CONTRIBUTIONS FROM THE MUSEUM OF PALEONTOLOGY
(Continuation of Contributions from the Museum of Geology)
UNIVERSITY OF MICHIGAN
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CONTRIBUTIONS TO THE GEOLOGY OF FOXE LAND, BAFFIN ISLAND

BY
LAURENCE M. GOULD, AUG. F. FOERSTE,
AND RUSSELL C. HUSSEY

UNIVERSITY OF MICHIGAN
ANN ARBOR

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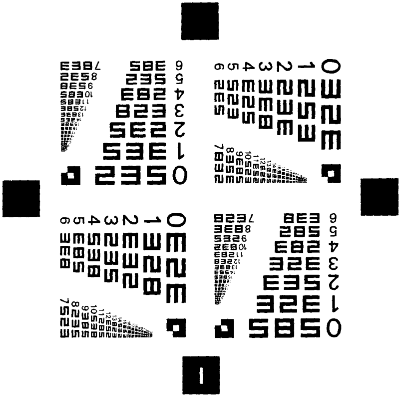

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(Continuation of Contributions from the Museum of Geology)

UNIVERSITY OF MICHIGAN

Editor: EUGENE S. MCCARTNEY

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CONTRIBUTIONS TO THE GEOLOGY OF FOXE LAND, BAFFIN ISLAND

By LAURENCE M. GOULD, AUG. F. FOERSTE AND RUSSELL C. HUSSEY

PART I: THE ROCKS AND THEIR DISTRIBUTION,
By Laurence M. Gould

PART II: THE CEPHALOPODS OF PUTMAN HIGHLAND,
By Aug. F. Foerste

PART III: CORALS, BRACHIOPODS, GASTROPODS AND OSTRACODS FROM PUTNAM HIGHLAND,
By Russell C. Hussey

PART I

THE ROCKS AND THEIR DISTRIBUTION

By LAURENCE M. GOULD

THE data and the fossils which constitute the basis for the following studies were collected by the author as geographer of the Putnam Baffin Island Expedition of 1927. This expedition was organized and directed by George Palmer Putnam[1] of New York and was sponsored primarily by the American Geographical Society, since its main purpose was geographic exploration.

The name "Foxe Land" has long been used in a very general way to indicate the southwestern portion of Baffin Island. In the following studies the peninsula which projects toward the southwest and adjacent parts of the main island proper will be

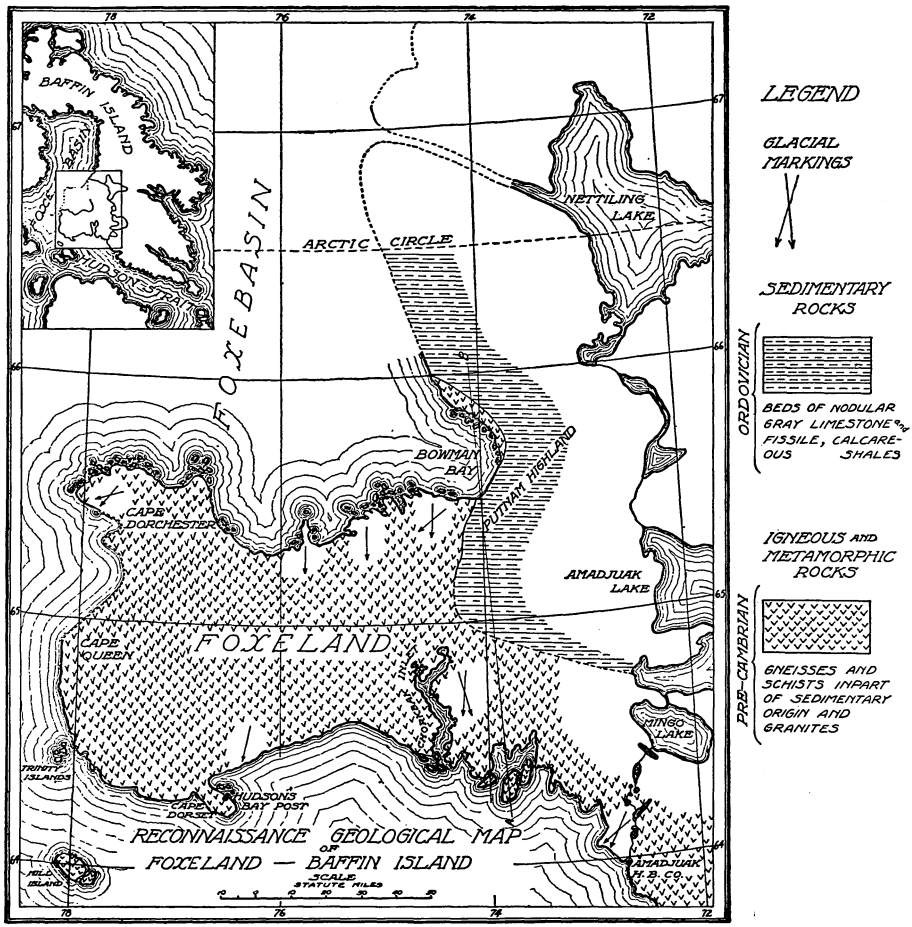
[1] Putnam, George Palmer, "The Putnam Baffin Island Expedition," *The Geographical Review*, Vol. XVIII, No. 1, pp. 1–40, January, 1928.

included in this term. These relationships are clearly indicated on the geological map and on the small insert with it (Map 1).

The physiographic characteristics of this region have been elsewhere sufficiently described.[2]

Pre-Cambrian crystalline rocks, mainly gneisses and schists with varying amounts of intrusive granites, comprise the rocks of the peninsula proper. Intense denudation beneath a continental ice-sheet has ironed these old rocks into a landscape which shows but little change from place to place and is ever one of dead monotony. Its bleakness is further accentuated by the almost complete absence of vegetation of any appreciable size. Along the north coast of Foxe Land for more than a hundred miles eastward from Cape Dorchester the general level of the land is but a few feet above the sea and even near Bowman Bay, where it becomes most nearly rugged, the general level is scarcely a hundred feet above the same level. This landscape with its flat or at least flatly-convex profiles of glacial origin furnishes a most startling contrast to the physiographic expression of the sediments of the region which are included in the Putnam Highlands. Here to the south of Bowman Bay rises a great northward-facing scarp of typical mesa character which stretches inland to the east and northeast farther than one can see. The general altitude of this scarp is from 600 to 700 feet above sea-level but the relatively low level and flatness of the adjacent pre-Cambrian rocks make it stand out sharply against the sky (Plate I, Fig. 1), even from very great distances. A nearer approach demonstrates that the Highland consists essentially of a great thickness of shales with a cap rock of limestone. The mesa character of the whole is as perfect as one might expect to find in the Colorado Desert, yet here it exists in a climate which is evidently decidedly humid. Two factors appear in large measure to have caused and preserved these sharp profiles: first, the total absence of vegetation, except for negligible amounts of lichens and mosses, has allowed

[2] Gould, L. M., "Report on the Physical Geography of the Putnam Baffin Island Expedition," *The Geographical Review*, Vol. XVIII, No. 1, pp. 27–40, January, 1928.


BAFFIN ISLAND
FOXE BASIN
ARCTIC CIRCLE
NETTLING LAKE
BOWMAN BAY
CAPE DORCHESTER
CUTHAND HIGHLAND
AMADJUAK LAKE
FOXE LAND
CAPE QUEEN
INGLEFIELD BAY
MINGO LAKE
TRIPET ISLANDS
HUDSONS BAY POST
AMADJUAK H.B. CO.
RECONNAISSANCE GEOLOGICAL MAP
OF
FOXE LAND — BAFFIN ISLAND
SCALE
STATUTE MILES
LEGEND
GLACIAL MARKINGS
SEDIMENTARY ROCKS
ORDOVICIAN
BEDS OF NODULAR GRAY LIMESTONE AND FISSILE, CALCAREOUS SHALES
IGNEOUS AND METAMORPHIC ROCKS
PRE-CAMBRIAN
GNEISSES AND SCHISTS IN PART OF SEDIMENTARY ORIGIN AND GRANITES

MAP 1

frost action unlimited opportunity to work; and secondly, the cap rock itself is of such a character as to be peculiarly subject to such action. It is a porous, nodular limestone which is conspicuously jointed; a very friable sort of rock which shatters and crumbles when struck with a hammer. In Figure 2 of Plate I this character of the rock is indicated. This non-resistive sort of rock maintains itself as the rim or cap rock of the mesa only because the underlying shales appear to offer no more resistance to weathering and erosion than would totally unconsolidated materials. The recession of this mesa escarpment has been so rapid in post-glacial time that all evidences of the Highlands having ever been glaciated have entirely disappeared.

Rather than a single distinct stratum, the mesa cap rock is found to consist of a series of beds which in most places total less than fifty feet. Considerable variation in both the thickness and the character of this series is noticeable in a horizontal direction. Figure 1, Plate II, shows it in its most nearly massive development, while Figure 2 of the same plate illustrates the same horizon not more than three miles distant. This latter exposure shows a typical manner in which the limestone grades into the fissile calcareous shales associated with it. Both are of the same blue-gray color and it is sometimes scarcely possible to delimit the boundaries between the two kinds of rocks.

These limestones and shales exhibit their greatest development along the north face of Putnam Highland. As determined by aneroid the maximum thickness here is 700 feet, of which about 600 feet consist of shales. The strata are all flat-lying and throughout this great thickness there is no evidence of any angular unconformities. Limestone beds like the cap rock are found interbedded with the shales far below the mesa rim. In Plate I, Figure 1, it will be noted that such strata form an imperfect shelf part way down the slope.

The limestone members of this series are highly fossiliferous and only the fact that but two or three hours were available for collecting and that the materials collected had to be carried out to our boat on our backs, a distance of about forty miles, prevented us from securing a much more comprehensive collec-

tion. With the exception of an ostracod elsewhere described by Dr. Hussey all the fossils figured by him and by Dr. Foerste were collected from the limestone strata at or near the rim of the mesa or from the bottoms of washes where they had accumulated after weathering out of the rocks above.

North of Putnam Highland and up the coast north of Bowman Bay as far as we voyaged and as far as we could see, the Putnam Highland Formation is represented by only a few feet of shale. Figure 1, the structure section along line A–B of the geological map, illustrates the relationships between the Highland and the terrain to the north. A more completely monotonous landscape than that exhibited where the shales are the country rock could hardly be imagined. For instance at latitude 66.2 degrees north, where the ostracod described by Dr. Hussey was collected, one can look inland in any direction across a landscape without any perceptible change of level. So flat is this terrain that where it passes beneath the waters of Foxe Basin there are ex-

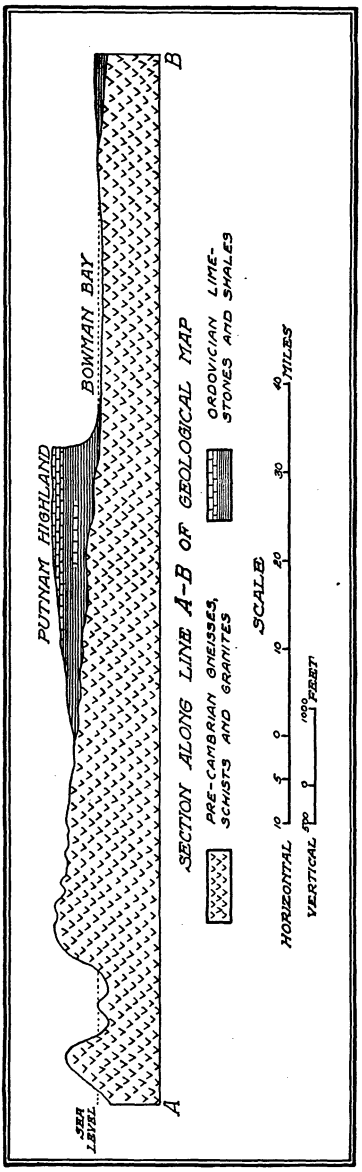


FIGURE 1

posed at low tide great mud flats in places at least ten miles wide.

On the geological map of North America compiled by Bailey Willis and George W. Stose and published by the United States Geological Survey in 1911, Silurian rock is mapped as occurring as a broad band from the head of Frobisher Bay northwestward to Foxe Basin, including a narrow strip along the north coast of Foxe Land. The same rock is also mapped as recurring across Foxe Basin on Melville Peninsula and on islands in Fury and Hecla Strait. Such a relationship seems to have been first suggested by Bell, who, writing in 1898, says: "The scanty information we possess goes to show that Foxe Basin is partly bordered on both sides by comparatively low land occupied by undisturbed fossiliferous Silurian limestone." [3]

It is at once evident that the rocks along the western coast of Baffin Island, believed by Bell to be Silurian, are in large part, and perhaps entirely, Ordovician. This is assuredly true of the regions studied by the Putnam Expedition and in the light of this information the existence of Silurian strata beyond our farthest north becomes more problematical than ever. Even greater uncertainty still exists as to the exact age of the rocks bordering the western side of Foxe Basin. Freuchen and Mathiassen,[4] who, as members of the Fifth Thule Expedition under the leadership of Knud Rasmussen, mapped portions of the eastern side of Melville Peninsula and the western part of northern Baffin Island, refer to the surface as being covered by rocks of Cambro-Silurian age. This designation appears to have been made before any of the fossils collected were studied.

[3] Bell, Robert, "Report of an Exploration on the Northern Side of Hudson Strait," *Canada Geol. Survey, Annual Report*, Vol. XI (N.S.), 1898, p. 17 M.

[4] Freuchen and Mathiassen, "Contributions to the Physical Geography of the Region North of Hudson Bay — Preliminary Report of the Fifth Thule Expedition," *Geographical Review*, Vol. XV, No. 4, p. 552, October, 1925.

PLATE I

FIG. 1

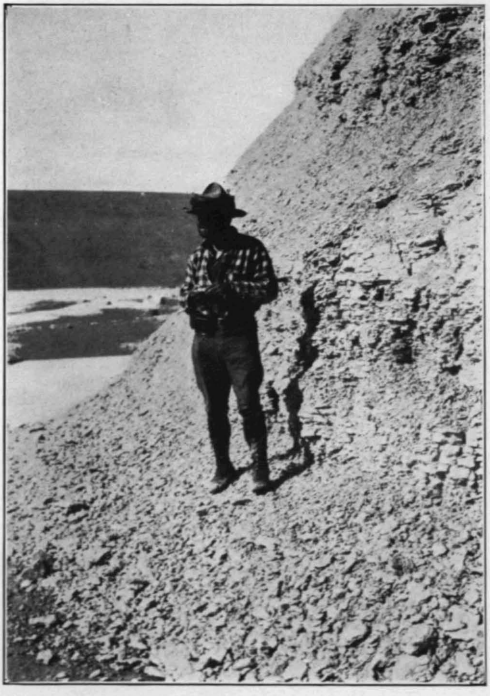


FIG. 2

PLATE II

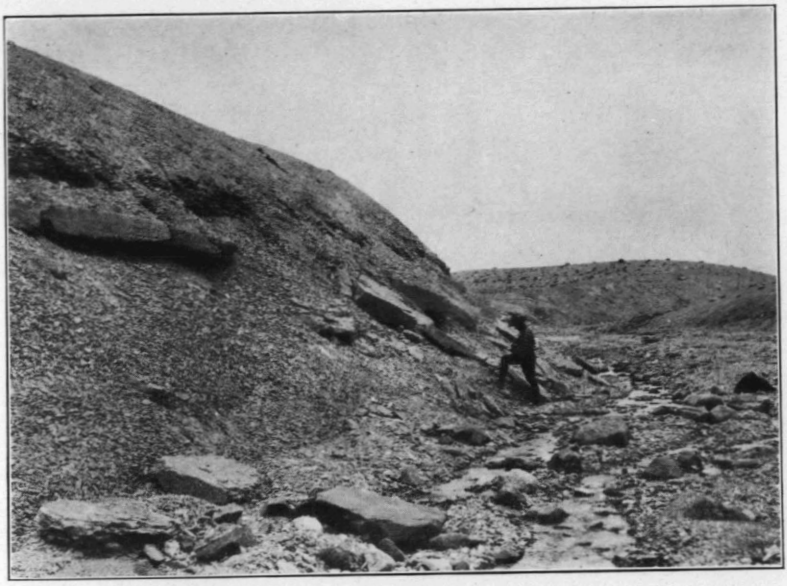


FIG. 1

FIG. 2

PART II

THE CEPHALOPODS OF PUTNAM HIGHLAND

By AUG. F. FOERSTE

THE cephalopods here discussed were collected by Professor Laurence M. Gould, geographer and geologist of the Putnam Baffin Island Expedition of 1927, and were kindly submitted to the writer for study.

They belong to a widely ranging Upper Ordovician fauna, first described from southern Manitoba, chiefly by Whiteaves. Here they occur on the west shore and on the islands of Lake Winnipeg, and in the adjacent part of the Red River Valley. A closely similar fauna occurs on the Nelson and Shammattawa rivers, southwest of Hudson Bay, and the cephalopods of this fauna have been studied by Professor W. A. Parks, and more recently by Foerste and Savage. A much more abundant and varied development of the southern Manitoba cephalopod fauna is that recently described by Gustaf Troedsson from Cape Calhoun, on the northern shore of Kane Basin, in the northwestern part of Greenland. It was believed long ago by John Richardson that the Lake Winnipeg fauna is represented also on Igloolik Island, on the northwestern margin of Foxe Basin, at the eastern end of Fury and Hecla Strait, and recent studies appear to confirm this opinion.

The wide geographical range of this cephalopod fauna is indicated by the following statements. From the Putnam Highland southeast of Foxe Basin, on the west shore of Baffin Land southwestward to the exposures southwest of Hudson Bay is a distance of 830 miles, while the total distance to the southern end of Lake Winnipeg, in the same direction, is 1200 miles. The distance of the Baffin Land locality from Cape Calhoun, in northern Greenland, almost directly northward, is 950 miles. Igloolik Island is only 320 miles northwest of the Baffin Land locality.

In his Report on the geology of the west shore and islands of Lake Winnipeg, published in 1900, Dowling divides the Ordovician strata of this area into the following formations, listed in descending order:

Stony Mountain formation
Upper Mottled limestone
Cat Head limestone
Lower Mottled limestone
Winnipeg sandstone.

Of these, the *Stony Mountain* formation is definitely correlated with the Richmond group, while the *Upper Mottled* limestone, *Cat Head* limestone, and *Lower Mottled* limestone were regarded by Dowling as of Galena or Trenton age. Regarding the *Winnipeg* sandstone, Dowling stated that "The fossils give no definite information as to the age of the beds, but suggest a passage from Black River to Trenton."

For the Upper Mottled limestone the term *Selkirk* limestone here is proposed, in view of the numerous fossils collected from this horizon at East Selkirk and Lower Fort Garry in the Red River valley. For the Lower Mottled limestone, the name *Dog Head* limestone is selected, from Dog Head, on the west shore of Lake Winnipeg, this being another important fossil locality. For the combined Selkirk, Cat Head and Dog Head limestone section the term *Red River* formation is proposed, which will result in the following list of strata, in descending order:

Stony Mountain formation		100+ feet
Red River formation	Selkirk limestone	130 feet
	Cat Head limestone	70 feet
	Dog Head limestone	70 feet
Winnipeg sandstone		100+ feet

In the area southwest of Hudson Bay, the Ordovician is divided by Savage and Van Tuyl, in descending order, into the

Shammattawa limestone, and
Nelson limestone.

Of these, the Shammattawa limestone is correlated with the Stony Mountain limestone, since it contains, in common with the latter, such characteristic species as *Streptelasma trilobatum*

(Whiteaves), the coarsely striated form of *Dinorthis* which resembles *Dinorthis subquadrata*, and the large and coarse form of *Rhynchotrema* which resembles *Rhynchotrema capax*. The Nelson limestone is correlated with the Red River formation, owing to the presence of *Cyrtogomphoceras nutatum*, which is closely related to *Cyrtogomphoceras magnum* (Whiteaves) and *Cyrtogomphoceras whiteavesi* (Miller) from that formation.

In the Kane Basin area in northern Greenland, Troedsson has divided the Ordovician into the

Cape Calhoun series, and
Gonioceras Bay formation.

Of these groups of strata, the Cape Calhoun series is regarded by Troedsson as including several distinct horizons: the Richmond, Trenton, and Black River, the fossils of which, unfortunately, were not collected separately, owing to the vertical exposures of these strata at Cape Calhoun, and owing to the absence of readily recognizable lithologic distinctions among the formations. However, those cephalopods which are listed by Troedsson from the Richmond part of his Cape Calhoun series suggest affinities with the Red River formation of the southern Manitoba area.

The cephalopods here studied, from the Putnam Highland, southeast of Foxe Basin, on the western side of Baffin Island, also suggest affinity with those of the Red River formation of southern Manitoba. This is true especially of *Cyrtogomphoceras baffinense*, which is a close relative of *Cyrtogomphoceras whiteavesi* (Miller), and which is listed by Dowling from all three members of the Red River formation, but which is most abundant from its lower, or Dog Head, member. The specimens here described as *Westonoceras putnami* and *Westonoceras gould* evidently show affinities with *Westonoceras manitobense* (Whiteaves), also from the Dog Head member, but how close the relationship may be, is not certain. It is noted, for instance, that both the Baffin Land species differ from the Manitoba type of the genus in having the sutures of the septa virtually straight across the lower part of the phragmacone, while they curve distinctly downward laterally in *Westonoceras manitobense*. In

this respect they differ also from *Thuleoceras ornatum* Troedsson, in which the lateral lobes are distinct, but much less pronounced than in the Manitoba species. The Putnam Highland specimens here referred to *Gonioceras* may belong to *Lambeoceras*, but, if so, this cannot be determined from their present state of preservation.

The Putnam Highland specimen here described as *Leurorthoceras* (?) *baffinense* is closely related to *Leurorthoceras* (?) *ruedemanni* Troedsson, described from the Gonioceras Bay section, along the northern margin of Kane Basin in northern Greenland. The species of *Cyrtogomphoceras* from that basin, however, are listed by Troedsson from the Richmond part of the Cape Calhoun series, while *Westonoceras* and *Ephippiorthoceras* are listed from the Trenton, with the possibility that the *Ephippiorthoceras* may be from a horizon as low as Black River. Unfortunately, Troedsson does not state on what basis he separated the specimens from the Cape Calhoun series into those of Richmond, Trenton, or Black River origin, considering the fact that they were not so discriminated in the field by Lauge Koch, the collector.

As stated in the earlier part of this paper, the strata included in the Red River formation of southern Manitoba were regarded by Whiteaves and Dowling as chiefly of Trenton age, with the basal parts possibly of Black River age. The first suggestion of the possibility of these strata being of Richmond age is given in Bassler's *Bibliographic Index of American Ordovician and Silurian Fossils*,[1] where, on page 1458, the Red River cephalopods are cited under the heading "Black River or Richmond (Manitoba)," with the supplementary statement: "This list includes the species from the Cat Head and associated formations in Manitoba. Although recorded as of Mohawkian age by Whiteaves, it is probable that many of them were derived from Richmond strata." Unfortunately there is no indication in this list as to which species gave rise to this correlation with the Richmond.

Troedsson, in his very important contribution "On the Middle and Upper Ordovician Faunas of Northern Greenland;

[1] U. S. National Museum, Bull. 92, Vol. 2, 1915.

I, Cephalopods"[2] (1926), refers more than half of the cephalopods studied by him to the Richmond division of the Cape Calhoun series. Among these are such characteristic Red River genera as *Narthecoceras* and *Cyrtogomphoceras*. Among other genera listed as Richmond are *Apsidoceras, Charactoceras, Lambeoceras, Huronia,* and *Diestoceras*. Among these, *Apsidoceras* is represented also in the Richmond of Anticosti, in the Shammattawa limestone of the Hudson Bay area, and in the Stony Mountain representative of the Richmond in southern Manitoba. *Charactoceras* occurs in the Richmond of Anticosti, and also in that of Ohio and Indiana; also in the Red River formation of southern Manitoba. *Lambeoceras* occurs in the Selkirk member of the Red River formation of Manitoba, and also in the Richmond of Indiana and Ohio. *Huronia* occurs not only in the Silurian, but also in the Shammattawa limestone of the Hudson Bay area, and in the Red River formation of southern Manitoba; it occurs also in the Richmond of Mocassin Mountain, in the Big Horn range of Wyoming. *Diestoceras* occurs in the Richmond of Anticosti, Indiana, and Ohio, and also in the Nelson limestone of the Hudson Bay locality.

Among the genera not listed by Troedsson from the Richmond part of the Cape Calhoun series, but of interest in this connection, are *Ephippiorthoceras* and *Westonoceras*, of which the former occurs also in the Shammattawa limestone of the Hudson Bay area, while the latter occurs also in the Nelson limestone and in the Dog Head member of the Red River formation.

Among the species found in the Dog Head member of the Red River formation in southern Manitoba is *Billingsites costulatum* (Whiteaves), representing a genus the typical members of which are known elsewhere only from the Richmond; for instance, in the Shammattawa limestone of the Hudson Bay area, in the English Head, Vaurial, and Ellis Bay formations of Anticosti, in the Stonington member of the Richmond in the northern peninsula of Michigan, and in the basal part of the Whitewater member of the Richmond in Ohio.

[2] Jubilaeumsekspeditionen Nord om Grønland 1920–1923. Nr. 1., Medd. om Grønland, 71. 1926.

The preceding notes indicate that the age of the Red River formation requires further study, and that there are arguments in favor of its Richmond, rather than Trenton, age.

When the Trenton age of the Red River formation first was accepted, this determination was based largely upon the presence of a large species of *Receptaculites*, and on large specimens of gasteropoda usually identified as *Maclurea magna*. Later, however, this gasteropod was described by Whiteaves as *Maclurea manitobensis*, and still later this species was made the genotype of the new genus *Maclurina* of Ulrich and Scofield.

The *Receptaculites* of the Red River formation was identified first with *Receptaculites neptuni* Hall (not Defrance), described as though from the Trenton at Carlisle, Pennsylvania. Later it was identified with *Receptaculites occidentalis* Salter, when the former name was abandoned on account of synonomy. The latter is a Black River species described originally from the Pauquette Rapids on the Ottawa River, in eastern Ontario, Canada. Later it was identified with *Receptaculites oweni* Hall, from the Galena of Illinois and Wisconsin. Dr. Ulrich, however, informs me that this Manitoba Red River species is distinct from the Trenton and Black River forms. Possibly it is related to *Receptaculites arcticus*, described by Etheridge from the west side of Kane Basin. Evidently both *Maclurina* and *Receptaculites* may occur in Richmond as well as in Trenton and Black River strata.

In fact, the possibility of the Red River formation belonging to the Richmond, instead of to the Trenton, is suggested by the presence also of such corals as *Calapoecia cribriformis*, *Columnaria* (*Palaeophyllum*) *stokesi*, and *Halysites gracilis*, all three of which are present in the Big Hill member of the Richmond in the peninsula east of Escanaba, on the northern peninsula of Michigan.

From this point of view it now becomes desirable to restudy the Ordovician exposures on the west side of the Kane Basin, along the eastern shore of Ellesmereland. Here, within a length of about fifty-five miles, occur four exposures, all apparently exposing Richmond strata. The most southern of these is Cape

Harrison, northwest of Norman Lockyer Island, on the northern coast of Princess Marie Bay, in latitude 79° 19′ north. The next, Cape Louis Napoleon, at the northern edge of the mouth of Dobbin Bay, is in latitude 79° 38′ north. Cape Hilgard is at 79° 41′; and Cape Frazer is at 79° 45′, about half way between Dobbin Bay and Scoresby Bay. From Cape Harrison, Whitfield described *Receptaculites pearyi*, *Halysites agglomeratiformis*, *Calapoecia borealis*, and *Heliolites perelegans*. From Cape Louis Napoleon, Etheridge described *Receptaculites arcticus* and cited *Maclurea magna*. From Cape Hilgard he described *Halysites catenulatus feildeni*, and cited *Favistella reticulata*, *Favistella franklini*, and *Maclurea magna*. From Cape Frazer he described *Receptaculites arcticus* and *Halysites catenulatus harti*. Fortunately all three of the forms of *Halysites* here mentioned are figured in the publications including their original descriptions, and all evidently belong to the Ordovician group of species in which the corallites are more quadratic than elliptical in cross-section, and do not alternate with narrow tubules, as in some Silurian species. The species of *Favistella* cited apparently are species of *Columnaria*. The *Calapoecia borealis* is an excellent representative of the genus *Calapoecia*. The figure of *Heliolites perelegans*, published by Whitfield, lacks every essential detail, and the presence of this genus at Cape Harrison needs verification.

It is evident that progress in knowledge of Arctic geology depends on the accumulation of data from all possible sources. To this progress every new locality makes some contribution. The fossils collected by Professor L. M. Gould very materially extend our knowledge of the geographic distribution of the Red River fauna, originally described from southern Manitoba, then identified in the Hudson Bay area and in northern Greenland, and now known also from the western side of Baffin Land. It now becomes necessary to determine how this equivalent of the Red River fauna in western Baffin Island is related to the fauna discovered at the head of Frobisher Bay, on the eastern side of Baffin Land, and only 200 miles southeast of the western Baffin Land exposure. This fauna at the head of Frobisher Bay has been identified as Trenton, but, according to Bassler, probably the material collected includes some Richmond species.

It is evident that the progress of our knowledge of Arctic Ordovician faunas is greatly retarded by the uncertainty which lingers as to the Black River, Trenton, or Richmond age of the various Red River formation faunas here discussed. Our present knowledge of the cephalopods and corals appears to favor the Richmond age of the entire Red River formation, as exposed in southern Manitoba, and of the combined Shammattawa-Nelson section, as exposed in the area southwest of Hudson Bay. At least the greater part of the Cape Calhoun series of northern Greenland appears to be of Richmond age. In the Greenland area, stratigraphical details are lacking.

As the fauna most typical of the doubtful part of the upper Ordovician of the American Arctic, that of the Red River formation of southern Manitoba here is selected. Of the areas of exposure known at present, it is the most easy of access. Moreover, it contains an abundant and diversified fauna. The list of fossils from this formation published by Dowling [3] includes 142 items, consisting of 5 species of algae, 3 *Receptaculitidae*, 2 sponges, 3 graptolites, 9 corals, 2 unclassified, 1 unsorted series of crinoid fragments, 1 cystoid, 1 starfish, 2 annelids, 9 bryozoans, 28 brachiopods, 12 pelecypods, 22 gasteropods, 1 Conularia, 26 cephalopods, 3 ostracods, and 13 trilobites.

Since Dowling's report has long been out of print, and is missing in many important libraries, that part pertaining to the cephalopods here is appended. In this list, various species have been identified with characteristic Trenton and Black River forms, in my opinion erroneously. For others, new generic affiliations have been proposed in recent years, chiefly by the present writer. These here are adopted, but the generic terms employed by Dowling in his list are added in brackets, for ready reference to the original literature. The most important part of this list is the indication of the horizon at which the individual species are found.

Regarding the Richmond age of the Stony Mountain formation, immediately above the Red River formation, there is no question. From this Stony Mountain formation Dowling lists 42

[3] *Geol. Surv. Canada, Ann. Rept.*, XI, pt. F, pp. 48–53 (1900).

STRATIGRAPHICAL DISTRIBUTION OF ORDOVICIAN CEPHALOPODS IN SOUTHERN MANITOBA.

LIST OF SPECIES	RED RIVER FORMATION			STONY MOUNTAIN FORMATION
	Dog Head limestone	Cat Head limestone	Selkirk limestone	
Cyclendoceras (Endoceras) subannulatum (Whitfield)	*	*	*	.....
Narthecoceras (Endoceras) crassisiphonatum (Whiteaves)	.....	.....	*	.....
Narthecoceras (Endoceras) simpsoni (Billings)	*	*	.....	.....
Armenoceras (Actinoceras) richardsoni (Stokes)	.....	.....	*	.....
Actinoceras bigsbyi (?) Bronn	*	*	*	.....
Ormoceras (Actinoceras) allumettense (Billings)	*	.....	*	.....
Deiroceras (Actinoceras) python (Billings)	.....	.....	*	.....
Paractinoceras (Actinoceras) canadense (Whiteaves)	*	.....	.....	.....
Orthoceras winnipegense Whiteaves	*	.....	.....	.....
Kionoceras (Orthoceras) magnisulcatum (Billings)	.....	.....	*	.....
Cycloceras (Orthoceras) selkirkense (Whiteaves)	.....	.....	*	*
Spyroceras (Orthoceras) anellus (Conrad)	.....	.....	*	.....
Lambeoceras (Tripteroceras) lambi (Whiteaves)	.....	.....	*	.....
Garryoceras (Tripteroceras) semiplanatum (Whiteaves)	.....	.....	*	.....
Billingsites (Ascoceras) costulatum (Whiteaves)	*	.....	.....	.....
Billingsites (Ascoceras) sp.	.....	.....	.....	*
Diestoceras (Poterioceras) nobile (Whiteaves)	*	.....	*	.....
Diestoceras (Poterioceras) apertum (Whiteaves)	*	*	.....	.....
Dowlingoceras (Poterioceras) gracile (Whiteaves)	*	.....	.....	.....
Cyrtogomphoceras (Oncoceras) magnum (Whiteaves)	.....	.....	*	.....
Cyrtogomphoceras (Oncoceras) intermedium (Whiteaves)	*	.....	.....	.....
Cyrtogomphoceras (Oncoceras) whiteavesi (Miller)	*	*	*	.....
Westonoceras (Cyrtoceras) manitobense Whiteaves	*	.....	.....	.....
Winnipegoceras (Cyrtoceras) laticurvatum (Whiteaves)	*	.....	.....	.....
Charactoceras (Eurystomites) plicatus (Whiteaves)	*	.....	.....	.....
Discoceras canadense Whiteaves	*	.....	.....	.....
Trochoceras (?) mccharlesi Whiteaves	*	.....	*	.....
Apsidoceras (Litoceras) insigne Whiteaves	.....	.....	.....	*

species and varieties, of which 18 species of bryozoans, 2 species of *Beatricea*, various corals, and one species each of *Kionoceras*, *Billingsites*, and *Apsidoceras* suggest affinities with the Richmond of Anticosti. It is the Richmond age of the underlying Red River formation which here is asserted.

LIST OF SPECIES DESCRIBED

1. Endoceras sp. (A)
2. Endoceras sp. (B)
3. Cyclendoceras sp. (A)
4. Cyclendoceras sp. (B)
5. Orthoceras sp.
6. Ephippiorthoceras sp. (A)
7. Ephippiorthoceras sp. (B)
8. Garryoceras semiplanatum (Whiteaves)
9. Dowlingoceras gracile (Whiteaves)
10. Leurorthoceras (?) baffinense Foerste
11. Gonioceras (?) sp. (A)
12. Gonioceras (?) sp. (B)
13. Westonoceras manitobense (Whiteaves)
14. Westonoceras putnami Foerste
15. Westonoceras gouldi Foerste
16. Westonoceras cf. gouldi Foerste
17. Winnipegoceras laticurvatum (Whiteaves)
18. Winnipegoceras dowlingi Foerste
19. Cyrtogomphoceras magnum (Whiteaves)
20. Cyrtogomphoceras whiteavesi (Whiteaves)
21. Cyrtogomphoceras baffinense Foerste
22. Cyrtogomphoceras cf turgidum Troedsson
23. Cyrtogomphoceras intermedium (Whiteaves)

NEW GENERA

Garryoceras; genotype: **Orthoceras semiplanatnm** Whiteaves.
Dowlingoceras; genotype: **Poterioceras gracile** Whiteaves.
Winnipegoceras; genotype: **Cyrtoceras laticurvatum** Whiteaves.

ENDOCERAS Hall

Endoceras Hall, Pal. New York, 1, p. 58, 207, footnote (1847). See also Foerste, Journ. Sci. Lab. Denison Univ., 20, p. 208 (1924).

First described species: *Endoceras subcentrale* Hall, Pal. New York, 1, p. 59, pl. 17, fig. 4 (1847).

Accepted genotype: *Endoceras proteiforme* Hall, Pal. New York, 1, p. 208, pls. 48, 49; see also Foerste, loc. cit., pls. 21, 22, 23, 25 (1924).

Conch containing long, funnel-like endocones within the siphuncle. According to Hyatt, the septal funnels or necks extend posteriorly only for the length of one camera, or from one septum to the next septum to that from which they originated. In the type of *Endoceras subcentrale*, however, they extend for the length of two camerae.

1. ENDOCERAS SP. (A)

(Plate II, Fig. 3; Plate X, Fig. 1)

Specimen 110 mm. long, with a lateral diameter of 58 mm., not enlarging to an appreciable extent within the limit of the length of the specimen. Almost five camerae occupy a length equal to the diameter of the conch. The sutures of the septa are directly transverse. The concavity of the septa is at least 10 mm. Apparently the siphuncle was 22 mm. in diameter and 5 or 6 mm. from contact with the ventral wall of the conch, but the specimen is slightly crushed dorso-ventrally, so that the original distance of the siphuncle from the ventral wall cannot be determined with confidence.

Locality and Horizon. — Putnam Highland, Baffin Island; in strata equivalent to the Red River formation of Manitoba.

Specimen No. 10280 in the Museum of Paleontology, University of Michigan.

Remarks. — Compared with typical *Endoceras proteiforme* Hall, from the Trenton at Middleville, New York, the number of camerae in a length equal to the diameter of the conch is less, the diameter of the siphuncle is considerably smaller, and its distance from the ventral wall of the conch is much greater. The number of camerae, moreover, is less than in *Endoceras nelsonense* Foerste and Savage, from the Nelson limestone west of Hudson Bay, in *Endoceras chidleyense* Foerste, from erratic blocks west of Cape Chidley in northern Labrador, probably of Black River age, and in *Endoceras baffinense* Foerste, from Frobisher Bay, on the east side of Baffin Island, probably of Trenton age, though possibly Richmond. Compared with *Endoceras nelsonense*, its siphuncle is of about the same relative size, but it

is nearer the ventral wall of the conch. Compared with *Endoceras chidleyense,* the siphuncle is at about the same distance from the ventral wall of the conch, and its size is only slightly greater. Compared with *Endoceras baffinense,* the siphuncle is of about the same size, and it is located at about the same distance from the ventral wall of the conch. Evidently this Putnam Highland specimen is related most closely to *Endoceras baffinense,* but it is not known to be identical.

2. ENDOCERAS SP. (B)

(Plate II, Fig. 2; Plate X, Fig. 2)

Specimen 110 mm. long, 75 mm. in diameter, not appreciably enlarging within the length of the specimen. Nearly six camerae in a length equal to the diameter of the conch. Sutures of septa directly transverse. Concavity of septa about 20 mm. Siphuncle apparently indicated by a downward flexure of the septum at the base of the specimen, suggesting a siphuncle about 30 mm. in diameter and only moderately eccentric in location, but both size and location are too indefinite to serve for exact specific discrimination of the specimen.

Locality and Horizon. — Putnam Highland, Baffin Island; in strata corresponding to the Red River formation of southern Manitoba.

Specimen No. 10279 in the Museum of Paleontology, University of Michigan.

Remarks. — This specimen might possibly belong to the same species as the preceding, here called *Endoceras sp. (A),* but the size and location of the siphuncle cannot be determined with sufficient accuracy to verify this.

CYCLENDOCERAS Grabau and Shimer

Cyclendoceras Grabau and Shimer, North American Index Fossils, 2, p. 43 (1910).

Genotype: *Endoceras annulatum* Hall, Pal. New York, 1, p. 207, pl. 44, figs. 1a, b (1847); see also Journ. Sci. Lab. Denison Univ., 19, p. 299, pl. 31, fig. 3 (1921); also 23, pl. 3, fig. 1 (1928).

Cyclendoceras included the annulated species otherwise having the structure of *Endoceras*. In the genotype, these annulations are relatively distant from each other. In the species figured by Whiteaves (*Royal Soc. Canada, Trans.*, 9, iv, pl. 5, figs. 2, 2a, 1892) from the upper or Selkirk member of the Red River formation at East Selkirk, in southern Manitoba, under the name of *Endoceras subannulatum* (not Whitfield), the annulations are much more numerous. Species of this type occur in the Maquoketa of Iowa, and in the Richmond of Idaho, Montana, and Colorado.

3. CYCLENDOCERAS SP. (A)

(Plate I, Fig. 1; Plate X, Fig. 3)

Specimen 110 mm. long, with a lateral diameter of 45 mm., not enlarging appreciably within the length of the specimen. Six camerae occupy a length equal to the diameter of the conch. The sutures of the septa apparently are directly transverse. The concavity of the septa equals 10 mm. The septal necks are exposed, but not sufficiently well to determine whether their length equals that of one or two camerae. The siphuncle is 18 mm. in diameter, and it is estimated that it was about 2 mm. distant from the ventral wall of the conch. The cast of the interior of the conch is annulated transversely, there being 10 annulations in a length equal to that of 11 camerae. These annulations vary from one fourth to one half of a millimeter in elevation. Ventro-laterally they slope downward toward the median part of the ventral side of the conch at an angle of about 33 degrees with a horizontal plane.

Locality and Horizon. — Putnam Highland, Baffin Island; in strata corresponding to the Red River formation of southern Manitoba.

Specimen No. 10266 in the Museum of Paleontology, University of Michigan.

Remarks. — This Baffin Land specimen is similar to *Cyclendoceras annulatum* (Hall), from the Trenton at Watertown, New York, in the relative number of its camerae and annulations,

compared with the diameter of the conch, and also in the relative size of its siphuncle and in the distance of the latter from the ventral wall of the conch. The annulations, however, curve much more strongly downward along the ventral side of the conch than in the New York species.

4. CYCLENDOCERAS SP. (B)

(Plate I, Fig. 2; Plate X, Fig. 4.)

Specimen 83 mm. long, 53 mm. in lateral diameter, not appreciably enlarging within the length of the specimen. Sutures of the septa apparently directly transverse. Four septa are exposed at intervals of 21 to 23 mm.; if intermediate septa were present originally, no definite trace remains in the specimen at hand. The concavity of the septa is at least 16 mm. The siphuncle is 17.5 mm. in diameter at the top of the specimen, and is located about 5 mm. from the ventral wall of the conch; the length of its septal necks cannot be determined. Nearly six annulations cross the conch in a length equal to its lateral diameter. These annulations curve downward ventro-laterally toward the median part of the ventral side of the conch, at an angle of about 33 degrees with a horizontal plane.

Locality and Horizon. — Putnam Highland, Baffin Island; in strata corresponding to the Red River formation in southern Manitoba.

Specimen No. 10274 in the Museum of Paleontology, University of Michigan.

Remarks. — This Baffin Land specimen is similar to typical *Cyclendoceras annulatum* (Hall) in the number of its annulations, and in the size and location of its siphuncle, compared with the diameter of the conch. It agrees with the New York species, moreover, in the small downward curvature of its annulations ventrally. The distance between the septa cannot, however, be determined with confidence, and there is a possibility of this distance being considerably greater than in the New York species.

ORTHOCERAS Breynius

Orthoceratites Breynius, Dissertatio Physica de Polythalmiis, pp. 12, 19, 31; pl. 3, figs. 1–7 (1732); not a generic name in accordance with the Linnaean system.

First published species: *Orthoceras regulare* Schlotheim, not illustrated, but with citation of figures differing greatly in form, and apparently in structure. See also Foerste, Journ. Sci. Lab. Denison Univ., 20, p. 218 (1924).

Typical *Orthoceras*, as originally figured by Breynius, had a shell with a smooth surface, the septa were distant, and the segments of the siphuncle were cylindrical, instead of expanded within the camerae. This genus is credited to Breynius only by courtesy, the latter not having used a binomial system of nomenclature. Schlotheim, who first adopted the binomial system in connection with this genus, included under *Orthoceratites regulare* very divergent types of orthocones, illustrating none of these himself. Hyatt was the first to confine this term to conchs with a smooth surface ("Genera of Fossil Cephalopods," *Boston Soc. Nat. Hist., Proc.* 22, p. 275, 1884), and Foerste restricted this name to those with distant septa and cylindrical segments of the siphuncle (*Journ. Sci. Lab. Denison Univ.*, 20, p. 218, 1924).

5. ORTHOCERAS SP.

(Plate II, Fig. 1; Plate X, Fig. 5)

Specimen 150 mm. long, enlarging from a lateral diameter of 54 mm. to one of 63 mm. in a length of 80 mm. The conch is depressed owing to pressure previous to fossilization. At its base, the shortest diameter is 46 mm. Two camerae occupy a total length equal to the maximum lateral diameter of the conch. The sutures of the septa are directly transverse. The concavity of the septa equals 15 to 18 mm. The siphuncle is not preserved. The surface of the conch apparently was smooth.

Locality and Horizon. — Putnam Highland, Baffin Island; in strata corresponding to the Red River formation.

Specimen No. 10261 in the Museum of Paleontology, University of Michigan.

Remarks. — In the absence of the siphuncle it is impossible to determine the generic relationship of this specimen beyond doubt, but the relatively long distance between the septa suggests that it is a typical species of *Orthoceras,* with cylindrical segments of the siphuncle.

EPHIPPIORTHOCERAS Foerste

Ephippiorthoceras Foerste, Geol. Surv. Canada, Memoir 145, p. 71, pl. 11, fig. 11, also text fig. 7.

Genotype: *Orthoceras formosum* Billings, Geol. Surv. Canada, Rept. of Progress for 1853–56, p. 317 (1857); also Foerste, as cited above.

Conchs orthoconic, with sutures of septa curving distinctly downward laterally, and with the segments of the siphuncle enlarging to vertically elliptical or spherical outlines, but not vertically depressed and disk-like, or nummuloidal.

6. EPHIPPIORTHOCERAS SP. (A)

(Plate IV, Fig. 3; Plate X, Fig. 7)

Specimen 75 mm. long, consisting of the ventro-lateral half of the conch. To judge from the outline of the cross-section at its base, its dorso-ventral diameter there is estimated at 35 mm., and its lateral one at 30 mm. The dorso-ventral diameter at the top of the specimen is estimated at 40 mm. Seven camerae occur in a length equal to the estimated dorso-ventral diameter of the conch at the top of the series counted. The sutures of the septa curve downward laterally about 7 mm. The saddles are conspicuous. The concavity of the septa is slight in a lateral direction, but conspicuous dorso-ventrally. The passage of the siphuncle through the septum at the base of the specimen appears to be obscurely indicated. This passage apparently is 2 mm. in diameter, and its center is about 10 mm. from the ventral wall of the conch.

Locality and Horizon. — Putnam Highland, Baffin Island; in strata corresponding to the Red River formation of southern Manitoba.

Specimen No. 10272 in the Museum of Paleontology, University of Michigan.

Remarks. — This Putnam Highland specimen closely resembles the *Ephippiorthoceras dowlingi* Foerste and Savage, from the Shammattawa River, on the western side of Hudson Bay, as far as can be determined from the fragment at hand. Compared with *Ephippiorthoceras baffinense* Foerste, the sutures of the septa curve more strongly downward along the lateral side of the conch.

7. EPHIPPIORTHOCERAS SP. (B)

(Plate IV, Fig. 4; Plate X, Fig. 8)

Specimen 65 mm. long, enlarging from a dorso-ventral diameter of 28.5 mm. at its base to 33 mm. at its top. The conch apparently is compressed laterally, and its lateral diameter is estimated at 26 mm. at its base, but the poor preservation of the specimen does not admit of an accurate determination of this diameter. Six camerae occur in a length equal to the dorso-ventral diameter of the conch. The sutures of the septa curve downward laterally about 3 mm. The concavity of the septa in a lateral direction is much less than dorso-ventrally. The center of the siphuncle is located 12 mm. from the ventral side of the conch at the top of the specimen, where the dorso-ventral diameter of the conch is 33 mm. The diameter of the siphuncle at its passage through the septum is 1.8 mm.

Locality and Horizon. — Putnam Highland, Baffin Island; in strata corresponding to the Red River formation in southern Manitoba.

Specimen No. 10275 in the Museum of Paleontology, University of Michigan.

Remarks. — This specimen resembles *Ephippiorthoceras dowlingi* Foerste and Savage in the small rate of enlargement of the conch, in the number of its camerae, and in the amount of downward curvature of the sutures of the septa laterally. The conch appears to have been more compressed laterally.

GARRYOCERAS, gen. nov.

Genotype: *Orthoceras semiplanatum* Whiteaves, Royal Soc. Canada, Trans., 9, iv, p. 81, pl. 8, figs. 3, 3a (1892).

Conchs with siphuncle on the more convex side of the conch, as in *Mixosiphonoceras* Hyatt (see Foerste, *Journ. Sci. Lab. Denison Univ.*, 21, p. 306, pl. 32, figs. 3 A–D, 1926), but with the dorsal side more strongly flattened, and with the sutures curved more strongly downward on this dorsal side. Moreover, the siphuncle is relatively much smaller, is cylindrical, and shows no trace of an actinosiphonate structure.

8. GARRYOCERAS SEMIPLANATUM (Whiteaves)

(Plate XI, Fig. 7 A, B)

Orthoceras semiplanatum Whiteaves, Royal Soc. Canada, Trans., 9, iv, p. 81, pl. 8, figs. 3, 3a (1892).

Original description: Shell compressed subcylindrical, increasing very slowly in thickness (at the rate, so far as can be ascertained, of three millimeters and a half in a length of five centimeters), nearly plano-convex in transverse section, one side being broadly and very gently convex and the other nearly flat, the shorter of the two diameters of the tube being about one third less than the longer, and the lateral margins narrowly rounded. Surface markings unknown; sutures of the septa shallowly concave on the flattened side, slightly convex on the other, and closely approximated, the six anterior chambers together measuring half an inch, on the median line of the flattened side; siphuncle small, cylindrical, placed close to the margin of the convex side.

Locality and Horizon. — Lower Fort Garry, in southern Manitoba; in the Selkirk member of the Red River formation.

Specimen No. 1834 in the Victoria Memorial Museum, at Ottawa, Ontario, Canada.

DOWLINGOCERAS, gen. nov.

Genotype: *Poterioceras gracile* Whiteaves, Royal Soc. Canada, Trans. 9, iv, p. 87, pl. 11, figs. 4, 4a, 4b (1892).

Conch somewhat similar to *Diestoceras* in form (see Foerste, *Journ. Sci. Lab. Denison Univ.*, 20, p. 262, pls. 25–28, 1924), but more slender, much more strongly compressed laterally, with a relatively much smaller siphuncle, enlarging but slightly within the camerae.

9. DOWLINGOCERAS GRACILE (Whiteaves)

(Plate I, Fig. 5; Plate III, Figs. 2 A, B)

Poterioceras gracile Whiteaves, Royal Soc. Canada, Trans., 9, iv, p. 87, pl. 11, figs. 4, 4a, 4b, 1892).

Original description: Shell fusiform, strongly compressed, straight and rather slender, flattened conical and obtusely pointed posteriorly, thickest at mid-length, where it is very gently convex, thence narrowing gradually and very slightly toward the aperture, which apparently is simple and broadly truncated; immediately behind the aperture there is a faint annular constriction; siphonal and antisiphonal regions narrowly rounded; sides compressed, somewhat expanded, especially at the mid-length and anteriorly; chamber of habitation occupying about one third of the entire length, which is more than twice but less than three times the maximum breadth; outline of transverse section, in the thickest part, elliptical, with the longer axis of the ellipse not quite twice the length of the shorter; surface showing indications of fine transverse costae, though the exterior of the test is not very well preserved. Septa rather closely approximated and averaging about 3 millimeters apart; siphuncle nearly marginal, moniliform, and slightly inflated between the septa, the maximum breadth of each siphuncular segment being one third less than its height or depth.

Locality and Horizon. — Black Island, near Swampy Island, Lake Winnipeg; in the Dog Head member of the Red River formation.

Specimen No. 1841 in the Victoria Memorial Museum, Ottawa, Ontario, Canada.

LEURORTHOCERAS Foerste

Leurorthoceras Foerste, Journ. Sci. Lab. Denison Univ., 19, p. 278 (1921).

Genotype: *Leurorthoceras hanseni* Foerste, loc. cit., p. 278, pls. 30, 31, 32, 34 (1921).

Conch flattened along its ventral side, the sutures of the septa with broad ventral lobes. The location of the siphuncle is distinctly ventral, but not in contact with the ventral wall of the conch. The septal necks are distinct and relatively long. The connecting rings enlarge within the camerae, and vary from vertically elliptical to approximately globular in outline, but they are not enlarged sufficiently in a lateral direction to secure a flattened disk-like appearance, as in typical *Actinoceras*.

10. LEURORTHOCERAS (?) BAFFINENSE, sp. nov.

Plate III, Fig. 1; Plate X, Figs. 6 A, B)

Specimen 170 mm. long, and 93 mm. wide at its broadest part. It consists of three fragments. It is estimated that the conch originally was about 140 mm. in diameter, but this cannot be determined with any accuracy. It is estimated also that nearly eleven camerae occur in a length equal to the diameter of the conch. The sutures of the septa curve downward at least 12 mm. on the ventral side of the conch, producing broad ventral lobes. The septa slope downward on the ventral side of the siphuncle at an angle of 40 degrees with the ventral vertical outline of the conch. From this it is assumed that the concavity of the septa was considerable. The siphuncle is about 5 mm. distant from the ventral wall of the conch. Its diameter is 16 mm., at least dorso-ventrally. The septal necks are 4 or 5 mm. long where the septa are 11 or 12 mm. distant from each other vertically. These septal necks curve concavely inward a distance of 4 or 5 mm. on the ventral side of the siphuncle and about 2 mm. on its dorsal side. In consequence, the lower half of each segment of the siphuncle appears to be prominently annulated at a strongly oblique angle, the slope being toward the interior of the conch. No other details are preserved.

Locality and Horizon. — Putnam Highland, Baffin Island; in strata corresponding to the Red River formation of southern Manitoba.

Specimen No. 10283 in the Museum of Paleontology, University of Michigan.

Remarks. — The specimen here described as *Leurorthoceras baffinense* is closely related to the second specimen figured by Troedsson under the name *Leurorthoceras* (?) *ruedemanni* ("On the Middle and Upper Ordovician Faunas of Northern Greenland; I, Cephalopods," pl. 31, figs. 3, 4; 1926). This specimen was numbered 137; and it came from the Gonioceras Bay formation, in the lower part of the Black River series of strata as exposed at Cape Calhoun, along the northern part of Kane Basin, on the coast of Greenland.

Compared with the latter, the Putnam Highland specimen here described has longer segments of the siphuncle, compared with the maximum dorso-ventral diameter of the latter, and the septal necks are relatively longer. Unfortunately, not enough of the transverse outline of the conch of the Putnam Highland specimen remains to insure that its outline is similar to that of typical *Leurorthoceras*, in which the ventral outline is distinctly flattened compared with the remainder of the outline of the conch, the latter forming almost a semicircle. Under these circumstances, its reference to the genus *Leurorthoceras* can be only tentative.

GONIOCERAS Hall

Gonioceras Hall, Pal. New York, 1, p. 54 (1847).

Genotype: *Gonioceras anceps* Hall, loc. cit., p. 54, pl. 14, figs. 1a–d (1847).

Conch strongly depressed dorso-ventrally, with its ventral face flat or only slightly convex, and with its dorsal face gently convex, these two faces being separated by the narrowly acute lateral margins of the conch. On approaching the lateral margin of the conch, the dorsal face of the conch tends to become slightly concave in some specimens. The sutures of the septa curve strongly downward along the median part of both

the dorsal and ventral faces of the conch. Along the lateral fourths or fifths of both of these faces the sutures curve strongly upward, forming very conspicuous saddles, and then they curve strongly downward as far as the acute margins of the conch, where they form very deep and narrowly angulated lateral lobes, which embrace both the dorsal and the ventral faces of these margins. The siphuncle is located slightly nearer the flat ventral face of the conch. Its segments are strongly nummuloidal, of small height, but broad.

Lambeoceras Foerste (*Journ. Cincinnati Soc. Nat. Hist.*, 22, p. 44, pl. 1, figs. 3 A–D; pl. 3, fig. 2, 1917) differs in having the dorsal and ventral faces of the conch equally convex, and its lateral margins less acute. The sutures of the septa curve downward along the entire width of both faces, but near the lateral margins they curve more directly outward. The siphuncle is located much nearer the ventral wall of the conch. The segments of the siphuncle are nummuloidal, and similar in form to those of *Gonioceras*.

The two specimens here described from western Baffin Land are referred to *Gonioceras* because their ventral sides present no evidence of distinct convexity, as in typical *Lambeoceras*; it is possible, however, that more complete and better preserved specimens might lead to an opposite opinion. Unfortunately, these specimens do not preserve their lateral parts, so that the course of their septa near the lateral margins cannot be determined.

11. GONIOCERAS (?) SP. (A)

(Plate I, Fig. 4)

Specimen 37 mm. in length along the median line of the specimen. Ventral side apparently nearly flat, and hence the specimen is assumed to be a *Gonioceras*, rather than a *Lambeoceras*. In this length of 37 mm. there are five camerae. The sutures of the septa curve strongly downward both ventrally and dorsally, but only the ventral side of the specimen is preserved fairly well. Since the lateral parts of the conch are not preserved, it cannot be determined whether the sutures here

recurved strongly, as in *Gonioceras*, or only moderately, as in *Lambeoceras*. In a dorso-ventral direction the septa are nearly horizontal along the median part of the conch, but slope distinctly downward from the ventral toward the dorsal side along the more lateral parts of the specimen. The siphuncle is faintly indicated along the septum at the base of the specimen, and here is located about as close to the ventral wall as in *Lambeoceras*.

Locality and Horizon. — Putnam Highland, Baffin Island; in strata corresponding to the Red River formation in southern Manitoba.

Specimen No. 10289 in the Museum of Paleontology, University of Michigan.

Remarks. — Not enough of the specimen remains to determine whether is it a *Gonioceras* or a *Lambeoceras*. It is characterized by the slightly angular concavity of the sutures of its septa along the median part of the ventral side of the conch.

12. GONIOCERAS (?) SP. (B)

(Plate V, Fig. 4)

Specimen 57 mm. in length along the median part of its ventral side, which is the only part preserved. This ventral part is nearly flat, suggesting the reference of the specimen to *Gonioceras*, rather than to *Lambeoceras*. Unfortunately, the lateral parts of this ventral side are not preserved, so that it is not possible to determine whether the lateral extensions of the sutures of the septa are strongly reversed in curvature, as in typical *Gonioceras*, or are only moderately reversed and for only a short distance, as in *Lambeoceras*. Ten camerae occupy a length of 52 mm. along the median line of the ventral side. The sutures of the septa curve downward distinctly, evidently producing lobes both on the ventral and dorsal sides of the flattened conch. To judge from that part of the conch preserved, the original width of these lobes was at least 65 mm., but may have been considerably greater. The siphuncle is obscurely indicated along the ventral side of the specimen, apparently

almost in contact with the latter, but nothing definite is known about its segments.

Locality and Horizon. — Putnam Highland, Baffin Island; in strata corresponding to the Red River formation of southern Manitoba.

Specimen No. 10264 in the Museum of Paleontology, University of Michigan.

Remarks. — Not enough of the specimen remains to determine whether it is a *Gonioceras* or a *Lambeoceras*. Compared with the preceding specimen (*A*), the camerae appear to be relatively more numerous.

WESTONOCERAS Foerste

Westonoceras Foerste, Journ. Sci. Lab. Denison Univ., 20, p. 253 (1924).

Genotype: *Cyrtoceras manitobense* Whiteaves.

Conch faintly concave along the dorsal outline, but more or less distinctly convex along the upper part of the phragmacone and the lower part of the living chamber, becoming faintly concave again toward the aperture. Ventral outline convex along its entire length, its maximum convexity being located five or six camerae beneath the base of the living chamber. Cross-section laterally compressed, especially at the point of the maximum diameter of the conch. From this point the cross-section of the conch contracts along the upper part of the phragmacone and along the entire living chamber. The sutures of the septa curve distinctly downward laterally in the genotype. The siphuncle is located near the ventral side of the conch but is not in contact with the latter. The inner margins of the septa, at the passage of the siphuncle through these septa, do not curve downward into septal necks, but end abruptly. The intervening connecting rings are in contact with the septa, both above and beneath. These connecting rings are conspicuously larger in diameter than the passages of the siphuncle through the septa, but their lateral vertical outlines are only moderately convex.

The two species from western Baffin Land, here described

under *Westonoceras*, differ from the genotype in having the sutures of the septa nearly straight, except along the upper part of the ventral outline of their phragmacones, where these sutures curve strongly upward.

13. WESTONOCERAS MANITOBENSE (Whiteaves)

(Plate V, Fig. 1; Plate XI, Fig. 5)

Cyrtoceras manitobense Whiteaves, Trans. Royal Soc. Canada, 7, sec. 4, p. 80, pl. 13, figs. 3, 4, 5; pl. 15, fig. 4 (1890).

Type specimen. — Specimen 127 mm. long, obliquely depressed dorso-laterally, so that the dorsal and left lateral sides of the conch are exposed equally well. In general, the dorsal outline of the conch is slightly convex, the upper part of the phragmacone, for a length of 65 mm., being almost straight. The ventral outline is much more strongly convex; the maximum convexity is somewhere between 30 and 40 mm. beneath the top of the phragmacone, where there is a tendency toward angularity. Owing to the oblique depression of the conch, it is not possible to determine exactly the length of the dorso-ventral diameters of the conch, but it is estimated that between eight and nine camerae occupied a length equal to the dorso-ventral diameter along the upper part of the phragmacone, a similar number occurring at its lower end. The sutures of the septa curve distinctly downward laterally, even at the lower end of the specimen, where its dorso-ventral diameter is only 13 mm. Along the lower part of the specimen the ventral saddles are on the same level as the dorsal ones. Along the upper part of the phragmacone, however, the ventral saddles attain a distinctly higher elevation. The dorsal saddles are broadly rounded; the ventral ones, on the contrary, are distinctly angular, at least at the base of the specimen. The center of the siphuncle is 3.5 mm. from the ventral wall of the conch, where its dorso-ventral diameter is 13 mm. The diameter of the siphuncle here is 3 mm., and its distance from the ventral wall is 2 mm. The segments of the siphuncle are oblong in outline, their vertical outlines being straight, except in the immediate vicinity of the septa, where

they curve abruptly inward. The concavity of the septa is relatively slight, and their inner margins, at the passage of the siphuncle, end abruptly, without any downward deflection forming a neck. This passage of the siphuncle through the septum is about 1 mm. in diameter where the diameter of the siphuncle is 3 mm.

The specimen is a cast of the interior of the conch, and the surface of this cast is ornamented by low, broad, vertical ribs, separated by narrow grooves, numbering about forty within the circumference of the conch at mid-height of the phragmacone. These vertical ribs are very distinct along the lower part of the phragmacone, but disappear farther up.

The maximum dorso-ventral diameter of the conch is about six or seven camerae beneath the base of the living chamber. From this point the conch narrows both dorso-ventrally and laterally as far as the aperture. This aperture slopes moderately downward from the ventral toward the dorsal side of the conch, without any indication of a hyponomic sinus, as far as known. The cast of the interior of the living chamber is transversely striated, the coarser markings numbering about five in a length of 5 mm., and the finer ones numbering about five in a length of 2 mm. In addition there appear to be distinct vertical striae, numbering about eight in a width of five mm. Some of these vertical marks appear like file-marks, so that the presence of these marks upon the specimen in its original state is in doubt.

Locality and Horizon. — Big Island, in Lake Winnipeg, in southern Manitoba; from the Lower Mottled or Dog Head limestone, beneath the Cat Head limestone of Dowling's Report;[4] in the Red River formation.

Specimen No. 1879 in the Victoria Memorial Museum, Ottawa, Canada.

[4] Dowling, D. B. "Report on the Geology of the West Shore and Islands of Lake Winnipeg," *Geological Survey of Canada, Annual Report*, Vol. XI, part F, p. 53 (1900).

14. WESTONOCERAS PUTNAMI, sp. nov.

(Plate V, Fig. 3; Plate XI, Figs. 3 A, B)

Specimen 105 mm. long, relatively straight along its dorsal outline, as far as preserved, moderately humped ventrally, the maximum elevation of the hump being at the fifth or sixth camera beneath the living chamber. Above and below this hump, the ventral outline of the conch appears to be only slightly convex, or nearly straight. The conch enlarges dorso-ventrally from a diameter of 11 mm. at its base to 32 mm. at the hump, and then narrows to about 27 mm. at the base of the living chamber, and to 22 mm. at the top of this chamber, as far as preserved. It is assumed that in its original state the specimen was moderately compressed laterally, but at present it is compressed obliquely by pressure, thus giving the conch a wider aspect dorsally than it probably had originally. At the level of the hump on its ventral side, the lateral diameter of the conch originally may have been approximately 28 mm. Along the lower half of the phragmacone the sutures of the septa are straight along their entire course around the conch; but, beginning at about the ninth suture beneath the living chamber, the sutures rise increasingly on approaching the median part of the ventral side of the conch, forming saddles about 5 mm. in height along the upper four or five sutures. No downward curvature of the sutures is present along the median part of their downward course. The sutures are at right angles to the vertical dorsal outline of the conch along the upper half of the phragmacone, but slope increasingly downward in a ventrad direction on approaching the lower end of the specimen.

At the lower end of the specimen, where its diameter is estimated at 13 mm., the diameter of the siphuncle is 3.5 mm. The concavity of the septa, at least in a lateral direction, is relatively small. The inner margin of these septa is not curved downward into a septal neck at the passage of the siphuncle through the septa. This passage is 1.5 mm. in diameter where the diameter of the segment of the siphuncle is 3.5 mm. A vertical section through the lower part of the siphuncle in a ventro-

lateral direction suggests that the ventral outline of its segments was almost straight, while its dorsal vertical outline appears to have been straight along the lower part of each segment, but moderately curved inward along the upper two fifths of each segment. No actinoceroid deposits occur within this siphuncle. The distance of the siphuncle from the ventral wall of the conch cannot be determined with exactness, but it is estimated at about 1 mm.

The upper part of the conch narrows from the hump on its ventral side as far as the aperture. This aperture is not preserved well enough to establish its characteristics, but it appears to have been similar to that of *Westonoceras manitobense*.

Locality and Horizon. — Putnam Highland, Baffin Island; in strata corresponding to the Red River formation in southern Manitoba.

Specimen No. 10273 in the Museum of Paleontology, University of Michigan.

Remarks. — This species is distinct from typical *Westonoceras manitobense* in the absence of distinct lateral lobes or downward curvatures along the sutures of its septa. The structure of its siphuncle appears to be similar.

15. WESTONOCERAS GOULDI, sp. nov.

(Plate V, Fig. 2; Plate XI, Figs. 1 A, B, C)

Specimen 120 mm. long, nearly straight along its dorsal outline, but conspicuously humped along its ventral side, the maximum convexity of this hump being five camerae beneath the base of the living chamber. Above and below this hump the ventral vertical outline of the conch is nearly straight. At the base of the specimen its dorso-ventral diameter is 22 mm., and its lateral one is 21.5 mm. At the level of the ventral hump mentioned above the corresponding diameters are 56 mm. and 43 mm., but the original lateral diameter here may have been a little greater. At the base of the living chamber these diameters are 49 and 38 mm. At the top of the specimen, about 34 mm. above the base of the living chamber, they are 38 mm. and 32

mm. Along the lower part of the specimen, below the level of the ventral hump, eleven camerae occur in a length equal to the dorso-ventral diameter of the conch at the top of the series counted. Along the lower half of the phragmacone the sutures of the septa are straight, but along the upper half of the specimen they rise distinctly along the ventral side of the specimen, forming conspicuous ventral saddles which, in some specimens, rise fully 5 mm. above the remaining portion of the same sutures laterally and dorsally. Along the median part of the dorsal side of the phragmacone, the upper five or six sutures curve narrowly downward, the upper two or three lobes having a depth of nearly 3 mm. The fifth suture below the living chamber is at right angles to the dorsal outline of the conch. Below this level the sutures slope increasingly downward in a ventral direction. Above this level, they rise slightly until close to the ventral saddles, where they curve strongly upward. At the base of the specimen, the concavity of the septa is slight.

At the base of the specimen, where its dorso-ventral diameter is 22 mm., the center of the siphuncle is 6 mm. from the ventral wall of the conch. The passage of the siphuncle through the basal septum here is 2.5 mm. in diameter. The lunular deposit of calcareous material embracing the inner margin of this lowest septum, at the passage of the siphuncle, is 5 mm. in diameter. The total diameter of the segments probably was at least 6.5 mm., but the connecting rings forming these segments no longer are preserved.

The specimen is a cast of the interior of the conch, and along the phragmacone the surface of this cast is marked by low, broad, vertical ribs, separated by narrow grooves. Ten of these ribs occupy a width of 27 mm. at the tenth camera above the base of the specimen. Evidently, the upper part of the living chamber is not preserved.

Locality and Horizon. — Putnam Highland, Baffin Island; in strata corresponding to the Red River formation of southern Manitoba.

Specimen No. 10263 in the Museum of Paleontology, University of Michigan.

Remarks. — This specimen evidently is related generically to *Westonoceras putnami,* from the same locality and horizon. It has the same straight course of the sutures of the septa dorsally and laterally, changing to an upward curvature ventrally, especially along the upper part of the phragmacone. In this respect both species differ conspicuously from typical *Westonoceras,* in which the sutures curve distinctly downward laterally.

16. WESTONOCERAS cf. GOULDI Foerste

(Plate I, Figs. 3 A, B; Plate XI, Figs. 2 A, B)

The specimen consists of seven camerae from the lower part of a phragmacone, their total length being 25 mm. The dorso-ventral diameter of the specimen enlarges from 22 mm. at its base to 35 mm. at its top. The corresponding lateral diameters are 21 mm. and 33 mm. The number of camerae in a length equal to the dorso-ventral diameter at the top of the series counted is nine. The sutures of the septa curve slightly downward laterally, the low ventral saddles being slightly angulated, while the median part of the much broader dorsal saddles is slightly curved downward into a faint lobe. The distance of the center of the siphuncle from the ventral wall of the conch varies from nearly 7 mm. at the base of the specimen to 10 mm. at its top. The corresponding diameters of the siphuncle vary from 6 mm. to 8 mm., and the corresponding diameters of the passages of the siphuncle through the septa vary from 2.8 mm. to slightly over 3 mm. The vertical outlines of segments of the siphuncle are slightly convex, the convexity increasing in the immediate vicinity of the septa. The inner margin of the septa at the passage of the siphuncle is not curved downward into a septal neck, but ends abruptly without any change in the slight general concavity of the septa. This inner margin of the septa is embraced by whitish calcareous deposits which, in vertical sections, appear lunulate, but depressed in a vertical direction. At the base of the specimen these lunulate deposits close the passage of the siphuncle centrally, but at its top they leave a passage 3 mm. in diameter.

The specimen is a cast of the interior of the conch. The surface of this cast is marked by fifty-five to sixty vertical, low, broad ribs, separated by narrow grooves, which are better defined laterally than along the median part of its ventral and dorsal sides.

Locality and Horizon. — Putnam Highland, Baffin Island; in strata corresponding to the Red River formation of southern Manitoba.

Specimen No. 10270 in the Museum of Paleontology, University of Michigan.

Remarks. — This specimen is assumed to be a fragment of a specimen of *Westonoceras gouldi.* In favor of such an interpretation are the rate of enlargement of the specimen, the location of its siphuncle, and the character of the vertical ribbing on its surface. The size of the passage of the siphuncle through the septa corresponds, and apparently the size of the segments of the siphuncle was similar. It differs from the type of *Westonoceras gouldi,* however, in the distinct, though slight, downward curvature of the sutures of its septa laterally. In this respect it resembles *Westonoceras manitobense,* in which the sutures of the septa curve much more strongly downward.

WINNIPEGOCERAS, gen. nov.

Genotype: *Cyrtoceras laticurvatum* Whiteaves, Geol. Surv. Canada, Pal. Foss., 3, pt. 3, p. 224, text fig. 14 (1897).

Conch strongly curved in a lengthwise direction, with the ventral side convex and the dorsal side strongly concave, differing in this respect from *Westonoceras,* in which the lengthwise curvature is relatively small, the dorsal outline being slightly gibbous along the upper part of the phragmacone and the lower part of the living chamber. In *Winnipegoceras* the conch is humped along the upper part of its ventral outline at a point five or six camerae below the base of the living chamber, and this chamber is long and attenuated toward the aperture, as in the genus named. Although the vertical dorso-ventral section through the genotype passes directly through the center of the

siphuncle for most of its length, the details of structure of this siphuncle still remain vague.

17. WINNIPEGOCERAS LATICURVATUM (Whiteaves)

(Plate IX, Figs. 1, 2)

Cyrtoceras laticurvatum Whiteaves, Geol. Surv. Canada, Pal. Foss., 3, pt. 3, p. 224, text fig. 14 (1897).

Type. — Specimen (Plate IX, Fig. 1) 330 mm. long, measured along its convex ventral outline. The convexity of this outline increases moderately from the smaller end of the specimen toward the upper part of the phragmacone, reaching a maximum at 50 mm. beneath the base of the living chamber. This chamber is 70 mm. long and is relatively straight. The dorso-ventral diameter of the conch increases from 20 mm. at a point 15 mm. above the base of the specimen to 55 mm. at a point 50 mm. beneath the base of the living chamber. At the base of this chamber the diameter is estimated at 45 mm., and near the aperture it diminishes to 36 mm. Where the dorso-ventral diameter of the conch is 55 mm., its lateral diameter is estimated at 38 mm. The sutures of the septa curve strongly downward laterally. The concavity of the septa is correspondingly great in a dorso-ventral direction, but is relatively smaller at right angles to this direction. The siphuncle is near the convex outline of the conch, but not in contact with the ventral wall. Where the dorso-ventral diameter of the conch is 50 mm., the corresponding diameter of the siphuncle is 8 mm., and its distance from the ventral wall of the conch is slightly over 2 mm. Owing to the strong concavity of the septa, the upper and lower faces of the segments of the siphuncle are correspondingly oblique. Along the lower half of the phragmacone, the vertical outlines of the segments are distinctly convex, and their general form is nummuloidal. Along the upper half of the phragmacone, the vertical outlines are less convex, the segments are relatively taller, and their general form is more oblong. In both parts of the phragmacone, the ventral outlines of the segments project in a ventral direction beyond the corresponding outlines of the

segments beneath, in a scalariform manner. The structure of the siphuncle is not clear. In some parts of the siphuncle the segments appear to be in contact with the septa both above and below, at least along the ventral side of the base and the dorsal side of the top of the segments. In those cases where a constriction of the siphuncle appears to intervene between the septa and the adjacent part of the segments of the siphuncle, this constriction is located on the ventral side of the top and on the dorsal side of the base of the segments. In no part of the specimen, however, has any septum been observed to curve downward into a septal neck.

Locality and Horizon. — Little Black Island, Swampy Harbor, Lake Winnipeg, in southern Manitoba; in the Lower Mottled limestone of Dowling's *Report on the Geology of the West Shore and Islands of Lake Winnipeg* (1900), here called the basal or Dog Head member of the Red River formation.

Specimen No. 7148 in the Victoria Memorial Museum, Ottawa, Canada.

In another specimen, from the same horizon and locality, the surface of the cast of the interior of the conch is marked longitudinally by low ribs, separated by narrow grooves, eight ribs occupying a width of 28 mm. where the dorso-ventral diameter of the conch is 40 mm. Specimen No. 7148a in the Victoria Memorial Museum.

A third specimen (Plate IX, Fig. 2) was found at the Point off Moose Creek, on Lake Winnipeg. It is of the same size as the type specimen and preserves almost as great a length of the phragmacone. Its most striking feature, however, is the living chamber, which is 100 mm. in length, and almost straight, except at the top where it curves slightly in a dorsal direction. At its base the dorso-ventral diameter of the chamber is 36 mm., narrowing to 33 mm. at the aperture. At the fourteenth septum beneath the living chamber the suture of this septum curves 3 mm. downward laterally; at the third septum this downward curvature equals 8 mm. At the largest dorso-ventral diameter, five camerae occur within a length equal to this diameter, when counted along the ventral outline. Along the lower part of the

phragmacone seven camerae occur within a corresponding length. Specimen No. 7153, Victoria Memorial Museum, Ottawa, Canada. From the Lower Mottled or Dog Head limestone.

18. WINNIPEGOCERAS DOWLINGI, sp. nov.

(Plate VIII, Fig. 1)

Conch attaining a dorso-ventral diameter of 65 mm. at the hump along the convex ventral outline of the conch. Apparently not fully mature, since the uppermost camera is not conspicuously shorter than those directly beneath. It is assumed that at later stages of growth the living chamber was elongated and relatively narrow, as in the genotype *Winnipegoceras laticurvatum* (Whiteaves), and that at gerontic stages of growth the base of the living chamber was 25 to 30 mm. above the base as exhibited in the specimen here described. Of course, there is a possibility of a difference of size, within the same species, corresponding to sex, but of that nothing is known at present.

Locality and Horizon. — Little Tamarack Island, in Lake Winnipeg; in the Lower Mottled or Dog Head member of the Red River formation.

Specimen No. 7152 in the Victoria Memorial Museum, Ottawa, Ontario, Canada.

CYRTOGOMPHOCERAS Foerste

Cyrtogomphoceras Foerste, Journ. Sci. Lab. Denison Univ., 20, p. 267 (1924).

Genotype: *Oncoceras magnum* Whiteaves, Royal Soc. Canada, Trans. 7, iv, p. 79, pl. 15, fig. 1 (1890).

Conch distinctly curved lengthwise, endogastric, and compressed laterally. The dorsal outline is conspicuously convex; the ventral outline is concave along the lower part of the phragmacone and along the upper part of the living chamber, but is more or less distinctly convex along the upper part of the phragmacone and the lower part of the living chamber. The sutures of the septa are nearly straight or curve slightly downward laterally. Along the lower part of the specimen they are

nearly directly transverse to the curving vertical axis of the conch, but toward the top of the phragmacone these sutures rise at an increasing angle from the ventral toward the dorsal side of the conch. The aperture of the living chamber has a corresponding obliquity, and this chamber narrows conspicuously toward the aperture. The siphuncle is relatively large; it is located near the ventral wall of the conch, and its segments are strongly nummuloidal.

19. CYRTOGOMPHOCERAS MAGNUM (Whiteaves)

(Plate VI, Fig. 1)

Oncoceras magnum Whiteaves, Trans. Royal Soc. Canada, 7, sec. 4, p. 79, pl. 15, fig. 1 (1890).

Specimen 187 mm. long. Its ventral side is moderately concave along the lower part of the phragmacone, but is distinctly gibbous for a length of 75 mm. along the upper part of the phragmacone and the lower part of the living chamber. At a point 43 mm. above the ventral margin of the base of the living chamber this ventral outline becomes concave again, as far as the aperture. The amount of the gibbosity equals 4 mm. The dorsal outline of the conch is much more strongly convex. Directly opposite the ventral margin of the base of the living chamber the radius of convex curvature of this vertical dorsal outline is 80 mm., changing to 180 mm. along the lower part of the phragmacone, and to 140 mm. along the top of the phragmacone and the entire length of the living chamber. The dorso-ventral diameter enlarges from 52 mm. at the base of the specimen to 106 mm. at the fourth camera beneath the dorsal margin of the base of the living chamber, and then decreases to 65 mm. at the aperture. Nine camerae occupy a length equal to the maximum dorso-ventral diameter of the conch, when measured along its dorsal outline, immediately beneath this diameter. The sutures of the septa are relatively straight. The ninth septum beneath the living chamber has a suture almost at right angles with the general vertical outline of the ventral side of the conch.

Below this level the sutures slope increasingly downward in a dorsal direction, the lowest septum at an angle of about 65 degrees with this outline. Above this level, the sutures rise at an increasing angle, until the suture at the base of the living chamber forms an angle of about 60 degrees in the opposite direction. Along the median part of the ventral side of the conch, the sutures tend to be angulate. In addition there is a slight tendency toward an upward deflection of the suture at the base of the living chamber at points about 22 mm. on each side of the median line of the conch. This results in an apparent downward curvature of the median part of the suture for a total width of 44 mm., but this downward deflection is slight. The margin of the aperture slopes downward in a ventral direction at about the same angle as the suture at the base of the specimen. The concave vertical outline along the upper part of the ventral side of the living chamber diminishes laterally and disappears along the dorsal side of the chamber. The attachment ring at the base of the living chamber is represented by a deep groove on the cast of the interior of the conch, varying from 5 to 7 mm. in height. The surface of this cast is marked also by low vertical ribs, especially along the upper part of the lateral sides of the phragmacone. Much fainter indications occur along the lower parts of the living chamber. The siphuncle is about 13 mm. in diameter at the base of the specimen, and apparently is within 1 mm. from the ventral wall of the conch. It is exposed relatively close to the ventral wall also half-way between the base and the top of the phragmacone.

Locality and Horizon. — East Selkirk, in southern Manitoba; in the Upper Mottled or Selkirk limestone, above the Cat Head limestone of Dowling's *Report on the Geology of the West Shore and Islands of Lake Winnipeg* (1900), where it forms the upper part of the Red River formation of southern Manitoba.

Specimen No. 1875 in the Victoria Memorial Museum, Ottawa, Ontario, Canada.

20. CYRTOGOMPHOCERAS WHITEAVESI (Miller)

(Plate VII, Figs. 1, 2, 3)

Oncoceras gibbosum Whiteaves (not Hall, 1847), Trans. Royal Soc. Canada, 7, sec. 4, p. 80, pl. 15, figs. 2, 3 (1890).

Oncoceras whiteavesi Miller, North Amer., Geol. Pal., 1st App., p. 697 (1892).

Type. — Specimen (Plate VII, Fig. 1) 102 mm. long, enlarging in a dorso-ventral direction from an estimated diameter of 32 mm. at the base of the specimen to 62 mm. at the base of the living chamber, and then diminishing to an estimated diameter of 31 mm. at the aperture of this chamber. The ventral vertical outline of the conch is distinctly gibbous for a length of 46 mm., the gibbosity equalling 5 mm. and extending about equal distances above and below the ventral margin of the base of the living chamber. Toward the aperture and along the lower part of the phragmacone this ventral outline is moderately, but distinctly, concave. The siphuncle, therefore, has an endogastric location, near, but not in contact with the ventral wall of the conch. The dorsal outline of the conch is strongly convex, having a radius of curvature of 60 mm. along the upper half of the phragmacone and along the living chamber. Along the lower part of the phragmacone this radius may have equalled 80 mm. About eight camerae occur in a length equal to the maximum diameter of the conch when counted immediately below this diameter along the dorsal outline of the conch. At the base of the specimen the sutures of the septa are almost directly transverse to the vertical ventral outline of the conch, but toward the top of the phragmacone these sutures rise at an increasing rate in a ventral direction, the uppermost septum forming an angle of about 60 degrees with the general ventral outline of the conch. The concavity of the septa is slight at the base of the specimen, but increases to 12 mm. at its top. The sutures of the septa are relatively straight. The three upper segments of the siphuncle are 15 mm. in diameter, the next lower segment has a diameter of 16 mm., and the two directly beneath measure 14 mm. The distance of these segments from the ventral wall

of the conch, in the same sequence, decreases from 4 to 1 mm. These segments appear strongly nummuloidal, being separated by constrictions at which the passage of the siphuncle through the septa is greatly narrowed. At the top of the siphuncle this constriction equals 8 mm. in diameter where the diameter of the segments of the siphuncle equals 15 mm. At the top of the siphuncle the septum appears to curve downward into a septal neck 1 mm. in length, the upper surface of the immediately underlying segment being that distance below the septum discussed. Elsewhere the septa appear to have sagged downward, until in contact with the top of the underlying segments.

The living chamber contracts strongly toward the aperture, laterally as well as dorso-ventrally. There is a faint concave depression in its vertical outlines about 10 mm. beneath the aperture. This aperture slopes downward in a ventral direction, apparently at about the same angle as the suture at the base of the living chamber. The annular ring at the base of this chamber is about 4 mm. in height, and is crossed by short, low, flat, vertical ribs, as in numerous other gomphoceroid cephalopods.

The shell of the conch is relatively thick, fully equalling 2 mm. on some parts of the conch. The shell is striated transversely, five raised lines occurring in a length of 5 mm. at a point 10 mm. above the base of the specimen, along its ventral side.

Locality and Horizon. — Pike Head, Lake Winnipeg, in southern Manitoba; in the Lower Mottled or Dog Head limestone, beneath the Cat Head limestone of Dowling's *Report on the Geology of the West Shore and Islands of Lake Winnipeg* (1900); in the Red River formation in southern Manitoba.

Specimen No. 1877, Victoria Memorial Museum, Ottawa, Canada.

Swampy Island specimen. — The specimen represented by figure 3 on plate 15 accompanying the original description of this species by Whiteaves is numbered 1882 in Victoria Memorial museum. Along the basal part of the specimen five transverse, low and broad, raised lines occur in a length of 7 mm.; farther up they becomes less numerous. Only the basal part of the specimen was figured.

Lower Moose Island specimen. — The transverse raised lines are shown much better by a specimen from Lower Moose Island, 90 mm. long, including the living chamber. Here the crests of six lines occur in a length of 5 mm. At a point 50 mm. above the base of the specimen six lines occupy a length of 9 mm. The margin of the aperture of the living chamber slopes strongly downward in a ventral direction, but there is no evidence of a hyponomic sinus, as supposed when studying the specimens of *Cyrtogomphoceras* found by Professors Savage and Van Tuyl in the area west of Hudson Bay. Specimen No. 7145 in the Victoria Memorial Museum, Ottawa, Canada. Plate VII, Fig. 3.

Black Island specimen. — A specimen preserving the natural dorsal and ventral outlines of the conch better than the type was found on Black Island, at Swampy Harbor, in Lake Winnipeg. It is represented by Figure 2 on Plate VII, and is numbered 7146 in the Victoria Memorial Museum, Ottawa, Canada.

21. CYRTOGOMPHOCERAS BAFFINENSE, sp. nov.

(Plate IV, Fig. 1; Plate XI, Fig. 4)

Specimen 115 mm. long. Its ventral side is relatively straight. From a point 27 mm. beneath the base of the living chamber to a point 28 mm. above this base the ventral vertical outline is slightly gibbous; this gibbosity does not exceed 3 mm. Above and below this gibbosity, the ventral outline is slightly concave. It is assumed that the lower part of the phragmacone, missing in the specimen at hand, was slightly concave along its length, so that the location of the siphuncle is endogastric. The dorsal side of the conch is conspicuously convex, the radius of curvature of its dorsal outline being 70 mm. On a level with the ventral margin of the base of the living chamber the dorso-ventral diameter of the conch is 65 mm., and the lateral one is about 50 mm. At the base of the specimen the corresponding diameters are estimated at 39 mm. and 30 mm.; and at the aperture of the living chamber they are approximately 41 mm. and 30 mm. Eight camerae occupy a length along the dorsal side of the conch equal to the dorso-ventral diameter of the latter, when

they are counted immediately below the level of the maximum dorso-ventral diameter of the conch. At the base of the specimen the sutures of the septa are almost directly transverse to the curving vertical axis of the conch. On approaching the base of the living chamber, however, the sutures rise at increasing rates from the ventral toward the dorsal side of the conch, the suture at the base of the living chamber rising at an angle of about 30 degrees with the horizontal plane. At the base of the specimen the sutures of the septa are nearly straight; but, at the top of the phragmacone the sutures curve downward about 5 mm., forming broad and shallow lateral lobes. The margin of the aperture appears to be approximately parallel to the base of the living chamber. The living chamber is constricted strongly from the base of the chamber to within 5 or 6 mm. from the margin of the aperture, above which the constriction is distinctly less, especially ventrally. This specimen is a cast of the interior of the conch, and the exterior of this cast is ribbed vertically, ten ribs occupying a width of 22 mm. ventro-laterally. The siphuncle is not exposed, but is assumed to be located near the relatively straight side of the conch, as in other species of *Cyrtogomphoceras.*

Locality and Horizon. — Putnam Highland, Baffin Island; in strata corresponding to the Red River formation of southern Manitoba.

Specimen No. 10262 in the Museum of Paleontology, University of Michigan.

Remarks. — This specimen differs from typical *Cyrtogomphoceras whiteavesi* (Miller) chiefly in the somewhat smaller curvature of its vertical dorsal outline, and in its moderately greater size. It evidently is closely related to the latter. From *Cyrtogomphoceras nutatum* Foerste and Savage it differs in the greater crowding of the camerae along the upper part of the ventral side of the phragmacone. Moreover, along the median part of this ventral side the sutures of the septa are relatively straight for a width of nearly 15 mm., with a tendency toward angulation on each side of this straightened part, a feature similar to that observed in some specimens of *Cyrtogomphoceras whiteavesi,* but not in *Cyrtogomphoceras nutatum.*

Second specimen. — A second specimen (Plate IV, Fig. 2; Plate XI, Fig. 6) of *Cyrtogomphoceras*, numbered 10278, consists of a fragment of the upper part of a phragmacone. Its siphuncle is 15 mm. in diameter, where that of the conch is 65 mm. The distance of this siphuncle from the ventral wall of the conch is 4 mm. The sutures of the septa do not rise as strongly dorsally as along the upper part of the phragmacone in the type of *Cyrtogomphoceras baffinense*.

22. CYRTOGOMPHOCERAS cf. TURGIDUM Troedsson

(Plate VII, Fig. 4)

Cyrtogomphoceras turgidum Troedsson, On the Middle and Upper Ordovician Faunas of Northern Greenland; I, Cephalopods, p. 97, pl. 2, fig. 2; pl. 57, figs. 1, 2; pl. 58, figs. 2–4.

Conch similar to *Cyrtogomphoceras whiteavesi* (Miller), but enlarging more rapidly at early stages of growth, and curving more strongly at the hump along the dorsal outline, and more distinctly concave along the ventral outline of the lower part of the phragmacone.

Locality and Horizon. — North end of Big Island, in Lake Winnipeg; in the lower part of the Lower Mottled or Dog Head member of the Red River formation.

Specimen No. 7144 in the Victoria Memorial Museum, Ottawa, Ontario, Canada.

23. CYRTOGOMPHOCERAS INTERMEDIUM (Whiteaves)

(Plate VIII, Fig. 2)

Oncoceras (*magnum* ? *var.*) *intermedium* Whiteaves, Palaeozoic Fossils, Geol. Surv. Canada, 3, pt. 3, pp. 221, 222, text fig. 13 (1897).

Specimen 200 mm. long, curved lengthwise. The ventral vertical outline is slightly concave, especially along the upper part of the specimen, where the radius of curvature of this outline is 275 mm., instead of 300 mm., as along the lower half of the specimen. The dorsal outline is conspicuously convex, the maximum curvature, with a radius of 120 mm., being at the

seventh camera beneath the dorsal side of the base of the living chamber. Above and below this point of maximum convexity the radius of curvature is nearer 200 mm. At the extreme top of the dorsal side of the specimen this outline becomes more convex again, but for how great a distance is unknown, since the aperture of the living chamber is not preserved. The dorso-ventral diameter of the conch increases from 37 mm. at the base of the specimen to 69 mm. at the maximum convexity of the dorsal outline; then it decreases to 56 mm. at the highest point at which this diameter can be measured, 40 mm. above the ventral part of the base of the living chamber. The lateral diameter, at the point of maximum diameter of the conch, is estimated at 60 mm., the specimen, in its present condition being sectioned vertically in a dorso-ventral direction. Along the larger part of the conch six camerae occur in a length equal to the dorso-ventral diameter of the conch, when the camerae are counted along the dorsal outline. Toward the lower part of the specimen this number increases to eight. The sutures of the septa are nearly straight. Compared with the slightly curved ventral outline of the conch, the sutures of the septa are nearly directly transverse at the base of the specimen, but rise at an increasing rate on approaching the upper part of the phragmacone. The septa are only moderately concave at the base of the specimen, but at the point of its maximum dorso-ventral diameter their concavity equals 16 mm. The largest segments of the siphuncle, between 28 and 29 mm. in diameter, are those between the fifth and ninth from the top of the phragmacone. Within these limits the dorso-ventral diameter of the conch varies from 60 mm. at the base to 67 mm. at the top of the series of segments under investigation. The maximum dorso-ventral diameter of the conch is at the third segment of the siphuncle; here the dorso-ventral diameter of the conch is 69 mm., while that of the siphuncle is only 26 mm. The second segment from the top has a diameter of 24.5 mm., and the topmost segment is still smaller. The thirteenth segment from the top of the phragmacone has a diameter of 17.5 mm., the dorso-ventral diameter of the conch here being approximately 50 mm. The segments of the siphuncle are

strongly nummuloidal. Where the diameter of the segments is between 28 and 29 mm., that of the septal necks is between 17 and 18 mm., so that the constrictions of the siphuncle at the septal necks equal about 5 mm. Most of the septal necks equal 1 mm. in height, or only slightly exceed this height. The septa are adnate to the lower face of the connecting rings, becoming free along the basal part of their convex exterior vertical outlines. This structure is seen most distinctly along the ventral side of the siphuncle, where the width of the septum intervening between the siphuncle and the nearest part of the wall of the conch is short; it is shown best by the unfigured half of the type here described. The same type of structure is shown also by the structure at the base of the seventh camera from the base of the specimen, and, to a less degree, also by that at the base of the eighth camera. This structure is obscured along the greater part of the length of the dorsal side of the siphuncle by the sagging of the soft deposit of matrix, filling the interior of the camerae, in a downward direction for a distance of about 1 mm., thus producing an appearance as though the septa had been in contact with the upper face of the underlying connecting rings of the siphuncle, instead of with the lower face of the overlying rings. The septa apparently consisted either of an extremely thin calcareous deposit, or it was more or less membranous and not sufficiently impregnated with calcareous material to crack into distinct fragments, rather than to sag.

Locality and Horizon. — Black Island, Lake Winnipeg, in southern Manitoba; from the Lower Mottled or Dog Head limestone, beneath the Cat Head limestone, of Dowling's *Report on the Geology of the West Shore and Islands of Lake Winnipeg* (1900); in the Red River formation of southern Manitoba.

Specimen No. 7143, Victoria Memorial Museum, Ottawa, Canada.

Remarks. — This specimen agrees with typical *Cyrtogomphoceras* in the nummulitic structure of its siphuncle and in the endogastric location of this siphuncle. It agrees also in the conch attaining its greatest diameter near the level of the top of the siphuncle, and tapering thence upward along the living

chamber. The sutures of the septa rise in a similar manner in a dorsal direction, the rate of rise increasing toward the top of the phragmacone. It differs, however, in its ventral outline, the latter being slightly concave along its entire length, instead of gibbous along the upper part of the phragmacone and the basal part of the living chamber. Moreover, there is a possibility of the aperture of this living chamber differing from that of typical *Cyrtogomphoceras*. In the specimen at hand, this living chamber appears to be more slender than in the genus named, and nothing is known of its aperture.

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PLATE I

FIG. 1. *Cyclendoceras sp.* (*A*). Ventral side of conch with annulations curving strongly downward ventrally; median parts weathered so as to expose the siphuncle, the entire width of the latter being indicated at the base of the specimen. Putnam Highland, in western Baffin Island. No. 10266, Mus. Paleontol., Univ. Michigan. See also Pl. X, Fig. 3.

FIG. 2. *Cyclendoceras sp.* (*B*). Ventral side of conch, with annulations curving slightly downward ventrally. Putnam Highland, in western Baffin Island. No. 10274, Mus. Paleontol., Univ. Michigan. See also Pl. X, Fig. 4.

FIG. 3. *Westonoceras cf. gouldi* Foerste. *A*, ventral side of conch, showing slight upward angulation of sutures of septa along median line; *B*, lateral view, with ventral outline on left. Putnam Highland, in western Baffin Island. No. 10270, Mus. Paleontol., Univ. Michigan. See also Pl. XI, Figs. 2 *A*, *B*.

FIG. 4. *Gonioceras sp.* (*A*). Ventral side, surface weathered. Putnam Highland, in western Baffin Island. No. 10289, Mus. Paleontol., Univ. Michigan.

FIG. 5. *Dowlingoceras gracile* (Whiteaves). Ventral side, part of specimen filed away so as to expose the siphuncle. Swampy Island, Lake Winnipeg. Figure copied from Royal Soc. Canada, Trans. 9, iv, pl. 11, fig. 4 a (1892). No. 1841, Victoria Memorial Museum. See also Pl. 3, Figs. 2 *A*, *B*.

PLATE I

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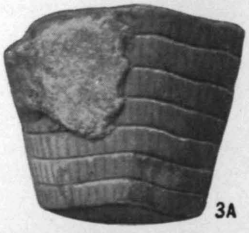

3A

3B

4

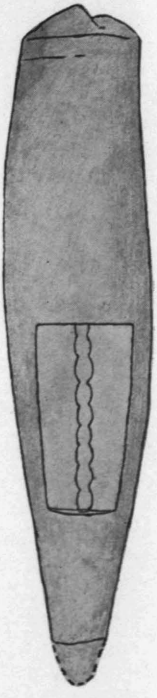

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PLATE II

All figures on this plate are reduced to nine tenths of their natural size.

FIG. 1. *Orthoceras sp.* Lateral view, showing distant sutures of septa. Putnam Highland, in western Baffin Island. No. 10261, Mus. Paleontol., Univ. Michigan. See also Pl. X, Fig. 5.

FIG. 2. *Endoceras sp.* (*B*). Lateral view, showing sutures of septa. Putnam Highland, in western Baffin Island. No. 10279, Mus. Paleontol., Univ. Michigan. See also Pl. X, Fig. 2.

FIG. 3. *Endoceras sp.* (*A*). Ventral view showing sutures of septa. Putnam Highland, in western Baffin Island. No. 10280, Mus. Paleontol., Univ. Michigan. See also Pl. X, Fig. 1.

PLATE II

PLATE III

FIG. 1. *Leurorthoceras baffinense* Foerste. Ventral side, showing downward curvature of sutures of septa. Putnam Highland, in western Baffin Island. No. 10283, Mus. Paleontol., Univ. Michigan. See also Pl. X, Figs. 6 *A*, *B*.

FIG. 2. *Dowlingoceras gracile* (Whiteaves). *A*, lateral view, with ventral outline on right, showing location of section exposing the siphuncle. *B*, cross-section showing location of siphuncle. Swampy Island, Lake Winnipeg. Figures copied from Royal Soc. Canada, Trans. 9, iv, pl. 11, figs. 4, 4b. See also Pl. I, Fig. 5.

PLATE III

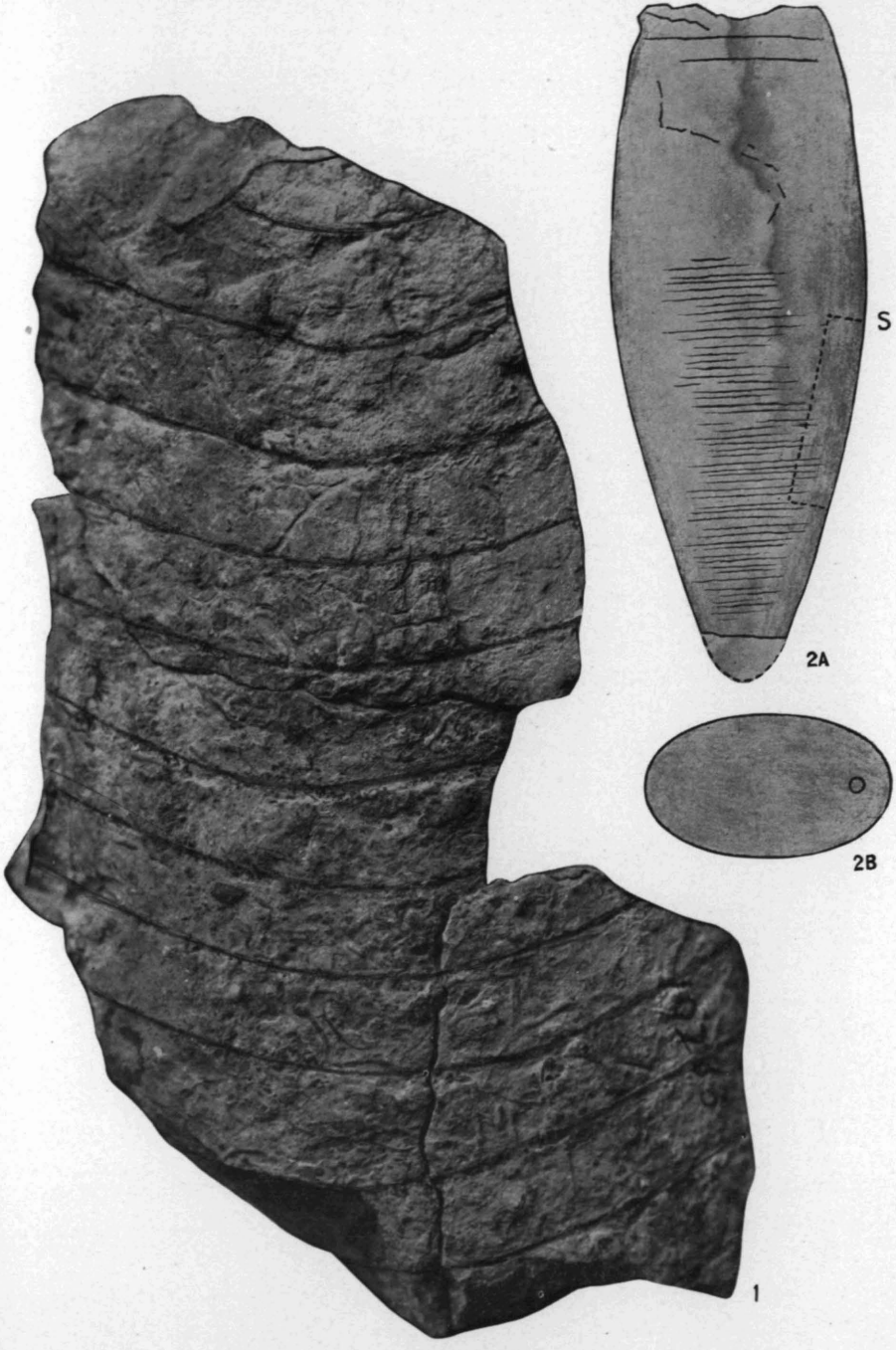

PLATE IV

FIG. 1. *Cyrtogomphoceras baffinense* Foerste. Lateral view, with ventral outline on right. Putnam Highland, in western Baffin Island. No. 10262, Mus. Paleontol., Univ. Michigan. See also Pl. XI, Fig. 4.

FIG. 2. *Cyrtogomphoceras cf. baffinense* Foerste. Lateral view, with ventral outline on right. Putnam Highland, in western Baffin Island. No. 10278, Mus. Paleontol., Univ. Michigan. See also Pl. XI, Fig. 6.

FIG. 3. *Ephippiorthoceras sp.* (*A*). Ventro-lateral view, showing ventral saddles and lateral lobes of sutures of septa. Putnam Highland, in western Baffin Island. No. 10272, Mus. Paleontol., Univ. Michigan. See also Pl. X, Fig. 7.

FIG. 4. *Ephippiorthoceras sp.* (*B*). Lateral view, with ventral outline on left. Putnam Highland, in western Baffin Island. No. 10275, Mus. Paleontol., Univ. Michigan. See also Pl. X, Fig. 8.

PLATE IV

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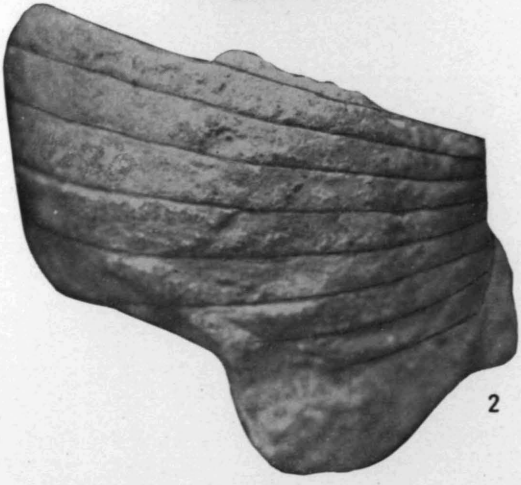

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PLATE V

FIG. 1. *Westonoceras manitobense* (Whiteaves). Dorso-lateral view, the conch being distorted by oblique lateral pressure during fossilization. Showing the dorsal side of the conch along the right half of the figure, and most of its lateral side along its left half. The median line of the dorsal side passes vertically about 10 mm. left of the most gibbous part of the right outline of the figure. The lateral lobes of the sutures of the septa are most conspicuous along the upper part of the phragmacone, but are distinct also near its base. Big Island, Lake Winnipeg, in southern Manitoba. No. 1879, Victoria Memorial Museum. See also Pl. XI, Fig. 5. Same specimen as Royal Soc. Canada, Trans., 7, iv, pl. 13, fig. 3 (1890).

FIG. 2. *Westonoceras gouldi* Foerste. Lateral view, with dorsal outline on left. Sutures of septa nearly straight, except along upper half of ventral side of phragmacone. Putnam Highland, in western Baffin Island. No. 10263, Mus. Paleontol., Univ. Michigan. See also Pl. XI, Figs. 1 *A*, *B*, *C*.

FIG. 3. *Westonoceras putnami* Foerste. Lateral view, with dorsal outline on right. Putnam Highland, in western Baffin Island. No. 10273, Mus. Paleontol., Univ. Michigan. See also Pl. XI, Figs. 3 *A*, *B*.

FIG. 4. *Gonioceras sp.* (*B*). Ventral side, strongly weathered. Putnam Highland, in western Baffin Island. No. 10264, Mus. Paleontol., Univ. Michigan.

PLATE V

PLATE VI

FIG. 1. *Cyrtogomphoceras magnum* (Whiteaves). Lateral view, with ventral outline on left. East Selkirk, in southern Manitoba. No. 1875, Victoria Memorial Museum. Same specimen as Royal Soc. Canada, Trans., 7, iv, pl. 15, fig. 1 (1890).

PLATE VI

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PLATE VII

FIG. 1. *Cyrtogomphoceras whiteavesi* (Miller). Vertical dorso-ventral section through type specimen, exposing the siphuncle, but passing through its center only along the upper three segments. Pike Head, in Lake Winnipeg. No. 1877, Victoria Memorial Museum. Same specimen as Royal Soc. Canada, Trans., 7, iv, pl. 15, fig. 2.

FIG. 2. *Cyrtogomphoceras whiteavesi* (Miller). Conch showing the typical ventral and dorsal outlines of this species. Black Island, Swampy Harbor, in Lake Winnipeg. No. 7146, Victoria Memorial Museum.

FIG. 3. *Cyrtogomphoceras whiteavesi* (Miller). Dorsal view of specimen which has been strongly depressed dorso-ventrally by pressure previous to fossilization; showing the transverse striae or bands. Lower Moose Island, in Lake Winnipeg. No. 7145, Victoria Memorial Museum.

FIG. 4. *Cyrtogomphoceras cf. turgidum* Troedsson. Lateral view, showing dorsal and ventral outlines. North end of Big Island, in Lake Winnipeg. No. 7144, Victoria Memorial Museum.

PLATE VII

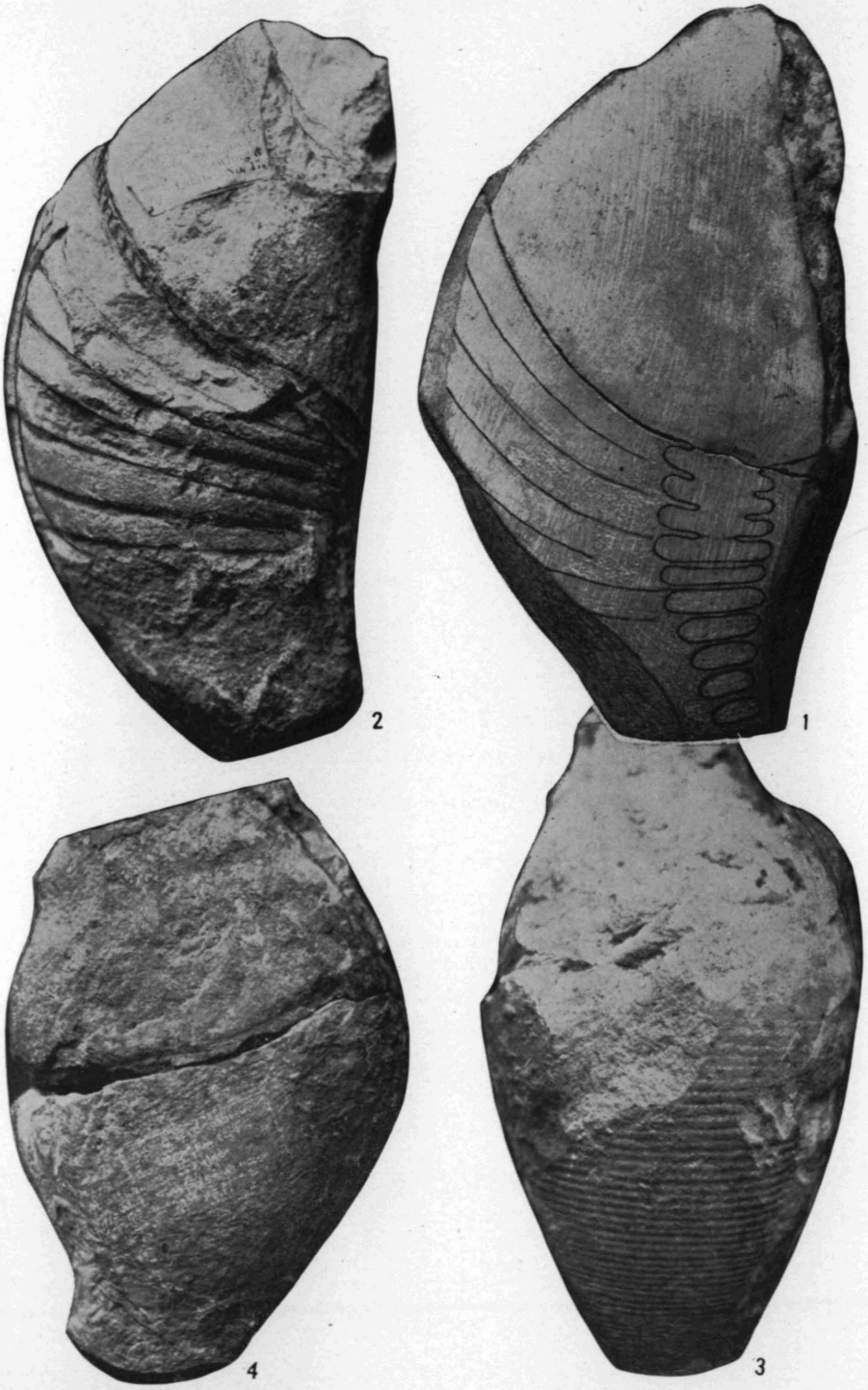


PLATE VIII

Both figures on this plate are reduced to four fifths of their natural size.

FIG. 1. *Winnipegoceras dowlingi* Foerste. Lateral view, with ventral outline on left. Little Tamarack Island, in Lake Winnipeg. No. 7152, Victoria Memorial Museum.

FIG. 2. *Cyrtogomphoceras intermedium* (Whiteaves). Dorso-ventral vertical section through the siphuncle, with ventral outline of conch on right. Black Island, in Lake Winnipeg. No. 7143, Victoria Memorial Museum. Same specimen as Geol. Surv. Canada, Pal. Foss., 3, pt. 3, p. 221, text fig. 13 (1897).

PLATE VIII

PLATE IX

Both figures on this plate are reduced to four fifths of their natural size.

FIG. 1. *Winnipegoceras laticurvatum* (Whiteaves). Dorso-ventral vertical section through siphuncle, with ventral outline on right. Little Black Island, in Lake Winnipeg. No. 7148, Victoria Memorial Museum. Same specimen as Geol. Surv. Canada, Pal. Foss., 3, pt. 3, p. 224, text fig. 14 (1897).

FIG. 2. *Winnipegoceras laticurvatum* (Whiteaves). Lateral view, weathered so as to show the sutures of the septa; omitting the apical part of the specimen, 50 mm. in length. Including this apical part, the lengthwise curvature of this specimen is closely similar to that of the type, represented by Fig. 1 on this plate. Point off Moose Creek, on west shore of Lake Winnipeg. No. 7153, Victoria Memorial Museum.

PLATE IX

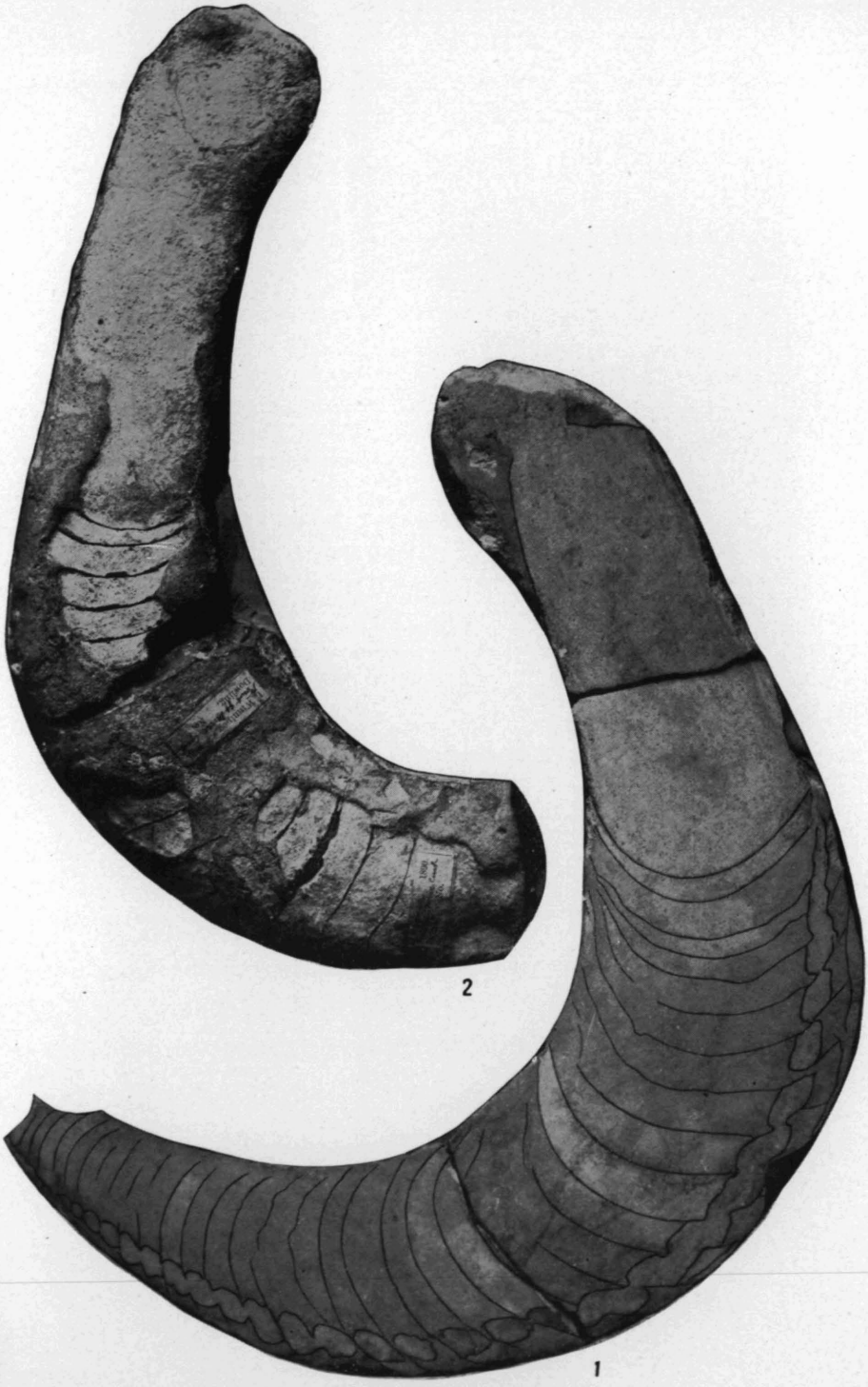


PLATE X

FIG. 1. *Endoceras sp.* (*A*). Cross-section, showing location of siphuncle. See also Pl. II, Fig. 3.

FIG. 2. *Endoceras sp.* (*B*). Cross-section, with an attempt to show the size and general location of the siphuncle. See also Pl. II, Fig. 2.

FIG. 3. *Cyclendoceras sp.* (*A*). Cross-section showing location of siphuncle. See also Pl. I, Fig. 1.

FIG. 4. *Cyclendoceras sp.* (*B*). Cross-section showing location of siphuncle. See also Pl. I, Fig. 2.

FIG. 5. *Orthoceras sp.* Cross-section, location of siphuncle unknown. See also Pl. II, Fig. 1.

FIG. 6. *Leurorthoceras baffinense* Foerste. *A*, dorso-ventral vertical section through the siphuncle, with the ventral outline of the conch on the left. *B*, cross-section of conch, showing location of siphuncle. See also Pl. III, Fig. 1.

FIG. 7. *Ephippiorthoceras sp.* (*A*). Cross-section, showing location of siphuncle. See also Pl. IV, Fig. 3.

FIG. 8. *Ephippiorthoceras sp.* (*B*). Cross-section showing location of siphuncle. See also Pl. IV, Fig. 4.

PLATE X

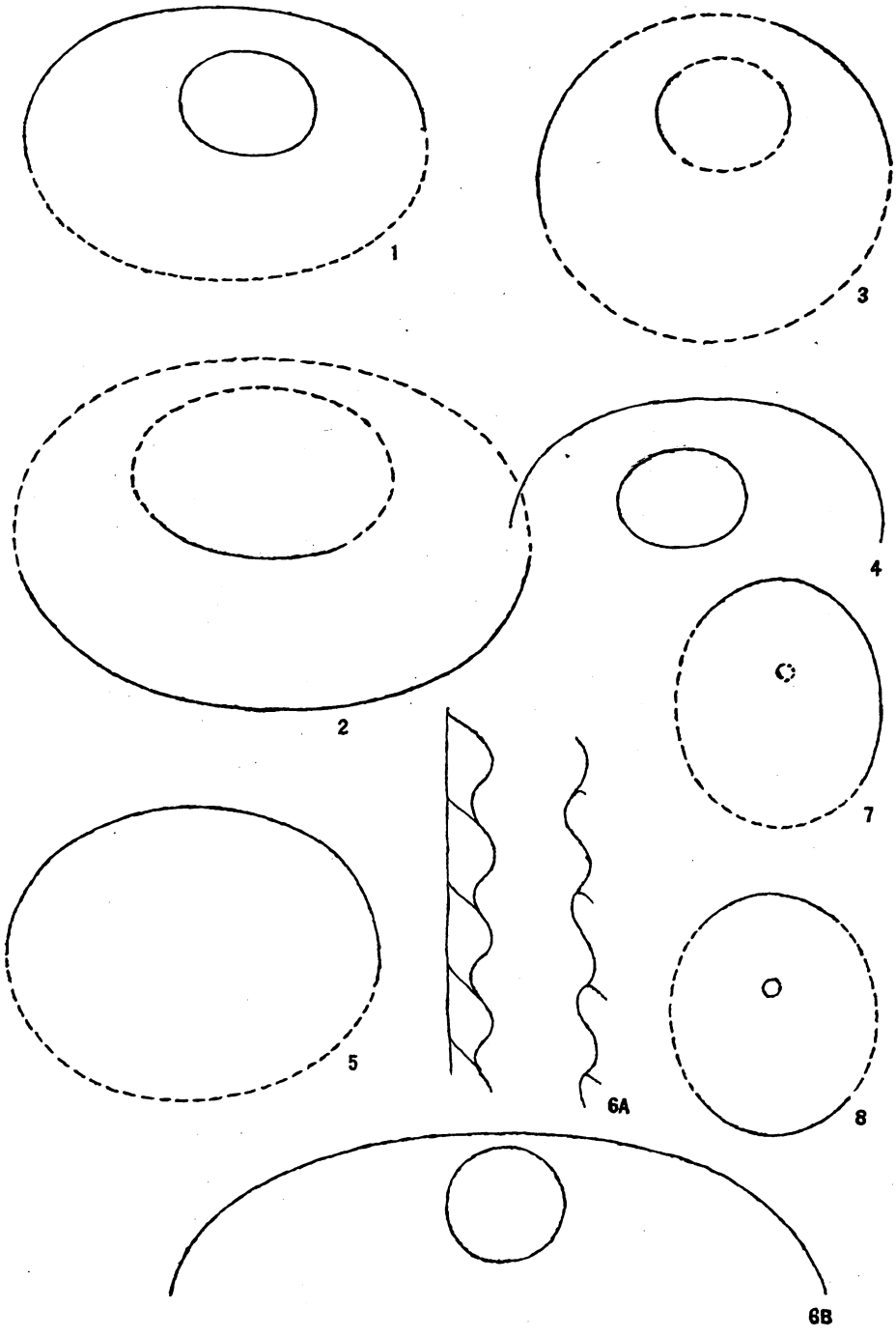


PLATE XI

FIG. 1. *Westonoceras gouldi* Foerste. *A*, cross-section at maximum diameter of conch; *B*, dorso-ventral vertical section at base of specimen, showing calcareous deposit embracing inner margin of septum at base of specimen, at passage of siphuncle; *C*, cross-section at base of specimen, showing location of siphuncle. See also Pl. V, Fig. 2.

FIG. 2. *Westonoceras cf. gouldi* Foerste. *A*, cross-section of specimen at its maximum diameter, showing location of siphuncle; *B*, dorso-ventral vertical section of basal part of specimen, magnified two diameters, showing siphuncle, and form of calcareous deposits embracing the inner margin of the septa at the passage of the siphuncle. See also Pl. I, Figs. 3 *A*, *B*.

FIG. 3. *Westonoceras putnami* Foerste. *A*, cross-section at maximum diameter of specimen; *B*, vertical section through specimen in a lateral direction, passing through center of siphuncle, but not through the center of the conch; figure magnified two diameters. See also Pl. V, Fig. 3.

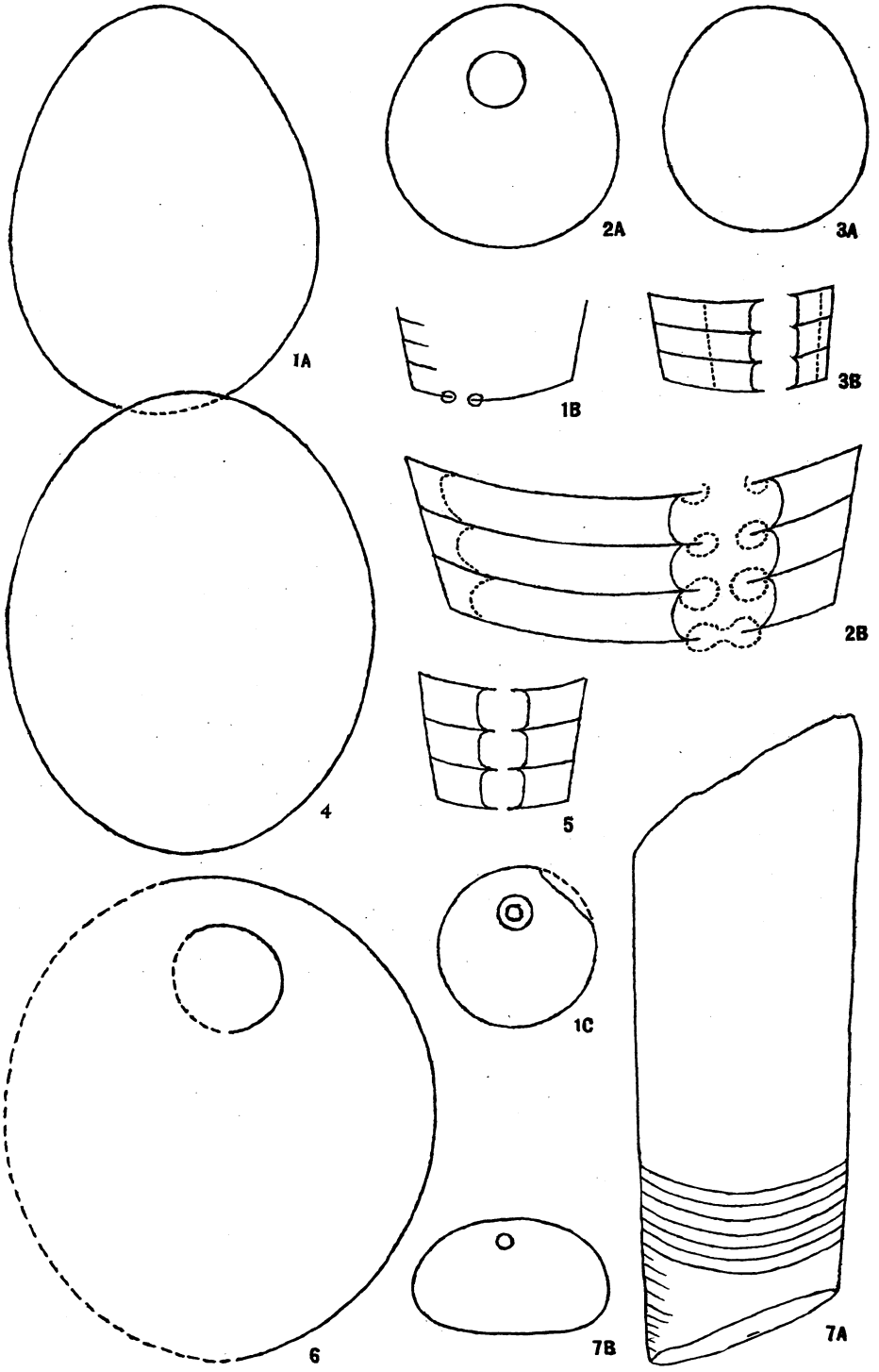
FIG. 4. *Cyrtogomphoceras baffinense* Foerste. Cross-section of conch at its maximum diameter. See also Pl. IV, Fig. 1.

FIG. 5. *Westonoceras manitobense* (Whiteaves). Vertical section through the center of the siphuncle in a lateral direction, but not through the center of the conch. Magnified two diameters. See also Pl. V, Fig. 1.

FIG. 6. *Cyrtogomphoceras cf. baffinense* Foerste. Cross-section at upper end of specimen, showing location of passage of siphuncle. See also Pl. IV, Fig. 2.

FIG. 7. *Garryoceras semiplanatum* (Whiteaves). *A*, dorsal view of conch; *B*, cross-section, showing location of siphuncle. Lower Fort Garry, in southern Manitoba. No. 1834, Victoria Memorial Museum. Copied from Royal Soc. Canada, Trans., 9, iv, pl. 8, figs. 3, 3a.

PLATE. XI



PART III

CORALS, BRACHIOPODS, GASTROPODS AND OSTRACODS FROM PUTNAM HIGHLAND

By RUSSELL C. HUSSEY

INTRODUCTION

THE specimens here described and figured were collected by Dr. L. M. Gould during the summer of 1927 while a member of the Putnam Baffin Island Expedition. This party explored and mapped parts of Baffin Land which were totally unknown, and during the course of these explorations Dr. Gould found an entirely new locality where fossils of Ordovician age are very abundant. Time was not available for making an extensive collection, but the material is exceptionally valuable for purposes of correlation, the Arctic Richmond horizon being clearly determined. This new locality is located on Putnam Highland.

Class ANTHOZOA

GENUS HALYSITES FISCHER

HALYSITES GRACILIS (Hall)

(Plate I, Fig. 4)

Several unusually well preserved specimens of this coral were found. There are two varieties of the species at the Putnam Highland locality, one in which the longer diameter of the corallites is about one-half millimeter, and another in which the diameter ranges from one to one and one-half millimeters. The shape of the corallites is typically quadrangular.

Horizon and Locality. — Richmond. Putnam Highland, Baffin Land. No. 10208, Museum of Paleontology, University of Michigan.

Class BRACHIOPODA

GENUS RHYNCHOTREMA HALL

RHYNCHOTREMA SP.

(Plate II, Figs. 1–3)

The specimen has been considerably weathered, but the general form can be determined. Outline broadly triangular. Brachial valve inflated, particularly towards the umbo. One slope of this valve shows five strong, rounded, plications; a sixth short one may have been present. Pedicle valve less inflated than the brachial. Sinus well-developed, deepening and widening towards the front, with three plications. One slope of the pedicle valve shows five strong, rounded, plications and traces of a sixth, which is the maximum number that could have been present. All traces of lamellose lines, which were probably present, have been removed by weathering. The general shape of this specimen and its association with *Halysites gracilis* suggest that it may be *Rhynchotrema perlamellosum.*

Horizon and Locality. — Richmond. Putnam Highland, Baffin Land. No. 10103, Museum of Paleontology, University of Michigan.

Class GASTROPODA

GENUS LOPHOSPIRA WHITFIELD

LOPHOSPIRA SP.

(Plate III, Figs. 3, 4)

Three volutions are preserved, the two upper ones being somewhat weathered. Lower volution tricarinate. Slope from the lower carina to the peripheral angle concave. Middle carina very prominent, angular. Upper carina removed about one half of the biconcave upper slope of the volution from the suture; the lower half of this slope is more strongly concave than the upper. No surface markings preserved.

Horizon and Locality. — Richmond. Putnam Highland, Baffin Land. No. 10211, Museum of Paleontology, University of Michigan.

Genus MACLURINA Ulrich and Scofield

MACLURINA CUNEATA (Whitfield)

(Plate II, Fig. 6; Plate III, Fig. 2; Plate IV, Fig. 2)

This species is distinguished from *Maclurina manitobensis*, found in the same beds, by the smaller umbilicus. The specimens are preserved as casts of the interior. A small fragment of the test, preserved on the inner side of an inner whorl in one individual, shows no traces of surface markings, being smooth.

Horizon and Locality. — Richmond. Putnam Highland, Baffin Land. No. 10215, Museum of Paleontology, University of Michigan.

MACLURINA MANITOBENSIS (Whiteaves)

(Plate III, Figs. 1, 5; Plate IV, Fig. 4)

This species is very common at the Putnam Highland locality where it reaches a diameter of eight inches. The specimens found are all casts of the interior. The general shape is very much like that of *Maclurina cuneata* from which it differs in having a larger umbilicus.

Horizon and Locality. — Richmond. Putnam Highland, Baffin Land. No. 10207, Museum of Paleontology, University of Michigan.

MACLURINA MANITOBENSIS (?) (Whiteaves)

(Plate II, Figs. 4, 8, 9; Plate IV, Fig. 3)

Only one specimen of this form is available for description. The shell is moderately large, and the oval outline is the result of distortion. About four and one-half volutions are preserved; these expand very rapidly after the second volution. The test is thick on the inside of the whorls. Whorls very flat on the base. Upper surface of whorls very steep, broadly convex. Umbilicus moderately large, deep, descending abruptly. The last whorl overlaps more than one half of the one below. Two patches of the test showing surface markings have been preserved; these markings consist of strong, rounded, revolving ridges about one millimeter wide, separated by rounded grooves.

Horizon and Locality. — Richmond. Putnam Highland, Baffin Land. No. 10214, Museum of Paleontology, University of Michigan.

Genus MACLURITES Lesueur

MACLURITES CRASSUS (Ulrich and Scofield)

(Plate I, Figs. 1, 2; Plate IV, Fig. 1)

Lower surface flat, the outer angle slightly obtuse. Inner whorls rounded. Umbilicus large, exposing a little more than one half of each of the inner whorls. Margin of umbilicus abruptly rounded to angular. Slopes of umbilicus abrupt, convex.

Horizon and Locality. — Richmond. Putnam Highland, Baffin Land. No. 10212, Museum of Paleontology, University of Michigan.

Genus TROCHONEMA Salter

TROCHONEMA SP. aff. UMBILICATUM (Hall)

(Plate II, Figs. 5, 7)

The general form of this species is like that of *Trochonema umbilicatum* or *Trochonema beachi*, although it is possibly a little lower-spired than either of these two. Peripheral band nearly vertical, flat. Above the peripheral band is a gently concave slope leading up to the shoulder-like space bordering the suture; the outer margin of this space is elevated a little above the suture.

Horizon and Locality. — Richmond. Putnam Highland, Baffin Land. No. 10210, Museum of Paleontology, University of Michigan.

Class EUCRUSTACEA

Genus LEPERDITIA Rouault

LEPERDITIA SP.

(Plate I, Fig. 3)

A single right valve was found. Outline somewhat oval. Valve strongly convex, greatest convexity about the middle.

Posterior end broadly rounded, shell narrowing a little anteriorly. Hinge-line straight. Eye spot relatively large, showing as a dark, pigmented area in the antero-dorsal fourth. Differs from *Leperditia fabulites* in being shorter, and in having the greatest height of the shell somewhat nearer the middle line. Resembles *Leperditia alta* in general outline.

Horizon and Locality. — Horizon uncertain. Found several miles north of Putnam Highland, Baffin Land. No. 10201, Museum of Paleontology, University of Michigan.

Faunal list of invertebrates, other than cephalopods, from Putnam Highland, Baffin Land.

Receptaculites sp.
Streptelasma corniculum Hall
Halysites gracilis (Hall)
Rhynchotrema sp.
Lophospira sp.
Maclurina cuneata (Whitfield)
Maclurina manitobensis (Whiteaves)
Maclurina sp.
Maclurites crassus (Ulrich and Scofield)
Trochonema sp.
Fusispira aff. nobilis Ulrich and Scofield
Leperditia sp.
Illaenus sp.

EXPLANATION OF PLATE I

FIGURES

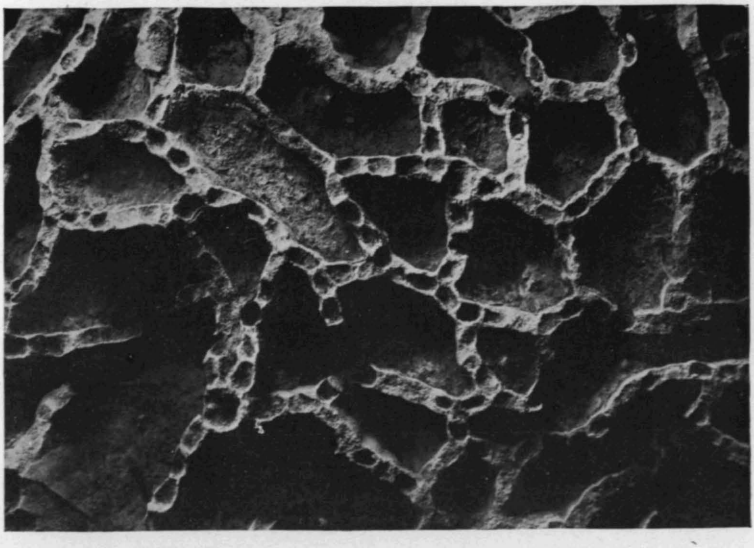
1–2. *Maclurites* crassus (Ulrich and Scofield)
1. View of the flat side
2. View showing the umbilicus
3. *Leperditia sp.* Right valve. × 2
4. *Halysites gracilis* Fischer. × 2

PLATE I

1

2

3



4

EXPLANATION OF PLATE II

FIGURES

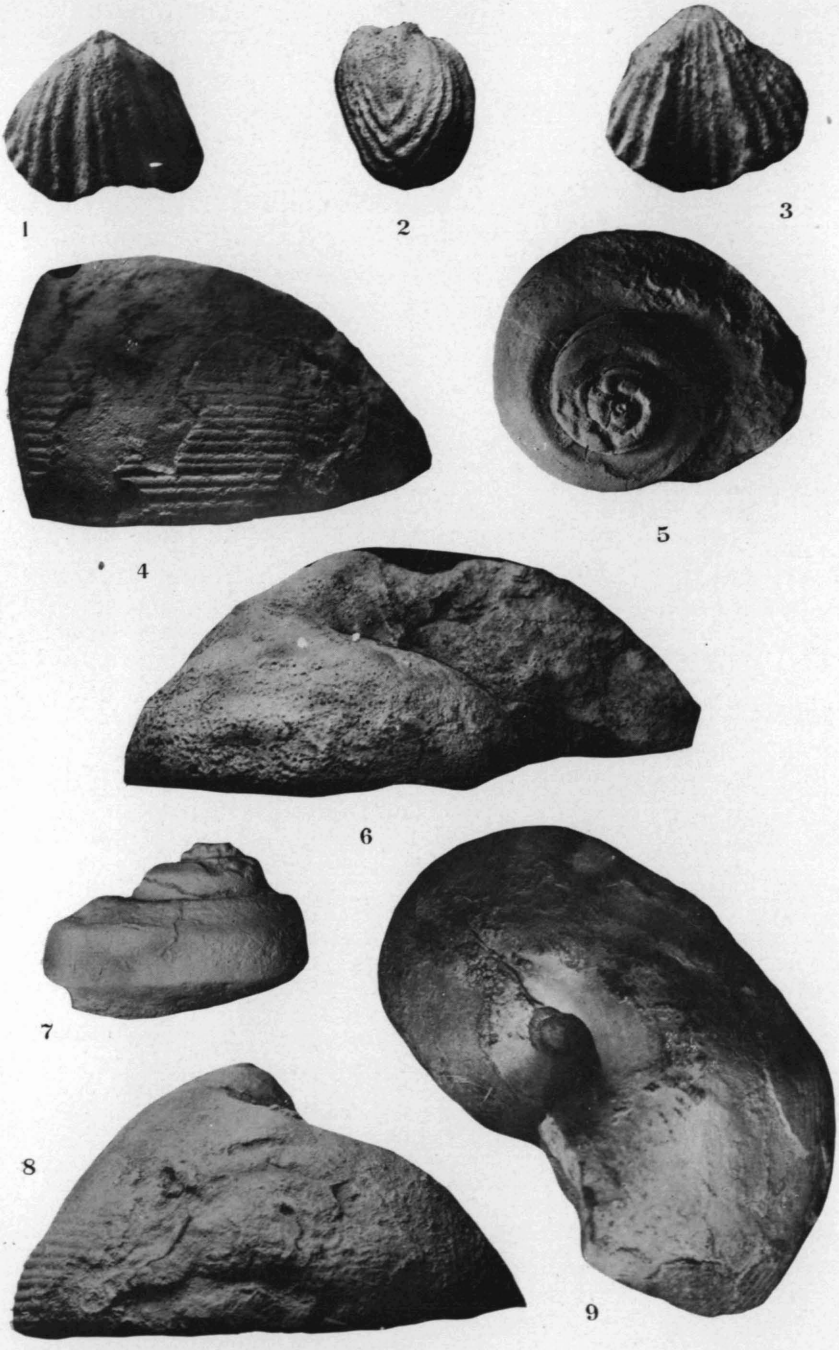
1–2. *Rhynchotrema sp.* Probably *R. perlamellosum*
1. Brachial valve
2. Side view
3. Pedicle valve

4, 8–9. *Maclurina manitobensis* (?) (Whiteaves)
4. A portion of the surface showing the surface markings
8. Side view
9. View showing the umbilicus

5, 7. *Trochonema sp. aff. umbilicatum* (Hall)
5. Apical view
7. Side view

6. *Maclurina cuneata* (Whitfield)

PLATE II



EXPLANATION OF PLATE III

FIGURES

1, 5. *Maclurina manitobensis* (Whiteaves)

2. *Maclurina cuneata* (Whitfield)

3–4. *Lophospira sp.*

3. Apical view

4. Side view

PLATE III

1

2

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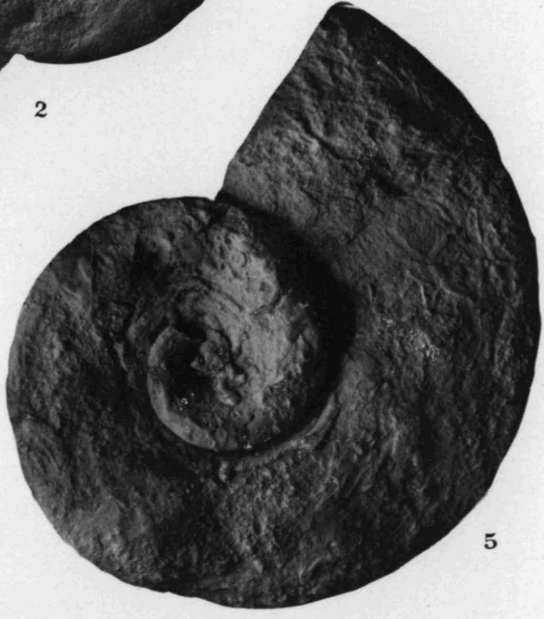
4



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EXPLANATION OF PLATE IV

FIGURES

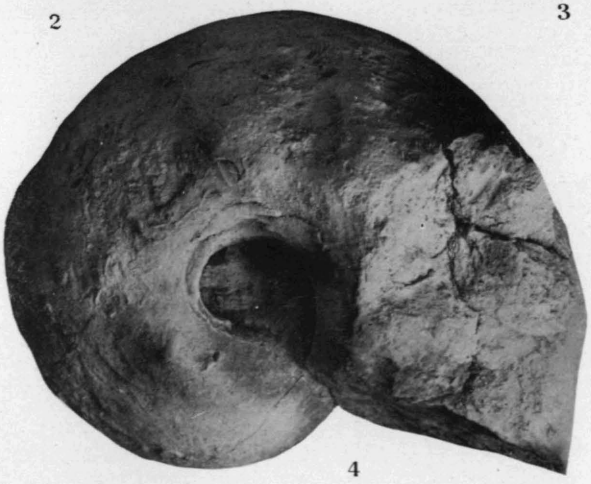
1. *Maclurites crassus* (Ulrich and Scofield)
2. *Maclurina cuneata* (Whitfield). View showing the umbilicus
3. *Maclurina manitobensis* (?) (Whiteaves). View of the flat side
4. *Maclurina manitobensis* (Whiteaves). View showing the umbilicus

PLATE IV

1

2

3



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(*Continued from inside of front cover*)

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