slightly fractured; common brachiopods, trilobites, few crinoids and gastropods. at 5 m, GSC loc. C-26837, at 6.5 m, GSC loc. C-26838, at 8.0 m, *Monograptus uniformis*, GSC loc. C-26839, at 9.5 m, GSC loc. C-26840

Air Photograph A16189-86
Coordinates: -3.1X, -1.8Y

About 6 m of beds here.
lime mudstone, thin-medium bedded; medium dark gray weathering to olive gray; well indurated; few trilobites, *Warburgella rugulosa canadensis*. 3 m, GSC loc. C-26855. these beds are stratigraphically below section 6.

Section 6

Prince of Wales Island, Smith Bay
Air Photograph A16189-86
Coordinates: -2.1X, -1.5Y

0.0-3.8
lime mudstone, thin-medium bedded, lenticular; brownish gray weathering to a light gray; well indurated, fetid, fractured, rare trilobites. at base, GSC loc. C-26856

3.8-11.5
lime mudstone, thin-medium bedded, slightly undulatory; medium gray-brown weathering to a light gray-brown to yellow-orange; well indurated, fetid, less resistant than preceding one; poorly preserved (few) brachiopods. at 4.7 m, GSC loc. C-26857, at 5.5 m, GSC loc. C-26858, at 6.2 m, GSC loc. C-26859 - more brachiopods here; few yellow-orange argillaceous lenses seen in places; unit becomes lime mudstone; wackestone as some beds are full of fossils, at 8 m, GSC loc. C-26860

11.5-13.8
lime mudstone wackestone, very thin-thin bedded, platy, recessive; gray brown weathering to a light gray; poorly indurated, fossiliferous, badly fractured, fetid, brachiopods, trilobites. at 11.7 m, GSC loc. C-26861, at 13.7 m, GSC loc. C-26862

13.8-15
covered interval.

15-19.8
c.f. unit from 11.5-13.8

19.8-26
lime mudstone, thin-medium bedded, nearly lenticular; medium gray weathering to a pinkish gray to gray brown; well indurated, fractured, blocky, fetid; few fossils, brachiopods, trilobites; yellow-orange argillaceous lenses fairly common. at 20.7 m, GSC loc. C-26863, at 24 m. GSC loc. C-26864

26-31
lime mudstone wackestone, thin-medium bedded, fairly lenticular, blocky; medium dark gray weathering to a medium gray brown; well indurated, fetid, fractured; almost a coquina of brachiopods in places, Spirifers (small). at 27 m, GSC loc. C-26865, at 29.5 m, GSC loc. C-26866

31-36.5
covered interval, recessive.

36.5-40.8
lime wackestone, packstone, thin-medium bedded; medium light gray weathering to a yellow-orange-brown bedding; blocky, fairly dense, not brittle, quite fossiliferous, abundant brachiopods, lesser amounts of other elements. at 40.6 m, GSC loc. C-26867

40.8-42
lime mudstone, thin bedded, platy; medium to light gray weathering to a light olive gray; somewhat recessive, although well indurated; some dark gray laminations present; fractured. at 41.6 m, GSC loc. C-26868

42-48
lime mudstone, thin-thick bedded, fairly lenticular; light gray weathering to a medium brown gray to a yellow-orange gray; well indurated, blocky, forms a small cliff at top of creek. at 48 m, GSC loc. C-26869, top of section.

Section 7

Prince of Wales Island, Smith Bay
Air Photograph A16189-86
Coordinates: -5.6X, +3.9Y

0-1.5
lime wackestone, medium bedded, blocky, undulatory; dark yellow-brown weathering to light gray to light olive gray; well indurated, slightly fetid; fractured, fossiliferous, rare brachiopods, abundant bryozoans on bedding planes, rare colonial corals; yellow-orange argillaceous lenses on some bedding planes. GSC loc. C-26847 at .25 m.

1.5-2.0
lime wackestone-packstone, thin bedded, slightly undulatory; dark gray to grayish black weathered to a medium light gray; well indurated argillaceous seams, fetid, extremely fossiliferous, brachiopods, crinoids, trilobites. GSC loc. C-26848 at 1.75 m.

2-11.5
lime mudstone-wackestone, thin-medium bedded, fairly lenticular; medium dark gray weathering to a medium light gray to gray brown, well indurated, fetid, fossiliferous; common brachiopods

(rhynchonellids), crinoids; fossils are dispersed throughout beds, but locally are concentrated in lenses of 3-10 cm; many brachiopods are disarticulated, but rhynchonellids are articulated. GSC loc. C-26849 at 2.5 m. GSC loc. C-26850 at 4.70 m - lense full of orthids and strophomenid brachiopods, quite argillaceous here, GSC loc. C-26851 at 6.25 m - zone of packstone-grainstone orthids and strophomenids, coquina of these brachiopods, GSC loc. C-26852 at 8.8 m - small packstone-grainstone lense with tremendous amounts of rhynchonellids, lesser strophomenids and orthids, GSC loc. C-26853 at 10.2 m - bedding rubbly here, fossils rare, few crinoids, rare poorly preserved brachiopods. This section is partially equivalent to the upper beds of section 6.

Section 8

Prince of Wales Island, Drake Bay
Air Photograph A16189-109
Coordinates: -4.4X, -3.7Y

0-6
argillaceous lime mudstone-shale, very thin to thin bedded occasional medium bed, platy; medium dark gray to olive gray weathering to a light olive gray-greenish gray; unit contains thin yellow orange argillaceous seams; moderately indurated, slightly fetid, rare brachiopods, slightly fractured. GSC loc, C-26871 at base, GSC loc. C-26872 at 2 m - 2 large brachiopods collected, GSC loc. C-26873 at 3 m - brachiopods become fairly common, picture taken of outcrop, GSC loc. C-26874 at 3.5 m - thin lense of fossils in one bed; common brachiopods (*Atrypa*), trilobites, GSC loc. C-26875 at 4 m - interbed of lime mudstone, thin-medium bedded, nearly lenticular; medium gray weathering to a yellow-orange; well indurated, blocky, rare fossils, brachiopods, trilobites; silty, more resistant than unit below, rare fish.

6-8.5
lime mudstone, thin-medium bedded, blocky, slightly undulatory; medium gray to olive gray weathering to a moderate yellow-brown; well indurated, slightly fractured, silty, few yellow-orange argillaceous seams; common brachiopods and gastropods; fetid. GSC loc. C-26876 at 6.8 m.

8.5-14.5
unit of intertonguing and channelling of soft argillaceous lime mudstone and more indurated silty lime mudstone-siltstone.

Unit A
silty lime mudstone-siltstone, thin-medium bedded, nearly lenticular; light gray weathering to a grayish-orange; well indurated, unfossiliferous (macro), slightly fractured. at 9 m, GSC loc. C-26877

Unit B
argillaceous lime mudstone-shale, very thin to thin bedded, undulatory; medium gray weathering to a light yellow gray; badly fractured, moderately indurated (lumpy bedded), rare brachiopods (Atrypa sp.), iron stains on bedding planes; dark gray to black laminations common, slightly silty. at 10 m, GSC loc. C-26878

Units A and B grade laterally upstream into calcareous siltstone which contains rare brachiopods, few argillaceous seams, rare poorly preserved fish at base. at 16.8 m, GSC loc. C-26879

14.5-17
lime mudstone, thin-medium bedded, fairly lenticular; medium gray weathering to an olive gray to yellow-orange; well indurated, quite silty, rare brachiopods, few argillaceous seams, rare poorly preserved fish at base. at 16.8 m, GSC loc. C-26880

17-26
interbedded lumpy bedded silty lime mudstone-wackestone (A) and (B) well indurated, silty lime mudstone; lumpy bedded units have abundant fossils; near top of unit argillaceous seams are rarer and bedding becomes medium; on bedding planes rare colonial corals (favositids). Channeling evident here, Unit A is the channel infill.

(A)
silty lime mudstone, thin-medium bedded, blocky, undulatory; medium light gray weathering to a light gray; well indurated, rare brachiopods present. at 19 m, GSC loc. C-26882

(B)
argillaceous lime-mudstone-wackestone, thin bedded, undulatory, lumpy; medium gray weathering to a greenish gray; common gray-green argillaceous seams; very fossiliferous; common colonial and solitary corals, gastropods, brachiopods, few orthocone cephalopods; these units thin and thicken laterally. at 18 m, GSC loc. C-26881, GSC loc. C-26883 at 20 m - lense of abundant, articulated brachiopods.

26-27.3
argillaceous lime mudstone-shale, very thin-thin bedded, platy, medium gray weathering to a medium gray to yellow-orange; little

argillaceous material on bedding planes; the odd bed is more argillaceous and contains a few brachiopods and crinoids, well indurated; slightly fetid, silty. at 26.5 m, GSC loc. C-26884

27.5-55.5
argillaceous lime mudstone, thin-medium bedded, nearly lenticular, blocky; medium gray to olive gray weathering to a light olive gray to gray brown; well indurated, silty; thin yellow-gray argillaceous seams between beds, slightly fossiliferous, rare brachiopods and few crinoids. at 29.5 m, GSC loc. C-26885, at 42 m, GSC loc. C-26886, at 47 m unit becomes more silty, and yellow-orange in color (siltstone ?), GSC loc.C-26887 at 49 m, near top bedding is thin-very thin.

55.5-61.5
lime mudstone, thin-medium bedded, blocky, lumpy; light olive gray-brownish gray weathering to a yellow-orange brown; well indurated, silty, slightly fetid, rare crinoids, rare brachiopods. at 57 m, GSC loc. C-26888, at 60.5 m, GSC loc. C-26889

61.5-68
sandstone-siltstone, very fine grained, platy, lenticular; medium light gray weathering to a brownish gray to dusky yellow; red-orange stains on bedding planes, moderately indurated, recessive unit, rare dark gray laminations. at 67.5 m, GSC loc. C-26890, one large trilobite pygidium from float.

68-80
broken outcrop; rubble, silty, lime mudstone, thin bedded; medium dark gray weathering to a dusky yellow to yellow-gray; well indurated in places, platy, lenticular in places, numerous large colonial corals seen in rubble; some beds have yellow-orange-gray silt layers near the top; probable sandstone interbeds are covered by talus. GSC loc. C-26891 at 73 m - poorly preserved brachiopods in talus.

80-89
silty lime mudstone, thin bedded; medium light gray weathering to a brownish gray; well indurated, blocky lumpy in places, few yellow-orange argillaceous seams, rare crinoids; toward top of unit argillaceous seams become more abundant; also in places large colonial corals in life position, rare brachiopods, gastropods. at 85.5 m, GSC loc. C-26892

89-94
covered interval; rubble is very fine grained sandstone and silty lime mudstone. c.f. unit from 61.5-68.

94-97.5
silty lime mudstone to calcareous siltstone; thin-medium bedded, variably undulatory and somewhat lumpy; medium light gray weathering to a yellow-gray; well indurated, blocky, few yellow-orange argillaceous lenses; dark gray laminations in places, rare crinoids. at 95 m, GSC loc. C-26893

97.5-103
lime mudstone, thin bedded, undulatory, lumpy; medium gray weathering to a brown gray; well indurated, numerous yellow-gray argillaceous seams convoluted, slightly fetid, few crinoids. at 99 m, GSC loc. C-26894

103-129.5
covered interval; grass, limestone rubble.

129.5-132
dolomite; fine crystalline, thin-medium bedded; medium gray to light olive gray weathering to a yellowish gray; blocky; well indurated, porous, some vugs 5 mm diameter, partially infilled with calcite; slightly fetid, rare colonial corals, poorly preserved; unit caps hills in surrounding areas. at 131 m, GSC loc. C-26895, top of section.

Section 9

Prince of Wales Island, Drake Bay
Air Photograph A16189-109
Coordinates: -0.5X, +3.5Y

0-8.5
very fine grained sandstone to siltstone; thin-medium bedded, lenticular, platy; light gray to light olive gray weathering to light gray-dusky yellow; well indurated, dolomitic, weak calcite cement in places; fine dark gray-black laminations, black organic remains, lenticular in shape, rare burrows? at 1 m, GSC loc. C-26896 - small load casts on bottoms of beds, at 7 m, GSC loc. C-26897

8.5-10.5
dolomite; very fine-fine crystalline; medium thick bedded; medium light gray weathering to a yellow-orange-gray; well indurated, silty, massive looking; debris contains some large gastropods and colonial corals poorly preserved; some large vugs partially infilled with calcite, some argillaceous seams present, faint dark gray laminations. at 9 m, GSC loc. C-26898

10.5-18.5
very fine grained sandstone; very thin-thin bedded, undulatory; medium light gray to olive gray weathering to a yellow gray; lower part contains argillaceous lenses, very thin shale partings between beds, well indurated, dolomitic. at 11 m, GSC loc. C-26899, at 12.5 m, GSC loc. C-26900

18.5-23
dolomite, very fine crystalline thin bedded, undulatory; medium dark gray-brown weathering to a yellow-gray-orange; argillaceous seams common; faint dark gray-black laminations, well indurated, silty, rare large vugs partially infilled with calcite. at 19.5 m, GSC loc. C-26901

23-41
siltstone-very fine grained sandstone; thin bedded, platy; medium gray to light gray brown weathering to a yellow-orange-gray; well indurated, rare crinoids, rare colonial corals. GSC loc. C-26902 at 27 m - numerous load casts on bottom of beds.

Broken section
continue downstream, trace unit from 18.5-23 m downstream for more section; now in the limestone facies, 1/4 mile downstream from section start, abundant brachiopods in lumpy bedded limestone unit. GSC loc. C-26903

15-18
lime mudstone; thin bedded; medium dark gray weathering to a yellow gray-medium gray; well indurated; silty, yellow gray argillaceous seams; few crinoids, rare brachiopods. this unit exhibits channeling and cross beds. at 17 m, GSC loc. C-26904

18-23
lime mudstone; medium bedded; medium dark gray weathering to medium gray-yellow orange; well indurated; breccia looking; contains stromatoporoids ? and colonial coral heads, not in growth position. corresponds to unit 18.5-23 upstream; however along strike this unit thins and thickens.

23-28
argillaceous lime mudstone interbedded with calcareous shale; laminar; thin bedded; medium dark gray weathering to a yellow-gray to gray brown; poorly indurated, fissile, silty; few crinoids, rare brachiopods, more limy units are more indurated. at 23.5 m, GSC loc. C-26905, GSC loc. C-26906 at 24.5 m - horizon of abundant tiny brachiopods and rare fish.

28-33.5
lime mudstone-calcareous siltstone; thin bedded; lenticular, platy; medium dark gray weathering to a yellow-gray; well indurated, very silty; rare brachiopods. GSC loc. C-26907 at 28.5 m - abundant fish, GSC loc. C-26908 at 32 m - poorly preserved common brachiopods, few trilobites, gastropods and pelecypods.

Isolated Outcrops
Prince of Wales Island
Cape John Dyer
Coordinates:

lime mudstone; very thin-medium bedded, lenticular, platy-blocky; medium dark gray to brownish gray weathering to a gray-orange to a dusky yellow; very silty, very well indurated; very thin beds more argillaceous than mediaum beds; rare brachiopods, rare poorly preserved fish in talus, common high spired gastropods at one horizon; beds dip upstream; GSC loc. C-26909

Upstream from previous unit
Coordinates:

lime mudstone-wackestone, thin bedded, undulatory, medium dark gray weathering to a yellow-orange gray; well indurated, silty, common crinoids, brachiopods. GSC loc. C-26910 - rare high spired gastropods and rare ostracodes.

Section 10

Prince of Wales Island
Cape John Dyer
Air Photograph A16153-18
Coordinates: -5.6X, +0.4Y

0-2
lime wackestone, thin bedded, undulatory; medium-dark gray weathering to a yellow-orange gray; well indurated, fetid, abundant crinoids, few brachiopods and rare trilobites, few yellow-gray argillaceous seams between beds. GSC loc. C-26911 at 1 m.

2-11.5
lime mudstone-wackestone, thin bedded, undulatory and lenticular in places; medium dark gray, weathering to a yellow-brown to yellow-gray; fetid, slightly silty, green-gray argillaceous seams; well indurated; rare crinoids, solitary horn corals, brachiopods, also common to abundant fish at upper levels. at 3.5 m, GSC loc.

C-26912; at 6.0 m, GSC loc. C-26913; at 9.10 m, GSC loc. C-26914; at 9.5 m, GSC loc. C-26915; at 9.7 m, GSC loc. C-26916; at 9.8-9.9 m, GSC loc. C-26917; at 10 m, GSC loc. C-26918; at 10.2 m, GSC loc. C-26919; at 10.4 m, GSC loc. C-26920; at 10.6 m, GSC loc. C-26921.

Section 11

Baillie Hamilton Island, North Coast
Air Photograph A16175-96
Coordinates: -2.7X, +4.1Y
Section begun in Cape Phillips Formation

0-82.5
argillaceous siltstone and shale; very thin-thin bedded; platy; lenticular; dark gray weathering to a yellowish gray to blue gray; moderate-poorly indurated, calcareous, rare inarticulate brachiopods; outcrop quite rubbly; common dark gray to black laminations. at 1.5 m, GSC loc. C-26922; at 14.5 m, GSC loc. C-26923; at 15 m, unit becomes slightly less silty, tending to an argillaceous limestone; at 24 m, GSC loc. C-26924; GSC loc. C-26925 at 35 m - talus, poorly preserved fish and ceratiocerid; GSC loc. C-26926 at 51 m - poorly preserved fossil; conularid?; at 67.5 m, GSC loc. C-26927.

82.5-118
silty shale to shaly siltstone; laminar to very thin bedded with occasional thin beds, platy, lenticular; medium dark gray to black weathering to a yellow-gray-blue gray; calcareous, moderately well indurated, strongly laminated, dark gray in color, lenticular. at 83 m, GSC loc. C-26928, GSC loc. C-26929 at 93 m - poorly preserved graptolite found in talus (Monograptus ?), GSC loc. C-26930 at 107.5 m - rare poorly preserved brachiopods; coarse ribbed.

118-133.5
lime mudstone; thin bedded, platy, lenticular; medium gray weathering to a yellow-gray to blue-gray; well indurated, slightly silty, dark gray-black gray laminations present; poorly preserved ceratiocerids and brachiopods seen in talus. GSC loc. C-26931 at 120.5 m - talus, poorly preserved spiriferid brachiopods, inarticulates, at 129 m, GSC loc. C-26932.

133.5-155
broken outcrop, limestone talus, appears similar to preceding unit but covered with talus, at 145 m, GSC loc. C-26933

Cape Phillips Formation
Unnamed Formation
Contact conformable

155-158
lime mudstone; thin bedded, lenticular to slightly undulatory; medium dark gray weathering to a gray-brown to a yellow-gray; well indurated, slightly silty, cliff former, rare orthocone cephalopods, tiny fragmented debris. at 156 m, GSC loc. C-26934

158-185
argillaceous lime mudstone; laminated-thin bedded, lenticular; medium dark gray weathering to a yellow-gray to gray-brown; dark gray laminations are in intervals and some are 5 m thick; silty, well indurated, rare crinoids, few tiny vugs infilled with sparite, rare ostracodes. at 159 m, GSC loc. C-26935; at 164 m - inarticulate brachiopods, poorly preserved, GSC loc. C-26936; at 176.5 m, GSC loc. C-26937; at 184 m - few brachiopods, GSC loc. C-26938.

185-226
lime mudstone; thin-medium bedded, fairly lenticular; medium dark gray weathering to a light yellow-gray to gray brown; well indurated; some yellow gray argillaceous seams, rare crinoids and brachiopods. GSC loc. C-26939 at 202 m - horizon of abundant brachiopods; GSC loc. C-26940 at 210.5 m - common brachiopods and rare trilobites.

226-242
c. f. unit below, but much more silty and weathering to yellow-orange. at 226 m, GSC loc. C-26941; at 236.5 m - horizon of abundant brachiopods, large strophomenids, GSC loc. C-26942; at 237.5 m - coquina of brachiopods (strophomenids), GSC loc. C-26943.

242-256
lime mudstone, thin bedded, somewhat undulatory; medium light gray weathering to a light gray to yellow gray; well indurated, slightly silty, common yellow-orange-gray argillaceous seams; rare crinoids and brachiopods in lower part. at 242.5 m, GSC loc. C-26944; at 247 m - horizon of abundant crinoids and brachiopods, GSC loc. C-26945; at 255 m, GSC loc. C-26946.

256-257
covered interval; limestone talus.

257-270
lime mudstone-wackestone; thin bedded, undulatory, lumpy; medium gray weathering to a yellow-gray; argillaceous, very well indurated, contains abundant skeletal debris and brachiopods, common crinoids, rare colonial corals; slightly silty. at 258.5 m, GSC loc. C-26947; at 259 m, GSC loc. C-26948; at 263 m, GSC loc. C-26949 - unit increases in sand and silt content upwards; also some beds are a packestone; at 266 m, GSC loc. C-26950 - above 266 m unit becomes rubbly and poorly exposed, common colonial corals; at 268 m, GSC loc. C-26951.

270-281.5
covered interval; sandy lime mudstone; poorly preserved brachiopods, large colonial corals (favositids).

281.5-291.5
covered interval; blue gray lime mudstone-packestone with silicified fauna. at 285-286 m - common gastropods, brachiopods, few corals and bryozoans, rubble collection, GSC loc. C-26952

291.5-292
sandy lime mudstone; thin bedded, rubbly outcrop; light olive gray weathering to a dark gray to yellow gray; well indurated, fetid; few silicified remains, bryozoa and corals, some crinoids, few vugs 2-3 mm diameter, partially infilled with sparite, dolomitic. GSC loc. C-26953

292-299.5
covered interval; limestone talus.

299.5-300
lime packestone; rubbly outcrop; thin bedded, blocky; pale yellow brown weathering to a medium light gray to blue gray; tiny fossiliferous fragments, few ostracodes, some brachiopods. GSC loc. C-26954

Section 12

Baillie Hamilton Island, South Coast
Air Photograph A16175-93
Coordinates: +5.8X, +2.1Y
Section begun in Cape Phillips Formation

0.38-5
argillaceous silty shale; very thin bedded, platy; medium dark gray weathering to a yellow-gray to blue gray; poorly indurated, rubbly

outcrop, dark gray laminations, calcareous, slightly fetid; dip 35° to E. at 1 m, GSC loc. C-26955; at 30 m - poorly preserved inarticulate brachiopods and ceratiocerids, GSC loc. C-26956.

38.5-57
covered interval; lithology probably same as underlying unit.

57-66
siltstone-silty lime mudstone; thin bedded, slightly undulatory; light-medium gray weathering to a yellow gray; well indurated, calcareous; rare brachiopods and trilobites, pelecypods and gastropods; unit contains thin yellow-gray argillaceous seams; also poorly preserved graptolite fragments in talus here. at 58 m, GSC loc. C-26957

66-72
covered interval; siltstone and shale debris. at 66 m - graptolite seen in talus, Monograptus ?, GSC loc. C-26958

72-118.5
argillaceous siltstone interbedded with silty lime mudstone; thin bedded, nearly lenticular; light olive gray to gray brown weathering to yellow-gray to blue gray; moderately well indurated, strongly calcareous, fractured; poorly preserved ceratiocerids and cephalopods here; dark gray to black laminations, fetid. at 95.5 m, GSC loc. C-26959

118.5-119.5
lime mudstone; thin bedded; medium light gray weathering to light gray; very well indurated; fetid, silty. at 119 m, GSC loc. C-26960

119.5-149
c.f. unit from 72-118.5. at 121 m, GSC loc. C-26961; at 147 m, GSC loc. C-26962

149-153.5
covered interval; siltstone talus.

Cape Phillips Formation
Unnamed Formation
Contact conformable

153.5-168
silty lime mudstone-calcareous siltstone; thin bedded, lenticular; medium gray to gray brown weathering to a yellow gray to gray brown; well indurated, slightly fetid, some beds have thin laminations

of gray-yellow silty material, calcareous. at 154.5 m, GSC loc. C-26963

168-170
argillaceous lime mudstone; very thin-thin bedded; lenticular; light brownish gray to medium light gray weathering to a yellow-gray; lami-dark gray, very well indurated; has silty sandy interbeds, soft sedimentary deformation cliff former, argillaceous layers show some truncation, calcareous. at 169 m, GSC loc. C-26964

170-195
silty lime mudstone-siltstone; thin bedded; lenticular; medium light gray brown weathering to yellow-orange; well indurated, laminated, calcareous; rare ostracodes, inarticulate brachiopods, Lingula, rare articulate brachiopods, Spriferids, ceratiocerids. at 184.5 m, GSC loc. C-26966; at 194.5 m, GSC loc. C-26967

195-215
covered interval, lime mudstone and siltstone talus. at 209 m talus changes color; it is silty lime mudstone, slightly undulatory bedded weathering to yellow gray to gray orange. at 210 m talus, GSC loc. C-26968

215-236.5
silty lime mudstone-siltstone; thin bedded, platy, lenticular, smooth; medium gray to light gray weathering to a yellow-gray to a yellow-orange; well indurated, calcareous, few rare brachiopods, rare gastropods. GSC loc. C-26969; at 215.5 m talus, single specimen of Gypidula pelagica GSC loc. C-26970; at 223.5 m, Gypidula pelagica, GSC loc. C-26971.

236.5-244
silty lime mudstone, thin bedded, lenticular, smooth; medium light gray to light brownish gray weathering to a light yellow-gray; well indurated, rare brachiopods Atrypa sp. at 238 m, GSC loc. C-26972

244-246.5
argillaceous lime mudstone-wackestone, thin bedded, undulatory (lumpy), medium dark gray to gray brown weathering to yellow gray orange; well indurated, argillaceous lenses between beds; common abundant brachiopods Gypidula, Atrypa, Schizophoria, rare trilobites. at 245 m, GSC loc. C-26973; at 245.5 m, GSC loc. C-26974.

246.5-251.5
silty lime mudstone; thin bedded; nearly lenticular; medium gray weathering to a yellow gray orange; well indurated; some yellow-orange colored traces in middle of beds; gray-brown in laminations. at 249 m, GSC loc. C-26975

251.5-254
covered interval; limestone and siltstone talus.

254-287
argillaceous lime mudstone; thin bedded, lumpy in places; weathering light medium gray; well indurated, fetid, sandy in places; common-abundant large colonial coral heads, favositid type, few brachiopods. at 254.5 m, GSC loc. C-26976; at 268 m - rare, poorly preserved brachiopods here, GSC loc. C-26977; at 270 m - large colonial coral, GSC loc. C-26978; at 285 m - small seam of concentration of abundant brachiopods and common gastropods, GSC loc. C-26979.

287-291
covered interval to rubbly outcrop; c.f. underlying unit.

291-315
argillaceous lime mudstone; thin bedded, undulatory (lumpy); medium dark gray-gray brown weathering to a light gray brown to a yellow-gray; well indurated, common yellow-gray argillaceous seams, other seams gray green in color; few brachiopods, common colonial corals; slightly silty - sandy, fetid; some beds have fair amount of tiny communited debris. at 300 m - colonial coral, GSC loc. C-26980; at 300 m, GSC loc. C-26981; at 303 m - few brachiopods, GSC loc. C-26982.

315-320
broken outcrop alternating with talus, same unit.

320-333
c.f. unit 291-315; common colonial corals, some crinoids. at 324 m, GSC loc. C-26983; at 331.5 m - thin unit with common brachiopods and trilobites, rare gastropods and ostracodes, GSC loc. C-26984.

333-340
covered interval; limestone talus, unit probably c.f. unit below.

340-354
argillaceous lime mudstone; thin bedded, undulatory (lumpy), brownish gray-medium gray weathering to a light yellow-gray; well

indurated, slightly fetid, common brachiopods, gastropods, few colonial corals; unit has fossils throughout, but some beds have more than others. at 345.5 m, GSC loc. C-26985; at 351.5 m, GSC loc. C-26986.

354-360
covered interval; limestone talus, weathering yellow-orange; well indurated.

360-378.5
c.f. unit 340-354; bedding not quite as lumpy; common brachiopods, pentamerids, strophomenids. at 365 m, GSC loc. C-26987; at 371 m, GSC loc. C-26988; at 373 m, GSC loc. C-26989.

378.5-397.5
covered interval, limestone talus weathering yellow-gray-orange; rubble quite fine.

397.5-411
c.f. unit 360-378.5; moderately indurated, abundant fossils, brachiopods, gastropods. at 403.5 m, GSC loc. C-26990

411-417
covered interval; limestone talus, quite blocky, rubble.

417-421
argillaceous lime mudstone-wackestone; thin-medium bedded; fairly lenticular; medium gray to gray brown weathering medium gray-brown with patches of yellow-orange; well indurated, silty, quite fetid, thin yellow-gray argillaceous seams on bedding planes, quite fossiliferous, small debris, common tiny brachiopods, bryozoans, some colonial corals, trilobites, rare gastropods, solitary corals and orthocone cephalopod. at 418.5 m, GSC loc. C-26991

421-445.5
covered interval; limestone talus, debris, coarse blocks to fine rubble.

445.5-448
argillaceous lime mudstone-wackestone; thin-medium bedded, rare medium bedded; lenticular to slightly undulatory; medium light gray to light olive gray-brown weathering to a light olive gray; well indurated, silty, yellow-gray argillaceous material on bedding planes, slightly fetid, abundant bryozoans, rare gastropods and rare colonial corals; amount of argillaceous material increases upwards and bedding more lumpy. at 446 m, GSC loc. C-26992

448-471
covered interval, platy, silty limestone from cliffs above.

471-473.5
silty lime mudstone-calcareous siltstone; very thin-thin bedded; lenticular, smooth, platy; light yellow-gray weathering to medium yellow-gray to yellow-orange; wavy laminations, moderately indurated. at 471.5 m, GSC loc. C-26993

473.5-478.5
covered interval; limestone and siltstone talus.

478-485
silty lime mudstone-calcareous siltstone; thin-medium bedded; fairly lenticular, blocky; medium light gray-light olive gray weathering to a yellow-gray-orange to medium gray; well indurated; rare colonial corals. at 479 m, GSC loc. C-26994; at 483.5 m, GSC loc. C-26995.

485-488
lime mudstone-wackestone, thin bedded, undulatory (lumpy); medium light gray with some pale yellow-brown patches weathering to a gray-orange to a gray-brown; well indurated, slightly fetid, silty thin yellow-gray argillaceous seams between beds, tiny fragmental debris, crinoids, ostracodes, colonial corals, rare trilobite fragments. at 486 m, GSC loc. C-26996

488-499
covered interval; limestone talus, common colonial corals in talus.

499-501.5
argillaceous lime mudstone; thin-medium bedded; fairly lenticular, somewhat uneven, blocky; medium dark gray to brown gray weathering to a yellow-gray-orange to light gray brown, fetid, well indurated, few-common colonial corals, rare medium gray argillaceous seams, silty. at 499 m, GSC loc. C-26997; at 500.5 m - thin horizon of common bryozoans, solitary and colonial corals, ostracodes and brachiopods, GSC loc. C-26998

501.5-504
c.f. unit 485-488

504-508
c.f. unit 499-501.5

508-512
covered interval, limestone talus somewhat coarse and blocky.

512-514
argillaceous lime mudstone; thin bedded, undulatory (lumpy); light olive gray-gray brown weathering to a light gray to light yellow gray; well indurated, fetid, yellow gray argillaceous seams between bedding planes; abundant colonial corals and rare gastropods. at 513.5 m, GSC loc. C-26999

514-516
argillaceous lime mudstone; thin bedded, nearly lenticular, smooth; medium gray brown weathering to a yellow-orange-gray; fetid, well indurated, rare yellow-gray argillaceous seams; tiny skeletal debris. at 515.5 m, GSC loc. C-27000

516-520
covered interval; limestone talus, quite blocky, weathering to yellow-orange.

520-527.5
argillaceous lime mudstone; thin bedded; bedding planes irregular, lumpy in places, lenticular in others; medium brown gray weathering to a dark yellow-orange to pale yellow-brown; well indurated, slightly fetid, few argillaceous seams present; tiny skeletal debris, some ostracodes. at 521.5 m, GSC loc. C-27001

527.5-572
covered interval; limestone talus, mainly fine rubble.

572-576.5
lime mudstone; very thin-thin bedded, nearly lenticular, smooth; medium gray weathering to a dark yellow-brown, slightly silty, fetid, well indurated; few to common very thin argillaceous laminations between bedding planes; few gastropods, ostracodes, rare brachiopods; rip-up phenomenon near top of unit. at 574 m, GSC loc. C-27002; at 575 m - rip-up phenomenon, GSC loc. C-27003

576.5-580
argillaceous lime mudstone-calcareous siltstone; very thin-medium bedded, lenticular, platy to blocky; medium light gray weathering to a pale yellowish brown to light olive gray; well indurated, laminated in places, slightly fetid, thin yellow-gray argillaceous seams between beds with tiny skeletal debris, rare to few ostracodes. at 578 m, GSC loc. C-27004; at 578.5 m - unit is laminar and very thin-thin bedded and less indurated.

580-592
covered interval; limestone and siltstone talus.

592-596
argillaceous lime mudstone, very thin-thin bedded; fairly lenticular, smooth, platy; medium gray weathering to yellow-gray-gray brown; moderately indurated, slightly fetid, silty, dark gray-brown laminations in some beds; rare-few ostracodes. at 593 m, GSC loc. C-27005

596-602
covered interval; limestone and siltstone, platy, quite fine debris, probably c.f. underlying unit.

602-607
c.f. unit 592-596

607-610
covered interval; very thin bedded, platy, silty, limestone, gray-brown weathering to yellow-gray.

610-611.5
c.f. unit 592-596. at 610.5 m, GSC loc. C-27006

611.5-618
covered interval.

618-621
c.f. unit 592-596

621-636
covered interval.

636-639.5
argillaceous lime mudstone-wackestone in places, laminar; thin-bedded, platy; pale yellow-brown to medium gray weathering to a yellow-gray to gray-brown; numerous medium gray and yellow-gray argillaceous seams, very wavy, moderately indurated, slightly fetid, abundant tiny ostracodes, some tiny skeletal fragmental debris, brachiopods. at 636.5 m, GSC loc. C-27007

639.5-642.5
covered interval; limestone and argillaceous material, platy.

642.5-645
argillaceous lime mudstone; thin bedded; slightly undulatory; medium dark gray to brownish gray weathering to light olive gray to dark yellow-orange; moderately indurated, silty, slightly fetid, some yellow-gray argillaceous seams. at 643.5 m, GSC loc. C-27008

645-649.5
covered interval, fine platy, silty shale and lime mudstone talus.

649.5-653
c.f. unit 642.5-645

653
end of section, no more outcrop from here to the sea.

Section 13

Bathurst Island
Air Photograph A16203-56
Coordinates: Base: -0.6X, -1.1Y; top: -0.2X, -45Y
Cut Through Creek
Section begun in Cape Phillips Formation

0-21
shale and mudstone, laminar to very thin bedded, platy, smooth; dark gray weathering to a medium dark gray to yellow-gray; calcareous, silty, strongly fetid, poor-moderately indurated, graptolitic, rare pyritized cephalopods. at 1 m - graptolites, GSC loc. C-27009; at 3 m - graptolites, GSC loc. C-27010; at 4.5 m - graptolites, GSC loc. C-27011; at 14 m unit becomes dolomitic and barren of fossils.

21-33
interbedded dolomitic shale and silty mudstone; shale, laminar; very thin bedded, platy, smooth; medium dark gray weathering to a medium gray to gray-yellow; silty, fetid; poorly indurated; contains few large yellow-orange concretions. Mudstone, very thin-thin bedded; medium dark gray weathering to a yellow gray to gray-orange; moderately indurated; more resistant than shale. at 32 m, GSC loc. C-27012

33-37.5
mudstone, medium-thick bedded, smooth; medium dark gray to gray-brown weathering to a pale olive to a dark yellow-orange; well indurated, silty, fetid, fractured. at 34 m, GSC loc. C-27013

37.5-124
interbedded shale and mudstone-siltstone; shale, laminar bedded; medium dark gray weathering to a dark gray to a dark reddish brown to a moderate yellow in places; fissile, dolomitic, fetid. Mudstone-siltstone, thin bedded, smooth; grayish-black to brownish black weathering to a gray-orange; well indurated, dolomitic, laminated in places, fetid; these units thin and thicken. Shale: mudstone = 6: 1. at 41 m GSC loc. C-27014; at 47.5 m - here shale weathers to dark red brown-greenish, very fetid, GSC loc. C-27015; at 55 m - graptolites, GSC loc. C-27016; at 55.5 m, GSC loc. C-27017, at 59 m - poorly preserved tiny traptolites, GSC loc. C-27018; at 70.5 m, GSC loc. C-27019; at 87 m - poorly preserved graptolites, GSC loc. C-27020; at 110.5 m - graptolites, GSC loc. C-27021.

124-180
covered interval, recessive, probably shale.

180-215.
interbedded shale and silty mudstone. Shale, laminar to very thin bedded; dark gray to gray-brown weathering to dark gray; platy, fissile, fetid, silty, dolomitic, recessive. Silty mudstone, thin bedded, smooth, yellow gray to yellow orange weathering to a medium dark gray to gray brown, dolomitic, moderately indurated. Shale:mudstone = 6:1.

Cape Phillips Formation
Bathurst Island Formation
Contact conformable

215-305
interbedded silty-sandy mudstone and very fine grained sandstone. Mudstone, laminar to very thin bedded, platy, flaggy; medium dark gray-gray brown eathering to a medium gray to gray brown; slightly calcareous, silty, sandy; fetid, moderately indurated. Sandstone, thin to medium bedded, fairly smooth, very fine grained; medium light gray to brownish gray weathering to a gray-orange and moderate yellow-brown; well indurated, slightly fetid, calcareous, argillaceous. Mudstone:sandstone = 1. 1. at 219 m, GSC loc. C-27022; at 231 m - graptolites, GSC loc. C-27023; at 235 m - tiny brachiopods, poorly preserved, GSC loc. C-27024; at 246 m - graptolites, GSC loc. C-27025; at 296 m - graptolites and brachiopods, GSC loc. C-27026; at 296.5 m - sandstone, GSC loc. C-27027.

305-324.5
interbedded, mudstone and sandstone, but mudstone is more massive looking. at 322 m - sandstone, GSC loc. C-27028

324.5-437
interbedded sandstone and mudstone, c.f. unit from 215-305. Sandstone:mudstone = 1:1. at 328.5 m - dark gray brown laminations common, GSC loc. C-27029; at 350.5 m - mudstone, GSC loc. C-27030; at 354 m - poorly preserved graptolites, GSC loc. C-27031; at 364.5 m - sandstone, GSC loc. C-27032.

437-442
very fine grained sandstone to siltstone; thin to medium bedded, smooth, platy, blocky; medium dark gray-gray brown weathering to a grayish orange, well indurated, calcareous, argillaceous, slightly fetid. at 438 m, GSC loc. C-27033

442-451
silty mudstone, very thin-thin bedded, platy, smooth; dark gray brown weathering to a medium gray to light yellow gray; moderately indurated, calcareous, fetid.

451-630
interbedded very fine grained sandstone and calcareous mudstone; c.f. previous units. Sandstone:mudstone = 1.5:1. at 471 m - mudstone, GSC loc. C-27034; at 493 m - mudstone, GSC loc. C-27035; at 519 m - sandstone, GSC loc. C-27036; at 555 m - mudstone, GSC loc. C-27037.

630-640
interbedded sandstone and mudstone. Sandstone:mudstone = 3:1. Thin bedded sandstone units are rare, most are very thin bedded, platy and have dark gray to black laminations. at 634.5 m, GSC loc. C-27038. Ripple marks seen in talus here. at 638 m - sandstone, GSC loc. C-27039.

640-673.5
interbedded sandstone and mudstone; here sandstone is commonly thin to medium bedded and blocky. at 655 m - sandstone; GSC loc. C-27040; at 657 m - mudstone, GSC loc. C-27041.

673.5-686.5
sandstone, very fine grained to silty, laminar to thin bedded, platy, smooth; medium gray brown to moderate yellow brown weathering to a dark yellow-orange to a moderate yellow-brown; argillaceous,

calcareous, moderately indurated, fetid; has dark gray-brown laminations. at 674 m, GSC loc. C-27042

686.5-708
interbedded sandstone and mudstone as before. Sandstone:mudstone = 5:1. at 696.5 m - mudstone, GSC loc. C-27043

708-786.5
interbedded sandstone and shaly mudstone. Sandstone:shaly mudstone = 1:5. Sandstone units form small peaks and shaly mudstone units form valleys. at 711 m - sandstone, GSC loc. C-27044

786.5-848
interbedded sandstone and mudstone. mudstone, laminar-thin bedded, platy, medium dark gray-gray brown weathering to a medium gray; fetid, calcareous, moderately indurated. Sandstone, very fine-fine grained; very thin-thin bedded, platy; medium dark gray-brownish gray weathering to a grayish orange; laminated, calcareous, fetid, micaceous, argillaceous, well indurated. Sandstone:mudstone = 5:1. at 807.5 m - sandstone, GSC loc. C-27045; at 816 m - mudstone, GSC loc. C-27046.

848-865
interbedded silty shale and rare fine grained sandstone. silty shale, laminar bedded, papery, platy, dusky yellow-brown weathering to a light olive gray-yellow gray; moderately poorly indurated, calcareous, silty, considerable mica on bedding planes, rare fish? spines. at 853 m, GSC loc. C-27048. sandstone, very fine-fine grained, thin bedded, smooth, lenticular; pale yellow-brown weathering to a grayish-orange to a pale yellow brown; argillaceous, calcareous, micaceous, moderately indurated. at 852.5 m, GSC loc. C-27047. Sandstone:shale = 1:10.

865-925.5
sandstone with minor shale interbeds. sandstone, very fine-fine grained, very thin-thin bedded; smooth platy; medium olive gray weathering to a pale yellow brown; argillaceous, calcareous, moderately indurated; in places dark gray-black, thin, wispy laminations. at 866 m, GSC loc. C-27049. Thin inner layers of laminar bedded material are quite micaceous. Peculiar weathering phenomena here, bedding is full of cone shaped depressions; shale increases upwards. at 894 m - shale, GSC loc. C-27050; at 898.5 m - sandstone, GSC loc. C-27051.

925.5-956
sandstone, very fine grained, very thin-thin bedded, smooth; medium dark brownish gray weathering to a light olive gray; dark gray-black wispy laminations, argillaceous, calcareous, moderately well indurated. at 931.5 m, GSC loc. C-27052

956-967.5
interbedded sandstone and mudstone; c.f. previous units. at 963.5 m - mudstone, GSC loc. C-27053

967.5-1196
interbedded sandstone and silty mudstone-siltstone. Silty mudstone-siltstone, thin bedded; medium dark gray weathering to a pale yellow brown-blue gray; well indurated, calcareous, laminated, silty. at 971m - abundant sole markings here, GSC loc. C-27054. Sandstone, very fine grained, thin bedded, smooth; medium dark brownish gray weathering to a light olive gray-pale yellow orange; well indurated, argillaceous, dark gray-black laminations, calcareous. Sandstone:mudstone-siltstone = 1:1. at 988 m, GSC loc. C-27055; at 1095 m - poorly preserved graptolites, GSC loc. C-27056; at 1102 m - graptolites, ceratiocerids, GSC loc. C-27057; at 1114 m - graptolites, GSC loc. C-27058; at 1134 m - graptolites, GSC loc. C-27059; at 1138 m, GSC loc. C-27060; at 1165 m - talus, graptolites, not far from original position, GSC loc. C-27061; at 1170 m - talus, graptolites, GSC loc. C-27062; at 1190 m - graptolites, GSC loc. C-27063.

1196-1209
covered interval, recessive.

1209-1224
sandstone, interbedded with silty shaly mudstone. Sandstone, very fine-grained, thin-medium bedded, smooth; medium dark gray to dark yellow-brown weathering to a grayish-orange to pale yellow-brown, well indurated, argillaceous, calcareous, slightly fetid. at 1200 m, GSC loc. C-27064. Shaly-silty mudstone, very thin bedded, smooth; dark gray-brownish black, weathering to a light yellow gray; moderately indurated, calcareous, slightly fetid. Mudstone:sandstone = 10:1. at 1211 m - graptolites, GSC loc. C-27065; at 1219 m - graptolites, GSC loc. C-27066.

1224-1263
sandstone with rare silty mudstone interbeds. c.f. unit before. at 1246 m - there is an approximately 22-30 cm thick bed of medium-coarse grained sandstone, medium gray with dark gray patches,

calcareous, well indurated and argillaceous. GSC loc. C-27067. at 1250 m - abundant sole marks here, GSC loc. C-27068; at 1257 m - sandstone with poorly preserved graptolites, GSC loc. C-27069.

1263-1311
interbedded sandstone and shaly mudstone as before, but more resistant, cliff former. Sandstone, very fine-fine grained, thin bedded, smooth; dark brownish gray weathering to a grayish-orange and pale yellow-brown; argillaceous, well indurated, calcareous, slightly fetid, micaceous. at 1272.5 m - common graptolite debris here, GSC loc. C-27070; shaly mudstone, laminar-thin bedded, smooth; dusky yellow brown weathering to a light yellow-gray; silty, sandy, calcareous, slightly fetid, moderately indurated. at 1274 m, GSC loc. C-27071

1311-1331
silty, sandy, shaly mudstone, laminar to very thin bedded, smooth; grayish black to black weathering to medium light gray to light yellow gray; moderately indurated, calcareous, tiny fossiliferous debris on some bedding planes. at 1316 m, GSC loc. C-27072

1331-1367
broken outcrop, much of unit covered by debris; sandstone perhaps interbedded with mudstone as below; poorly preserved brachiopods seen in the rubble.

1367-1418
sandstone with some light gray weathering to shaly mudstone interbeds. Sandstone very fine-fine grained, very thin-thin bedded, smooth; medium light gray-light brownish gray weathering to a gray-orange to pale yellow-orange; calcareous argillaceous, moderately well indurated. at 1369 m - sandstone, GSC loc. C-27073. Sandstone:mudstone = 5:1.

1418-1454
interbedded sandstone and mudstone. Sandstone, very fine grained, very thin-thin bedded; moderate yellow brown weathering to a dark yellow-orange; slightly calcareous, unit quite recessive. at 1421 m - mudstone, GSC loc. C-27074; at 1421.5 m - sandstone, GSC loc. C-27075.

1454-1464.5
calcareous silty mudstone and shale with some rare very fine grained sandstone beds. Laminar-very thin bedded; brownish black

and black weathering to a light olive gray to pale yellow brown and gray-orange; recessive. at 1455 m, GSC loc. C-27076

1464.5-1491.5
sandstone and mudstone interbedded as before.

1491.5-1492.5
lime mudstone, thin bedded; dark gray brown weathering to a grayish orange to a pale yellow brown; rubbly outcrop, silty, some chert? at 1492 m, GSC loc. C-27077

1492.5-1502
sandstone and mudstone interbedded as before, recessive.

1502-1502.5
lime mudstone as before, but with abundant crinoids, rare gastropods. at 1502 m, GSC loc. C-27078

1502.5-1518
interbedded sandstone and lime mudstone, very rubbly. Sandstone:lime mudstone = 2-3:1.

1518-1525.5
covered interval, probably sandstone.

1525.5-1527.5
lime mudstone, thin bedded, fairly smooth; medium dark gray weathering to a medium light gray to grayish-orange; well indurated, silty, slightly fetid. at 1526 m, GSC loc. C-27079

1527.5-1551
interbedded sandstone and rare mudstone. sandstone, very fine grained, very thin-thin bedded, smooth; medium olive gray weathering to a pale yellow brown; argillaceous, moderate-well indurated, dolomitic dark yellow-brown laminations present. at 1530 m, GSC loc. C-27080

1551-1557
interbedded sandstone and lime mudstone, c.f. unit from 1502.5-1518. Sandstone:lime mudstone = 1:1. at 1552 m, GSC loc. C-27081

1557-1618
interbedded sandstone and mudstone, c.f. unit from 1527.5-1551, sandstone now calcareous. at 1602 m, GSC loc. C-27082

APPENDIX 3

EXPLANATION OF PLATES

PLATE 1

Crania sp.

Figures 1, 2. Dorsal exterior and interior, X2.0, GSC 46941, GSC loc. C-26911, Prince of Wales Island.

Skenidioides sp.

Figures 3-7. Ventral, dorsal, posterior, anterior, lateral views, X5, GSC 46942, GSC loc. C-26886, Prince of Wales Island.

Figures 8-10. Dorsal exterior, interior, lateral views, X5, GSC 46943, GSC loc. C-26915, Prince of Wales Island.

Figures 11-15. Ventral exterior, interior, posterior, anterior, lateral views, X5, GSC 46944, same loc.

Figures 16-19. Ventral exterior, interior, posterior, lateral views, X5, GSC 46945, same loc.

Figures 20-22. Dorsal exterior, interior, posterior views, X5, GSC 46946, same loc.

Skenidioides robertsensis Johnson, Boucot, and Murphy, 1973

Figures 23-26. Ventral exterior, interior, posterior, lateral views, X5, GSC 46947, GSC loc. C-33700, Devon Island.

Figures 27-30. Ventral exterior, interior, posterior, lateral views, X5, GSC 46948, same loc.

Figures 31-34. Ventral exterior, interior, posterior, lateral views, X5, GSC 46949, same loc.

Figures 35-37. Dorsal exterior, interior, posterior views, X4.5, GSC 46950, same loc.

Figures 38, 39. Dorsal exterior, interior views, X4.5, GSC 46951, same loc.

Figures 40, 41. Dorsal exterior, interior views, X4.5, GSC 46952, same loc.

Plate 1. (Continued)

<u>Isorthis</u> <u>bistria</u> n. sp.

Figures 42, 43. Rubber replica of dorsal interior and dorsal internal mold, X2.2, GSC 46953, GSC loc. C-26957, Baillie Hamilton Island.

Figures 44, 45. Rubber replica of ventral interior and ventral internal mold, X2.2, GSC 46954, same loc.

Figures 46, 47. Rubber replica of ventral interior and ventral internal mold, X2.2, GSC 46955, same loc.

Figures 48, 49. Rubber replica of dorsal interior and dorsal internal mold, X2.2, GSC 46956, same loc.

PLATE 2

Isorthis bistria n. sp.

Figures 1-3. Dorsal exterior, anterior, lateral views, X2.2, GSC 46957, GSC loc. C-26957, Baillie Hamilton Island.

Figures 4-6. Dorsal interior mold, dorsal exterior, dorsal exterior, X2.2, GSC 46958, 46959, 46960, same loc.

Protocortezorthis quadriforma n. sp.

Figures 7-11. Ventral interior views, X2, GSC 46961, 46962, 46963, 46964, 46965, GSC loc. C-26915, Prince of Wales Island.

Figures 12-14. Ventral interior views, X2, GSC 46966, 46967, 46968, GSC loc. C-26914, Prince of Wales Island.

Figures 15, 16. Dorsal interior views, X2, GSC 46969, 46970, same loc.

Figures 17-22. Dorsal interior views X2, GSC 46971, 46972, 46973, 46974, 46975, 46976, GSC loc. C-26917, Prince of Wales Island.

Figures 23-27. Ventral, dorsal, posterior, anterior, lateral views, X2, GSC 46977, GSC loc. C-26913, Prince of Wales Island.

Figures 28-32. Ventral, dorsal, posterior, anterior, lateral views, X2, GSC 46978, same loc.

Figures 33, 34. Ventral exterior, interior, X2, GSC 46979, same loc.

Figures 35, 36. Ventral interior, dorsal interior, X2, GSC 46980, 46981, same loc.

PLATE 3

Protocortezorthis carinatus n. sp.

Figures 1-5. Dorsal interior views, GSC 46982, 46983, 46984, 46985, 46986, X3, GSC loc. C-26883, Prince of Wales Island.

Figures 6, 7. Ventral interior views, X3, GSC 46987, 46988, same loc.

Figures 8-12. Ventral, dorsal, posterior, anterior, lateral views, X3, GSC 46989, same loc.

Figures 13-17. Ventral, dorsal, posterior, anterior, lateral views, X3, GSC 46990, same loc.

Figures 18-22. Ventral, dorsal, posterior, anterior, lateral views, X3, GSC 46991, same loc.

Figures 23-27. Ventral, dorsal, posterior, anterior, lateral views, X3, GSC 46992, same loc.

Figures 28-32. Ventral, dorsal, posterior, anterior, lateral views, X3, GSC 46993, same loc.

Cortezorthis sp.

Figures 33, 34, 38, 39. Ventral, dorsal, anterior, lateral, internal views, X2, GSC 46994, GSC loc. C-26903, Prince of Wales Island.

Dalejina devonensis n. sp.

Figures 35-37. Ventral exterior, interior, posterior views, X5, GSC 46995, GSC loc. C-33702, Devon Island.

Figures 40, 41. Dorsal exterior, interior views, X5, GSC 46996, same loc.

Figure 42. Dorsal interior view, X5, GSC 46997, same loc.

Figures 43, 44. Ventral exterior, interior views, X5, GSC 46998, same loc.

Plate 3. (Continued)

Figures 45-47. Dorsal exterior, interior, posterior views, X5, GSC 46999, GSC loc. C-33700, Devon Island.

Figures 48-50. Dorsal exterior, interior, posterior views, X5, GSC 47000, same loc.

PLATE 4

Schizophoria fossula transversiforma n. sp., n. subsp.

Figures 1-5. Ventral, dorsal, posterior, anterior, lateral views, X1.5, GSC 47001, GSC loc. C-26831, Prince of Wales Island.

Figures 6, 7. Ventral exterior, interior views, X1.5, GSC 47002, GSC loc. C-26860, Prince of Wales Island.

Figures 8, 9. Ventral exterior, interior views, X1.5, GSC 47003, same loc.

Figure 10. Ventral interior view, X1.5, GSC 47004, same loc.

Figures 11, 12. Ventral exterior, interior views, X1.5, GSC 47005, same loc.

Figures 13, 14. Ventral exterior, interior views, X1.5, GSC 47006, same loc.

Figures 15, 16. Ventral exterior, interior views, X1.5, GSC 47007, same loc.

Figures 17-19. Ventral interior views, X1.5, GSC 47008, 47009, 47010, same loc.

Figures 20, 21. Dorsal interior views, X1.5, GSC 47011, 47012, same loc.

Figures 22-28. Ventral interior views, X1.5, GSC 47013, 47014, 47015, 47016, 47017, 47018, 47019, GSC loc. C-26861, Prince of Wales Island.

Schizophoria fossula fossula n. sp., n. subsp.

Figures 29-31. Ventral exterior, interior, lateral views, X1.5, GSC 47020, GSC loc. C-26942, Baillie Hamilton Island.

Figures 32-35. Ventral interior views, X1.5, GSC 47021, 47022, 47023, 47024, same loc.

Figures 36-38. Ventral interior, exterior, lateral views, X1.5, GSC 47025, GSC loc. C-26990, Baillie Hamilton Island.

Figure 39. Ventral interior view, X1.5, GSC 47026, same loc.

PLATE 5

Schizophoria fossula fossula n. sp., n. subsp.

Figures 1-4. Dorsal exterior, interior, lateral, anterior views, X1.5, GSC 47027, GSC loc. C-26990, Baillie Hamilton Island.

Figures 5-7. Dorsal exterior, interior, anterior views, X1.5, GSC 47028, same loc.

Figures 8, 9. Dorsal exterior, interior views, X1.5, GSC 47029, same loc.

Figures 10-13. Dorsal exterior, interior, anterior, lateral views, X1.5, GSC 47030, same loc.

Figures 14-17. Dorsal exterior, interior, anterior, lateral views, X1.5, GSC 47031, same loc.

Schizophoria protonevadaensis n. sp.

Figures 18, 19. Ventral, dorsal exterior views. X1.6, GSC 47032, GSC loc. C-26913, Prince of Wales Island.

Figures 20, 21. Ventral interior views, X1.6, GSC 47033, 47034, same loc.

Figure 22. Dorsal interior view, X1.6, GSC 47035, same loc.

Figures 23-27. Ventral, dorsal, posterior, anterior, lateral views, X1.5, GSC 47036, GSC loc. C-26873, Prince of Wales Island.

Figures 28-32. Ventral, dorsal, posterior, anterior, lateral views, X1.5, GSC 47037, same loc.

Figures 33-37. Ventral, dorsal, posterior, anterior, lateral views, X1.5, GSC 47038, GSC loc. C-26881, Prince of Wales Island.

PLATE 6

Schizophoria protonevadaensis

Figures 1-5. Ventral, dorsal, posterior, anterior, lateral views, X1.5, GSC 47039, GSC loc. C-26881, Prince of Wales Island.

Figures 6, 7. Ventral, dorsal views of internal mold, X1.5, GSC 47040, same loc.

Schizophoria fossula fossula n. sp., n. subsp.

Figures 8-12. Ventral, dorsal, posterior, anterior, lateral views, X2, GSC 47041, GSC loc. C-26990, Prince of Wales Island.

Tyersella sp.

Figures 13, 14. Ventral exterior, interior views, X2, GSC 47042, GSC loc. C-26939, Baillie Hamilton Island.

Figures 15, 20, Ventral exterior, interior views, X2, GSC 47043, same loc.

Figures 16, 17. Ventral exterior, interior views, X2, GSC 47044, same loc.

Figures 18, 19. Dorsal exterior, interior views, X2, GSC 47045, same loc.

Figures 21, 22. Dorsal exterior, interior views, X2, GSC 47046, same loc.

Figures 23, 24. Dorsal exterior, interior views, X2, GSC 47047, same loc.

Salopina submurifer, Johnson, Boucot, and Murphy, 1973

Figures 25, 26. Ventral exterior, interior views, X4.7, GSC 47048, GSC loc. C-33700, Devon Island.

Figures 27, 34. Ventral exterior, interior views, X4.7, GSC 47049, same loc.

Plate 6. (Continued)

Figures 28, 35. Dorsal exterior, interior views, X5, GSC 47050, same loc.

Figures 29-31. Posterior, dorsal, exterior, interior views, X5, GSC 47051, same loc.

Figures 32, 33. Dorsal exterior, interior views, X5, GSC 47052, same loc.

Figures 36-40. Ventral, exterior, interior, posterior, anterior, lateral views, X5, GSC 47053, GSC loc. C-26806, Prince of Wales Island.

Figures 41, 42. Ventral exterior, interior views, X5, GSC 47054, same loc.

Figures 43, 44. Dorsal exterior, interior views, X5, GSC 47055, same loc.

Figures 45, 46. Dorsal exterior, interior views, X5, GSC 47056, same loc.

Figures 47, 48. Dorsal exterior, interior views, X5, GSC 47057, same loc.

Figure 49. Dorsal interior view, X5, GSC 47058, same loc.

PLATE 7

Grayina magnifica (Kozlowski)

Figure 1. Internal mold of ventral valve, X2.1, GSC 47059, GSC loc. C-26854, Prince of Wales Island.

Figure 2. Internal mold of dorsal valve, X2.1, GSC 47060, same loc.

Plicogypa c.f. P. kayseri (Peetz)

Figure 3. Dorsal exterior view, X2.5, GSC 47061, GSC loc. C-26903, Prince of Wales Island.

Figure 4. Internal mold of ventral valve, X2.5, GSC 47062, GSC loc. C-26874, Prince of Wales Island.

Figure 5. Internal mold of dorsal valve, X2.5, GSC 47063, same loc.

Plicogypa thorsteinssoni Johnson

Figures 6-10. Ventral, dorsal, posterior, anterior, lateral views, X1.7, GSC 47064, GSC loc. C-26883, Prince of Wales Island.

Figures 11-15. Ventral, dorsal, posterior, anterior, lateral views, X1.7, GSC 47065, same loc.

Figures 16-20. Ventral, dorsal, posterior, anterior, lateral views, X1.7, GSC 47066, same loc.

Figures 21-25. Ventral, dorsal, posterior, anterior, lateral views, X1.7, GSC 47067, same loc.

Gypidula pelagica (Barrande)

Figure 26. Internal mold of ventral valve, X1.3, GSC 47069, GSC loc. C-26845, Prince of Wales Island.

Figure 27. Internal mold of ventral valve, X1.3, GSC 47070, same loc.

Figures 28, 32. Ventral and anterior views, X1.3, GSC 47071, same loc.

Plate 7. (Continued)

Figure 29. Internal mold of dorsal valve, X1.3, GSC 47072, same loc.

Figure 30. External view of dorsal valve, X1.3, GSC 47073, same loc.

Figure 31. Internal mold of dorsal valve, X1.3, GSC 47074, same loc.

PLATE 8

Gypidula pelagica pyraforma n. subsp.

Figures 1-3, 5, 6. Ventral, dorsal, posterior, anterior, lateral views, X1.3, GSC 47075, GSC loc. C-26986, Baillie Hamilton Island.

Figures 4, 7, 8, 11, 12. Ventral, dorsal, posterior, anterior, lateral views, X1.3, GSC 47076, same loc.

Figures 9, 10, 13-15. Ventral, dorsal, posterior, anterior, lateral views, X1.3, GSC 47077, same loc.

Figures 16-20. Ventral, dorsal, posterior, anterior, lateral views, X1.4, GSC 47078, GSC loc. C-26987, Baillie Hamilton Island.

PLATE 9

<u>Gypidula</u> <u>pelagica</u> <u>pyraforma</u> n. subsp.

Figures 1-5. Ventral, dorsal, posterior, anterior, lateral views, X1.3, GSC 47079, GSC loc. C-26989, Baillie Hamilton Island.

Figures 6-10. Ventral interior views, X1.3, GSC 47080, 47081, 47082, 47083, 47084, GSC loc. C-26973, Baillie Hamilton Island.

Figures 11-13. Dorsal interior views, X1.3, GSC 47085, 47086, 47087, same loc.

Figures 14-16. Dorsal interior, posterior, lateral views, X1, GSC 47088, same loc.

<u>Gypidula</u> <u>dyerensis</u> n. sp.

Figure 17. Ventral valve interior view, X1.2, GSC 47089, GSC loc. C-26915, Prince of Wales Island.

Figure 18. Ventral exterior view, X1.5, GSC 47089, same loc.

Figure 19. Ventral interior view, X1.2, GSC 47090, same loc.

Figure 20. Dorsal interior view, X1.2, GSC 47091, same loc.

Figure 21. Ventral interior view, X1.2, GSC 47092, same loc.

Figure 22. Dorsal interior view, X1.2, GSC 47093, same loc.

Figures 23, 24. Dorsal exterior and interior views, X1.2, GSC 47094, same loc.

PLATE 10

<u>Gypidula</u> <u>dyerensis</u> n. sp.

Figures 1-5. Ventral, dorsal, posterior, anterior, lateral views, X1.25, GSC 47095, GSC loc. C-26913, Prince of Wales Island.

Figures 6, 7. Ventral, lateral views, X1.5, GSC 47096, GSC loc. C-26920, Prince of Wales Island.

Figure 8. Ventral view, X1.5, GSC 47097, same loc.

Figure 9. Dorsal view, X1.5, GSC 47098, GSC loc. C-26913, Prince of Wales Island.

Figure 10. Ventral view, X1.5, GSC 47099, same loc.

Figures 11, 12. Ventral, lateral views, X1.5, GSC 47100, same loc.

PLATE 11

Gypidula dyerensis n. sp.

Figures 1-3. Ventral, posterior, anterior views, X1.3, GSC 47101, GSC loc. C-26913, Prince of Wales Island.

Figure 4. Dorsal view, X1.7, GSC 47102, GSC loc. C-26915, Prince of Wales Island.

Figure 5. Dorsal view, X1.7, GSC 47103, GSC loc. C-26913, Prince of Wales Island.

Figure 6. Ventral view, X1.5, GSC 47104, same loc.

Carinagypa careopleura Johnson

Figures 7, 10, 11. Ventral, lateral, anterior views, X1.3, GSC 47105, GSC loc. C-26888, Prince of Wales Island.

Figures 8, 9. Anterior, ventral views, X1.3, GSC 47106, same loc.

Figure 12. Dorsal view, X1.3, GSC 47107, same loc.

Figures 13, 14. Ventral, anterior views, X1.3, GSC 47108, same loc.

Figures 15, 17. Dorsal interior views, X3, GSC 47109, 47110, same loc.

Figure 16. Ventral interior view, X3, GSC 47111, same loc.

Leptaena sp.

Figures 19, 20, 22, 23. Ventral, anterior, ventral interior, posterior views, X1.4, GSC 47113, GSC loc. C-26913, Prince of Wales Island.

Leptaena nassichuki n. sp.

Figures 18, 21, 24. Lateral, dorsal exterior, interior views, X1.3, GSC 47114, GSC loc. C-26945, Baillie Hamilton Island.

PLATE 12

Leptaena nassichuki n. sp.

Figures 1, 2. Dorsal exterior, interior views, X1.4, GSC 47115, GSC loc. C-26940, Baillie Hamilton Island.

Figures 3, 4. Dorsal exterior, interior views, X1.5, GSC 47116, same loc.

Figures 5-7. Ventral exterior, interior, posterior views, X1.5, GSC 47117, same loc.

Figures 8, 11, 12. Ventral interior, exterior, posterior views, X1.5, GSC 47118, same loc.

Iridistrophia johnsoni n. sp.

Figures 9, 10, 13, 14. Dorsal exterior, interior, posterior, lateral views, X1.2, GSC 47119, GSC loc. C-26942, Baillie Hamilton Island.

Figures 15, 16, 20. Ventral exterior, interior, posterior views, X1.2, GSC 47120, GSC loc. C-26940, Baillie Hamilton Island.

Figures 17, 21. Ventral exterior, posterior views, X1.2, GSC 47121, same loc.

Figures 18, 19. Ventral interior, exterior views, X1.2, GSC 47122, same loc.

Figures 24, 26. Dorsal, exterior, interior views, X3.2, GSC 47123, GSC loc. C-26942, Baillie Hamilton Island.

Figures 25, 27. Ventral exterior, interior views, X3.2, GSC 47124, same loc.

Figures 22, 28, 34. Dorsal exterior, interior, posterior views, X1.2, GSC 47125, GSC loc. C-26940, Baillie Hamilton Island.

Plate 12. (Continued)

Figures 23, 29, 35. Dorsal exterior, interior, posterior views, X1.2, GSC 47126, same loc.

Figures 30, 31. Dorsal exterior, interior views, X3.8, GSC 47127, GSC loc. C-26942, Baillie Hamilton Island.

Figures 32, 33. Ventral exterior, interior views, X3.8, GSC 47128, same loc.

PLATE 13

Iridistrophia johnsoni n. sp.

Figures 1, 2, 5, 6. Dorsal exterior, interior, anterior view of posterior, posterior views, X1.2, GSC 47129, GSC loc. C-26942, Baillie Hamilton Island.

Figures 3, 4, 7, 8. Dorsal exterior, interior, lateral, posterior views, X1.2, GSC 47130, same loc.

Figures 9, 10, 13, 14, 17. Ventral, dorsal, posterior, anterior, lateral views, X1.2, GSC 47131, same loc.

Figures 11, 12. Dorsal interior, exterior views, X1.2, GSC 47132, same loc.

Figures 15, 16, 20. Ventral exterior, interior, posterior views, X1.2, GSC 47133, same loc.

Figures 18, 19, 21. Ventral exterior, interior, posterior views, X1.2, GSC 47134, same loc.

Eoschuchertella sp.

Figures 22, 24. Ventral exterior, interior views, X1.2, GSC 47135, GSC loc. C-26650, Prince of Wales Island.

Figures 23, 25. Ventral interior, posterior views, X1.2, GSC 47136, same loc.

Figures 26, 27. Ventral exterior, interior views, X1.2, GSC 47137, same loc.

Figures 28, 29. Ventral exterior, interior views, X1.2, GSC 47138, same loc.

Figures 30, 31, 32. Dorsal exterior, interior, posterior views, X1.2, GSC 47139, same loc.

Figures 33-35. Ventral exterior, interior, posterior views, X1.2, GSC 47140, same loc.

PLATE 14

Iridistrophia thorsteinssoni n. sp.

Figures 1, 5, 9. Ventral exterior, interior, X1.1, posterior views, X1.3, GSC 47141, GSC loc. C-26917, Prince of Wales Island.

Figures 2, 6, 10. Ventral exterior, interior, X1.1, posterior views, X1.3, GSC 47142, same loc.

Figures 3, 7, 11. Dorsal exterior, interior, X1.1, posterior views, X1.3, GSC 47143, same loc.

Figures 4, 8, 12. Dorsal interior, X1.1, posterior, X1.3, exterior, X1.1, views, GSC 47144, same loc.

Figures 18, 22, 27. Dorsal exterior, interior, X1.1, posterior views, X1.3, GSC 47145, same loc.

Figures 14, 15. Ventral exterior, interior views, X1.1, GSC 47146, same loc.

Barbaestrophia bieleri n. sp.

Figures 13, 16, 17. Posterior, ventral exterior, interior views, X1.2, GSC 47147, GSC loc. C-26940, Baillie Hamilton Island.

Figures 19, 20. Ventral exterior, interior views, X1.2, GSC 47148, same loc.

Figures 21, 26. Ventral exterior, interior views, X1.2, GSC 47149, same loc.

Figures 23-25. Dorsal exterior, interior, posterior views, X1.2, GSC 47150, same loc.

Figures 28, 29. Dorsal exterior, interior views, X1.2, GSC 47151, same loc.

Strophonella c.f. S. plasi Havlíček

Figures 31, 32. Ventral exterior, interior views X1.1, GSC 47152, GSC loc. C-26940, Baillie Hamilton Island.

Figures 30, 33, 34. Dorsal posterior, exterior, interior views, X1.1, GSC 47153, GSC loc. C-26942, Baillie Hamilton Island.

PLATE 15

"Brachyprion" sp.

Figures 1, 2. Ventral exterior, interior views, X3.0, GSC 47154, GSC loc. C-33700, Devon Island.

Figures 3, 4. Dorsal exterior, interior views, X3.0, GSC 47155, same loc.

Figure 5. Dorsal interior view, X3.0, GSC 47156, same loc.

Mesodouvillina sp. 1

Figures 7, 8, 11, 12. Ventral, dorsal, posterior, lateral views, X2.1, GSC 47157, GSC loc. C-26806, Prince of Wales Island.

Figures 9, 13. Ventral exterior, interior views, X2.1, GSC 47158, same loc.

Figures 6, 10, 14. Lateral ventral, dorsal views, X2.1, GSC 47159, same loc.

Figures 15, 16. Dorsal exterior, interior views, X2.1, GSC 47160, same loc.

Figures 17, 18. Dorsal exterior, interior views, X2.1, GSC 47161, same loc.

Mesodouvillina musculusvarius n. sp.

Figures 19, 20. Rubber replica of ventral interior and ventral interior mold, X1.2, GSC 47162, GSC loc. C-26851, Prince of Wales Island.

Figures 21, 24. Rubber replica of ventral interior and ventral interior mold, X1.2, GSC 47163, same loc.

Figures 22, 25. Rubber replica of ventral interior and ventral interior mold, X1.2, GSC 47164, same loc.

Figures 23, 26. Rubber replica of ventral interior and ventral interior mold, X1.2, GSC 47165, same loc.

PLATE 16

Mesodouvillina musculusvarius n. sp.

Figures 1, 5. Rubber replica of dorsal interior and dorsal interior mold, X1.2, GSC 47166, GSC loc. C-26851, Prince of Wales Island.

Figures 2, 6. Rubber replica of dorsal interior and dorsal interior mold, X1.2, GSC 47167, same loc.

Figures 3, 7. Rubber replica of dorsal interior and dorsal interior mold, X1.2, GSC 47168, same loc.

Figures 4, 8. Rubber replica of dorsal interior and dorsal interior mold, X1.2, GSC 47169, same loc.

Figures 9, 10. Rubber replica of dorsal interior and dorsal interior mold, X1.2, GSC 47170, same loc.

Mesodouvillina sp. 2

Figures 11, 12. Ventral interior, posterior views, X1.1, GSC 47171, GSC loc. C-26916, Prince of Wales Island.

Figure 16. Ventral exterior view, X1.5, GSC 471742, same loc.

Figures 13, 17. Ventral posterior, interior views, X1.1, GSC 47172, same loc.

Figures 15, 19, 26. Dorsal exterior, interior, X3, dorsal interior, X10.3, GSC 47173, GSC loc. C-26917, Prince of Wales Island.

Figures 14, 18. Ventral exterior, interior views, X1.5, GSC 47174, same loc.

Figure 20. Ventral exterior, X1.5, GSC 47175, same loc.

Figures 21, 22. Dorsal interior, exterior views, X1.5, GSC 47176, same loc.

Mesodouvillina tuberosus n. sp.

Figures 23-25. Ventral, dorsal, lateral views, X2.1, GSC 47177, GSC loc. C-26990, Baillie Hamilton Island.

PLATE 17

Mesodouvillina tuberosa n. sp.

Figures 1, 3, 4. Ventral, dorsal, lateral views, X2.1, GSC 47178, GSC loc. C-26990, Baillie Hamilton Island.

Figures 2, 7, 9, 10. Dorsal interior, lateral, X15.1, dorsal exterior, interior views, X2.1, GSC 47179, GSC loc. C-26991, Baillie Hamilton Island.

Figures 5, 6, 8. Ventral, dorsal, lateral views, X2.1. GSC 47180, GSC loc. C-26990. Baillie Hamilton Island.

Figures 11, 12. Ventral exterior, interior views, X2.1, GSC 47181, GSC loc. C-26991, Baillie Hamilton Island.

Figures 13, 14. Dorsal exterior, interior views, X2.1, GSC 47182, GSC loc. C-26990, Baillie Hamilton Island.

Figures 15, 16. Dorsal exterior, interior views, X2.1, GSC 47183, same loc.

Figures 17, 18. Ventral exterior, interior views, X2.1, GSC 47184, same loc.

Figures 19, 20. Ventral exterior, interior views, X2.1, GSC 47185, same loc.

Mesodouvillina equicosta n. sp.

Figures 21, 22. Ventral exterior, interior views, X1.5, GSC 47186, GSC loc. C-26940, Baillie Hamilton Island.

PLATE 18

Mesodouvillina equicosta n. sp.

Figures 1, 2, 5, 6. Ventral, dorsal, posterior, lateral views, X1.5, GSC 47187, GSC loc. C-26945, Baillie Hamilton Island.

Figures 3, 4. Ventral exterior, interior views, X1.5, GSC 47188, GSC loc. C-26940, Baillie Hamilton Island.

Figures 7, 8. Dorsal exterior, interior views, X1.5, GSC 47189, same loc.

Figures 9, 10. Ventral exterior, interior views, X1.5, GSC 47190, same loc.

Figures 11, 15. Ventral exterior, interior views, X4, GSC 47191, same loc.

Figures 12, 17. Dorsal exterior, interior views, X1.5, GSC 47192, same loc.

Figures 13, 14, 16. Dorsal exterior, interior, posterior views, X1.5, GSC 47193, same loc.

Figures 18, 19. Dorsal exterior, interior views, X1.5, GSC 47194, same loc.

Figures 20, 21. Dorsal interior views, X1.5, GSC 47195, 47196, same loc.

Figure 22. Dorsal exterior view, X1.5, GSC 47197, same loc.

Cymostrophia cf. *C. golem* Havlicek

Figures 23-25. Rubber replica of ventral interior, ventral interior mold, lateral view of ventral interior mold, X1.3, GSC 47198, GSC loc. C-26872, Prince of Wales Island.

Figures 26-28. Ventral, posterior, lateral views, X1.3, GSC 47199, same loc.

PLATE 19

Cymostrophia sp.

Figures 1, 2. Ventral exterior, interior views, X2, GSC 47200, GSC loc. C-26913, Prince of Wales Island.

Figures 3, 4. Ventral exterior, interior views, X2, GSC 47201, same loc.

Figures 5-7. Ventral exterior, interior, lateral views, X2, GSC 47202, same loc.

Figures 8, 9, 13. Ventral exterior, interior, lateral views, X2, GSC 47203, same loc.

Figures 10-12. Ventral, dorsal, lateral views, X2, GSC 47204, same loc.

Figures 15, 16. Dorsal exterior, interior views, X3, GSC 47205, GSC loc. C-26914, Prince of Wales Island.

Asymmetrochonetes spinalonga n. gen., n. sp.

Figures 14, 21, 22. Ventral exterior, interior, posterior views, X4, GSC 47206, GSC loc. C-26915, Prince of Wales Island.

Figures 17, 18. Ventral exterior, interior views, X4, GSC 47207, same loc.

Figures 19, 20. Ventral exterior, interior views, X4, GSC 47208, same loc.

Figures 23, 24. Ventral exterior, interior views, X4, GSC 47209, same loc.

Figures 25-27. Ventral exterior, interior, lateral views, X4, GSC 47210, same loc.

Figures 28, 32. Dorsal exterior, interior views, X6, GSC 47211, same loc.

Plate 19. (Continued)

Figures 29, 33. Dorsal exterior, interior views, X6, GSC 47212, same loc.

Figures 30, 31. Dorsal exterior, interior views, X6, GSC 47213, same loc.

Figures 34, 35. Dorsal interior views, X6, GSC 47214, 47215, same loc.

PLATE 20

Machaeraria obesa n. sp.

Figures 1-5. Ventral, dorsal, posterior, anterior, lateral views, X1.6, GSC 47216, GSC loc. C-26919, Prince of Wales Island.

Figures 6, 12. Ventral exterior, interior views, X1.3, GSC 47217, GSC loc. C-26914, Prince of Wales Island.

Figures 7-11. Ventral, dorsal, posterior, anterior, lateral views, X1.5, GSC 47218, GSC loc. C-26915, Prince of Wales Island.

Figures 13-16, 20. Ventral, dorsal, posterior, lateral, anterior views, X1.5, GSC 47219, same loc.

Figures 17, 21. Ventral exterior, interior views, X2.5, GSC 47220, GSC loc. C-26911, Prince of Wales Island.

Figures 19, 22, 23. Ventral exterior, posterior, interior views, X2.5, GSC 47221, same loc.

Figure 18. Dorsal interior view, X2.5, GSC 47222, GSC loc. C-26916, Prince of Wales Island.

Figure 24. Dorsal interior view, X4.9, GSC 47223, GSC loc. C-26915, Prince of Wales Island.

Ancillotoechia gutta gutta Johnson, Boucot, and Murphy, 1973

Figures 25, 26, 31-33. Ventral, posterior, dorsal, anterior, lateral views, X2, GSC 47224, GSC loc. C-26806, Prince of Wales Island.

Figures 27, 28, 34-36. Ventral, posterior, dorsal, anterior, lateral views, X2, GSC 47225, same loc.

Figures 29, 37. Ventral views, X2, GSC 47226, 47227, same loc.

Figures 30, 38. Dorsal interior views, X4, GSC 47228, 47229, same loc.

PLATE 21

Ancillotoechia gutta gutta Johnson, Boucot, and Murphy, 1973

Figures 1-5. Ventral, dorsal, posterior, anterior, lateral views, X2, GSC 47231, GSC loc. C-26806, Prince of Wales Island.

Figures 8-12. Ventral, dorsal, posterior, anterior, lateral views, X2, GSC 47232, same loc.

Ancillotoechia gutta rotunda n. subsp.

Figures 6, 13, 20, 27, 34. Ventral, dorsal, posterior, anterior, lateral views, X2.2, GSC 47233, GSC loc. C-26952, Baillie Hamilton Island.

Figures 7, 14, 21, 28, 35. Ventral, dorsal, posterior, anterior, lateral views, X2.2, GSC 47234, same loc.

Figures 15-19. Ventral, dorsal, posterior, anterior, lateral views, X2.2, GSC 47235, same loc.

Figures 22-26. Ventral, dorsal, posterior, anterior, lateral views, X2.2, GSC 47236, same loc.

Figures 29-33. Ventral, dorsal, posterior, anterior, lateral views, X2.2, GSC 47237, same loc.

Ancillotoechia plicaminor n. sp.

Figures 36-40. Ventral, dorsal, posterior, anterior, lateral views, X1.5, GSC 47238, GSC loc. C-26852, Prince of Wales Island.

Figures 43-47. Ventral, dorsal, posterior, anterior, lateral views, X1.5, GSC 47239, same loc.

Figures 50-54. Ventral, dorsal, posterior, anterior, lateral views, X1.5, GSC 47240, same loc.

Figures 57-61. Ventral, dorsal, posterior, anterior, lateral views, X1.5, GSC 47241, same loc.

Plate 21. (Continued)

Figures 64-68. Ventral, dorsal, posterior, anterior, lateral views, X1.5, GSC 47242, same loc.

Figures 41, 48, 55, 62, 69. Ventral, dorsal, posterior, anterior, lateral views, X1.5, GSC 47243, same loc.

Ancillotoechia magnaplica n. sp.

Figures 42, 49, 56, 63, 70. Ventral interior views, X1.8, GSC 47246, 47247, 47248, 47249, GSC loc. C-26915, Prince of Wales Island.

PLATE 22

Ancillotoechia magnaplica n. sp.

Figures 1-5. Ventral, dorsal, posterior, anterior, lateral views, X1.6, GSC 47250, GSC loc. C-26913, Prince of Wales Island.

Figures 6, 13. Dorsal interior views, X2.2, GSC 47251, 47252, GSC loc. C-26915, Prince of Wales Island.

Figures 7, 14, 22, 31, 36. Ventral, dorsal, posterior, anterior, lateral views, X1.6, GSC 47253, GSC loc. C-26913, Prince of Wales Island.

Figures 8-12. Ventral, dorsal, posterior, anterior, lateral views, X1.6, GSC 47254, same loc.

Figures 15-19. Ventral, dorsal, posterior, anterior, lateral views, X1.6, GSC 47255, same loc.

Figures 23-27. Ventral, dorsal, posterior, anterior, lateral views, X1.6, GSC 47256, same loc.

Figures 20, 21, 28-30. Ventral, dorsal, posterior, anterior, lateral views, X1.6, GSC 47257, same loc.

"Uncinulus" sp.

Figures 32-34, 38, 39. Ventral, dorsal, posterior, anterior, lateral views, X1.5, GSC 47260, GSC loc. C-26811, Prince of Wales Island.

Figure 35. Interior views of articulated specimen, X3, GSC 47261, GSC loc. C-26806, Prince of Wales Island.

Figures 37, 40-43. Lateral, ventral, dorsal, posterior, anterior views, X1.4, GSC 47262, same loc.

Hebetoechia ornatrix Havlíček

Figures 44-48. Ventral, dorsal, posterior, anterior, lateral views, X1.4, GSC 47265, GSC loc. C-26825, Prince of Wales Island.

Plate 22. (Continued)

Figures 50-54. Ventral, dorsal, posterior, anterior, lateral views, X1.4, GSC 47266, same loc.

Figures 55-59. Ventral, dorsal, posterior, anterior, lateral views, X1.4, GSC 47267, GSC loc. C-26824, Prince of Wales Island.

Figures 49, 60. Ventral interior views, X1.8, GSC 47268, 47269, GSC loc. C-26825, Prince of Wales Island.

PLATE 23

Hebetoechia ornatrix Havlíček

Figures 1, 2. Dorsal interior views, X9, X4.4, GSC 47270, GSC loc. C-26823, Prince of Wales Island.

Figures 3, 4. Dorsal interior views, X4.4, GSC 47271, 47272, same loc.

Figures 14, 31. Dorsal interior views, X4.4, X9, GSC 47273, same loc.

Figures 25, 42. Dorsal interior views, X4.4, X9, GSC 47274, same loc.

Figures 15-19. Ventral, dorsal, posterior, anterior, lateral views, X1.5, GSC 47275, GSC loc. C-26829, Prince of Wales Island.

Figures 20-24. Ventral, dorsal, posterior, anterior, lateral views, X1.5, GSC 47276, same loc.

Figures 26-30. Ventral, dorsal, posterior, anterior, lateral views, X1.5, GSC 47277, same loc.

Figures 32-36. Ventral, dorsal, posterior, anterior, lateral views, X1.5, GSC 47278, same loc.

Figures 37-41. Ventral, dorsal, posterior, anterior, lateral views, X1.5, GSC 47279, same loc.

"Tadschikia" crassiforma crassiforma n. sp., n. subsp.

Figure 5. Dorsal interior view, X2.8, GSC 47282, GSC loc. C-26974, Baillie Hamilton Island.

Figure 6. Ventral interior view, X1.4, GSC 47283, same loc.

Figures 7, 8, 13. Ventral, dorsal, anterior views, X1.4, GSC 47284, same loc.

Figure 9. Dorsal interior view, X2.8, GSC 47285, same loc.

Figures 10-12. Dorsal, ventral, lateral views, X1.4, GSC 47286, same loc.

PLATE 24

"Tadschikia" crassiforma crassiforma n. sp., n. subsp.

Figures 1-5. Ventral, dorsal, posterior, anterior, lateral views, X1.5, GSC 47287, GSC loc. C-26989, Baillie Hamilton Island.

Figures 6-10. Ventral, dorsal, posterior, anterior, lateral views, X1.5, GSC 47288, same loc.

Figures 11-15. Ventral, dorsal, posterior, anterior, lateral views, X1.5, GSC 47289, same loc.

"Tadschikia" crassiforma producta n. sp., n. subsp.

Figures 17-21. Ventral, dorsal, posterior, anterior, lateral views, X1.5, GSC 47290, GSC loc. C-26949, Baillie Hamilton Island.

Figures 23-27. Ventral, dorsal, posterior, anterior, lateral views, X1.5, GSC 47291, same loc.

Figures 29-33. Ventral, dorsal, posterior, anterior, lateral views, X1.5, GSC 47292, same loc.

Figures 16, 22. Ventral exterior, interior views, X1.7, GSC 47293, GSC loc. C-26952, Baillie Hamilton Island.

Figures 28, 34. Ventral exterior, interior views, X1.7, GSC 47294, same loc.

PLATE 25

"Tadschikia" crassiforma producta n. sp., n. subsp.

Figures 1, 2. Interior views of articulated specimens, X4.3, GSC 47295, 47296, GSC loc. C-26952, Baillie Hamilton Island.

"Tadschikia" crassiforma crassiforma n. sp., n. subsp.

Figures 3, 8. Ventral interior and oblique view of ventral interior, X2.8, GSC 47297, GSC loc. C-26974, Baillie Hamilton Island.

Linguopugnoides uyenoi n. sp.

Figures 4-7. Ventral, dorsal, posterior, anterior, lateral views, X1.3, GSC 47289, GSC loc. C-26883, Prince of Wales Island.

Figures 9-12. Ventral, dorsal, posterior, anterior, lateral views, X1.3, GSC 47300, same loc.

Figures 13-17. Ventral, dorsal, posterior, anterior, lateral views, X1.3, GSC 47301, same loc.

Figures 18, 24, 30, 36, 42. Ventral, dorsal, posterior, anterior, lateral views, X1.3, GSC 47302, same loc.

Figures 19-23. Ventral, dorsal, posterior, anterior, lateral views, X1.3, GSC 47303, same loc.

Figures 25-29. Ventral, dorsal, posterior, anterior, lateral views, X1.3, GSC 47304, same loc.

Figures 31-35. Ventral, dorsal, posterior, anterior, lateral views, X1.3, GSC 47305, same loc.

Figures 37-41. Ventral, dorsal, posterior, anterior, lateral views, X1.3, GSC 47306, same loc.

PLATE 26

Atrypa nieczlawiensis Kozlowski

Figures 1-5. Ventral, dorsal, posterior, anterior, lateral views, X1.3, GSC 47307, GSC loc. C-26974, Baillie Hamilton Island.

Figures 6-10. Ventral, dorsal, posterior, anterior, lateral views, X1.3, GSC 47308, same loc.

Figures 11-15. Ventral, dorsal, posterior, anterior, lateral views, X1.3, GSC 47309, same loc.

Figures 16-20. Ventral, dorsal, posterior, anterior, lateral views, X1.3, GSC 47310, same loc.

Figures 21-25. Ventral, dorsal, posterior, anterior, lateral views, X1.3, GSC 47311, same loc.

Figures 26-30. Ventral, dorsal, posterior, anterior, lateral views, X1.3, GSC 47312, same loc.

Figures 31, 32, 36, 37. Dorsal interior views, X1.3, GSC 47313, 47314, 47315, 47316, same loc.

Figures 33-35. Ventral interior views, X1.3, GSC 47317, 47318, 47319, same loc.

Figures 38-42. Ventral, dorsal, posterior, anterior, lateral views, X1.3, GSC 47320, same loc.

PLATE 27

Atrypa sp. 1

Figures 1-5. Ventral, dorsal, posterior, anterior, lateral views, X1.3, GSC 47321, GSC loc. C-26915, Prince of Wales Island.

Figure 6. Ventral interior view, X1.3, GSC 47322, same loc.

Figure 12. Dorsal interior view, X1.3, GSC 47323, same loc.

Atrypa sp. 2

Figures 7-11. Ventral, dorsal, posterior, anterior, lateral views, X1.3, GSC 47324, GSC loc. C-26874, Prince of Wales Island.

Figures 13-17. Ventral, dorsal, posterior, anterior, lateral views, X1.3, GSC 47325, same loc.

Spirigerina sp. 1

Figures 19-22. Ventral exterior, interior, anterior, lateral views, X1.6, GSC 47326, GSC loc. C-26911, Prince of Wales Island.

Figures 23, 24. Dorsal exterior, interior views, X1.6, GSC 47327, same loc.

Figures 25, 26. Ventral exterior, interior views, X1.6, GSC 47328, same loc.

Figures 27-30, 36. Dorsal exterior, interior, oblique interior, anterior, lateral views, X1.6, GSC 47329, same loc.

Dubaria thetis (Barrande)

Figures 31-35. Ventral, dorsal, posterior, anterior, lateral views, X1.6, GSC 47330, GSC loc. C-26876, Prince of Wales Island.

Figures 37-41. Ventral, dorsal, posterior, anterior, lateral views, X1.6, GSC 47331, same loc.

Figures 43-47. Ventral, dorsal, posterior, anterior, lateral views, X1.6, GSC 47332, same loc.

Plate 27. (Continued)

Arctispira canadensis n. gen., n. sp.

Figures 42, 48. Ventral interior views, X7, GSC 47334, 47335, GSC loc. C-33700, Devon Island.

PLATE 28

Arctispira canadensis n. gen., n. sp.

Figures 1-5. Ventral, dorsal, posterior, anterior, lateral views, X7, GSC 47336, GSC loc. C-33700, Devon Island.

Figure 11. Dorsal interior view, X7, GSC 47337, same loc.

Figures 6-10. Ventral, dorsal, posterior, anterior, lateral views, X6, GSC 47338, GSC loc. C-26939, Baillie Hamilton Island.

Figures 12-16. Ventral, dorsal, posterior, anterior, lateral views, X6, GSC 47339, same loc.

Figures 19-23. Ventral, dorsal, posterior, anterior, lateral views, X6, GSC 47340, same loc.

Figures 26-30. Ventral, dorsal, posterior, anterior, lateral views, X6, GSC 47341, same loc.

Figures 17, 24, 32. Ventral interior views, X6, GSC 47342, 47343, 47344, same loc.

Figures 18, 25, 31. Dorsal interior views, X6, GSC 47345, 47346, 47347, same loc.

Notoparmella costalata n. sp.

Figures 33-37. Ventral, dorsal, posterior, anterior, lateral views, X6, GSC 47348, GSC loc. C-26939, Baillie Hamilton Island.

Figures 39-43. Ventral, dorsal, posterior, anterior, lateral views, X6, GSC 47349, same loc.

Figures 44-48. Ventral, dorsal, posterior, anterior, lateral views, X6, GSC 47350, same loc.

Figures 38, 49. Ventral interior views, X6, GSC 47351, 47352, same loc.

Figure 55. Dorsal interior view, X6, GSC 47353, same loc.

Notoparmella gilli Johnson

Figures 50-54. Ventral, dorsal, posterior, anterior, lateral views, X5, GSC 47354, GSC loc. C-26973, Baillie Hamilton Island.

PLATE 29

Notoparmella gilli Johnson

Figures 1, 2. Dorsal exterior, interior views, X5, GSC 47355, GSC loc. C-26973, Baillie Hamilton Island.

Figure 3. Ventral exterior view, X5, GSC 47356, same loc.

Figure 6, 7. Ventral exterior, interior views, X5, GSC 47357, same loc.

Figure 8. Dorsal interior view, X5, GSC 47358, same loc.

Figures 9, 10. Dorsal exterior, interior views, X5, GSC 47359, same loc.

Figure 11. Ventral exterior view, X5, GSC 47360, same loc.

Figures 12, 13. Dorsal exterior, interior views, X5, GSC 47361, same loc.

Figure 14, Dorsal interior view, X5, GSC 47362, same loc.

Figures 15, 16. Ventral exterior, interior views, X5, GSC 47363, GSC loc. C-26974, Baillie Hamilton Island.

Figures 17, 18. Ventral exterior, interior views, X5, GSC 47364, same loc.

Figure 19. Dorsal interior view, X5, GSC 47365, same loc.

Notoparmella costalata n. sp.

Figures 4, 5. Dorsal interior views, X6, GSC 47366, 47367, GSC loc. C-26939, Baillie Hamilton Island.

Coelospira exilicosta orbita n. sp., n. subsp.

Figures 20-24. Ventral, dorsal, posterior, anterior, lateral views, X7, GSC 47368, GSC loc. C-26940, Baillie Hamilton Island.

Plate 29. (Continued)

Figures 28, 29, 25-27. Ventral, dorsal, posterior, anterior, lateral views, X7, GSC 47369, same loc.

Figure 30. Ventral interior view, X7, GSC 47370, same loc.

Figure 31. Dorsal interior view, X7, GSC 47371, same loc.

PLATE 30

Coelospira exilicosta orbita n. sp., n. subsp.

Figures 1-5. Ventral, dorsal, posterior, anterior, lateral views, X7, GSC 47372, GSC loc. C-26940, Baillie Hamilton Island.

Coelospira exilicosta exilicosta n. sp., n. subsp.

Figures 6, 7, 11-13. Ventral, dorsal, posterior, anterior, lateral views, X7, GSC 47373, GSC loc. C-33704, Devon Island.

Figures 8-10. Ventral interior views, X7, GSC 47374, 47375, 47376, same loc.

Figures 14-17. Dorsal interior views, X7, GSC 47377, 47378, 47379, 47380, same loc.

Nucleospira sp.

Figures 18-22. Anterior, ventral, dorsal, posterior, lateral views, X2, GSC 47381, GSC loc. C-26913, Prince of Wales Island.

Figures 23, 24. Ventral exterior, interior views, X1.7, GSC 47382, same loc.

Figures 25, 26. Ventral exterior, interior views, X1.7, GSC 47383, same loc.

Figures 27, 34. Dorsal interior, lateral views, X1.7, GSC 47384, same loc.

Figure 28. Dorsal interior view, X1.6, GSC 47385, GSC loc. C-26915, Prince of Wales Island.

Protathyris sp.

Figures 29-33. Ventral, dorsal, posterior, anterior, lateral views, X2, GSC 47387, GSC loc. C-26850, Prince of Wales Island.

Figures 36-40. Ventral, dorsal, posterior, anterior, lateral views, X2, GSC 47388, same loc.

Plate 30. (Continued)

Figures 43-47. Ventral, dorsal, posterior, anterior, lateral views, X2, GSC 47389, same loc.

<u>Cyrtinaella</u> sp.

Figures 35, 41, 42, 48, 49. Ventral exterior, posterior, lateral, anterior, internal views, X3, GSC 47390, GSC loc. C-26886, Prince of Wales Island.

PLATE 31

Cyrtina maclennani n. sp.

Figures 1-6, 10. Dorsal interior views, X5, GSC 47391, 47392, 47393, 47394, 37495, 47396, 47397, GSC loc. C-26915, Prince of Wales Island.

Figures 7, 8, 21, 22. Posterior views, X3, GSC 47398, 47399, 47400, 47401, same loc.

Figure 9. Ventral interior view, X3, GSC 47402, same loc.

Figures 11-15. Ventral, dorsal, posterior, anterior, lateral views, X2.5, GSC 47403, same loc.

Figures 16-20. Ventral, dorsal, posterior, anterior, lateral views, X2.5, GSC 47404, same loc.

Figures 23-27. Ventral, dorsal, posterior, anterior, lateral views, X2.5, GSC 47405, same loc.

Figures 30-34. Ventral, dorsal, posterior, anterior, lateral views, X2.5, GSC 47406, same loc.

Figures 37-41. Ventral, dorsal, posterior, anterior, lateral views, X2.5, GSC 47407, same loc.

Figures 44-48. Ventral, dorsal, posterior, anterior, lateral views, X2.5, GSC 47408, same loc.

Cyrtina sp. 1

Figures 49, 50, 60, 62. Dorsal interior views, X3, GSC 47409, 47410, 47411, 47412, GSC loc. C-26886, Prince of Wales Island.

Figures 51-55. Ventral, dorsal, posterior, anterior, lateral views, X3, GSC 47413, same loc.

Figures 56-59, 61. Ventral, dorsal, posterior, anterior, lateral views, X3, GSC 47414, same loc.

Plate 31. (Continued)

<u>Cyrtina</u> sp. 2

Figures 28, 29, 35, 36. Dorsal interior views, X3, GSC 47415, 47416, 47417, 47418, GSC loc. C-26903, Prince of Wales Island.

Figures 42, 43. Ventral interior, posterior views, X3, GSC 47419, same loc.

PLATE 32

Cyrtina sp. 2

Figures 4, 5, 10. Posterior, lateral, dorsal views, X3, GSC 47420, GSC loc. C-26903, Prince of Wales Island.

Howellella sp. 1

Figures 1-3, 6, 7. Ventral, dorsal, posterior, anterior, lateral views, X3, GSC 47421, GSC loc. C-26952, Baillie Hamilton Island.

Figures 8, 16, 31. Posterior views, X3, GSC 47422, 47423, 47424, same loc.

Figures 9, 30. Posterior, ventral interior views, X3, GSC 47425, same loc.

Figures 26-28, 32, 33. Dorsal interior views, X3, GSC 47426, 47427, 47428, 47429, 47430, same loc.

Figures 11-15. Ventral, dorsal, posterior, anterior, lateral views, X3, GSC 47431, same loc.

Figures 17-21. Ventral, dorsal, posterior, anterior, lateral views, X3, GSC 47432, same loc.

Figures 23-25. Ventral, posterior, lateral views, X3, GSC 47433, same loc.

Figures 22, 29. Posterior, ventral interior views, X3, GSC 47434, same loc.

Figure 34. Posterior view, X3, GSC 47435, GSC loc. C-26806, Prince of Wales Island.

Figures 35-39. Ventral, dorsal, posterior, anterior, lateral views, X3, GSC 47436, same loc.

Figures 40-44. Ventral, dorsal, posterior, anterior, lateral views, X3, GSC 47437, same loc.

Figure 45. Dorsal interior view, X3, GSC 47438, same loc.

PLATE 33

Howellella sp. 1

Figures 1, 2. Dorsal interior views, X3, GSC 47439, 47440, GSC loc. C-26806, Prince of Wales Island.

Figures 3, 4. Ventral interior and oblique view of ventral valve, X3, GSC 47441, same loc.

Figure 5. Posterior view of ventral valve, X3, GSC 47442, same loc.

Undispirifer laeviplicatus (Kozlowski)

Figures 6-10. Ventral, dorsal, posterior, anterior, lateral views, X2.5, GSC 47444, GSC loc. C-26915, Prince of Wales Island.

Figures 11, 12. Ventral interior and oblique view of ventral interior, X2.5, GSC 47445, same loc.

Figures 13-15. Dorsal interior views, X2.5, GSC 47446, 47447, 47448, same loc.

Figures 16, 17. Posterior and ventral exterior views, X2.5, GSC 47449, same loc.

Figures 18, 19. Dorsal exterior, interior views, X2.5, GSC 47450, same loc.

Figures 20, 21. Dorsal exterior, interior views, X2.5, GSC 47451, same loc.

Figures 22-26. Ventral, dorsal, posterior, anterior, lateral views, X1.9, GSC 47452, GSC loc. C-26903, Prince of Wales Island.

Figures 27-31. Ventral, Dorsal, posterior, anterior, lateral views, X1.9, GSC 47453, same loc.

Figures 32-36. Ventral, dorsal, posterior, anterior, lateral views, X1.9, GSC 47454, GSC loc. C-26883, Prince of Wales Island.

Howellella sp. 2

Figures 37, 38. Posterior, anterior views, X3, GSC 47455, GSC loc. C-26861, Prince of Wales Island.

PLATE 34

Howellella sp. 2

Figures 1, 8. Ventral exterior, interior views, X3, GSC 47456, GSC loc. C-26861, Prince of Wales Island.

Figures 2, 9, 13. Dorsal exterior, posterior, lateral views, X3, GSC 47457, same loc.

Figures 3, 4. Ventral, exterior, posterior views, X3, GSC 47458, same loc.

Figures 5, 6. Dorsal exterior, interior views, X3, GSC 47459, same loc.

Figures 7, 18. Dorsal exterior, interior views, X3, GSC 47460, same loc.

Figures 10, 11. Dorsal exterior, interior views, X3, GSC 47461, same loc.

Figure 12. Dorsal interior view, X3, GSC 47462, same loc.

Figures 14, 15. Lateral, posterior views of ventral valve, X3, GSC 47463, same loc.

Figures 16, 17. Ventral exterior, posterior views, X3, GSC 47464, same loc.

Undispirifer laeviplicatus (Kozlowski)

Figures 19-23. Ventral, dorsal, posterior, anterior, lateral views, X1.9, GSC 47465, GSC loc. C-26883, Prince of Wales Island.

Figures 24-28. Ventral, dorsal, posterior, anterior, lateral views, X1.9, GSC 47466, same loc.

Figures 29-33. Ventral, dorsal, posterior, anterior, lateral views, X1.9, GSC 47467, same loc.

Figure 34. Internal mold of ventral valve, X1.9, GSC 47468, GSC loc. C-26903, Prince of Wales Island.

Plate 34. (Continued)

Figures 35-37. Ventral, dorsal, posterior views of internal mold, X1.9, GSC 47469, GSC loc. C-26881, Prince of Wales Island.

Acanthospirifer sp.

Figures 38, 40. Ventral exterior views, X1.8, GSC 47470, 47471, GSC loc. C-26841, Prince of Wales Island.

Figures 39, 41, 42. Dorsal exterior views, X1.8, GSC 47472, 47473, 47474, same loc.

Figures 43-47. Ventral, dorsal, posterior, anterior, lateral views, X1.8, GSC 47475, same loc.

PLATE 35

Acanthospirifer macdonaldi n. sp.

Figures 1-5. Ventral, dorsal, posterior, anterior, lateral views, X3, GSC 47476, GSC loc. C-26940, Baillie Hamilton Island.

Figures 6-10. Ventral exterior, interior, posterior, lateral, anterior views, X3, GSC 47477, GSC loc. C-26942, Baillie Hamilton Island.

Figures 11, 12. Dorsal exterior, interior views, X3, GSC 47478, same loc.

Figures 13, 14. Ventral exterior, posterior views, X3, GSC 47479, same loc.

Figures 15-17. Ventral exterior, interior, posterior views, X3, GSC 47480, same loc.

Figures 18-22. Dorsal exterior, interior, posterior, anterior, lateral views, X3, GSC 47481, same loc.

Acanthospirifer norfordi n. sp.

Figures 23-27. Ventral exterior, interior, lateral, posterior, anterior views, X3, GSC 47483, GSC loc. C-26990, Baillie Hamilton Island.

Figures 28-31. Ventral exterior, interior, lateral, posterior, anterior views, X3, GSC 47484, same loc.

Figures 33-36. Dorsal exterior, interior, anterior, lateral views, X3, GSC 47485, same loc.

Figures 38-41. Dorsal exterior, interior, anterior, lateral views, X3, GSC 47486, same loc.

Figures 32, 37, 42. Dorsal exterior, interior, posterior views, X3, GSC 47487, same loc.

PLATE 36

Figure 1. Slab from Cape Phillips Formation, Section 12, Baillie Hamilton Island, GSC 47488, GSC loc. C-26969, 95.5 meters above section base. Note dark gray to light-colored laminations.

Figure 2. Slab from transitional beds, Section 12, Baillie Hamilton Island, GSC 47489, GSC loc. C-26962, 147 meters above section base. Note curved laminations near bottom of slab.

Figure 3. Slab from unnamed carbonate unit, Section 12, Baillie Hamilton Island, GSC 47490, GSC loc. C-26974, 245.5 meters above section base. Gypidula-Atrypa-Schizophoria Community. Note geopetals.

Figure 4. Slab from unnamed carbonate unit, Section 12, Baillie Hamilton Island, GSC 47491, GSC loc. C-26989, 373 meters above section base. Note spar-filled shells, as well as fine fossil debris. G-A-S Community.

Figure 5. Slab from unnamed carbonate unit, Section 12, Baillie Hamilton Island, GSC 47492, GSC loc. C-26990, 403.5 meters above section base. Note oncolites and disarticulated shells.

Figure 6. Slab from unnamed carbonate unit, Section 12, Baillie Hamilton Island, GSC 47493, GSC loc. C-26991, 418.5 meters above section base. Note oncolites, pellets, and argillaceous laminations.

Figure 7. Slab from unnamed carbonate unit, Section 12, Baillie Hamilton Island, GSC 47494, GSC loc. C-26997, 499 meters above section base. Ostracode Community, Note burrows and argillaceous laminations.

PLATE 37

Figure 1. Slab from unnamed carbonate unit, Section 12, Baillie Hamilton Island, GSC 47495, GSC loc. C-26992, 446 meters above section base. Coral Community. Note colonial corals and fragments "floating" in the matrix.

Figure 2. Slab from unnamed carbonate unit, Section 12, Baillie Hamilton Island, GSC 47496, GSC loc. C-27003, 575 meters above section base. Ostracode Community. Note elongate, rounded intraclasts.

Figure 3. Slab from unnamed carbonate unit, Section 12, Baillie Hamilton Island, GSC 47497, GSC loc. C-26993, 471.5 meters above section base. Ostracode Community. Note small scale ripple marks near top of slab.

Figure 4. Slab from unnamed carbonate unit, Section 12, Baillie Hamilton Island, GSC 47498, GSC loc. C-27008, 643.5 meters above section base. Ostracode Community.

Figure 5. Slab from unnamed carbonate unit, Section 1, Prince of Wales Island, GSC 47499, GSC loc. C-26803, 6 meters above section base. Note algal stromatolite and large vugs.

Figure 6. Slab from unnamed carbonate unit, Section 7, Prince of Wales Island, GSC 47500, GSC loc. C-26851, 6.25 meters above section base. Mesodouvillina-Ancillotoechia Community. Note large strophomenids and dark laminations near top and bottom of slab.

PLATE 38

Figure 1. Slab from unnamed unit, Section 4, Prince of Wales Island, GSC 47501, GSC loc. C-26823, 1.5 meters above section base. Hebetoechia Community.

Figure 2. Slab from Reef core, Prince of Wales Island, GSC 47502, GSC loc. C-26844. Note stromatoporoids and colonial coral.

Figure 3. Slab from unnamed carbonate unit, Section 11, Baillie Hamilton Island, GSC 47503, GSC loc. C-26942, 236.5 meters above section base. Iridistrophia-Mesodouvillina-Schizophoria Community. Note common crinoidal debris.

Figure 4. Slab from unnamed unit, Section 10, Prince of Wales Island, GSC 47504, GSC loc. C-26913, 6 meters above section base. Ancillotoechia-Cyrtina Community. Note abundant crinoidal debris.

Figure 5. Slab from unnamed unit, Section 6, Prince of Wales Island, GSC 47505, GSC loc. C-26867, 40.6 meters above section base. Note abundant oncolites and fragmentary brachiopod valves.

Figure 6. Slab from unnamed unit, Prince of Wales Island, Section 3, GSC 47506, GSC loc. C-26813, 4.5 meters above section base. Note burrows and argillaceous material.

Figure 7. Slab from unnamed unit, Prince of Wales Island, Section 6, GSC 47507, GSC loc. C-26860, 8 meters above section base. Schizophoria-Howellella Community. Note crinoidal debris and disarticulated valves.