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GEOLOGICAL SURVEY OF CANADA

A. P. LOW, B.Sc., DEPUTY HEAD AND DIRECTOR.

PALÆOZOIC FOSSILS

VOL. III, PART IV (AND LAST).

5. *The Fossils of the Silurian (Upper Silurian) rocks of Keewatin, Manitoba, the north eastern shore of Lake Winnipegosis, and the lower Saskatchewan River.*
6. *The Canadian species of Plectoceras and Barrandoceras.*
7. *Illustrations of seven species of fossils from the Cambrian, Cambro Silurian, and Devonian rocks of Canada.*
8. *Revised list of the fossils of the Guelph formation of Ontario.*

With Appendix, consisting of a list of errata, and an index to the volume.

BY

J. F. WHITEAVES, LL.D., F.G.S., F.R.S.C., ETC.,

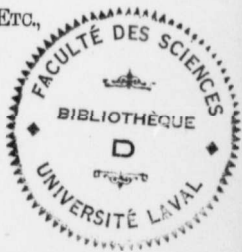
Palæontologist, Zoologist, and Assistant Director.



OTTAWA

PRINTED BY S. E. DAWSON, PRINTER TO THE KING'S MOST
EXCELLENT MAJESTY
SEPTEMBER, 1906

No. 950.



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THE UNIVERSITY OF CHICAGO

PH.D. THESIS

IN THE FIELD OF

PHYSICS

BY

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1941

DEPARTMENT OF PHYSICS

CHICAGO, ILL.

This, the fourth and concluding part of the third volume of "Palaeozoic Fossils," published by this Survey, consists, as indicated more fully on its title page, of four papers. Three of these are descriptive of palaeozoic fossils from various localities in the Dominion, and are illustrated by eight text figures and twenty plates. The fourth paper is a revised list of the fossils of the Guelph formation of Ontario. These four papers are supplemented by an Appendix, which consists of a list of errata in this and in previous parts, with an index to the whole volume.

For permission to reprint the two text figures of *Steganoblastus Ottawaensis* from the third part of the "Treatise on Zoology", edited by Dr. E. Ray Lankester, and for clichés of the original blocks, the Survey is indebted to the courtesy of the publishers, Messrs. Adam and Charles Black, of Soho Square, London, England.

A. P. LOW.

GEOLOGICAL SURVEY OF CANADA,
OTTAWA, June 23rd, 1906.

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GEOLOGICAL SURVEY OF CANADA.

PALÆOZOIC FOSSILS.

VOL. III.

5. *The Fossils of the Silurian (Upper Silurian) rocks of Keewatin, Manitoba, the north eastern shore of Lake Winnipegosis, and the lower Saskatchewan River.*

By J. F. WHITEAVES.

A. FROM KEEWATIN.

A. 1.—FROM THE ATTAWAPISKAT RIVER.

COLLECTED BY DR. R. BELL IN 1886.

The exposures of fossiliferous limestone on the lower portion of this river are described on pages 27G and 28G of Dr. Bell's "Report on an exploration of portions of the At-ta-wa-pish-kat and Albany rivers, Lonely Lake to James Bay," which forms part of the Annual Report of this Survey for 1886, New Series, vol. II. The fossils were collected at Rainy Island (N. Lat. 53° 05', W. Long. 84° 23') and seventeen to thirty miles below Rainy Island. Those from the first of these localities are referred to on page 27G, and those from the second on page 28G, of Dr. Bell's Report. In that report, the few and for the most part fragmentary fossils from each of these localities were provisionally stated to be probably of Devonian age. But, the subsequent receipt of a fine series of fossils from similar rocks on the Ekwan River, collected by Mr. Dowling in 1901, has convinced the writer, as elsewhere stated,* that not only the fossiliferous limestones of the Attawapiskat, but also those of the Fawn River (or branch of the Severn), are of Silurian age.

ANTHOZOA.

TETRACORALLA.

ZAPHRENTIS STOKESI, Edwards and Haime.

- Zaphrentis Stokesi*, Milne Edwards and Haime. . . 1851. Polyp. Foss. Terr. Palæoz., p. 330, pl. 3, fig. 9.
" " Billings. 1866. Catal. Silur. Foss. Anticosti, p. 34.
" " Nicholson. 1875. Palæont. Ont., pp. 43 and 58.

* In the Ottawa Naturalist for October, 1902, vol. XVI, No. 7, p. 139.

- Zaphrentis Stokesii*, Rominger. 1876. Geol. Surv. Mich., Fossil Corals, p. 144, pl. 51, three figs. in lower row.
Zaphrentis Stokesii, Lambe 1900. Contr. Canad. Paleont., vol. IV, pt. II, p. 120, pl. 9, figs. 1, 1 a, and 2.

Rainy Island: one fragment (Lambe).

The types of *Z. Stokesii* are from Drummond Island, Lake Huron. In Canada the species is recorded as having been collected from the Niagara limestone at Cabot's Head, Georgian Bay, Lake Huron; at Isle of Man (Burnt Island) Lake Timiscaming, and at the north end of that lake; also from divisions Nos. 3 and 4 of the Anticosti group at four localities on that island.

HEXACORALLA.

FAVOSITES GOTHLANDICUS, Lamark.

- Favosites Gothlandica* (Lamarck) Lambe.....1899. Contr. Canad. Paleont., vol. IV, pt. I, p. 3, pl. I, fig. 1.

Seventeen to thirty miles below Rainy Island: one specimen, which has been identified with this species by Mr. Lambe.

This is the Silurian coral, with spiniform septa and mural pores in or near the angles of the corallites, that Mr. Lambe identifies with *F. Gothlandica*, and the same remark applies to all the specimens that are referred to under this name in this paper. The Devonian specimens, with septal squamule, that were identified with *F. Gothlandica* by E. Billings, Professor H. A. Nicholson, and the writer, are now referred to *F. basalticus* (Goldfuss), *F. Alpenensis*, Winchell, or *F. Billingsii*, Rominger.

HYDROZOA.

STROMATOPORIDÆ, genus and species undetermined.

Rainy Island: one fragment.

BRACHIOPODA.

STROPHEODONTA (BRACHYPRION) sp. indet. *

Rainy Island: a small single valve of a species apparently rather similar to the fossil from the Niagara formation of the Western United States which Hall refers to *Strophodonta profunda* in the Twentieth Regents Report, and figures on Plate 13 (4), but which Winchell and Marcy seem to have previously described and figured as *Strophomena Niagarensis*. As Mr. Schuchert suggests that this western fossil may not be the same as the eastern Rochester shale species, it will be convenient in this paper to refer to the former as *Stropheodonta Niagarensis*. The valve from Rainy Island is moderately convex, and marked with minute crowded radii, of two sizes, also with faint corrugations at the hinge line.

Seventeen to thirty miles below Rainy Island: a large but very imperfect valve, that seems also to be rather nearly related to *S. Niagarensis*, but that may be distinct from the Rainy Island specimen. The former is proportionally more convex, and tumid or geniculate at or about the midlength, and its sculpture is slightly different from that of the latter.

ORTHIS, sp. indet.

Seventeen to thirty miles below Rainy Island: three imperfect and badly preserved specimens of an apparently rather coarsely ribbed species.

MERISTINA (?) EXPANSA, Whiteaves.

Plate 27, figs. 6, 6 a, and 7.

Meristina (?) expansa, Whiteaves 1904. Geol. Surv. Canada, Ann. Rep., vol. XIV, pt. F., p. 45.

"Shell tumid, regularly and rather strongly biconvex, transversely sub-elliptical and always a little wider than long; front margin of the valves not at all sinuated; surface entirely devoid of any kind of ribs.

"Ventral valve with a rather depressed though slightly prominent umbo, and an incurved beak.

"Dorsal valve with a much more depressed umbo and a smaller beak.

"Surface markings of the exterior of the test unknown, those of its exfoliated inner layer consisting of numerous, close-set and very minute, concentric raised lines, as well as of a few rather distinct concentric lines of growth; structure of the test fibrous.

"Characters of the interior of the valves unknown, though there is clearly a long mesial septum in the ventral valve, and apparently a similar one in the dorsal."

Seventeen to thirty miles below Rainy Island: four comparatively large and four small specimens. Ekwan River: two large specimens and one small one.

"These specimens are mere casts of the interior of the closed valves, with small portions of the inner layer of the test attached to some of them. It is by no means clear whether the beak of the ventral valve of any of them is perforate or not. They are provisionally and very doubtfully referred to *Meristina*, on account of their general resemblance in external form to the European *M. tumida*, but it may be that they should rather be referred to *Meristella* or *Reticularia*. They seem to differ from *Reticularia septentrionalis* in their uniformly, transversely and broadly subelliptical contour, and in the more depressed umbo of the ventral valve of each."

MOLLUSCA.

GASTEROPODA.

LOPHOSPIRA, sp. indet.

Rainy Island: one very imperfect and badly preserved cast of the interior of the shell of a species of this genus. Limestone rapid, Fawn River: two similar casts.

EUOMPHALUS, sp. indet.

Rather large; much wider than high, outer whorl rounded subquadrate in transverse section; spire slightly elevated; umbilicus very wide but shallow.

Rainy Island: four casts of the interior of a possibly undescribed species of this genus.

CEPHALOPODA.

ACTINOCERAS KEEWATINENSE, Whiteaves.

Plate 30, figs. 7 and 8.

Actinoceras keewatinense, Whiteaves. ... 1904. Geol. Surv. Canada, Ann. Rep., vol. XIV, pt. F., p. 54.

"This is a provisional name for some peculiar, obliquely subnummuloidal and presumably submarginal siphuncles, or portions of siphuncles, somewhat resembling those of *A. cochleatum* (Schlotheim). They are longicone and increase very slowly in thickness, nearly circular in transverse section, and encircled, at more or less regular intervals, by narrow and rather deep, obliquely transverse constrictions. Between these constrictions the siphuncle is laterally compressed and but slightly expanded, while its transverse diameter is from two to three times as great as the distance between the constrictions.

"The surface markings of these siphuncles consist of fine, close-set longitudinal striae," and their internal structure is as represented by fig. 8 on Plate 30.

Rainy Island: three fine and rather slender specimens. The best of these, "which shows ten of the siphuncular constrictions, is three inches and nearly a half in length, by twelve millimetres in diameter near the smaller end, and twenty two near the larger. In this specimen the width of the siphuncle is about twice as great as the distances between the constrictions. In another equally slender but shorter specimen from the same locality, which shows seven siphuncular constrictions, the width of the siphuncle is nearly three times as great as the distance between the constrictions, at the smaller end; and only twice as great as at the larger." Similar specimens have since been found on the Ekwan and Winisk rivers.

The only other fossil Cephalopoda collected on the Attawapiskat by Dr. Bell are (1) a rough cast of the interior of part of the shell of a slender, longicone orthoceratite; and (2) a fragment of the mould of the exterior of a large straight, subcylindrical shell, shewing four distant linear longitudinal grooves; both from Rainy Island.

A 2.—FROM THE EKWAN* RIVER.

COLLECTED BY MR. D. B. DOWLING IN 1901.

The fossils from this and the next locality have been enumerated or described in Appendix I to Mr. Dowling's "Report on an exploration of Ekwan River, Sutton Mill Lakes, and part of the west coast of James Bay," which forms Part F of vol. XIV of the Annual Report of this Survey, published in October, 1904. Most of the letter press which relates to these fossils is reprinted from that Appendix, but the twenty three new species described therein are here illustrated for the first time.

Commencing at thirty-five miles from its mouth, there are five exposures of limestone on the Ekwan, from which these fossils were collected. These exposures are scattered over an interval in which the last is forty miles from the first, and are as follows.

Lower rapid.

Middle rapid.

Foot of portage road.

Portage road at falls.

Upper rapid.

Although these limestones are flat lying and presumably gradually ascending, they seem to hold much the same kind of fossils.

ANTHOZOA.

TETRACORALLA.

ZAPHRENTIS STOKESI, Edwards and Haime.

Portage road at falls, two specimens; and upper rapid, one specimen (Lambe).

PYCNOSTYLUS GUELPHENSIS, Whiteaves.

- Pycnostylus Guelphensis*, Whiteaves 1884. This volume, pt. 1, p. 3, pl. 1, figs. 1, 1a and 1b; and (1895) pt. II, p. 49.
 " " Lambe 1900. Contr. Canad. Paleont., vol. IV, pt. II, p. 132, pl. 10, figs. 4 and 4a.

Foot of portage road, one specimen; and portage road at falls, one specimen (Lambe).

*Formerly written "Equan."

PYCNOSTYLUS ELEGANS, Whiteaves.

- Pycnostylus elegans*, Whiteaves 1884. This volume, pt. 1, p. 4, pl. 1, figs. 2 and 2 a; and (1895) pt. II, p. 49.
 " " Lambe 1900. Contr. Canad. Palaeont., vol. IV, pt. II, p. 133.

Portage road at falls: one specimen (Lambe).

HEXACORALLA.

FAVOSITES GOTHLANDICUS, Lamarck.

Foot of portage road, five specimens; portage road at falls, one specimen; and upper rapid, one specimen (Lambe).

FAVOSITES HISINGERI, Edwards and Haime.

Lower rapid, one specimen: foot of portage road, one specimen; and portage road at falls, one specimen (Lambe).

OCTOCORALLA.

HALYSITES CATENULARIA, L.

"The typical form, as identified by United States and Canadian paleontologists, under this name or that of *Catenipora escharoides*, Lamarck, and *C. agglomerata*, Hall." Lambe.

Foot of portage road: one specimen that, according to Mr. Lambe, is like specimens from the Niagara and Guelph formations of Ontario, and from Division 4 of the Anticosti group of Anticosti.

LYELLIA SUPERBA, Billings. (Sp.)

- Trematopora superba*, Billings 1866. Cat. Silur. Foss. Anticosti, p. 93.
Lyellia superba, Lambe 1899. Contr. Canad. Palaeont., vol. IV, pt. I, p. 87, pl. 5, figs. 4, 5 & 5 a.

Portage road at falls: one specimen (Lambe).

HYDROZOA.

STROMATOPORIDÆ, genus and species undetermined.

Portage road at falls: two fragments.

ECHINODERMATA.

CRINOIDEA, genera and species undetermined.

Foot of portage road: two portions of finely annulated columns, which are circular in section and perforate by a pentalobate axial canal.

Portage road at falls: a cast of the interior of a dorsal cup, that shews little more than its general shape, and the impress of a few large hexagonal plates.

POLYZOA.

FENESTELLA SUBARCTICA, Whiteaves.

Plate 23. The only figure.

Fenestella subarctica, Whiteaves. 1904. Geol. Surv. Canada, Ann. Rep.,
vol. XIV, pt. F., p. 39.

"Zoarium spreading, somewhat fan-shaped, but probably funnel-shaped when perfect. Branches very slender, carinated on the celluliferous face, and averaging from a fourth to a third of a millimetre in thickness. Bifurcations very infrequent in the only specimen collected, occurring at intervals of five mm. or more. Interstices much wider than the branches. Dissepiments about one mm. apart, or four and a half to five in the space of five mm. Fenestrules longer than wide, irregular in shape but usually somewhat rectangular, nearly or quite a mm. long, and approximately about half as wide as long. Zoecial apertures circular, in two ranges, opening somewhat laterally, twenty in each range in the space of five mm., and three to four on each side in the length of a fenestrule, closely disposed but separate, slightly irregular in their distribution, sometimes alternate on the two sides of the keel, sometimes opposite, their margins indenting the borders of the fenestrules. Under a highly magnifying simple lens, the keel appears to be minutely spinose in places."

"Portage road at falls: one fairly good specimen."

"Mr. R. S. Bassler, of the United States National Museum, to whom the writer is indebted for critical suggestions in regard to the structural peculiarities and affinities of this species, and of those of a *Phanopora* from Sutton Mill Lakes, writes that the zoecial apertures of this *Fenestella* 'seem unusually large, but this is due to the removal of the outer investment of the zoarium.'"

BRACHIOPODA.

TRIMERELLA EKWANENSIS, Whiteaves (nom. emend.)

Plate 24, fig. 7; and pl. 25, figs. 1 and 2.

Trimerella Ekwansensis, Whiteaves. 1902. Ottawa Naturalist, vol. XVI, p. 141,
pl. 2, figs. 1 & 2; and pl. 3, fig. 1.

"Shell rather large, attaining to a length of upwards of three inches. Pedicle valve flattened somewhat obliquely, most convex and deepest at a short distance from the beak, nearly as wide as long, broadly rounded in front, more narrowly rounded at the sides, and obtusely pointed behind, the umbo and beak being moderately produced, their lateral margins meeting at an angle of about 98°, and the beak gently incurved. Characters of the interior of this valve unknown.

"Brachial valve regularly but moderately convex, most prominent externally at or about the midlength, a little wider than long, broadly rounded in front and less so at the sides, as in the pedicle valve, but abruptly contracted at the umbo, which is narrowly rounded and but slightly produced, while its beak is strongly incurved and recurved. Casts of the interior of this valve are marked with a longitudinal, linear, median groove, that represents the median plate and that extends from the umbo almost to the front margin, also with a lateral and slightly divergent linear groove, on each side, that extends from the umbo to a little beyond the midlength.

"Surface of both valves marked only with a few distinct concentric lines of growth."

Portage road at falls: "one imperfect and badly preserved specimen with both valves *in situ*, a nearly perfect pedicle valve, three imperfect brachial valves with most of the test preserved, and a cast of the interior of a large brachial valve.

"Judging by these specimens, this species would appear to belong to the group of *T. acuminata* rather than to that of *T. grandis*, though it seems to be always much shorter and wider than *T. acuminata*, *T. Ohioensis* or *T. Lindströmii*. The marginal contour of its brachial valve is not very unlike that of *T. Lindströmii*, but in the latter this valve is represented as flattened anteriorly to the umbo, and its pedicle valve has quite a different outline, the umbo being proportionately broader laterally, and the beak straight rather than incurved.

TRIMERELLA BOREALIS, Whiteaves.

Plate 25, figs. 3 & 3 a.

Trimerella borealis, Whiteaves. 1902. Ottawa Naturalist, vol. XVI, p. 142, pl. 3, figs. 2 & 3.

"Shell unknown; cast of the interior of both of the closed valves small, compressed, not far from circular in marginal outline, but a little wider than long.

"*Supposed pedicle valve*" (Fig. 3 a). "On the cast of the interior of this valve there are five linear grooves, of unequal length, that radiate forward and outward from the umbo. The middle one, that corresponds to the median plate, extends as far forward as a little past the midlength, the two next to it, on either side, are a little shorter, and the two outer ones shorter still.

"*Supposed brachial valve*" (Fig. 3). "On the cast of the interior of this valve there are two flattened conical casts of the platform vaults in the umbonal region, and between them there is a median, longitudinal linear groove, that is, however, widest posteriorly and that represents the median

plate. Each of these casts of the platform vaults is bounded externally by a short but deeply impressed linear groove, and the groove that represents the median plate extends from the umbo to within a very short distance from the front margin.

"The only specimen collected is not sufficiently perfect to admit of exact measurements, but the two figures are of the natural size.

Lower rapid: "one imperfect and slightly distorted cast of the interior of both valves.

"The specimen would seem to indicate a much smaller species than the preceding, with different markings on the interior of at least one of its valves, and a much less produced umbo on the brachial valve. It can be scarcely be mistaken for any other American species of *Trimerella*."

STROPHEODONTA (BRACHYPRION) sp. indet.

Very similar to the "*Strophomena Niagarensis*" of Winchell & Marcy, the *Strophodonta profunda* of Hall, as figured and described in the Twentieth Regents Report of the State of New York, but with the surface markings essentially like those of *S. varistriata*, var. *arata*. Radii thin and distant, with smooth spaces between them.

Foot of portage road: one well preserved but imperfect ventral valve.

PLECTAMBONITES TRANSVERSALIS, Wahlenberg. (Sp.)

- Anomites transversalis*, Wahlenberg 1821. Act. Soc. Upsaliensis, vol. III, p. 64.
Strophomena elegantula, Hall. 1843. Geol. N. York, Rep. Fourth Distr.,
 p. 72, fig. 1.
Strophomena transversalis, Hall. 1843. Idem, p. 105, fig. 4.
Leptena transversalis, Hall. 1852. Pal. N. York, vol. II, p. 256, pl. 53,
 fig. 5.
 " " Billings. 1856. Canad. Nat. & Geol., vol. I, p. 138, pl.
 2, figs. 14 & 15.
Plectambonites arca & tenera, Shaler. 1865. Bull. Mus. Comp. Zool., vol. IV, p. 64.
Plectambonites transversalis, Hall & Clarke. . 1892. Pal. N. York, vol. VIII, pt. I, p. 298,
 pl. 15, figs. 34-36.

Foot of portage road: two imperfect but characteristic ventral valves.

In the Museum of the Survey there are specimens of this species from the Clinton and Niagara formations at Grimsby, Dundas and Hamilton, Ont.; from Divisions 2, 3 and 4 of the Anticosti group, four miles west of Jupiter River, at East Point, and at the Jumpers, Anticosti; also from the Silurian (Upper Silurian) rocks at Lake Temiscouata, N. B.

ORTHIS, sp. indet.

Upper rapid: one half of the ventral valve of a very small, rather coarsely ribbed and probably undescribed species of *Orthis*, allied to *O. Davidsoni*.

CAMAROTÆCHIA EKWANENSIS, Whiteaves.

Plate 25, figs. 4, 4 a, and 4 b.

Camarotæchia Ekwanensis, Whiteaves. 1904. Geol. Surv. Canada, Ann. Rep., vol. XIV, pt. F, p. 42.

"Shell small, moderately convex, transversely subelliptical and wider than long.

"Ventral valve with an extremely small, narrow, erect or straight beak, behind; and a well defined mesial sinus, that extends backward to about the midlength in front; the whole surface of the valve marked with thirteen rather distant, angular radiating ribs, three in the mesial sinus and five on each side

"Dorsal valve with a still smaller beak, and with a fold corresponding to the mesial sinus of the ventral, its surface marked with twelve angular ribs, four on the fold and four on each side of it.

"Hinge area and interior of the valves unknown.

"Portage road at falls: one well preserved cast of the interior of the closed valves.

This small rhynchonelloid may possibly prove to be an extreme variety of *C. neglecta* (the *Atrypa neglecta*, Hall, of the second volume of the Palæontology of the State of New York) from which it seems to differ chiefly in its transversely and rather narrowly subelliptical marginal outline.

ATRYPA RETICULARIS, L.

Foot of portage road: two small specimens.

GLASSIA VARIABILIS? Var.

Plate 26, figs. 6, 6 a, and 6 b.

Cf. *Glossia variabilis*, Whiteaves. 1904. Geol. Surv. Canada, Ann. Rep., vol. XIV, pt. F, p. 42.

Foot of portage road: one specimen, that is doubtfully referred to this species. It does not show any vestige of the spiralia or of any of the other characters of the interior of the shell. It is perhaps a little more convex than the typical form from the Winisk River, and the sinus in its ventral valve seems to be a little deeper proportionately. In these respects the specimens from the Ekwan and Fawn rivers are more like the *Atrypa subovata* of Sowerby, and those from the Winisk are more like the *A. compressa* of the same author, both of which are now regarded as forms of *Glossia subovata*. The original description of *G. variabilis* is reprinted on page 273, and the typical form of the species is illustrated on Plate 26, figs. 3, 4 and 5.

SPIRIFER CRISPUS? Hisinger. Var.

Plate 27, fig. 1.

Shell apparently similar, in size and general shape, to the *S. crispus*, as described and figured by European and American paleontologists, but with narrow and angular, not broad and rounded ribs.

Middle rapid: one specimen.

SPIRIFER (?) sp. indet.

Portage road at falls, one specimen; and foot of portage road, one specimen; both casts of the interior of ventral valves that are possibly referable to *S. radiatus*, Sowerby, but that are much too imperfect and too badly preserved to be satisfactorily determined, even generically.

RETICULARIA SEPTENTRIONALIS, Whiteaves.

Plate 27, figs. 2, 3, 4 and 5.

Reticularia septentrionalis, Whiteaves.....1904. Geol. Surv. Canada, Ann. Rep., vol. XIV, pt. F, p. 44.

"Shell strongly biconvex, but often with a faint, shallow, narrow longitudinal groove or depression in the median line of each valve; varying in outline in different specimens from subovate or somewhat pentagonal and a little longer than wide, to not far from circular and as wide as long, but always abruptly contracted and attenuate in the umbonal region behind; front margin of the valves straight and entirely devoid of a mesial fold or sinus.

"Ventral valve with a narrow but prominent or produced umbo, a depressed, incurved and acute beak, and an extremely small delthyrium.

"Umbo and beak of the dorsal smaller and less prominent.

"Most of the specimens are little more than mere casts of the interior of the closed valves. Their surface is entirely devoid of ribs of any kind, and at first sight would seem to be marked only with concentric lines of growth. But, upon closer examination, numerous, obscure, close-set and very slightly raised concentric lines, or faint and minute, low, rounded ridges, can be detected on portions of the exfoliated test that happen to be preserved, and the shell structure, under a lens, is seen to be fibrous.

"Characters of the interior of the valves unknown, though there are indications of a median septum in each.

"Lower rapids, one specimen; middle rapid, one specimen; and portage road at falls, four specimens.

"This large and nearly smooth species is provisionally referred to the genus *Reticularia* on account of its general resemblance to *R. modesta* (Hall), and *R. perplexa* (McChesney) which is the *Spirifer lineatus* of

Shumard and other American paleontologists, but not of Martin; though it may prove to be a *Martinia*."

RETICULARIA (?) sp. indet.

"Foot of portage road: two specimens, each of which has the whole of the dorsal valve and most of the ventral preserved, though the umbo and beak of the latter are broken off. Both are transversely subelliptical in outline and wider than long, and both have a rather shallow marginal sinus in the ventral valve. They are entirely ribless, but the better preserved one of the two is finely and nodosely cancellated by numerous, close set, minute concentric ridges, that are crossed by similar radiating ones.

"At the portage road at the falls a specimen, with the same general shape and with a similar sinus in the ventral valve, was collected, but it is so much worn that its surface markings are quite obliterated, and the beak of the ventral is so imperfect that it is impossible to tell whether it was originally perforate or not. This specimen seems to correspond fairly well with E. Billings' figures of *Athyris Blanca*, from the Silurian rocks of Maine, which Hall and Clarke refer to *Meristina*, but which Schuchert says is a *Meristella*."

MERISTINA (?) EXPANSA, Whiteaves.

Portage road at falls, one specimen; and foot of portage road, an unusually large but imperfect specimen.

The original description of this species is reprinted on page 245, ante.

MOLLUSCA.

PELECYPODA.

AMBONYCHIA UNDULATA, Whitfield. (Sp.)

Plate 28, fig. 4.

- Leptodomus undulatus*, Whitfield.....1878. Ann. Rep. Geol. Surv. Wiscons. for 1877, p. 81; & (1880) Geol. Wiscons., vol. IV, p. 293, pl. 18, figs. 1 & 2.
Ambonychia undulata, Whiteaves.....1904. Geol. Surv. Canada, Ann. Rep., vol. XIV, pt. F, p. 46.

"Portage road at falls, an imperfect left valve; and foot of portage road, a nearly perfect and very convex right valve.

"Both of these specimens are marked with "strong, regularly rounded concentric undulations." Mr. E. O. Ulrich, who has kindly examined the five specimens of pelecypoda from the Ekwan River collected by Mr. Dowling, and to whom the writer is indebted for some critical suggestions

in regard to them, thinks that *Leptodomus undulatus* is an *Ambonychia* allied to *A. planistriata*, Hall, and that the former had fine surface radii.

AMBONYCHIA SEPTENTRIONALIS, Whiteaves.

Plate 28, fig. 5.

Ambonychia septentrionalis, Whiteaves. 1904. Geol. Surv. Canada, Ann. Rep., vol. XIV, pt. F, p. 46.

"Shell obliquely and acuminate subovate or subrhomboidal, very inequilateral, rather strongly convex, most prominent in the umbonal region of each valve. Anterior side very short, abruptly truncated, or rather inflected, and flattened; posterior side a little longer, broadly rounded at its extremity and forming a subangular junction with the hinge line above. Umbones prominent, tumid but rather narrow; beaks incurved, anterior, and almost if not quite terminal; hinge line straight behind the beaks, equal to about two thirds of the greatest length of the valves beneath.

"Surface marked with a few faint and obscure concentric undulations and lines of growth, also by extremely minute radiating lines. Test very thin.

"Hinge dentition and muscular impressions unknown.

• "Portage road at falls: a cast of the interior of both valves, with part of the test preserved.

"This shell is rather similar to the *A. affinis* of Ulrich from the Middle Galena of Minnesota and Illinois, both in its shape and surface markings. But, in the former the posterior end is more broadly rounded and not so much produced below, and the radiating raised lines of the surface are much more minute."

MYTILARCA FERNOIDES, Whiteaves.

Plate 27, fig. 8.

Mytilarca fernoides, Whiteaves. 1904. Geol. Surv. Canada, Ann. Rep., vol. XIV, pt. F, p. 47.

"Shell compressed convex, rather obliquely subovate and very inequilateral, or broadly mytiloid and subalate behind. Anterior side very short, truncated or abruptly inflected above and rounded below; posterior side a little longer, its outer margin truncated somewhat obliquely and forming an angular or subangular junction with the cardinal border above, but rounded below. Cardinal border behind the beaks straight, its entire length equal to fully two thirds or more of the greatest length of the valves below; hinge area large; umbones apparently not very prominent; beaks appressed, incurved and almost terminal.

"Surface marked with a few impressed and concentric striae of growth ; test rather thick.

"Hinge with both cardinal and lateral teeth ; muscular impressions unknown.

"Portage road at falls : one testiferous left valve.

"Mr. Ulrich thinks that this shell is "closely related to, if not quite the same as, *Ambonychia aphoa*, Hall," from the Niagara limestone of Illinois, which he (Mr. Ulrich) referred to *Mytilarca* in 1894, in the seventh volume of the Reports of the Geological Survey of Ohio. *A. aphoa*, however, was based upon a mere cast, which does not show the proportionate length of the hinge line, the size of the cardinal area, nor the surface markings, so that it is scarcely possible to make a satisfactory comparison between it and the specimen from the Ekwan River."

CTENODONTA SUBOVATA, Whiteaves.

Plate 27, figs. 9 and 9 a.

Ctenodonta subovata, Whiteaves..... 1904. Geol. Surv. Canada, Ann. Rep., vol. XIV, pt. F, p. 47.

"Shell small, inequilateral, moderately convex, subovate and one fourth longer than high. Anterior (?) side short and rounded ; posterior (?) side produced, a little longer, and more narrowly rounded at its outer termination ; ventral margin gently convex ; superior border sloping abruptly downward in front of the beaks and much more gradually so behind them ; umbones small and moderately prominent : beaks also small, incurved and placed in advance of the midlength ; ligament external, short, placed on the shorter end of the hinge line.

"Surface faintly, very minutely and concentrically striated.

"Hinge dentition and muscular impressions unknown.

"Dimensions of the only specimen collected : maximum length, twenty millimetres ; greatest height, fifteen mm. and a quarter ; maximum thickness, ten mm. and a quarter.

"Portage road at falls : one testiferous specimen, with both valves.

"The homologies of the shell of *Ctenodonta* are unknown, and it is not at all clear which is the anterior and which the posterior side of this species. If the shorter is the posterior side, as in *Nucula* and as would seem to be indicated by the position of the ligament, then the beaks of this species are placed a little behind the midlength and *vice versa*.

"In outline this shell agrees very nearly with my *C. simulatrix* and less closely with *C. Albertina*, but these species had the ligament on the longer, instead of the shorter end of the hinge." Ulrich.

GASTEROPODA.

PLEUROTOMAINA (or EUOMPHALOPTERUS) sp. indet.

Upper rapid: five badly preserved casts of the interior of the shell of a widely umbilicated species of *Pleurotomaria* or *Euomphalopterus*, with a very low, obtuse spire. These specimens are very similar in shape to casts of *Pleurotomaria Valeria*, Billings, which is an *Euomphalopterus*, but the outer whorl of each is not so distinctly keeled at the periphery.

EUOMPHALOPTERUS, sp. indet.

Foot of portage road: a specimen with the upper half of the shell completely worn away, the basal half, which is all that is left, being narrowly umbilicated and showing part of a peripheral alation.

MEGALOMPHALA ROBUSTA, Whiteaves.

Plate 28, figs. 9 and 9 a; and pl 29, fig. 1.

Megalomphala robusta, Whiteaves.....1904. Geol. Surv. Canada, Ann. Rep., vol. XIV, pt. F, p. 48.

"Shell large for the genus, strongly convex but deeply and rather widely umbilicated on both sides, the umbilicus occupying about one half of the entire diameter though its margin is not very distinctly defined. Whorls at least three and perhaps more, increasing very rapidly in size and laterally expanding, coiled closely on the same plane and everywhere in close contact, but with little or scarcely any overlapping; their periphery encircled by a continuous slit-band; exposed portions of the inner ones truncated almost vertically but somewhat obliquely on each side. Outer whorl rounded on the periphery in some specimens, faintly and obtusely subangular in others, distinctly subangular round the umbilical margin on both sides, the umbilical wall being steep but somewhat oblique. Slit-band narrow, in half grown specimens moderately elevated and bounded on each side of its summit by a spiral raised line, but this minute double keel becomes obsolete on the outer half of the last volution, in adult shells. Outline of transverse section near the aperture subreniform and much wider than high in some specimens but somewhat triangular and nearly or quite as high as wide in others; outer lip not preserved in any of the specimens collected, but apparently not abruptly expanded; apertural slit unknown.

"Surface of most of the specimens collected marked only with curved, transverse striae of growth, but in one specimen the markings consist of small narrow, thin transverse ridges, with flat spaces between them.

"Portage road at falls: seven specimens, all of which are imperfect at the aperture. The largest is seventy-two millimetres in its maximum diameter.

"The generic name *Megalomphala*, Ulrich, 1897, is, however, too close to *Megalomphalus*, Brusina, 1871."

SALPINGOSTOMA BOREALE, Whiteaves.

Plate 28, figs. 10 & 11.

Salpingostoma boreale, Whiteaves 1904. Geol. Surv. Canada, Ann. Rep. vol. XIV, pt. F, p. 49.

Shell small, consisting of three rounded volutions that are a little wider than high and coiled on the same plane, in close contact, with little or no overlap, or at least closely contiguous if not actually in contact; umbilicus wide and open, exposing most of the inner whorls. Aperture trumpet shaped, lip widely and abruptly expanded.

"Surface marked with minute rounded spiral ribs, that are crossed by small, crenate, lamellose raised ridges. The slit-band is not well shown in either of the few specimens collected, but it seems to be narrow, and continuous, at least at some distance behind the aperture.

"Middle rapid, foot of portage road, and portage road at falls; one specimen from each of these localities. The largest of these specimens, though only twenty-three millimetres, or less than an inch, in its maximum diameter, has an abruptly expanded aperture. The other two are obviously immature shells, each about eleven mm. in its greatest diameter. In one of them the posterior half of the earliest volution is free from, and not quite in contact with that which immediately succeeds it.

"It is only in the continuity of the slit-band that this species and shells of this genus are supposed to differ from *Trematnotus*, or as Dr. Paul Fischer spells it, *Trematnotus*."

EUOMPHALUS, sp. indet.

Lower rapid: a cast of the interior of the outer half of the outer volution of the shell, apparently of a typical *Euomphalus*, which is flattened above, rounded, transversely undulated, and not very widely umbilicated below.

GYRONEMA SPECIOSUM, Whiteaves.

Plate 29, fig. 2.

Gyronema speciosum, Whiteaves 1904. Geol. Surv. Canada, Ann. Rep., vol. XIV, pt. F, p. 50.

"Shell quite large for the genus, imperforate, turbinate, a little higher or longer than wide, spire slightly higher than the outer whorl. Whorls

six or seven, rounded, ventricose; aperture widely subovate, not far from circular, lip thin and simple.

"Surface marked with numerous and rather close-set small spiral ridges, that are crossed by still more numerous, more close-set and minute, transverse raised lines. On the last whorl but one there are about eight of these spiral ridges, and on the last or outer one there are not less than twelve and probably as many as fifteen.

"Portage road at falls: two specimens. The larger of these was probably about forty-five millimetres high or long, when perfect, and its maximum width is thirty-five mm."

GYRONEMA DOWLINGII, Whiteaves.

Plate 29, fig. 3.

Gyronema Dowlingii, Whiteaves. 1904. Geol. Surv. Canada, Ann. Rep., vol. XIV, pt. F, p. 50.

"Shell turbinate, higher or longer than wide, spire elevated, volutions rounded and ventricose; umbilicus almost or quite closed. Lower whorls of the spire marked with three rather distinct, acute and prominent spiral keels. Outer whorl encircled by four comparatively large spiral keels and by a few much smaller spiral ridges, or minute raised lines. Between the second and third spiral keels there are three close set, low and rounded, minute spiral raised lines, and there are indications of a few small spiral ridges in the umbilical region, below the lowest of the four large spiral keels.

"Portage road at falls: one imperfect specimen with the apical whorls broken off, but with the test preserved on the last two whorls of the spire and on part of the outer whorl.

"A rather smaller species than the preceding and with very different sculpture. It is somewhat similar in shape to the *Cyclonema sulcatum* of Hall, from the Guelph formation of Ontario (which is probably a *Gyronema* rather than a *Polytropis*). But the whorls of *G. Dowlingii* are not shouldered above, its suture is not channelled, and its outer volution is encircled by only four large spiral keels. *G. Dowlingii* is still more closely allied to, but apparently quite distinct from, the *Cyclonema carinatum* of Sowerby, as figured by Lindström in his monograph of the Silurian Gastropoda and Pteropoda of Gotland, which Ulrich says is a *Gyronema*."

GYRONEMA BREVISPIRA, Whiteaves.

Plate 29, fig. 4.

Gyronema brevispira, Whiteaves. 1904. Geol. Surv. Canada, Ann. Rep., vol. XIV, pt. F, p. 51.

"Shell rather small, turbinate conical and wider than high; spire shorter than the outer volution. Whorls four or five, those of the spire



obliquely compressed; last whorl of the spire angulated and carinated below, next to the suture; outer whorl obliquely compressed above, rounded and almost imperforate below, the umbilicus being represented by a minute, short and very narrow chink behind the columellar lip; aperture ovately subcircular; lip thin and simple.

"Surface encircled by small narrow and acute spiral keels. On the last whorl but one there are five of these keels, and on the outer whorl eleven. "Portage road at falls: two specimens."

LOXONEMA, sp. indet.

Foot of portage road, a specimen of a small, slender species, with six whorls preserved; and, upper rapid, a much more imperfect but otherwise similar specimen. Portage road at falls: a fragment of a larger shell, with apparently similar characters, but with only two of the whorls preserved.

ORTHONYCHIA OBTUSA, Whiteaves.

Plate 29, figs. 5, & 5 a.

Orthonychia obtusa, Whiteaves.....1904. Geol. Surv. Canada, Ann. Rep., vol. XIV, pt. F, p. 51.

"Shell straight, conical, slightly compressed at the sides, but more so on the right than on the left side, and moderately elevated, the height being less than the maximum length at the aperture or base. Apex erect, bluntly pointed and rather eccentric; base with two faint, obscure, shallow undulations on the right side. Aperture and outline of transverse section, at and near the base, subovate but somewhat irregular in outline; lip shallowly undulated on the right side.

"Surface markings unknown, though casts of the interior are quite smooth, and the exterior of large pieces of the thin and presumably inner layer of the test, that happen to be preserved, is marked with numerous, irregular and often not continuous, fine concentric striae. Muscular impressions unknown.

"Foot of portage road: two specimens, which are very different in shape to any species of *Orthonychia* or *Platyceras* that the writer is acquainted with.

PLATYCERAS COMPACTUM, Whiteaves.

Plate 29, fig. 6.

Platyceras compactum, Whiteaves.....1904. Geol. Surv. Canada, Ann. Rep., vol. XIV, pt. F, p. 52.

"Shell turbinate, imperforate, a little wider than high, spire small and short. Whorls certainly three and probably as many as four or five in perfect specimens (the apex being broken in both of those collected)

rounded, closely coiled and increasing rapidly in size; outer whorl inflated and expanded, with two faint low rounded spiral plications near and at the aperture in young specimens, and from three to four in adult ones.

"Surface marked with numerous, close-set, transverse lines of growth, that are flexuous where they cross the spiral plications.

"Portage road at falls: one apparently adult and one half grown specimen. The former, which is well preserved and nearly perfect, is thirty five millimetres wide, and was probably about thirty mm. high when perfect, allowing two mm. for a small piece broken off at the apex.

DIAPHOROSTOMA PERFORATUM, Whiteaves.

Plate 29, figs. 7, & 7a.

Diaphorostoma perforatum, Whiteaves. 1904. Geol. Surv. Canada, Ann. Rep., vol. XIV, pt. F, p. 52.

"Shell depressed turbinate, much wider than high; spire short, raised very little above the highest level of the outer whorl; base narrowly but deeply umbilicated. Whorls five, increasing rapidly in size, those of the spire flattened above and rounded below; the outer one rounded and ventricose, but depressed at the suture above; umbilical margin rounded and very indistinctly defined. Aperture rounded subovate, pointed above and slightly insinuated on the columellar side by the encroachment of the preceding whorl, wider and rounded below; lip thin and simple; characters of the columella not well shown in the only specimen collected.

"Surface marked with numerous close-set, nearly straight and very minute transverse raised lines, that are scarcely visible without the aid of a lens; also by a few larger and more distant impressed lines of growth.

"Middle rapid: one nearly perfect specimen, with the test preserved.

"This shell seems to be referable to the genus *Platyostoma*, Conrad (1842), but Lindström asserts that this name is preoccupied by Klein in 1753, by Meigen in 1803, and by L. Agassiz in 1829. For this reason Dr. Paul Fischer (in 1885) proposed to distinguish Conrad's genus by the name *Diaphorostoma*, though Lindström maintains that both *Platyostoma*, Conrad, and *Strophostylus*, Hall, are mere synonyms of *Platyceras*. Fischer explicitly states that the only difference between *Diaphorostoma* and *Strophostylus* is the obliquely folded columella of the latter, while Eastman, in the first volume of his translation of Zittel's "Text-book of Paleontology," quotes *Strophostylus*, Hall, as a synonym of *Platyostoma*, Conrad."

STROPHOSTYLUS AMPLUS, Whiteaves.

Plate 30, figs. 1, and 1 a.

Strophostylus amplus, Whiteaves.....1904. Geol. Surv. Canada, Ann. Rep., vol. XIV, pt. F, p. 53.

"Shell imperforate, subglobose, widely expanded and slightly depressed, about as wide as high, spire small and very short. Whorls four, increasing very rapidly in size, those of the spire rounded; the outer one moderately convex as viewed dorsally, expanded widely in the direction of its height, widest above the midheight and rather narrowly rounded at the base; suture distinctly impressed; aperture very large, apparently widely subovate; outer lip thin and simple; characters of the columella not well shown in either of the specimens collected; posterior portion of the outer lip extended considerably so as to embrace part of the preceding whorl.

"Surface marked with fine transverse striae of growth, which are curved convexly forward parallel to the outer lip.

"Portage road at falls: three specimens, which do not show the exact shape of the aperture at all well. The interior of each is completely filled with stone, so that the inner edge of the columella is covered, but in one of the specimens there are indications of a flexuous longitudinal groove just behind the columella."

STROPHOSTYLUS INFLATUS, Whiteaves.

Plate 30, figs. 2 and 3.

Strophostylus inflatus, Whiteaves.....1904. Geol. Surv. Canada, Ann. Rep., vol. XIV, pt. F, p. 53.

"Shell subglobose, naticoid, imperforate, about as wide as high, spire short. Whorls probably four in perfect specimens, though not more than three are preserved in the most perfect specimen collected, increasing rapidly in size, the outer one inflated and ventricose, most convex at about its midheight; aperture not well shown in the specimen described, but apparently subovate; outer lip thin and simple, its posterior portion apparently not so extended as to embrace part of the previous whorl.

"Surface marked with obliquely transverse lines of growth.

"Portage road at falls: a cast of the interior of the shell of a large specimen with small portions of the test preserved, from which the foregoing description was made, and two small specimens; also a large testiferous specimen (fig. 3) that is probably referable to this species, though its outer whorl is considerably compressed laterally."

STROPHOSTYLUS FILICINCTUS, Whiteaves.

Plate 30, figs. 4, 5 and 6.

Strophostylus filicinctus, Whiteaves.....1904. Geol. Surv. Canada, Ann. Rep., vol. XIV, pt. F, p. 54.

"Shell depressed turbinate and wider than high, spire rather short, less than half as high as the outer whorl, as viewed dorsally. Whorls six or perhaps seven, rounded but slightly flattened at the suture above, increasing rapidly in size, the outer one strongly inflated, ventricose and imperforate at the base. Aperture subcircular, lip thin and simple.

"Surface marked with extremely minute and close set, low, rounded, spiral raised lines, and by fine transverse striæ of growth. On the last volution but two of one specimen there are nineteen of these spiral raised lines, and four and a half in a millimetre. On the outer whorl of an apparently adult specimen, and near the aperture, there are three spiral raised lines to a mm.

"Portage road at falls: two specimens, with the minute surface markings well preserved. One of these (fig. 6) is a testiferous specimen with nearly the whole of the spire preserved, but with the outer whorl almost completely broken off; and the other (fig. 4) a cast of the interior of the last two whorls of the shell of an adult specimen, with a small piece of the test preserved, at and near the aperture. Beside these there are four specimens that are probably referable to this species, though none of them show any trace of the minute spiral lines upon the exterior of the test. Three of these are from the portage road at the falls, and one from the foot of the portage road.

"This species would seem to be congeneric with *Cyclonema cancellatum* of Lindström, from the Silurian rocks at Gotland, which Ulrich says is a *Strophostylus*."

CEPHALOPODA.

ENDOCERAS (or NANNO) sp. indet.

Portage road at falls: two fragments of siphuncles, or of a siphuncle, that are presumed to be referable to either *Endoceras* or *Nanno*, on account of their resemblance, in a general way, to specimens collected at Kingston Mills, Ont., in 1902, by Dr. R. W. Eells, Mr. W. A. Johnston, and the writer.

ACTINOCERAS KEEWATINENSE, Whiteaves.

Plate 30, figs. 7 & 8.

Upper rapid: two distorted fragments.

KIONOCERAS CANCELLATUM, Hall. (Sp.)

- Orthoceras cancellatum*, Hall.....1852. Pal. N. York, vol. II, p. 292, pl. 63, figs. 1, & 4a, b; and pl. 65, figs. 4 a, b.
- Orthoceras columnare*, Hall.....1860. Rep. Progr. Geol. Surv. Wisconsin, p. 4; & (1867) Twentieth Rep. N.Y. St. Mus. Nat. Hist., p. 351; but not *O. columnare*, Marklin, 1857.
- Orthoceras Scammoni*, *O. Hoyii*, *O. lineolatum*, & *O. irregulare*, McChesney.....1861. Descr. New Foss. Pal. Rocks of the Western States, pp. 92-94; teste Hall.
- Orthoceras Woodworthii*, McChesney.....1865. Idem., pl. 7, fig. 7; teste Hall.
- Orthoceras Cadmus*, Billings.....1866. Cat. Silur. Foss. Anticosti, &c., p. 83.
- Orthoceras angulatum*, Hall.....1867. Twentieth Rep. N.Y. St. Mus. Nat. Hist., p. 353, pl. 19 (10), figs. 10 & 11; but not *O. angulatum*, Wahlenberg, 1821.
- Orthoceras virgatum*, Hall.....1867. Op. cit., p. 353; but not *O. virgatum*, Sowerby, 1839.
- Orthoceras subcancellatum*, Hall.....1877. Miller's Amer. Pal. Foss., First Ed., p. 245.
- Orthoceras orus*, Hall.....1877. Idem., p. 245.
- Kionoceras cancellatum*, Whiteaves.....1904. Geol. Surv. Canada, Ann. Rep., vol. XIV, pt. F, p. 55.

"Portage road at falls, two fragmentary specimens, the largest less than two inches in length; and middle rapid, two similar fragments; all of which seem to be referable to this species. Each of these specimens is a portion of a longicone orthoceratite, with a circular transverse section, a central or nearly central siphuncle, and marked with narrow longitudinal ridges, separated by wider grooves or intervals, with minute, close-set, transverse, raised lines between them. Specimens with similar external characters have been found in the Niagara and Guelph formations at three localities in Ontario and Quebec. These are the *Orthoceras Cadmus*, of Billings, from Grimsby and Elora; a specimen from Elora that the writer has referred to *O. Scammoni*; and a specimen from L'Anse à la Barbe, near Port Daniel, in the Baie des Chaleurs, in the Museum of the Survey, labelled *O. virgatum* by E. Billings.

"*O. Cadmus*, *O. subcancellatum* and *O. orus* are names that have been given to this shell on the assumption that Hall's *Orthoceras cancellatum* is not the same as the *Orthoceratites cancellatus* of Eichwald. Billings, in a paper entitled 'New Species of Fossils from the Clinton and Niagara formations' and published with his 'Catalogues of the Silurian Fossils of the Island of Anticosti', says that his *O. Cadmus* appears to be *O. cancellatum*, Hall, not Eichwald. And in the explanation of fig. 11, of Plate 19 (10) of the Twentieth Regent's Report, Hall says that the character of the surface of impressions of the exterior of specimens from Wisconsin

and Illinois that he figures and refers to *O. angulatum* and *O. virgatum*, is 'precisely like that of *O. cancellatum*, Hall, from the Niagara group of New York, and differs in no essential particular from the minute surface markings of *O. columnare*.' But Dr. Foord has shown that Eichwald's *Orthoceratites cancellatus* is an *Endoceras*, and the specific name *cancellatum* does not appear to be preoccupied in *Orthoceras*, and certainly is not in *Kionoceras*. And if it be objected that 'once a synonym always a synonym', then the next specific name to be selected would seem to be *K.* or (*O.*) *Scammoni*, if Hall's *O. cancellatum* is not the same as the *O. canaliculatum* of Sowerby."

ORTHO CERAS, sp. indet.

Apparently brevicone; longitudinally ridged, ridges unequal in size and irregular in distribution.

Portage road at falls: a fragment that is not sufficiently long to shew conclusively whether it formed part of a brevicone orthoceratite or not.

ORTHO CERAS EKWANENSE, Whiteaves.

Plate 33, figs. 1 & 1 a.

Orthoceras Ekwansense, Whiteaves1904. Geol. Surv. Canada, Ann. Rep., vol. XIV, pt. F, p. 56.

"Shell increasing rather rapidly in thickness, compressed, elliptical in cross section; surface of the test smooth; septa very close together; siphuncle apparently central, though the internal structure is badly preserved in the only specimen collected.

"Portage road at falls: one specimen, a little over two inches in length, and nearly two inches in its longer diameter at the larger end. Perhaps a *Rhizoceras*, which is possibly an inadvertent spelling of *Rhizoceras*."

PHRAGMOCERAS LINEOLATUM, Whiteaves.

Plate 34, figs. 1, 1a, 2 & 3.

Phragmoceras lineolatum, Whiteaves1904. Geol. Surv. Canada, Ann. Rep., vol. XIV, pt. F, p. 57.

"Shell, or cast of the interior of the shell, apparently essentially similar to that of *P. Nestor*, as described and figured by Hall, in general shape and in that of its aperture, but with the exterior of the test marked with very numerous, closely and regularly disposed, minute transverse impressed lines, that give to the surface a minutely ribbed appearance, under a lens.

"Middle rapid, a cast of the interior of a large body chamber (figs. 1 & 1 a); foot of portage road, one good specimen and three fragments;

portage road, at falls, two good specimens (figs. 2 & 3) and one fragment ; and upper rapid, a large but imperfect cast of the body chamber and of nine or ten of the chambers between the septa.

"The type of *P. Nestor* is a mere cast of the interior of the shell, with no indications of the surface markings of the test, and in *P. Nestor*, var. *Canadense*, there are remains of rather coarse longitudinal ribs."

CRUSTACEA.

OSTRACODA.

ISOCHILINA or LEPERDITIA, sp. indet.

Upper rapid : a rather large right valve about twelve millimetres long, but with only its interior exposed.

TRILOBITA.

ILLENUS, sp. indet.

Middle rapid, one pygidium ; foot of portage road, three glabellæ and four pygidia ; and portage road at falls ; one pygidium. The dorsal furrows of these three glabellæ are well defined, but the shape and position of the eyes, or ocular lobes, are not well shewn in either.

BRONTEUS EKWANENSIS, Whiteaves.

Plate 42, fig. 1.

Bronteus Ekwansensis, Whiteaves 1904. Geol. Surv. Canada, Ann. Rep., vol. XIV, pt. F, p. 58.

"Pygidium very large, attaining to a length of a little more than four inches and a little longer than wide, longitudinally and broadly subelliptical but truncated anteriorly, its posterior end being rather narrowly rounded and its lateral margin nearly straight on each side anterior to the midlength. Axis moderately convex, inversely subtriangular, longer than wide, with an obtuse apex, occupying more than one-third but less than one-fourth of the entire length of the pygidium and marked with a transverse groove near its anterior margin. Pleural region most prominent at and near the midlength of each of the pleural ribs, decreasing abruptly in convexity outward to the lateral margins of the pygidium, but much more gradually so to its posterior margin ; marked by fifteen large flattened convex radiating ribs, with narrow grooves between them ; each rib being narrow at and near the axis and wider at some distance from it, though all the ribs fade out at a short distance from the margin and before reaching it. The median rib is shallowly bifurcate posteriorly.

"Surface apparently smooth. Cephalon and thoracic segments unknown.

"Lower rapid, one imperfect pygidium; middle rapid, the largest and most perfect pygidium collected (fig. 1); and foot of portage road, one imperfect pygidium and two fragments."

BRONTEUS AQUILONARIS, Whiteaves.

Plate 42, fig. 2.

Bronteus aquilonaris, Whiteaves.....1904. Geol. Surv. Canada, Ann. Rep., vol. XIV, pt. F, p. 58.

"Pygidium of medium size, apparently not exceeding an inch and a half in width, transversely subelliptical and much wider than long, with an almost flat but slightly convex axis, and still flatter pleural region. Axis short, inversely subtriangular, with an obtuse apex and somewhat concave sides, nearly twice as wide as long, almost smooth but marked with one transverse furrow near the anterior margin; median rib a little wider than any of the lateral ribs and bifurcate posteriorly; lateral ribs seven on each side, straight and flattened convex, all of the ribs fading out before reaching the margin.

"Surface apparently smooth. Cephalon and thoracic segments unknown.

"Portage road at falls, three pygidia, each with the axis imperfect; and foot of portage road, one pygidium with the axis well preserved (fig. 2).

"*Bronteus Niagarensis*, Hall, from the Niagara limestone of Ontario, has a much larger pygidium, with the midrib entire and contracted at its midlength, while the lateral ribs are wider and flexuous. *B. acamas*, Hall, from 'limestone of the Niagara group at Wisconsin' and Ontario (which S. A. Miller says is a synonym of *B. occasus* of Winchell and Marcy) has a much larger and more pointed pygidium, with an 'entirely simple' and undivided midrib. *B. insularis* of Billings, from the Anticosti group of Anticosti, is a diminutive species with a pygidium less than half an inch wide and wider than large; while *B. Pompilius*, Billings, from the Silurian (Upper Silurian) rocks at Port Daniel, has a small pygidium with a 'longitudinal median lobe in the axis.'"

CERAURUS TARQUINIUS, Billings (Sp.).

Cheirus Tarquinius, Billings.....1863. Proc. Portland Nat. Hist. Soc., vol. I, p. 121, fig. 22.

Portage road at falls, and foot of portage road. At each of these localities two heads were collected, which seem to be essentially similar to the types of *C. Tarquinius*, from Port Daniel, in the Museum of the Sur-

vey, though the characters of the posterior angles of the cephalon of that species are still unknown. In the Ekwon River specimens, the eyes are opposite the second lobe of the glabella, the cheeks are coarsely punctured, and each of the posterior angles of the cephalon ends in a short spine.

E. Billings adopted the name *Cheirurus* in preference to *Ceraurus* for the Canadian species of that genus, and in a list of Lower Silurian fossils in the Geology of Canada (1863) gives 1815 as the date of publication of *Cheirurus*, Beyrich. But, Salter, in his Monograph of the British Silurian Trilobites, and the United States paleontologists, give 1832 as the date of publication of *Ceraurus* by Green, and 1845 as that of *Cheirurus* by Beyrich, and consequently use the former of these names.

In the second part of the third volume of the Final Report on the Geological and Natural History Survey of Minnesota, Dr. J. M. Clarke places *C. Tarquinius* in the same group, or section of the genus, as *C. pleurex-anthemus*. But it seems to the writer that the pygidium of a Port Daniel specimen of *C. Tarquinius* is essentially similar to that of *C. Niagarensis* or *C. insignis*, and that it is very different from that of *C. pleurex-anthemus*.

A. 3.—FROM SUTTON MILL LAKES.

FROM THE CLIFF OF LIMESTONE ON THE SMALL ISLAND IN THE NORTHERN LAKE.
COLLECTED BY MR. D. B. DOWLING IN 1901.

ANTHOZOA.

TETRACORALLA.

ZAPHRENTIS STOKESI, Edwards and Haime.

Four specimens (Lambe).

HEXACORALLA.

FAVOSITES HISINGERI, Edwards & Haime.

One specimen (Lambe).

POLYZOA.

PHENOPORA KEEWATINENSIS, Whiteaves.

Plate 24, figs. 6 & 6 a.

Phenopora Kewatinensis, Whiteaves. 1904. Geol. Surv. Canada, Ann. Rep., vol. XIV, pt. F, p. 40.

“Zoarium bifoliate, branching, consisting of a thin, flattened frond, which is six millimetres wide on an average, but ten mm. wide at a bifur-

cation, and which bifurcates at intervals of about eleven mm. Zoëcia rhombic, a little longer than wide, seven in two millimetres measuring lengthwise, and eight to eight and a half measuring transversely, divided by thin, straight longitudinal partitions, which form their sides and separate them into longitudinal rows. Apertures of the zoëcia obliquely oval.

"Surface marked by arching striae, which curve convexly forward."

One specimen.

"In regard to this specimen, M. Bassler writes as follows. 'It is a *Phænopora* closely allied to several Clinton species, but I should regard it as new. In zoecial structure it is very close to *P. multifida*, Hall, and especially to *P. fimbriata*, James. *P. multifida* has a different zoecial growth, and slightly larger zoëcia. *P. fimbriata* has about the same zoecial measurements, but the growth of the zoarium is quite different.'

"Seven other species of *Phænopora* are known to occur in the Cambro-Silurian and Silurian rocks of Canada. These are: *P. incipiens*, Ulrich, from the Trenton limestone of Montreal; *P. constellata* and *P. explanata*, Hall, also *P. punctata*, Nicholson & Hinde, from the Clinton of Ontario; *P. ensiformis*, Hall, from the Clinton and Niagara formations of Ontario; and *P. excellens* (*Ptilodictya excellens*, Billings) & *P. superba* (*Ptilodictya superba*, Billings) from the Anticosti group of that island."

BRACHIOPODA.

STROPHEODONTA (BRACHYFRION) sp. indet.

Surface marked with very fine, equal, radiating raised lines.

Three very imperfect specimens.

CAMAROTECCHIA EKWANENSIS, Whiteaves.

Two specimens, that are probably referable to this species, though the ribs seem to be more rounded, perhaps because the test is exfoliated.

CRUSTACEA.

TRILOBITA.

CALYMENE NIAGARENSIS? Hall.

Calymene Niagarensis, Hall 1843. Geol. Rep. Fourth Distr. N.Y., p. 102; and (1852) Pal. N. York, vol. II, p. 397, pl. 67, figs. 11 and 12.

Calymene Blumenbachii, Billings (pars) 1863 and 1866. The specimens from the Niagara and Guelph formations of Ontario, and from the Anticosti group of Anticosti, referred to under that name in the Geol. Canada, and Cat. Silur. Foss. Anticosti.

An imperfect head that is probably referable to this species, though it shews little more than a cast of the glabella, which is proportionately wider in front than that of average examples of *C. Niagarensis* from the Anticosti group of Anticosti. The Canadian Calymenes that E. Billings identified with *C. Blumenbachii* are now usually referred to four species, viz., *C. senaria*, Conrad, from the Trenton limestone; *C. callicephalo*, Green, from the Hudson River group; *C. Niagarensis*, Hall, from the Niagara, Guelph and Lower Helderberg formations, and from the Anticosti group; and *C. platys*, Green, from the Corniferous limestone.

ENCRINURUS, sp. indet.

One pygidium. The axis of this pygidium is long and slender, with sixteen or seventeen annulations, each of the six anterior ones being minutely tuberculated. There are nine lateral ribs on each side, without any tubercles.

A. 4.—FROM THE WINISK RIVER.

COLLECTED BY MR. W. McINNES in 1903.

ANTHOZOA.

TETRACORALLA.

STREPTELASMA, sp. indet.

A small slab of limestone, with two specimens in longitudinal and one corallum in transverse section, on its worn and exposed surface. These sections shew only the general shape, which is straight and conical with an obtuse base, and some of the septa, with a few of the dissepiments between them.

From an exposure thirty one miles above the mouth of the river.

HEXACORALLA.

FAVOSITES GOTHLANDICUS, Lamarck.

From the same exposure as the preceding species, two small colonies, on the same piece of limestone; and from an exposure thirty four miles from the mouth of the river, one specimen.

BRACHIOPODA.

TRIMERELLA, sp. indet.

Two worn casts of the interior of pedicle valves, which shew only the general shape, and obscure casts of the platform vaults or umbonal chambers.

From loose blocks at or near the mouth of the river.

STROPHEODONTA (BRACHYPRION) NIAGARENSIS †

(Winchell & Marcy.)

Cfr. *Strophomena niagarensis*, Winchell & Marcy. 1865. Mem. Boston Soc. Nat. Hist., vol. 1, p. 92, pl. 2, fig. 9.

Strophodonta profunda, (pars) Hall. 1867. Twentieth Ann. Rep. Reg. Univ. St. N. York, p. 369. pl. 13 (4), figs. 3 and 4.

Two very immature, detached valves of a strophomenoid shell, that correspond very well in all but size, with the descriptions and figures of the exterior of this species. The more perfect of the two, a small ventral valve, is moderately convex, wider than long, and its cardinal angles are produced. Its surface markings consist of fine radiating raised lines, with from two to six still smaller ones between each pair of the larger ones. The characters of the interior are not shown in either. Both of them are from loose pieces at or near the mouth of the river.

One good sized and fairly well preserved specimen, collected at an exposure ten miles above the mouth of the river, has been kindly compared with typical western specimens of *S. Niagarensis*, by Mr. C. Schuchert. These western shells, Mr. Schuchert thinks, are "more convex, and their larger striae more prominent, causing the intermediate areas with the finer striae to be more depressed," but these may be only local peculiarities. At the same locality three other Strophomenoids were collected, which may prove to be varieties of *S. Niagarensis*, but which do not show the characters of the hinge area, or of the interior of either valve. One is a small ventral, with very fine and equal radiating striae. The other two are medium sized detached valves that are moderately convex, or tumid, gibbous and geniculate, at about the midlength, wider than long, with the cardinal angles slightly produced, and the front margin nasute. Their surface markings consist of minute, fasciculate, radiating raised lines, with minute punctures between them. According to Mr. Schuchert, *S. Niagarensis* is "closely related to *Strophomena imbrex*, Pander, variety, as identified by Lindström from the Silurian of Gotland," and E. Billings has recognized and recorded *S. imbrex* as occurring in the Hudson River formation at Cape Robert, Anticosti.

A concave dorsal valve from an exposure thirty-one miles above the mouth of the river, may also be referable to *S. Niagarensis*, though it shows only the general shape, and the surface markings of the exterior, but neither the hinge area, dentition, nor any of the characters of the interior.

LEPTENA RHOMBOIDALIS, Wilckens (Sp.)

Three very small but characteristic specimens in a small loose block of limestone, picked up at or near the mouth of the river.

A full synonymy of American specimens of this widely distributed species, with references, is given on page 240 of Mr. Charles Schuchert's "Synopsis of American Fossil Brachiopoda," published at Washington, in 1897, as Bulletin No. 87 of the United States Geological Survey.

ORTHIS, sp. indet.

From an exposure ten miles above the mouth of the river; a cast of the interior of a ventral valve of a coarse-ribbed species.

CAMAROTECCHIA (?) WINISKENSIS (N. Sp.)

Plate 25, figs. 5 & 6.

Shell compressed, broadly rounded in front, obtusely angular behind, the larger specimens somewhat pentagonal in marginal outline and a little wider than long, the smaller ones ovately subcircular or widely subovate, and a little longer than wide; front margin of the valves shallowly sinuate.

Ventral valve with a rather obscurely defined shallow median depression, that is obsolete or undeveloped in young specimens, marginal in older ones, and that extends backward to a little beyond the midlength in full grown ones; a nearly straight, rather prominent or produced umbo, and an acute and very slightly incurved beak.

Dorsal valve (of apparently not quite mature individuals) uniformly compressed convex and moderately inflated, its umbo and beak much smaller than those of the ventral.

Surface of both valves marked with numerous, closely disposed and very narrow radiating ribs, with fine grooves between them. In the largest specimen collected, a detached ventral valve some fifteen millimetres wide by twelve mm. and a half long, there are six ribs in the sinus, and fourteen or fifteen on each side.

Hinge area and characters of the interior of the valves unknown.

The foregoing description is based upon three detached ventral valves, that are a little wider than long, and upon two smaller specimens, with both valves, that are a little longer than wide, all from an exposure thirty-four miles above the mouth of the river; but one small specimen from an exposure ten miles above the mouth of the river, is also probably referable to this species.

CAMAROTECCHIA (?) COALESCENS. (N. Sp.)

Plate 25, fig. 7.

Shell very small, moderately convex, subovate in marginal outline and a little longer than wide, with a shallow sinus or depression at and near

the front margin of the ventral valve, and a corresponding fold in the dorsal.

Umbo of the ventral valve moderately prominent or produced, its beak slightly incurved; umbo and beak of the dorsal much less prominent and smaller.

Surface marked with low, rounded radiating ribs, that are wider than the narrow grooves between them. In the most typical specimens there are four ribs in the sinus of the ventral and eight on each side, with a corresponding number on the dorsal; but in others there are as many as five or six on the fold of the dorsal, and eleven or possibly twelve on each side. In the sinus of the ventral and on the fold of the dorsal two ribs often coalesce near the front margin, a circumstance which has suggested the foregoing specific name.

Hinge area and characters of the interior of the valves unknown.

Dimensions of a typical and perfect ventral valve: maximum height, seven millimetres and a half; greatest width, six mm. and a half.

A few specimens, mostly single valves or portions of valves, on a small piece of limestone from an exposure twenty-four miles above the mouth of the river. One of these specimens, however, is apparently a ventral valve of a very small specimen of *C. Winiskensis*.

SPIRIFER, sp. indet.

From loose pieces of limestone at or near the mouth of the river: a cast of the interior of the ventral valve of a small specimen, not more than eight millimetres in width, of a *Spirifer*, with a narrow mesial sinus,

GLASSIA VARIABILIS, Whiteaves.

Plate 26, figs. 3, 4 and 5.

Glassia variabilis, Whiteaves..... 1904. Geol. Surv. Canada, Ann. Rep., vol. XIV, pt. F, p. 42.

"Shell very small, strongly compressed and lenticular in outline in transverse section, or moderately convex and varying in marginal outline from nearly circular and sometimes a little wider than long to subovate and a little longer than wide.

"Ventral valve with the front margin either nearly straight and devoid of sinus, or faintly sinuated, or provided with a rather wide but not distinctly defined, shallowly concave but not very deep, mesial sinus, that extends backward to about the midlength. Umbo of the ventral valve small, narrow and not very prominent or produced, its beak slightly incurved and apparently perforate.

"Dorsal valve with the umbo and beak smaller than those of the ventral.

"Surface apparently smooth.

"Spiralia directed toward the dorsal side (Schuchert); jugum, muscular impressions, and hinge dentition unknown.

"Dimensions of a typical and average specimen (from the Winisk River): maximum length, slightly over eight millimetres; greatest width, eight mm. and a half; maximum thickness, four mm.

"Two small loose blocks of limestone from or near the mouth of the Winisk River, collected by Mr. W. McInnes in 1903, are almost exclusively composed of nearly perfect shells of this species, many of which have the spiralia, or internal spiral cones, preserved. Some of the best of these specimens have been examined by Mr. Charles Schuchert, who writes as follows in regard to them in a letter dated March 9, 1904. The spiral cones in the Winisk shell are directed toward the dorsal side, but I cannot see the jugum. For the present I would refer it to *Glossia*. In external characters it is very near to *G. subovata* (Sowerby) but the difference in the spiralia will distinguish them, as the latter has the cones inwardly or medially directed. This difference is certainly of specific value, but for the present I should not regard it as of generic importance, as different genera of the Atrypidae have the spiralia directed either laterally, medially or dorsally."

MOLLUSCA.

GASTEROPODA.

EUOMPHALUS, sp. indet.

A cast of the interior of a specimen of a closely coiled *Euomphalus*, that is perhaps conspecific with a similar cast from the lower rapid of the Ekwan. From an exposure thirty four miles above the mouth of the river.

A cast of the interior of the shell of a species of *Euomphalus* or "*Phanerotinus*", was collected at an exposure ten miles above the mouth of the river. This cast shews little more than that the spire is depressed, and that the whorls, which are flattened above and rounded below, are slender and separate, though spirally coiled. Two smaller but otherwise similar casts were collected by Mr. Low in 1886 at Limestone Rapid on the Fawn River.

TROCHONEMA, sp. indet.

An imperfect cast of the interior of a shell, with a flattened biangular periphery,—that seems to be referable to this genus. From loose pieces of limestone at or near the mouth of the river.

LOXONEMA, sp. indet.

An imperfect cast of the interior of the shell of a rather large species of this genus. From an exposure ten miles above the mouth of the river.

CEPHALOPODA.

ACTINOCERAS KEEWATINENSE, Whiteaves.

A cast of the interior of four chambers of a siphuncle, that is apparently part of a specimen of this species, the types of which are from the Attawapiskat River. The original description of these types is reprinted on page 246 ante, and two of them are figured on Plate 30, figs. 7 and 8.

From loose pieces of limestone at or near the mouth of the river.

CYRTOCERAS, sp. indet.

A badly preserved cast of the interior of the shell of a small, slender and slightly compressed species of this genus. From an exposure thirty-one miles above the mouth of the river.

CRUSTACEA.

TRILOBITA.

BRONTEUS, sp. indet.

A portion of a diminutive cephalon, and a small and imperfect pygidium, on a small loose piece of limestone at or near the mouth of the river.

ENCRINURUS, sp. indet.

A very small pygidium, about three mm. wide and a little more than two long, with only the inner surface exposed. There are three small circular pits, corresponding to as many small tubercles on the exterior, on each of the pleure. Also from a small loose piece of limestone picked up at or near the mouth of the river.

A worn cast of the interior of a pygidium of a species of *Encrinurus* was found at an exposure thirty-four miles from the mouth of the river.

A 5. FROM "LIMESTONE RAPID", FAWN RIVER, OR BRANCH OF THE SEVERN.

COLLECTED BY MR. A. P. LOW IN 1886.

The rocks at this locality are described on pages 15F & 18F of Mr. Low's "Preliminary Report on an Exploration of the Country between Lake Winnipeg and Hudson Bay", published in the Annual Report of this Survey

for 1886, New Series, volume II. In that publication it is stated that "the limestones of the Severn and Fawn rivers, as roughly determined from the fossils collected, are not older than the Galena, and may be as new as the Niagara, more investigation is, however, required to fix their precise horizon." Later, in 1899, in an Address by the writer before Section E. of the American Association for the Advancement of Science at Columbus, Ohio, these rocks were stated to be possibly of Devonian age, on the evidence in them of a fragment that was inadvertently referred to *Sphaerospongia tessellata*. But, it has since been clear that this fragment is part of a specimen of a species of *Receptaculites*, and that the fossils at Limestone Rapid are of the same age as those already enumerated or described from the Attawapiskat and Ekwan rivers.

SPONGIÆ.

RECEPTACULITES, sp. indet.

A fragment which has been inadvertently and erroneously recorded as part of a specimen of *Sphaerospongia tessellata*, in "Contributions to Canadian Paleontology", vol. I, p. 259, as well as in the Address at Columbus,—though its plates are clearly square, whereas most of those of *Sphaerospongia* are distinctly hexagonal.

ANTHOZOA.

HEXACORALLA.

FAVOSITES GOTHLANDICUS, Lamarck.

Several specimens (Lambe).

ALVEOLITES NIAGARENSIS, Rominger.

Alveolites Niagarensis, Rominger. 1876. Geol. Surv. Mich., Fossil Corals, p. 39, pl. 16, figs. 1 & 2; but not *A. Niagarensis*. Nicholson, 1875, which is apparently not a true *Alveolites*.

" " Lambe. 1899. Contr. Canad. Paleont., vol. III, pt. 2, p. 23.

One specimen (Lambe).

HYDROZOA.

STROMATOPORIDÆ, genus and species uncertain.

One specimen.

ECHINODERMATA.

CRINOIDEA, genus and species uncertain.

Portions of small annulated columns.

BRACHIOPODA.

ORTHIS.

An imperfect ventral valve of a very small, rather coarsely ribbed and probably undescribed species of *Orthis*, allied to *O. Davidsoni*; and two fragments of a larger and more finely ribbed species.

GLASSIA VARIABILIS, Whiteaves.

Plate 26, figs. 7, 8 and 9.

Thirteen specimens, which are probably referable to this species. Three of these are figured on Plate 26. See also page 273 ante.

RHYNCHOSPIRA LOWI. (N. Sp.)

Plate 25, figs. 8 and 9.

Shell small, somewhat compressed, subcircular and a little wider than long or subovate and longer than wide, but always pointed more or less obtusely behind; surface of both valves radiately ribbed.

Ventral valve rather more convex than the dorsal, its umbo rather obtuse, or not very prominent or produced, and its beak truncated and perforate, the perforation being rather large and circular, or nearly circular, in outline. In the median line there is a slightly greater distance between the two ribs that bound it than between any of the others, but there is no distinct mesial sinus in the ventral valve, nor fold upon the dorsal.

Dorsal valve with an obscure, narrow, longitudinal median depression in the umbonal region, and a small, slightly incurved, and imperforate beak.

Surface of both valves marked with from about ten to sixteen simple or bifurcating, subangular radiating ribs.

Characters of the interior of the valves unknown.

Approximate dimensions of the largest and most perfect specimen known to the writer: length, seven millimetres; greatest width, eight mm.

A few specimens, on two small thin and nearly flat pieces of limestone.

This little shell seems to differ from *Rhynchospira formosa*, (the *Trematospira formosa* of Hall,)* from the Lower Helderberg rocks of the State

* Palaeontology of the State of New York, vol. III, pt. 1 (1859) p. 215; and pt. 2 (1861) pl. 36, figs. 2 a-t; & pl. 95 A, figs. 7-11.

of New York, principally in its very diminutive size, though it may prove to be only a local or stratigraphical variety of that species. *Rhynchospira Electra* (the *Retzia Electra* of E. Billings)* from the Silurian rocks of Maine, has a much more nearly pentagonal contour, and apparently more inflated valves.

MOLLUSCA.

GASTEROPODA.

LOPHOSPIRA, sp. indet.

Two very imperfect and badly preserved casts of the interior of the shell of specimens of a species of this genus. As previously stated, on page 246, a similar cast was collected at Rainy Island, on the Attawapiskat River, by Dr. R. Bell, in 1886.

EUOMPHALUS, or STRAPAROLLUS, sp. indet.

Two imperfect casts.

CEPHALOPODA.

Only two specimens of cephalopoda were collected at this locality. One of these is an obscure fragment of an orthoceratite; and the other a piece of a rather large, slightly curved, subcylindrical siphuncle, with faint, oblique and rather distant constrictions.

B. FROM MANITOBA.

B. 1.—FROM STONEWALL.

COLLECTED BY T. C. WESTON IN 1884, BY D. R. DOWLING IN 1891 AND 1902, AND BY J. B. TYRRELL AND W. H. ROBSON IN 1897.

ANTHOZOA.

TETRACORALLA.

APHYLLOSTYLUS GRACILIS, Whiteaves.

Plate 24, figs. 1 and 1 a.

Aphylostylus gracilis, Whiteaves.....1904. Ottawa Naturalist, vol. XVIII, no. 6, p. 113.

The original descriptions of this genus and species are as follows :—

* Proceedings of the Portland Natural History Society (1863) vol. I, p. 114, pl. 3, fig. 11.

"APHYLLOSTYLUS, gen. nov.

"Corallum consisting of slender, contiguous, subcylindrical corallites, that are circular or nearly circular in transverse section, and that seem to have formed part of a compound, branched, fasciculate, ascending and somewhat spreading colony, essentially as in *Pycnostylus*. Surface markings of the exterior of the corallites unknown.

"The structure of the interior of the corallites consists of conspicuous transverse tabulae, and of numerous, very minute, spiniform septa. The tabulae, though irregular in their disposition and in their distances apart, are for the most part complete and continuous. The spiniform septa consist of both longitudinal and transverse rows of close-set, very short, straight and inwardly directed, minute spinules, not very unlike those of a Silurian Favosite, but much smaller and shorter. Where the tabulae are comparatively far apart, the longitudinal arrangement of the rows of spinules is very obvious, and there are from four to seven spinules in each longitudinal row, between two of the tabulae. But, in places where the tabulae are close together, the transverse arrangement of the rows of spinules is more apparent, and there are either one or two transverse rows of spinules between two tabulae.

"The general shape of the corallites in this genus, their mode of growth and their internal tabulae, appear to be essentially similar to those of *Pycnostylus*, but in the latter the septa are marginal, well developed, and consist of thin, continuous, longitudinal ridges.

"*Pycnostylus* seems to be most nearly related to *Amplexus*, which is usually referred to the Zaphrentidae, and it may be that *Aphylostylus* should also be included in that family.

"APHYLLOSTYLUS GRACILIS, sp. nov.

"Corallites slender, averaging about two or three millimetres in diameter; septal spinules very minute, scarcely visible to the naked eye.

"This genus and species are based upon fragments of colonies, in six small pieces of limestone of Silurian (Upper Silurian) age, from Stonewall, about thirty-one miles west of East Selkirk, collected by J. B. Tyrrell in 1897. Each of these pieces of limestone shows both longitudinal and transverse sections of a few contiguous corallites, upon one or more of its recently broken surfaces. The internal structure of most of these corallites is well preserved, but their mode of branching is nowhere very clearly seen. Two or three similar specimens had previously been collected by the writer in 1888 from loose masses of limestone on the banks of the Fairford River, about six or seven miles below the Hudson Bay post at Fairford, Manitoba."

HEXACORALLA.

FAVOSITES GOTHLANDICUS, Lamarck.

Common.

FAVOSITES ASPER, d'Orbigny.

- Favosites alveolaris*, Lonsdale.....1839. Murchison's Silur. Syst., p. 681. pl. 15 bis, figs. 1, 1a, 1b, and 2, 2a.
- Favosites aspera*, d'Orbigny.....1850. Prodr. de Paleont., vol. I, p. 49.
- " " Milne-Edwards & Haime. 1851. Polyp. Foss. Terr. Paleoz., p. 234; and (1855) Brit. Foss. Corals, p. 257, pl. 60, figs. 3 and 3 a.
- " " McCoy.....1855. Brit. Paleoz. Foss., p. 20.
- Favosites prolificus*, Billings.....1865. Canad. Natur., Second Series, vol. II, p. 429; and (1866) Cat. Silur. Foss. Anticosti, p. 6.
- Favosites capax* (?) Billings.....1866. Cat. Silur. Foss. Anticosti, p. 6.
- Favosites Niagarensis*, Rominger (non Hall). 1876. Geol. Surv. Michigan, Fossil Corals, p. 22, pl. 5, fig. 1.
- Favosites aspera*, Lebedeff.....1892. Obersilurische Fauna des Timan, p. 8, pl. 1, figs. 1, a, b, c.
- Favosites prolificus*, Whiteaves.....1895. This volume, pt. II, p. 113.
- Favosites aspera*, Lambe.....1899. Contr. Canad. Paleont., vol. IV, pt. 1, p. 4, pl. 1, fig. 2.

Apparently the most abundant and characteristic fossil at this locality.

BRACHIOPODA.

The inarticulate brachiopoda in the collections from this locality are represented by a cast of the interior of a valve of a small *Dinobolus*, apparently allied to, or possibly identical with, the *D. Conradi* of Hall. The articulata are represented by several, very badly preserved valves of a small shell that may be referable to *Plectambonites*, or *Leptaena*.

MOLLUSCA.

GASTEROPODA.

The gasteropoda collected at this locality are all imperfect casts of the interior of the shell, that can not be satisfactorily identified specifically, and in one case not even generically. At least three genera are represented, viz., *Lophospira*, *Trochonema*, and perhaps *Straparollus*.

CEPHALOPODA.

SPYRO CERAS MERIDIONALE. (N. Sp.)

Plate 30, fig. 9.

Shell longicone, slender, slightly curved and somewhat compressed, the outline of a transverse section near the larger end being broadly elliptical and not very far from circular.

Test unknown: surface of the cast of the interior marked with straight, narrow, annular, transverse ribs, that are rather close together at and near the smaller or posterior end, but comparatively distant at and towards the larger, anterior end. At and near the smaller end the ribs are about one millimetre apart at their summits, but at the larger end they are about four mm. apart, and much narrower than the rather shallow grooves between them.

Septation, and shape and position of the siphuncle unknown.

The only specimen known to the writer, which was collected by Mr. Dowling in 1902, is about sixty-five mm. in length. It is seven mm. in diameter at the smaller end, and sixteen and a half at the larger.

TRIPLEURO CERAS ROBSONI, Whiteaves.

Plates 31 & 32. The only figure in each.

Tripleuroceras Robsoni, Whiteaves.....1898. Ottawa Naturalist, vol. XII, no. 6, p. 123.

Original description: "Shell large, robust, longicone, straight and increasing very slowly in breadth and thickness, flattened in the broad siphonal and presumably ventral region, but rounded and much narrower at the sides: characters of the antisiphonal side and nature of the surface markings unknown. Sutures of the septa broadly and concavely arched on the venter, nearly straight where they pass over the sides; the three or four next to the body chamber closer together than those which immediately precede them. Siphuncle marginal, presumably ventral, large, expanded between the septa and apparently nummuloidal.

"Three imperfect and badly preserved casts of the interior of shells of this species, from Stonewall, Manitoba, were presented to the Museum of the Survey in the fall of 1897, two by Mr. W. H. Robson, of Lethbridge, Alberta, and one by Mr. Donald Gunn, of Stonewall. The whole of the antisiphonal and presumably dorsal region of each of these specimens is buried in a very hard dolomitic limestone, so that it is doubtful whether they are referable to Hyatt's genus or not. The two presented by Mr. Robson are septate throughout, and the larger one" which is figured on

Plate 32, "has a nearly cylindrical, septate but possibly adventitious object, like a cast of the interior of the shell of a small *Orthoceras*, some two inches in length and fully half an inch in thickness, exposed in the middle of its siphuncle posteriorly. The one presented by Mr. Gunn" which is figured on Plate 31, "has a considerable portion of the ventral side of the body chamber preserved but the lateral margin on both sides is very imperfect.

"The species seems to differ from the "*Orthoceras (Actinoceras) Beloitense*" of Whitfield,* from the Trenton limestone of Wisconsin, which it resembles in some respects, in its more flattened venter, more concavely arched septa in the ventral region, and in its proportionately larger and apparently nummuloidal siphuncle."

But, in regard to the siphuncle of *T. Robsoni*, it would have been better to say, that its exact shape, size and relative position are not at all clearly shewn in the few specimens yet collected, though it seems to have been marginal and enlarged between the septa.

CYRTOCERAS (?) CUNEATUM. (N. Sp.)

Shell widely arcuate, strongly but rather obliquely compressed, very narrow on the periphery or venter, much wider but narrowly rounded on the dorsum, the outline of the transverse section being ovate cuneate, and the lateral diameter to the dorso-ventral about as three to five.

Septa averaging about six millimetres apart laterally, the sutural lines being shallowly concave on both sides and produced into a narrow pointed saddle on the venter. Siphuncle and test unknown.

The specimen upon which the foregoing description is based is a cast of the interior of part of the septate portion of the shell. It is evidently not a true *Cyrtoceras*, but a probably new generic type, which there is not yet sufficient material to define satisfactorily.

TROCHOCERAS INSIGNE, Whiteaves.

Plate 41. The only figure.

Trochoceras insigne, Whiteaves. 1898. Ottawa Naturalist, vol. XII, p. 124.

Original description. "Shell, or rather cast of the interior of the shell, rather large and attaining to a maximum diameter of fully five inches, dextral and consisting of two slender, closely contiguous volutions that are coiled on very nearly the same plane, and slightly compressed both above and below, so that the outline of a transverse section of the outer volution would be broadly elliptical, with the dorso-ventral diameter a little greater

* *Geology of Wisconsin*, Vol. IV, p. 226, pl. 8, fig. 1; & pl. 10, figs. 9 & 10.

than the lateral. Surface of the test unknown, that of the cast marked by large, transverse rib-like plications, which are moderately prominent on each of the sides, but obsolete on the periphery or venter,—and by very small, acute, thread-like spiral ridges. The transverse plications are rather distant, slightly flexuous and somewhat sigmoidal on each side of the outer volution, where they are separated by wide and shallowly concave depressions. The small spiral ridges are numerous, comparatively close together, though not very regularly disposed, and in one specimen, at least, rather larger and more prominent on the periphery of the outer volution than on its sides. Sutures of the septa concavely arched on both of the sides, where each suture intersects one, or rarely two, of the transverse plications. Shape and position of the siphuncle unknown.

"The first specimen of this shell that the writer had seen was given to the late Chief Justice Wallbridge by a quarryman at Stonewall and presented to the Museum of the Survey by Prof. E. J. Chapman in 1895. The exact locality from which this specimen was obtained was for a long time doubtful, but there is now every reason for believing that it came from the quarries at Stonewall. At any rate, in the fall of 1897, two specimens, which are known to have been collected at Stonewall, were presented to the Museum, one by Mr. John Gunn, and the other by Mr. W. H. Robson. At the same time, also, Mr. Tyrrell obtained a characteristic fragment of a specimen of this species, *in situ*, at the Stonewall quarries. By far the most perfect of the specimens yet received is the one presented by Mr. Gunn, and figured on Plate 41. It has two entire volutions preserved, which are gyroceran rather than nautilian in their mode of coiling, but very slightly asymmetrical. The inner volution is openly coiled, the apex or initial point being widely eccentric, and there is a large central perforation about an inch and a quarter in diameter.

"These specimens seem to indicate a previously undescribed species, which is here referred provisionally to *Trochoceras* rather than to *Lituites*, until the shape and relative position of its siphuncle be ascertained, when it may have to be transferred to *Plectoceras*, *Peismoceras* or *Discoceras*. It differs from *Lituites Bickmoreanus*, Whitfield (from the Niagara limestone of Indiana) which Hyatt says is a *Plectoceras*, in its more openly coiled inner volution, in its broadly elliptical and not sub-quadrate cross section, and in its closer transverse plications, which are quite obsolete on the periphery. Professor Whitfield, who has kindly compared two of the best specimens from Stonewall with the types of his species, thinks that the two forms are quite distinct.

B. 2.—FROM DAVIS POINT, LAKE MANITOBA.

COLLECTED BY J. B. TYRRELL AND J. F. WHITEAVES IN 1888.

The section at this locality is thus described on pages 195 and 196E of Mr. Tyrrell's "Report on North-western Manitoba, with portions of Assiniboia and Saskatchewan," in the Annual Report, New Series, Vol. V, pt. 1, of this Survey for 1890-91. Mr. Tyrrell's Report is dated 1892, but the volume of which it forms part is dated 1893.

"North west of the head of the Fairfield River the shore of the lake is generally low, and it is not till the vicinity of Davis Point is reached that the Silurian again makes its appearance. At the southern end of this low exposure, a thin and even-bedded dolomitic limestone crops out of the bank near the water's edge, and many slabs of the same rock are scattered over the shore. No fossils were found in it, but it is doubtless the same band as is exposed at Fairfield.

"At the north end of the exposure, and apparently overlying the last mentioned rock is a layer of very thick-bedded limestone, also slightly dolomitic. It is yellow, hard and tough, but not compact like the last, being largely composed of the debris of Stromatoporoids and corals. It weathers white, with a very rough surface." And it is from this upper layer that the following species of fossils were collected.

ANTHOZOA.

TETRACORALLA.

ZAPHRENTIS STOKESI, Edwards & Haime.

One specimen, which Mr. Lambe thinks is most probably referable to this species.

PYCNOSTYLUS GUELPHENSIS, Whiteaves.

Apparently common at this locality, though only a few specimens were collected.

HEXACORALLA.

FAVOSITES GOTHLANDICUS, Lamarck.

Apparently also common at this locality.

HYDROZOA.

(*Clathrodictyon ostiolatum*, Nicholson, and *C. vesiculosum*, Nicholson and Murie, are quoted by Mr. Tyrrell as having been collected at Davis Point

in 1888, on the authority of the late Professor H. A. Nicholson, who, in a letter to the present writer, received June 24, 1889, says that he can "pretty certainly identify" both of these species in the specimens forwarded to him from that locality. But, it is to be noted that Nicholson has nowhere quoted Manitoba as a locality for either of these species, in any of his subsequent publications; and that no specimen of any Stromatoporoïd from Davis Point in the Museum of the Survey is labelled with either of these names by him.)

C. FROM THE NORTH-EAST SHORE OF LAKE WINNIPEGOSIS.

COLLECTED BY MR. J. B. TYRRELL IN 1889.

The rocks from which these fossils were collected are described on 153-158E of Mr. Tyrrell's "Report on North-western Manitoba, with portions of Assiniboia and Saskatchewan," published by this Survey.

ANTHOZOA.

HEXACORALLA.

ALVEOLITES LABECHEI, Milne Edwards & Haime.

- Alveolites Labechei*, Milne Edwards & Haime. 1851. Polyp. Foss. Terr. Palæoz., p. 257; & (1855) Brit. Foss. Corals, p. 262, pl. 61, figs. 6, 6 a, & 6 b.
 " " Billings.....1866. Cat. Silur. Foss. Anticosti, p. 33.
 " " Lambe.....1899. Contr. Canad. Paleont., vol. IV, pt. 1, p. 21.

East shore, north of Birch Island: one specimen that is "thought to belong to this species." (Lambe).

BRACHIOPODA.

STROPHEODONTA ACANTHOPTERA, Whiteaves. (Sp.).

Plate 24, figs. 8 and 9.

- Strophomena acanthoptera*, Whiteaves.....1891. Canad. Rec. Sci., vol. IV, p. 294, pl. 3, figs. 1 and 2.
Strophodontia acanthoptera, Schuchert.... 1897. Synops. Amer. Foss. Brachiozoa, p. 419.

Original description of Strophomena acanthoptera. "Shell varying in outline from broadly semicircular or semioval and regularly rounded in front, to subtrigonal with the front margin produced and somewhat pointed in the centre,—but always broadest at the cardinal margin, which is produced on each side into a long, very slender and slightly curved spine;

length of each cardinal spine a little more than one half of the greatest breadth of either valve without the spines. Ventral valve regularly convex from beak to front, though the nasute forms are most prominent anteriorly along the median line; umbonal region compressed; beak small and raised very little above the general level of the hinge line; area transversely elongated and very narrow in the direction of its height, with a small equilateral foramen in the centre. Dorsal valve concave, with a perfectly straight cardinal margin, an extremely minute beak and a hinge area much narrower than that of the ventral.

"Surface marked by numerous, but comparatively distant and, for the most part simple, radiating raised lines, which increase by intercalation and alternate at unequal distances with from one to five (or perhaps more) shorter and much smaller ones, the whole being crossed by extremely minute and close set concentric striations, and by a few more or less distant lines of growth. Characters of the interior unknown.

"Collected at several localities on the northern portion of the east shore of Lake Winnipegosis, in the district of Saskatchewan and in the adjacent part of the Province of Manitoba by Mr. J. B. Tyrrell in 1889, (but previously found loose in this vicinity by Mr. D. B. Dowling in 1888,) also on the shores and islands of Cedar Lake, and on the Saskatchewan below Cedar Lake, by Mr. J. B. Tyrrell in 1890. At each of these localities it is apparently abundant and often associated with *Isochilina grandis*, var. *latimarginata*, Jones.

"The specimens consist either of natural moulds of the exterior of the shell or of casts of the interior, in a compact fine grained dolomite, and in no case is there any vestige of the actual test remaining. In several of these natural moulds, however, the minutest details of the surface ornamentation are well preserved, and it is from wax impressions made from two of these moulds that the figures" on Plate 24 were drawn.

"The species is apparently most nearly allied to the *Strophomena Leda* of Billings,* from division 3 of the Anticoosti group of the Island of Anticoiti (which Mr. Billings correlates with the Llandovery of England and with the Clinton of the State of New York), but seems to differ therefrom in its much larger size, and in the greater proportionate length of its cardinal spines. Both it and *S. Leda* are evidently what Professor H. S. Williams† would call 'geological mutations' of the 'race which began in *Strophomena alternata* in the Trenton stage,' but they form a marked exception to his statement that in the American race of the *S. alternata* type, the slender mucronate points at the terminations of the hinge line first appear in the Tully limestone."

*Geological Survey of Canada, Palaeozoic Fossils, vol. I, 1865, p. 120, figs. 98 and 99.

†See his paper on "The Cuboides Zone and its Fauna," in Bull. Geol. Soc. America, published May, 1890.

Two other species of brachiopoda are represented in the collections made by Mr. Tyrrell at some of the exposures on the north-east shore of Lake Winnipegosis, or on the islands adjacent thereto. These are:— three very imperfect specimens of a shell like a small *Athyris*; and a few casts of the interior, or moulds of the exterior, of the valves of a small *Camarotoechia*.

MOLLUSCA.

PELECYPODA.

PTERINEA OCCIDENTALIS. (N. Sp.)

Plate 28, figs. 1, 2 and 3.

Shell small, always longer than high, and in some specimens considerably elongated, the main body of each valve in the shorter specimens being compressed convex, while that of the longer ones is strongly and obliquely convex; right valve almost if not quite as convex as the left; anterior wing more abruptly inflected than the posterior.

Anterior side short and consisting usually of a well defined lobe-like wing, that is straight above and rounded obliquely below; posterior side longer and much wider in the direction of its height than the anterior, its lower and non-alate portion broadly rounded at the base, the extremity of its upper and alate portion subtruncate almost vertically in some specimens, and obliquely so in others, the cardinal margin behind the beaks being proportionately longer in some specimens than in others. Hinge line straight and ascending from the anterior to the posterior end, but apparently not very far from horizontal in some specimens; umbones moderately prominent, beaks small, appressed and placed near the anterior end. Surface marked with numerous, regularly disposed and close-set impressed lines.

Hinge dentition and muscular impressions unknown.

Abundant at an exposure on the north-west point of Ami Island, near the north-east shore of Lake Winnipegosis, where most of the specimens are compressed convex and moderately elongated. One of these is represented by figure 1, on Plate 28. Abundant also on the weathered surfaces of small, thin slabs of limestone at the Grand Rapids of the Saskatchewan River, below Old Portage, where the specimens are strongly convex and much elongated. One of these is represented by figure 2 on the same Plate. At both of these localities, the specimens collected are for the most part casts of the interior of the left valve, but a few have either the whole or a part of the test preserved. The testiferous left valve represented by figure 3 on Plate 28, is exposed on the weathered surface of a small slab of limestone (apparently loose) from Swan Lake, at

the head of Shoal River, Manitoba, collected by Mr. Tyrrell in 1889. This valve is associated with several characteristic specimens of *Stropheodonta acanthoptera*.

The specimens from Ami Island and the Saskatchewan upon which this species is based, are those that were referred to *Pterinea aviculoidea*, with a query, in the provisional lists of fossils that accompany Mr. Tyrrell's report. But it has since been apparent that they differ materially from the Wisconsin specimens of that species, as figured by Whitfield, (1) in their different marginal outline, (2) in their more prominent umbones, and (3) in their proportionately larger anterior wing.

ILIONIA (?) PARVULA. (N. Sp.)

Plate 28, figs. 6, 7 and 8.

Shell small, compressed, narrowly and ovately subelliptical, nearly twice as long as high. Anterior side narrowly rounded; posterior side more pointed but not much longer than the anterior; beak small, low, incurved, and placed not far from the midlength.

Surface closely and concentrically ribbed.

Hinge dentition and muscular impressions unknown.

Ami Island, one left valve; and Long Point, two right valves; all of which are figured of the natural size.

This little shell may prove to be only a small form, or perhaps a mere local variety of the *Ilionia* (?) *costulata*, from the Guelph formation of Ontario, which is described and figured in the first part of this volume. *I. parvula*, however, seems to be uniformly smaller than *I. costulata*, and the beak of the former is placed nearer the midlength. Both of these shells are only provisionally referred to *Ilionia*. They are probably indicative of a new generic type, which there is not yet sufficient material to define satisfactorily.

GASTEROPODA.

The gasteropoda in the collections made by Mr. Tyrrell on the north-eastern side of Lake Winnipegosis are imperfect and indeterminate casts of the interior, or moulds of the exterior, of the shell of two species of *Murchisonia*, and of one species each of *Pleurotomaria* and *Straparollus*.

CRUSTACEA.

OSTRACODA.

ISOCHILINA GRANDIS, var. LATIMARGINATA, Jones.

Isophilina grandis, var. *latimarginata*, Jones. 1891. Contr. Canad. Micro-Paleont., pt. III, p. 78, pl. 10, figs. 1, a, b, c; 2, a, b, c; and 3, 4.

Long Point, Lake Winnipegosis, several specimens; also at two localities on the Lower Saskatchewan.

LEPERDITIA HISINGERI, Schmidt.

Leperditia Hisingeri (Schmidt) Jones..... 1891. Contr. Canad. Micro-Paleont., pt. III, p. 82 (which see for the synonymy of European examples of this species) pl. 13, figs. 1 and 9.

Long Point, Lake Winnipegosis: several specimens.

LEPERDITIA HISINGERI, var. FABULINA, JONES.

Leperditia Hisingeri, var. *fabulina*, Jones. 1891. Contr. Canad. Micro-Paleont., pt. III, p. 82, pl. 10, figs. 5 and 7; and pl. 13, figs. 3, 5, and 6.

Long Point, Lake Winnipegosis; and Grand Rapids, Saskatchewan River.

LEPERDITIA HISINGERI, var. GIBBERA, JONES.

Leperditia Hisingeri, var. *gibbera* Jones..... 1891. Op. cit. supra, p. 82, pl. 13, fig. 4.

Long Point, Lake Winnipegosis: one left valve.

LEPERDITIA MARGINATA, Schmidt.

Leperditia marginata, Schmidt..... 1873. Mém. Académ. Imp. Sci. St.-Petersbourg, Ser. 7, vol. XXI, No. 2, p. 19, figs. 29-31; and (1883) vol. XXXI, p. 18, pl. 1, figs. 13-19.
" " Jones..... 1891. Contr. Canad. Micro-Paleont., pt. III, p. 86, pl. 10, figs. 6, a, b. and c.

Long Point, Lake Winnipegosis: one specimen.

TRILOBITA.

ACTIDASPIS PERARMATA, Whiteaves.

Plate 42, fig. 3.

Actidaspis perarmata, Whiteaves..... 1891. Canad. Rec. Sc., vol. IV, p. 300, pl. 3, fig. 6.

"Body depressed, very slightly convex, its general outline, apart from the marginal spines, longitudinally subelliptical and a little longer than broad.

"Head about twice as broad as long, occupying one third of the total length, exclusive of the spines on the pygidium: its front margin broadly subtruncate, nearly straight but faintly sinuous and very obscurely three lobed, with a slight indentation on each side of the glabella immediately in front of the anterior termination of each of the ocular ridges: its posterior margin much more distinctly flexuous and curved backward in the centre with a moderately convex curve, and forward with a shallowly con-

cave curve, on each side. Eyes small, placed very near the posterior margin of the head and opposite the most contracted portion of each of the free cheeks: ocular ridges moderately prominent, slightly curved and converging obliquely forward from the eyes to their terminations near the frontal margin, where they are about twice as close together as at their commencement anteriorly. Characters of the glabella unknown. Outer margin of each of the free cheeks somewhat expanded anteriorly and forming a not very prominent rounded lobe, which is armed with eight very short pointed spines—slightly contracted behind the midlength and terminating posteriorly in a straight and pointed genal spine, which is a little shorter than that of the pleura of the first abdominal segment, and diverges outward and backward at an angle of 40° to a line that might be drawn at a right angle to the longitudinal axis.

“Thorax arched upon the axis, depressed and flattened on the pleure: composed of nine segments: axis occupying more than one third of the entire breadth without the spines, and narrowing very gradually to the posterior end: its annulations horizontal, subparallel and nearly straight, but faintly sinuous at their margins, both in front and behind. Pleure also decreasing very gradually in breadth to the posterior end of the thorax, nearly straight and terminating externally on each side in a long and very slender spine, which is bent backward and outward at an angle of about 57° . The spines increase gradually in length posteriorly, the two spines on the anterior thoracic segment being shorter than the pleure from which they proceed, and nearly equal in length to the genal spines immediately in front of them, whereas in the posterior thoracic segment the pleural spines are nearly three times as long as the pleure and as the spines on the pleure of the anterior thoracic segment.

“Pygidium broad and short, its outer margin broadly rounded and fringed with spines, its inner or anterior margin almost straight and nearly three times as broad as the length of the non-spinose portion along the median line; its axis moderately convex and its pleure flat. Axis narrowly rounded posteriorly and terminating just within the margin of the pygidium, apparently bearing two transverse annulations, the posterior unarmed and the anterior bearing a long and very slender primary spine on each of its rounded postero-lateral angles. These primary spines, whose length considerably exceeds that of the united pygidium and thorax, diverge for the greater part of their length at an angle of about 48° , but curve slightly inward at their outer ends. Outer margin of the pygidium armed with four secondary internal spines between the two primaries, and with five secondary external spines on each side of the latter. The four secondary internal spines are moderately close together, nearly equal in length and about one fourth as long as the primaries. The five outer

secondary spines on each side are much closer together than the four inner ones and not more than one-half as long.

"Surface markings unknown.

"Long Point, at the north east angle of Lake Winnipegosis, just outside of the northern boundary of Manitoba, J. B. Tyrrell, 1890: a single and not very well preserved cast of the interior of the dorsal or upper side, in a compact and slightly vesicular dolomite. Although the surface markings are not even faintly indicated, and the characters of the glabella and some of those of the central portion of the thorax are unknown, the whole of the marginal outline of the specimen can be ascertained with considerable accuracy.

"In the elucidation of its characters the writer has been materially assisted by Mr. L. M. Lambe.

"The species appears to be of the type of the *A. Prevostii* of Barrande,* from the Upper Silurian rocks (Etage E.) of Bohemia, but it has a smaller number of short spines on the lateral margins of the two free cheeks, a proportionately broader axis to the thorax, much longer primary spines on the pygidium, and differs from that species in several other particulars."

D.—FROM THE LOWER SASKATCHEWAN.

COLLECTED BY MR. J. B. TYRRELL IN 1889 AND 1890, AND BY MR.
D. B. DOWLING IN 1891.

The rocks from which these fossils were collected are described on pages 144-153E of Mr. Tyrrell's Report on North-western Manitoba, etc., already referred to as published by this Survey.

ANTHOZOA.

TETRACORALLA.

PETRAIA (PYGMÆA ? VAR.) OCCIDENTALIS.

Plate 24, figs. 2, 3, 4 and 5.

Cfr. <i>Petraia pygmaea</i> , Billings.....	1862. Geol. Surv. Canada, Paleoz. Foss., vol. I, p. 103, fig. 91; and (1866) Cat. Silur. Foss. Anticosti, p. 33.
" " Nicholson.....	1875. Paleont. Ont., p. 59.
" " Lambe.....	1900. Contr. Canad. Paleont., vol. IV, pt. II, p. 106, pl. 6, figs. 6, 6 a, and 6 b.

* Système Silurien du Centre de la Bohême, Prague et Paris, tome I, 1852, p. 739, pl. 39,
figs. 33-41.

Corallum similar to the typical form of *P. pygmaea*, in internal structure and external shape, but apparently always a little larger. The specimens from the Saskatchewan average about ten millimetres in height and occasionally attain to a still larger size, while Anticosti specimens of *P. pygmaea* average only six mm. in height and are not known to exceed ten.

Saskatchewan River, tramway at Grand Rapids, J. B. Tyrrell, 1890 : several specimens, on the weathered surfaces of small pieces of limestone.

HEXACORALLA.

FAVOSITES GOTHLANDICUS, Lamarck.

Saskatchewan River, at Roche Rouge, Cross Lake Rapids, and Chemahawin, J. B. Tyrrell, 1890 : a few specimens from each of these localities (Lambe).

FAVOSITES ASPER, d'Orbigny.

Saskatchewan River, at Roche Rouge, J. B. Tyrrell, 1890 ; and in the *Pentamerus* beds at the Grand Rapids, D. B. Dowling, 1891 ; a few specimens from each of these localities (Lambe).

ALVEOLITES NIAGARENSIS, Rominger.

Specimens, which Mr. Lambe has identified with this species, were collected at Grand Rapids, Roche Rouge, Cross Lake Rapids and Chemahawin, by Mr. Tyrrell in 1890 ; and at the Grand Rapids by Mr. Dowling in 1891.

HALYSITES CATENULARIA, L.

Saskatchewan River : at the the foot of Grand Rapids ; at Cross Lake Rapids ; at Old Fort Island, Cedar Lake ; on the west shore of Cedar Lake ; and at Chemahawin. At each of these localities specimens were collected by Mr. Tyrrell in 1890.

HALYSITES COMPACTUS, Rominger.

- Halysites compactus*, Rominger 1876. Geol. Surv. Mich., Fossil Corals, p. 78, pl. 29, fig. 3.
 " " Whiteaves 1884. This volume, pt. I, p. 2.
Halysites agglomeratus, var. *compactus*,
 Whiteaves 1895. Idem. pt. II, p. 48.
Halysites compacta, Lambe 1899. Contr. Canad. Paleont., vol. IV, pt. I, p. 71, pl. 4, figs. 5, 5 a, 6, 7, 8 and 8 a.

Saskatchewan River, foot of Grand Rapids, J. B. Tyrrell, 1890 : one specimen (Lambe).

OCTOCORALLA.

LYELLIA AFFINIS, Billings. (Sp.)

- Heliolites affinis*, Billings.....1865. Canad. Nat., N.S., vol. II, p. 427; and (1866) Cat. Silur. Foss. Anticosti, pp. 5 and 30, fig. 12.
- Lyellia papillata*, Rominger.....1876. Geol. Surv. Mich., Fossil Corals, p. 15, pl. 2, fig. 3.
- " Tyrrell.....1892. Geol. Surv. Canada, Rep. N.W. Manitoba, etc., pt. E, pp. 147, 148, and 150.
- Lyellia affinis*, Lambe.....1899. Contr. Canad. Palaeont., vol. IV, pt. 1, p. 84, pl. 5, figs. 1 and 1 a.
- Propora affinis*, Kiser.....1903. Rev. der Mittelsilurischen Helioliten, etc., Christiania Videnskabs-Selskabets Skrifter. I. Math. naturv. Klasse, No. 10.

Saskatchewan River; at the foot of Grand Rapids; at the tramway at Grand Rapids; at Roche Rouge and Cross Lake Rapids; J. B. Tyrrell, 1890; and at Grand Rapids, D. B. Dowling, 1891. A few specimens from each of these localities (Lambe).

BRACHIOPODA.

STROPHEODONTA ACANTHOPTERA, Whiteaves. (Sp.)

Saskatchewan River: at the foot of Grand Rapids; at Roche Rouge; at Old Fort Island, Cedar Lake; on the west side of Cedar Lake; below Cedar Lake; and at Chemahawin; J. B. Tyrrell, 1890. Abundant at each of these localities.

LEPTENA RHOMBOIDALIS (Wilckens).

Saskatchewan River, at Chemahawin, J. B. Tyrrell, 1890: one ventral valve.

ORTHIS, sp. indet.

Saskatchewan River, at the foot of Grand Rapids, J. B. Tyrrell, 1890: an imperfect small dorsal valve, with extremely narrow ribs, which bifurcate near the anterior margin.

CONCHIDIUM DECUSSATUM, Whiteaves. (Sp.)

Plate 26, figs. 1 and 2.

- Pentamerus decussatus*, Whiteaves.....1891. Canad. Rec. Sc., vol. IV, p. 295, pl. 3, figs. 3 and 4.
- Conchidium decussatum*, Hall & Clarke.....1894. Pal. N. York, vol. VIII, pt. 2, p. 235, pl. 65, figs. 1 and 2; and pl. 66, fig. 15.

Original description of Pentamerus decussatus. "Shell large, usually longitudinally and rather narrowly subovate, about one third longer than broad, and broadest a little in advance of the mid-length, but sometimes nearly as broad as long; front margin regularly rounded in most specimens, but somewhat pointed in the centre in others. Ventral valve strongly convex, very tumid, prominent, and rounded or obtusely angulated along the median line, and narrowing rapidly to the margin on both sides, but devoid of a distinctly defined mesial fold, its umbo prominent and rather broad, and its beak so strongly recurved as almost to touch that of the opposite valve. Fissure rather large, triangular, a little higher than broad, completely covered by the recurved beak and visible only when the beak is broken off. Dorsal valve much flatter than the ventral, gently and uniformly convex, or flattened with a faint longitudinal depression in the centre, its beak small, rather narrow and slightly incurved.

"Surface marked by very numerous, closely disposed, rounded and but slightly elevated radiating raised lines, which are crossed by smaller, more close set and irregularly disposed concentric raised lines, as well as by a few distant and more or less imbricating lines of growth. The radiating raised lines, which are rather irregular in their arrangement and unequal in size, increase so rapidly by division that as many as from sixty to one hundred or more of them can be counted around the front margin of an adult specimen, though, on account of its greater convexity, there is always a larger number on the ventral valve than on the dorsal.

"Septum of the ventral valve well developed, comparatively thick but very short, occupying less than one fourth of the entire length in some specimens, but a little longer in others, though rarely or never exceeding one third of the total length. Septa of the dorsal valve thin, feebly developed and almost rudimentary, very slightly divergent and much shorter than the ventral septum. Muscular and vascular impressions unknown. Interior of the valves rather minutely papillose.

"Dimensions of the specimen figured: maximum length, eighty-seven millimetres, greatest breadth, fifty nine mm.; maximum height or depth through the closed valves, fifty-two mm.; amount of recurvature of beak of ventral valve, sixteen mm.

"The only locality in which this species is known to the writer to have been certainly found *in place*, is in a light brownish yellow dolomitic limestone at the foot of the Grand Rapids of the Saskatchewan, where a number of fine specimens were collected by Mr. Tyrrell in 1890. Boulders containing it have been found at several localities in Manitoba, and elsewhere in the central portion of the Dominion. It is almost certainly the shell referred to by Sir John Richardson as a '*Pentamerus*, very like *P.*

Knightsii, which was gathered by Dr. Bigsby 'in 1823' on the Lake of the Woods and presented by him to the British Museum,* as specimens of the shell which I here call *P. decussatus* have since been collected from boulders on the south west shores of that lake by Dr. G. M. Dawson in 1873 and by Dr. A. C. Lawson in 1884. Other localities at which the species has been obtained from boulders are as follows:—Nelson River, about sixty miles above its mouth, Dr. R. Bell, 1879; Lower Fort Garry, Dr. R. Bell, 1880; Kenogami River, six miles above the mouth of the Bagutchevan, Dr. R. Bell, 1886. Mouth of the Fairford River and Steep Rock Island, Lake Manitoba, J. F. Whiteaves, 1888. North east side of Lake Winnipegosis and Red Deer River near its mouth, J. B. Tyrrell, 1889; Virden, Manitoba, C. N. Bell, 1889.

"In Appendix No. 1 to Franklin's 'Narrative of a Second Expedition to the Shores of the Polar Sea, in the years 1825, 1826 and 1827,' " Sir John Richardson says that 'Mr. Sowerby determined a shell, occurring in great abundance in the strata at Cumberland House' 'to be the *Pentamerus Aylesfordii*,' which is regarded by Dr. Davidson as a synonym of *P. Knightsii*. Although Cumberland House is 135 miles farther up the Saskatchewan than the locality at which Mr. Tyrrell obtained *P. decussatus* in place, it is by no means improbable that the specimens which Mr. Sowerby determined as *P. Knightsii* are really referable to the present species. However this may be, it seems to the writer that *P. decussatus* differs materially from the true *P. Knightsii*, especially in the following particulars. The umbo of the ventral valve of the former is narrower and less prominent, while its beak is much less strongly curved; the coarser surface markings of both valves do not consist of comparatively distant and irregular radiating ribs, as in *P. Knightsii*, but of close set, irregularly disposed, unequal and not much elevated radiating raised lines; and the mesial septa of both valves of *P. decussatus* are not more than half the comparative length of those of *P. Knightsii*."

The fossil brachiopoda from the Saskatchewan River that were doubtfully and provisionally referred to *Rhynchonella altiplicata*, *Atrypa reticularis*, and *Trematospira formosa*, in Mr. Tyrrell's Report, are too imperfect to be satisfactorily determined.

MOLLUSCA.

PELECYPODA.

PTERINEA OCCIDENTALIS, Whiteaves.

Saskatchewan River, at Grand Rapids below Old Portage, J. B. Tyrrell, 1890: the specimens referred to on page 287 *ante*, in connection with the original description of this species, which is figured on Plate 28.

*Journal of a Boat Voyage through Rupert's Land and the Arctic Sea, vol. I, foot note to page 62; and vol. II, p. 197.

ILIONIA (?) PARVULA, Whiteaves.

Saskatchewan River, below Cedar Lake, J. B. Tyrrell, 1890: an imperfect cast of the interior of a single valve of a shell that seems to be referable to this species, as described on page 288 *ante*, and figured on Plate 28.

GASTEROPODA.

PHANEROTREMA OCCIDENS, Hall. (Sp.)

- Pleurotomaria labrosa*, var. *occidens*, Hall..1864. Eighteenth Rep. Reg. Univ. St. N. York, p. 343.
Pleurotomaria occidens, Hall.....1867. Twentieth Rep. Reg. Univ. St. N. York, p. 364, pl. 15 (6), figs. 11 and 12.
Phanerotrema occidens, Ulrich and Scofield.1897. Geol. and Nat. Hist. Surv. Minn., Final Rep., vol. III, pt. II, p. 952.

Saskatchewan River, at Grand Rapids, below Old Portage, J. B. Tyrrell, 1890: a cast of the interior of a specimen that appears to be referable to this species.

In Mr. Tyrrell's collections from the Saskatchewan, there are, also, fragmentary and indeterminable specimens of several other species of gasteropoda, belonging apparently to the genera *Pleurotomaria*, *Murchisonia*, *Loxonema*, *Euomphalus*, and *Poleumita*.

CEPHALOPODA.

SPYROCERAS, sp. indet.

Longicone, slender, straight; test unknown, surface of the cast marked with nearly straight, transverse, annular ribs, and with minute, longitudinal and continuous, raised lines. Characters of the interior of the shell unknown.

Saskatchewan River, at Chemahawin, J. B. Tyrrell, 1890: a portion of a cast of the interior of the shell, nearly forty-five millimetres in length, by about thirteen mm. in width at the larger end.

In some respects this specimen is not unlike the type of *S. meridionale* from Stonewall, described on page 281 and figured on Plate 30 (fig. 9) of this volume, but the Stonewall shell is distinctly curved, and shews no traces of fine longitudinal raised lines.

GOMPHOCERAS PARVULUM, Whiteaves.

Plate 35, figs. 2, 2 a, and 2 b.

- Gomphoceras parvulum*, Whiteaves.....1891. Canad. Rec. Sci., vol. IV, p. 298, pl. 3, figs. 5, and 5 a, b.

"Shell small, straight, slender, rather more than three times as long as broad, and broadest a little in advance of the midlength; sides slightly compressed, the outline of a transverse section near and at the commence-

ment of the body chamber being ovate: venter narrower than the dorsum and especially so at both ends; lateral outline conical, with the ventral border not much more convex than the dorsal. Septate portion occupying a little more than one-half the entire length, narrowly conical in lateral aspect, pointed posteriorly and about twice as long as it is broad anteriorly. Body chamber crenulated around the base, its outer margins at first nearly straight and almost parallel on both sides as viewed laterally, its anterior termination rounded but much more broadly so on the ventral side than on the dorsal; ventral region at the summit laterally compressed on each side of the aperture. Aperture, as viewed from above, extremely contracted, Y-shaped, with the stem about twice as long as either of the two branches, which diverge from it at an angle of about 115° . The stem is a narrow slit which expands at its outer termination into a narrow and longitudinally elliptical orifice, exactly in a line with the siphuncle, and the branches are similarly narrow divergent slits, each of which widens into a smaller and circular orifice externally.

"Surface markings consisting only, so far as known, of extremely fine transverse striations, which are too minute to be shown in the figure.

"Sutures slightly concave at the sides, closely approximated but rather nearer together posteriorly than anteriorly; siphuncle marginal and placed in the median line of the venter.

"Approximate dimensions of an average specimen (the one figured): entire length, thirty eight millimetres; length of the septate portion twenty one mm.; greatest breadth, twelve mm.

"Grand Rapids of the Saskatchewan below Old Portage, J. B. Tyrrell, 1890: a number of casts of the interior of the shell, in a pale brownish yellow or nearly white dolomitic limestone.

"A singular little species, apparently well characterized by its diminutive size, ovately conical, slender and nearly equilateral contour, as viewed laterally, and by its narrowly contracted and widely divergent Y-shaped aperture. It is not at all likely to be mistaken for any American species, and is perhaps most nearly related to the *G. clava* of Barrande,* young specimens of which have a very similar marginal outline. The aperture of *G. clava*, however, is regularly T-shaped at all stages of growth, and in the adult stage it seems to differ very widely from the present species, both in its dimensions and in its general contour."

* *Système Silurien du Centre de la Bohême, Prague et Paris, tome II, 1865, pl. 77, figs. 6-22, et pl. 92, figs. 10-13.*

G. clava is from Etage E. of Bohemia, which is said to be the equivalent of the Lower Ludlow of England.

CRUSTACEA.

OSTRACODA.

ISOCHILINA GRANDIS, var. LATIMARGINATA, Jones.

Cedar Lake, at the north end of Mossy Portage, J. B. Tyrrell, 1889 (not 1890): two loose specimens.

Saskatchewan River: at the Grand Rapids below Old Portage, three specimens; below Cedar Lake, one specimen; at Cross Lake Rapids, one specimen; and at Roche Rouge, several specimens; all collected by J. B. Tyrrell in 1890.

LEPERDITIA HISINGERI, var. FABULINA, Jones.

Saskatchewan River, foot of Grand Rapids, J. B. Tyrrell, 1890: a right and a left valve.

LEPERDITIA HISINGERI, var. EGENA, Jones.

Leperditia Hisingeri, var. *egena*, Jones1891. Contr. Canad. Micro-Paleont., pt. III, p. 82, pl. 12, fig. 8.

Saskatchewan River, at Grand Rapids below Old Portage, J. B. Tyrrell, 1890: a few specimens.

LEPERDITIA PHASEOLUS (Hisinger) Jones.

Leperditia phaseolus (Hisinger) Jones ... 1891. Contr. Canad. Micro-Paleont., pt. III, p. 85, pl. 13, figs. 7 and 8.

Saskatchewan River, at Roche Rouge, J. B. Tyrrell, 1890: two right valves.

LEPERDITIA WHITEVESII, Jones.

Leperditia Whitevesii, Jones..... 1891. Contr. Canad. Micro-Paleont., pt. III, p. 87, pl. 12, figs. 11, 12, 13, 14, and wood cut fig. 6.

Saskatchewan River: at Old Fort Island, Cedar Lake, one specimen; and at Chemahawin, eight specimens; all collected by Mr. J. B. Tyrrell in 1890.

LEPERDITIA CÆCA, Jones.

Leperditia caeca, Jones1891. Contr. Canad. Micro-Paleont., pt. III, p. 88, pl. 12, figs. 6, 7 and 9.

Saskatchewan River: at Grand Rapids below Old Portage, several specimens; and below Cedar Lake, three specimens; J. B. Tyrrell, 1890.

TRILOBITA.

The trilobites in Mr. Tyrrell's collection from the Saskatchewan are represented by a fragment of a rather large species of *Ilænus*, from Chemahawin; and by an imperfect cast of the dorsal surface of the pygidium of an *Encrinurus*, from Roche Rouge.

GEOLOGICAL SURVEY OF CANADA.

PALÆOZOIC FOSSILS.

VOL. III.

6. *The Canadian species of Plectoceras and Barrandoceras.*

By J. F. WHITEAVES.

The genus *Plectoceras* was first described by Hyatt in 1883, on page 268 of his "Genera of Fossil Cephalopoda," published in the twenty-second volume of the Proceedings of the Boston Natural History Society. In that paper it is placed in the Family Tainoceratidae, and is described as follows:—

"PLECTOCERAS*, nobis, includes Silurian species having costæ curved posteriorly on the sides and crossing the abdomen as in *Trocholites* and sutures similar, but with ventral saddles. The whorls quadrate, the abdomens narrower than the dorsum and the sides convergent outwards. The siphons are ventral and holocoanoidal. The young are precisely similar in form, smoothness of the shell and striæ of growth, and in sutures to the straight sutured forms of *Trocholites*. Type, *Plect. (Naut.) Jason*, sp., Bill., *Canad. Nat.*, vol. 4, 1859, p. 464, *Mus. Geol. Surv. Can.*"

In the "Phylogeny of an Acquired Characteristic," published in 1894, in the thirty-second volume of the "Proceedings of the American Philosophical Society, pages 499 and 500, the genus, and three of its species are thus described.

" PLECTOCERAS.

"This genus was described in *Genera of Fossil Cephalopods*, page 268, by the author, to include the costated forms similar to *Discoceras*, but having the siphuncle ventrad of the centre.

"The type was *Plectoceras (Naut.) Jason*, sp. Billings. The mode of coiling may be quite close and regular, with perhaps a slight impressed zone or flattened dorsum, or the coil may be open, and sometimes it is very irregular. In several specimens of *Jason* the first whorls may touch, the ephebic volution may be open and free and yet the extremity of the living chamber again come in contact. The umbilical perforation is large

* Πλεκτός, twisted or plaited.

and the impressed zone is absent until the whorls come in contact and it is invariably absent in gerontic whorls.

"The species are as follows :

"PLECTOCERAS JASON, sp. Billings. (*Canadian Nat.*, iv, p. 464).

"Type in Museum of Geological Survey at Ottawa. It occurs in the Calciferous* of the Mingan Islands and there are similar forms in the same horizon in Newfoundland.

"PLECTOCERAS OBSCURUM, n. s.

"This species occurs in the Black River fauna in New York, and is quite commonly mistaken for the young of *Eurystomites undatus*, but it has an open gyroceran spiral, the siphuncle is nearer the venter and the costae are more highly developed and more prominent, and have a distinct character from those of that species.

"PLECTOCERAS BICKMOREANUS, sp. Whitfield (*Bull. Am. Mus.*, New York).

"This species of the Niagara fauna has an open gyroceran whorl, and in the gerontic stage the last whorl is free and in some specimens completely straightened out and lituicoid in aspect."

Hyatt's latest views on Fossil Cephalopoda are embodied in the article on Cephalopoda in the first volume of Dr. C. E. Eastman's translation of Zittel's Text Book of Paleontology, published in 1900. In this article (p. 520) *Plectoceras* is made the type of a new family called Plectoceratidae, and this family and the genera of which it is said to be composed are thus described.

"Family 6. PLECTOCERATIDÆ.

"Gyroceracones, nautilicones, and torticones having annular costae from the neanic stage until late in life, and in some genera, more or less prominent longitudinal ridges, which usually disappear in the epebic stage. Siphuncle ventrad of centre.

"*Plectoceras*, Hyatt. Ordovician and Silurian. *Sphyradoceras*, Hyatt (*Peismoceras*, *Systrophoceras*, Hyatt). Silurian and Devonian. The first is gyroceraconic, with some discoidal nautilicones, and the second is almost exclusively torticonic of the trochoceran type."

There appear to be at least three species of *Plectoceras* in Canada, as follows, though the generic position of the one last cited is still uncertain.

* Mr. Billings, however, describes *Nautilus Jason* as a fossil of the "Chazy limestone." J. P. W.

(1.) PLECTOCERAS JASON, Billings. (Sp.)

Plate 36, figs. 1 and 2.

- Nautilus Jason*, Billings 1859. Can. Nat. and Geol., vol. IV, p. 464.
Plectoceras Jason, Hyatt 1883. Proc. Boston Soc. Nat. Hist., vol.
 XXII, p. 208; and (1894) Proc. Amer.
 Philos. Soc., vol. XXXII, p. 498.

Original description of Nautilus Jason. "Discoid, planorbiform, all the whorls exposed in the umbilicus. Section of shell broad oval, the ventral and dorsal sides being depressed convex, the other two sides rounded, the two diameters being to each other as fifteen to seventeen. The tube increases in diameter at such a rate as to give to the coil a diameter of three inches and a half on the completion of the second whorl, at which point the septa are two lines distant from each other in their centres, two and a half lines in the middle of the ventral side, and a little less than one and a half lines on the dorsal or inner side of the whorl. They become gradually more approximate as they approach the apex, so that where the tube is half an inch in diameter they are one line distant in their centres. They are only moderately convex, and their edges cross the ventral aspect in a straight line, but on the sides with a gentle curve towards the apex of the shell.

"The surface exhibits a series of rounded ridges which, starting from the umbilicus, curve backward, and make a deep rounded undulation toward the apex on the ventral aspect. The distance of the ridges from each other along the median ventral line is about five lines, and the intervening spaces are shallow and concave. The surface is also marked with obscure fine striae, and smaller ridges all parallel with the larger.

"The siphuncle is from one and a half to two lines in diameter, cylindrical, not inflated, and distant about two lines from the outer margin.

"On comparing this species with the figures of *L. undatus* (Emmons) given in the Paleontology of New York, vol. 1, plate 13, we find that our best preserved specimen is exactly the size of figure 1; that the ventral aspect is not angular at the sides, nor do the ridges pass straight across, as shown in fig. 1 *b*; and that in fig. 3 the septa are more than three lines distant in their centres instead of two lines, as they are in our specimens. The specimen represented on plate 13 *bis* has the septa three and a half lines nearly distant about the completion of the second whorl, while those next the chamber of occupation are more approximate, as they usually are in all the Nautilidae. Our species therefore, although closely allied, is a distinct species from *L. undatus*.

"Locality and Formation.—Mingan Islands; Chazy limestone."

The foregoing description was evidently based upon three fine and remarkably well preserved specimens from Clear Water Point, in the

Museum of the Survey, the largest of which is fully four inches in its greatest diameter. One of these specimens still bears the original written label; "Mingan. Clear Water Point. L. 1859;" the L. of course meaning Logan. This is the locality referred to on page 134 of the "Geology of Canada" (1863) as the bay "above Clear Water Point," where the lowest part of the Chazy formation is said to be visible. A section of the rocks exposed at this locality is given, part of which is said to consist of twenty feet of "grey nodular limestone with *Columnaria parva*, *Stenopora adhaerens*, *Fenestella incepta*, *Orthis piger*, *Strophomena incrassata*, *Ctenodonta nasuta*, *Nautilus Jason*, *Amphion Canadensis*, *Harpes antiquatus*, and *Illenus globosus*." Clear Water Point is on the north shore of the Gulf of St. Lawrence, opposite to the Mingan Islands.

In the same Museum there are two other specimens of *Plectoceras Jason*. One of these is a large and imperfect but characteristic specimen, labelled as having been collected at St. Charles Island by J. Richardson in 1860; and the other, labelled only "Mingan."

(2.) PLECTOCERAS HALLI, Foord. (Sp.)

Plate 35, figs. 3, 4, and 4 a.

- Inachus undatus* (pars) Conrad.....1842. In Emmons' Geol. New York, pt. II, Surv. Second Geol. Distr., p. 394, no. 104, "fig. 2, edge view;" probably, though the figure is diagrammatical and apparently inaccurate.
- Lituites undatus*, (pars) Hall.....1847. Pal. N. York, vol. I, p. 52, pl. 13, figs. 1 a and 1 b.
- " " (pars) Emmons.....1856. Amer. Geology, pt. II, p. 146, pl. 5, fig. 14 a; probably.
- Cryptoceras unilatum*, Chapman.....1857. Canad. Journal, N.S., vol. II, No. X, p. 267; and Annals and Mag. Nat. Hist., Second Series, vol. 20, p. 107.
- Lituites undatus*, Billings.....1863. Geol. Canad., pp. 156 and 951.
- Trocholites undatus*, (pars) Hyatt.....1883. Proc. Boston Soc. Nat. Hist., vol. XXII, p. 267.
- Trochoceras Halli*, Foord.....1891. Cat. Fossil Cephalop. Brit. Mus., pt. II, p. 42, figs. 4 a, and 4 b.
- Plectoceras obscurum*, Hyatt.....1894. Proc. Amer. Philos. Soc., vol. XXXII, p. 446.
- Plectoceras Halli*, Whiteaves.....1903. Ottawa Naturalist, vol. XVII, p. 120.

This is the shell that Dr. Foord separated from the *Lituites undatus* of Hall in 1891, and described and figured under the name *Trochoceras Halli*. The specific characters of *T. Halli* are said to be as follows: "The shell, which is not complete, consists of two volutions; the asymmetry is slight, but quite discernible. The shell increases its diameter about three times in the last volution. The section is distinctly

subquadrate, the ventral side being the broadest, as well as being considerably flattened. The surface is ornamented with oblique, rounded, not very prominent annulations, divided by concave interspaces of about equal width. The annulations bend backward on the ventral side and there form a deep sinus; while on the dorsal or concave side, approaching the umbilicus, they become quite obsolete; the young shell is almost smooth. The entire surface of the test is covered with very fine transverse lines both on the ribs and the interspaces, and there are also obscure traces of longitudinal lines. The septa are a little more than 1 line apart, where the shell has a ventro-dorsal diameter of 6 lines. The siphuncle is not seen." The species is said to be represented in the British Museum collection by two specimens from the Black River limestone at Lorette, and the specimen figured is not much more than two inches in its maximum diameter. These specimens are obviously those that Dr. Bigsby collected at Indian Lorette in 1822, and that Salter referred to *Lituites undatus* in 1853.*

The specimen from Watertown, N.Y., that Hall figures under the name *Lituites undatus* and that Foord includes in his synonymy of *Trochoceras Halli*, is very little more than two inches and a quarter in its greatest diameter. It is No. 12521 of the palaeontological department of the New York State Museum at Albany, and has been kindly lent to the writer by Dr. John M. Clarke. It is obviously immature, as the earlier volution and part of the later one are smooth, the oblique rib-like folds, which are five in number on each side, being developed only on the outer portion of the last volution. The venter is flattened and unusually smooth, while the siphuncle is both marginal and ventral. It is most probable that this specimen is the original of the smaller figure of *Inachus undatus*, Conrad, in Emmons' report on the Geology of the Second District of the State of New York.

In 1898 Mr. T. C. Weston visited Lorette, on behalf of this Survey, and succeeded in collecting for its Museum a fine series of unusually large and well preserved specimens, that agree very well with Foord's descriptions of *Trochoceras Halli*, but that give some additional information in regard to its characters. These specimens have been described, and their generic and specific relations discussed in some detail, in two papers, the one entitled "Notes on some Canadian specimens of '*Lituites undatus*,' and the other "Additional Notes on some Canadian specimens of '*Lituites undatus*,'" published in the Ottawa Naturalist for October and December, 1903. The latest results of a study of these and other specimens are embodied in the foregoing synonymy. It is now obvious that the *Trochoceras Halli* of Foord is a *Plectoceras* closely allied to *P. Jason* (Billings) but apparently

* In the Quarterly Journal of the Geological Society of London, vol. IX, p. 86.

distinct therefrom, and that it is both generically and specifically identical with the subsequently described *Plectoceras obscurum* of Hyatt.

The latter conclusion is based upon a direct comparison of the specimens of *P. Halli*, collected by Mr. Weston, with the types of *P. obscurum* in the Museum of Comparative Zoology at Cambridge, Mass., kindly lent to the writer by Dr. W. Y. M. Woodworth, in 1903. As elsewhere stated,* the types of *P. obscurum* are three in number, one a comparatively perfect specimen from the Black River limestone at Watertown, N. Y., marked 2077; and the others, two fragments from Watertown, each marked 2078. The specimen marked 2077 has nearly the whole of one side worn away, but the other side shews the general shape of the shell and its surface markings very well. It is about three inches and a half in its maximum diameter and consists of two entire whorls. The inner whorls, if there were any, are not preserved. Both sides of the specimen shew that the whorls are at first so closely coiled that the inner half of the outer whorl is in close contact with the one that immediately precedes it, but that its outer half is free and slightly uncoiled. At the anterior end of the shell, the outer whorl is about seventeen millimetres apart from that which immediately precedes it. And it would seem to be the body chamber, which occupies rather less than one half of the outer whorl, that is free and separate. The surface markings are precisely similar to those of the fine specimens of *P. Halli* collected by Mr. Weston at Lorette. On the worn side all the septa but the last are obliterated, and the shape and position of the siphuncle are not at all clearly shewn. A label, in Hyatt's hand writing, however, states that the siphuncle is "marginal and ventral," as it is known to be in *P. Halli*. The two fragments marked 2078 shew neither the external form of the shell, the outline of the transverse section, nor any of the surface markings. One of these is a little more than about one-third of the outer whorl of a specimen which has been worn down in such a manner as to shew a longitudinal section of the body chamber and of the last five septa, which latter average from five to five and a half millimetres in their greatest distance apart. The other shews scarcely anything, except that the venter is much flattened.

Adult or presumably adult specimens of *P. Halli* average about three inches and a quarter in their maximum diameter, and appear to be always smaller than full grown individuals of *P. Jason*. The former, too, are more closely coiled, the rib-like folds on the outer volution are more numerous and much narrower proportionately, while the siphuncle is quite marginal. The characters of the external aperture are well shewn in some of the specimens of *P. Halli* collected by Mr. Weston. The lip is thin and simple, and its outer margin is exactly parallel with the flexuous,

* Ottawa Naturalist, vol. XVII, pp. 161 and 162.

rib-like folds and raised lines of growth that cross the outer volution, both of which are nearly straight on the dorsum, curved obliquely and convexly backward on each side, and deeply and concavely sinuate on the venter.

In a large number of specimens there is some diversity in the mode of coiling, and in the surface ornamentation. The volutions are always rather closely coiled, but they may be either separate but closely contiguous throughout, or partly in contact and partly free. In some specimens the volutions are most distant posteriorly, and in others anteriorly. But, in any case, there is no impressed zone or contact furrow on the dorsum.

On the outer volution, the oblique, rib-like folds are most prominent in the ventral and ventrolateral region, but in some large specimens from Lorette there is a narrow, shallow longitudinal depression in the median line of the venter, upon which some of these ribs or folds are more or less obsolete. And, as before stated, in the small specimen from Watertown that Hall figures as "*Lituities undatus*," the whole of the flattened venter is practically smooth. The sutural lines of the Lorette specimens are nearly straight, and the siphuncle is cylindrical, ventral and marginal.

In the Museum of the Survey there are specimens of *Plectoceras Halli* from the following localities in the Province of Quebec. Falls of the St. Charles River, Indian Lorette; collected by Logan and Richardson in 1852, by Ami and Giroux in 1888, and by Weston in 1898. St. Ambroise, four miles north of Indian Lorette; and Lac Oureau river (the Naque-reau river of the "Geology of Canada") above the mouth of the Rivière Rouge and S. W. of Joliette; collected by Logan and Richardson in 1852. Also, three miles west of Napierville, south of Montreal, collector and date not stated. From Ontario, a few specimens of *P. Halli* have recently been collected at two localities near Ottawa by Walter R. Billings and J. E. Narraway.

By one alias or another, this species has long been regarded as a characteristic fossil of the Black River limestone of the State of New York by Emmons and Hall, and of the Province of Quebec by E. Billings and Foord. But, it is to be noted that the limestone at the falls of the St. Charles River, Lorette, where it is most abundant, was said to be of Trenton age by Bigsby and Salter in 1853, and by Ells in 1888, though Ells says that the beds at the foot of the fall "have a Black River facies in their lowest portion."

(3.) PLECTOCERAS (?) UNDATUM, Conrad. (Sp.)

Plate 37. The only figure.

Inachus undatus (pars) Conrad. 1842. In Emmons' Geol. New York, Pt. II, Surv. Second Geol. Distr., p. 394, no. 104, fig. 1.

- Lituites undatus* (pars) Hall.....1847. Pal. N. York, vol. I, p. 52, pl. 13, fig. 1; and pl. 13 *bis*, the only figure.
Lituites undatus (pars) Emmons.....1855. American Geology, Pt. II, p. 146, pl. 5, fig. 14.
Trocholites undatus (pars) Hyatt.....1883. Proc. Boston Soc. Nat. Hist., vol. XXII, p. 267.
Eurystomites undatum, Hyatt.....1894. Proc. Amer. Philos. Soc., vol. XXXII, p. 445.

The type of this species, as now restricted, is a specimen from the Black River limestone at Watertown, N. Y., collected more than sixty years ago by Dr. Crawe, of that city. This specimen is the original of Emmons' larger figure of *Inachus undatus* in the report on the Geology of the Second District of the State of New York; and of Hall's representation of *Lituites undatus* on Plate 13, fig. 1, of the first volume of the Paleontology of the State of New York. It is about three inches and a half in its maximum diameter, but is very imperfect anteriorly. Only one side of this fossil is preserved, and all that the specimen shews is the general shape of the shell and some of the coarser surface markings, but there are no indications of the siphuncle. Another specimen from Watertown, collected by Dr. Crawe, which is figured by Hall (op. cit., pl. 13 *bis*) is fully six inches in its maximum diameter, though part of the body chamber is broken off. It also gives no information as to the shape or relative position of the siphuncle. Both of these specimens are in the American Museum of Natural History at New York City.

It is still doubtful to which genus of Cephalopoda this species should be referred. *Inachus* was long ago rejected for it, as being preoccupied in Crustacea and for other reasons. It is equally clear that it is not a *Lituites*, and that it does not even belong to the family Lituitidae. Hyatt regarded it as a *Trocholites* in 1883, but ultimately abandoned this view and placed it in *Eurystomites* in 1894. On Plate 5, figs. 1 and 2, of the "Phylogeny of an Acquired Characteristic," a small specimen from Poland, Herkimer County, State of New York, is figured under the name *Eurystomites undatus*. This specimen, which is in the Walcott collection in the Museum of Comparative Zoology at Cambridge, Mass., has been kindly lent to the writer by Mr. Samuel Henshaw. It is about forty-three millimetres, or about an inch and three quarters, in its maximum diameter. One whorl and a half are preserved; these are in close contact, widely elliptical in cross section, and wider laterally than in a dorsoventral direction. On the earlier half of the outer whorl the test is marked with numerous, close-set and minute, transverse raised lines, which are straight in passing over the venter. But on the latter half of this volution, the lines of growth are curved convexly on each side, and concavely backward on the venter. The sutural lines are nowhere ex-

posed, and the siphuncle is ventral and marginal. It is difficult to see how two of the large specimens figured by Hall as *Lituities undatus*, or the small specimen from Poland that Hyatt figures as *Eurystomites undatus*, can be distinguished generically from *Plectoceras*.

All the specimens from the Province of Quebec that were formerly identified with *Lituities undatus* are *Plectoceras Halli*. The only specimen that the writer has seen, that was certainly collected in Canada and that is probably referable to *Plectoceras undatum* (or, as Hyatt calls it, to *Eurystomites undatus*) is the original of the figure on Plate 37. It was obtained, a few years ago, from the Black River limestone exposed in an excavation for a sewer in a street not far from Queen's College, Kingston, and has recently been acquired for the Museum of this Survey, in exchange, from the authorities of Queen's University. It is a cast of the interior of the septate portion of the shell, five inches and a half in its maximum diameter, with fragments of the test attached. Its outer volution is subquadrate in transverse section, and the sutural lines are nearly straight on the sides, but shallowly concave on the venter or periphery. In the Museum of Queen's University there are two large specimens of *P. undatum* (or *Eurystomites undatus*) that are supposed to have been collected from the Black River limestone at or near Kingston, but it is not at all certain where either of them are from.

If a *Plectoceras*, *P. undatum* is obviously a much larger species than *P. Jason* or *P. Halli*.

Eurystomites plicatus, nobis, from the Galena-Trenton formation of Little Black Island, Lake Winnipeg, which is described and figured in the third part of this volume, has much the appearance of a *Plectoceras*, externally, but its siphuncle is known to be "ventrad of the centre."

The genus *Barrandeoceras* also was first described by Hyatt in 1883, in his "Genera of Fossil Cephalopoda," already referred to as having been published in the twenty-second volume of the Proceedings of the Boston Natural History Society. On page 299 of that memoir it is placed in the family Nautilidae, and is thus described:

"BARRANDEOCERAS, nobis, includes gyroceran and nautilian shells with very large umbilical perforations, and compressed, slightly costated or smooth whorls, generally without an impressed zone, though this is sometimes present. The venter is narrower than the dorsum, the siphon near but above the centre, septa deeply concave, and sutures with ventral saddles, lateral lobes and dorsal saddles, without annular lobes. Type, Barr. (Naut.) natator, sp. Bill. Can. Nat. N.S., vol. 4, Mus. Geol. Surv. Can. The genus also includes the Bohemian forms Barr. (Naut.) Bohemicum, sp. Barr., Vol. 2, Syst. Sil. pl. 32, 53; Sternbergi, ibid., pl. 36, 37;

tyrannus, *ibid.*, pl. 38; Sacheri, *ibid.*, pl. 39. Living chamber is about one-half of a volution in length; it is about three-fourths of a volution in length in the type species."

In 1894, in the "Phylogeny of an Acquired Characteristic" (*Proc. Amer. Philos. Soc.*, vol. XXXII, pp. 450 and 451) the genus is placed in the new family Tarphyceratidae, and is described as follows:

"BARRANDEOCERAS.

"This genus was described in my *Genera of Fossil Cephalopoda* to include shells having large umbilical perforations, compressed slightly costated or smooth whorls. The venter usually narrower than the dorsum, the whorls barely in contact or with very slight contact furrow, siphuncle near but above centre, septa deeply concave, sutures having usually ventral and dorsal saddles and lateral lobes. This last statement is true of all the forms having the gyroceran mode of coiling, but not of those which have the closer nautilian form. In these there is a slight dorsal lobe and a different form of the paranepionic whorl which may eventually lead to their generic separation.

"The type is *Barrandeoceras (Naut.) natator*, sp. Billings."

Eight species of this genus are enumerated or described by Hyatt in the "Phylogeny," two from the Cambro-Silurian rocks of the Province of Quebec, one from the same formation in the State of New York, four from the Silurian rocks of Bohemia, and one from the Niagara group of Indiana.

At present (1906) four species of *Barrandeoceras* have been recognized as occurring in Canada, two in the Chazy, and two in the Black River limestone.

These are as follows:

(1.) BARRANDEOCERAS NATATOR, Billings. (Sp.)

Plate 39, figs. 1, 1a, and 1b.

<i>Nautilus natator</i> , Billings.....	1859.	<i>Canad. Nat.</i> , vol. IV, p. 466.
<i>Barrandeoceras natator</i> , Hyatt.....	1883.	<i>Proc. Boston Soc. Nat. Hist.</i> , vol. XXII, p. 299; and (1894) <i>Proc. Amer. Phil. Soc.</i> , vol. XXXII, p. 452.

Original description of Nautilus natator. "Discoid planorbiform, all the whorls exposed in the umbilicus. Tube slender, gradually increasing in size, so that on the completion of the fifth whorl the diameter of the coil is four and one fourth inches. Section oval, the dorso-ventral diameter being greater than the lateral in the proportion of about 8 to 6 (?). Septa at the end of fourth whorl, three in about seven lines, measured on the side. Surface and siphuncle unknown.

"The specimen is imperfect ; but if it has not been compressed laterally, then, as nearly as I can determine, the dorso-ventral diameter at the end of the fifth whorl is sixteen lines and the lateral twelve ; at the fourth whorl five to seven ; and it would appear therefore that the third must be scarcely three lines in its greatest diameter.

"I have not seen the first and second whorls, but as there is an empty space nine lines in diameter in the centre of the coil, I presume that they did once exist and occupy that space. The whorls are in contact, but the outer ones are not indented by those next preceding.

"*Locality and Formation.*—Mingan Islands ; Chazy limestone.

"*Collectors.*—Sir W. E. Logan, J. Richardson."

The original label is not preserved and the exact locality from which the specimen was collected is unknown. The label now attached to the tablet upon which it is placed states that it was collected in 1856.

The same specimen is thus described by Hyatt, under the name *Barrandoceras natator*, in his "Phylogeny of an Acquired Characteristic."

"This species has volutions compressed oval in section, the dorsum somewhat broader than the venter ; siphuncle is extracentroventran, even in the neanic stage ; septa deeply concave ; sutures with dorsal and ventral saddles and the lateral lobes as in other species of the genus.

"The volutions are in contact, but no contact furrow was formed at any age. The contact takes place as in the young of *Estonioceras perforatum*, on the venter of the paranepionic volution.

"The volution in the neanic stage, dorso-ventral diameter 13* mm., has a much narrower venter in proportion to the dorsum than in the adult. The venter was rounded at all stages and also the dorsum. The aneanic and nepionic stage were not present in the original specimen in the Museum at Ottawa, but in following out the same lines it is easily ascertained that the umbilical perforation must have been enormous, at least 15-17 mm. in diameter. The living chamber was somewhat over one-fourth of a volution in length. The whole diameter was about 108 mm. It was reported as having been found in the Chazy limestone."

(2.) *BARRANDEOCERAS MINGANENSE*, Hyatt.

Barrandoceras Minganense, Hyatt.....1894. Proc. Amer. Phil. Soc., vol. XXXII, p. 451.

"Loc., Mingan Islands.

"There is a specimen from the Chazy limestone of the Mingan Islands in the collection of the Museum of the Geological Survey at Ottawa which has very similar characters to those of *Barrandoceras natator*, but is distinct in some of its characters. The living chamber is short and, if complete, about a quarter of a volution in length. It is free and in section

is compressed oval, the abdomen broader than the dorsum, but the centro-dorsal (*) diameter is longer than the transverse.

"The siphuncle is nearer the centre, being ventrocentren. The neanic, or perhaps an epebic stage has slight annulations or raised lines of growth, judging from the marks on the section. This is labelled as coming from the white limestone of Large Island.

"There is no impressed zone at any stage observed. The epebic stages have a whorl similar to that of *Barrandoceras convolvans* in the neanic stage, but the abdomen is broader." Hyatt, op. cit. supra.

(3.) BARRANDEOCERAS SUBCOSTULATUM, Whiteaves.

Plate 38. The only figure.

- Barrandoceras subcostulatum* Nom. prov. Whiteaves. . . . 1898. Ottawa Naturalist, vol. XII, p. 121.
- Cfr. *Lituites convolvans*, Hall (non Hisinger) . . . 1847. Pal. N. York, vol. I, p. 53, pl. 13, figs. 2 and 2 a.
- Hortholus Americanus*, d'Orbigny. . . 1850. Prodr. de Paléont., tome 1, p. 1 (non *Hortholus convolvans*, Montfort, 1808).
- Lituites Americanus*, S. A. Miller. . . 1889. N. Amer. Geol. and Palaeont., p. 442.
- Barrandoceras convolvans*, Hyatt. 1894. Proc. Amer. Phil. Soc., vol. XXXII p. 451.
- " " S. A. Miller. 1897. N. Amer. Geol. and Palaeont., Second Appendix, p. 771.

Original description of Barrandoceras subcostulatum. "Shell consisting of about two gyroceran volutions which are coiled loosely on the same plane, but nowhere in close contact, and gradually becoming more eccentric, the outer one slightly compressed both above and below, so that the outline of a transverse section near the aperture would be broadly elliptical, and the dorsoventral diameter a little greater than the lateral.

"Surface of the test distinctly costulate, though in the only specimen that the writer has seen, the ribbing is most clearly defined on the inner volution, where it consists of rather distant but irregularly disposed, small, thin, acutely angular and slightly flexuous transverse ribs or ridges, which are generally much narrower than the very shallow depressions between them, and marked with numerous minute striations parallel to the ribs. Sutures of the septa not clearly indicated; shape and relative position of the siphuncle unknown."

Black River limestone at Wolfe Island near Kingston, the fine specimen, figured, which is fully four inches in its maximum diameter, and which was presented to the Museum of the Survey by Professor James Fowler in 1888.

* Presumably a typographical error for ventrodorsal.

Lituities convolvans, Hall (non Hisinger) is distinctly included by Hyatt in his genus *Barrandeoceras*, as stated in the foregoing list of its synonyms. The only difference that can be detected between the two specimens of that species that Hall figures, and the type and only known specimen of *B. subcostulatum* is that the former are described and figured as smooth, whereas the surface of the inner whorl of the latter, at least, is distinctly costulate. But, it is only upon well preserved, testiferous specimens that the surface markings are at all clearly shewn, and the two specimens of *B. convolvans* that Hall figures, are mere casts of the interior of the shell.

(4.) *BARRANDEOCERAS VAGRANS*, Billings. (Sp.)

Plate 40, figs. 1, 1a, 2 and 2 a.

Gyroceras (Lituities) vagrans. Billings. 1857. Geol. Surv. Canada, Rep. Progr. 1853-54-55-56, p. 308.

Original description of Gyroceras (Lituities) vagrans. "Shell elongated, tapering at the rate of nearly two lines to the inch; laterally compressed, section elliptical, dorso-ventral diameter greater than the lateral, apparently in the proportion of twelve to eight; about seven inches of the apical extremity of the shell spirally enrolled so as form two whorls not in contact, the interior one of which is one inch in diameter, and the exterior three inches; septa convex, distant one line and a half at a dorso-ventral diameter of one inch.

"The specimen exhibits an artificial polished section passing through the central plane of the whorls, showing clearly the construction of the tube to the apex, where it has a diameter of only one line; some of the septa and almost one-half of the transverse section, but neither the siphuncle, the character of the surface, nor the length of the produced oral extremity is indicated; several specimens still lying imbedded in the rock which are known to me, are in my opinion of this species, and if so, then the free portion was gently curved, and in some individuals at least six inches in length, thus giving thirteen inches as the total length. It is scarcely necessary to observe that from the above materials the generic rank of the fragment cannot be determined with the certainty desirable; the tube is too much curved to come within the definition of *Cyrtoceras*, the whorls too widely separated for *Nautilus* or *Lituities*, and yet, without a view of the aperture we cannot say positively that it is a *Gyroceras*.

"*Formation.*—Black River limestone.

"*Localities.*—La Petite Chaudière Rapids, Ottawa River, and in the outcrop of the Black River limestone, near Mile End, St. Lawrence Street, Montreal."

Of the specimens referred to in this quotation, the only one that the writer has seen is the fossil from La Petite Chaudière that has been rubbed down on one side and polished in such a manner as to exhibit the "artificial polished section" described by E. Billings. This specimen, which is now figured for the first time (figs. 1 and 1a) is evidently intended as the type of the species, though it shews little more than the mode of coiling and the lateral compression of the whorls.

Of late years a few imperfect specimens, that are apparently referable to this species, have been collected at La Petite Chaudière, on the Quebec side of the Ottawa River, at Tetreauville, by Mr. W. R. Billings, Mr. J. E. Narraway, and the writer. One of these specimens, the original of figs. 2 and 2a on Plate 40, is an imperfect cast of the interior of the septate portion of the shell. It shews that on the convex exterior of the cast, each of the sutural lines forms a single, widely and very shallowly concave sinus or "lobe" on each side, and a low, simple, undivided and obtusely subangular saddle on the venter. On the dorsum, also, there are indications of a similar saddle. It seems to the writer that the few specimens of *Gyroceras* (or *Lituities*) *vagrans* that have yet been obtained are clearly congeneric with *Barrandoceras convolvans*, and *B. subcostulatum*.

Figures 3 and 3a were inadvertently printed on Plate 40, because the writer was at first under the impression that the original of both was also a fragment of a specimen of *B. vagrans*. But it soon became apparent that this fragment is a piece of a specimen of a *Cyrtoceras*, and most probably of *C. sinuatum*, Billings, the type of which is a badly preserved cast of the interior of a shell, also from the Black River limestone at La Petite Chaudière. The exterior of this fragment (figure 3) shews that the surface ornamentation consists of narrow, transverse and slightly flexuous ribs, with wider spaces between them; and the inner portion (figure 3a) which has been broken in such a way as to exhibit a longitudinal and nearly median section, shews that the siphuncle is placed a little outside of the middle, or, as Hyatt, would have said, somewhat ventrad of the center.

GEOLOGICAL SURVEY OF CANADA.

PALEOZOIC FOSSILS.

VOL. III.

7. *Illustrations of seven species of fossils from the Cambrian, Cambro-Silurian, and Devonian rocks of Canada.*

By J. F. WHITEAVES.

These species have been described, at various times, in the "Canadian Record of Science" or "Ottawa Naturalist." But, four of them have not previously been figured at all, and not one of them has been either described or figured in any of the publications of the Survey.

A. FROM THE CAMBRIAN ROCKS OF BRITISH COLUMBIA.

ANOMALOCARIS CANADENSIS, Whiteaves.

Anomalocaris Canadensis, Whiteaves1892. Canad. Rec. Sci., vol. V, pp. 205 and 206, with the text figure here reproduced.

The following is a copy of the original description of this genus and species:

ANOMALOCARIS. (Gen. nov.)

"Carapace and its appendages unknown or too obscurely indicated for their characters to be defined: body many jointed and consisting of not less than nine to thirteen segments, exclusive of the caudal segment; ventral portion of each of the body segments bearing a pair of slender, narrowly elongated and acutely pointed, simple and probably branchial appendages, of the nature of uropods or foot gills: posterior terminal segment margined with three pairs of caudal spines, one terminal and the other two lateral,—the posterior pair of uropods represented in the woodcut apparently belonging to a pre-caudal segment whose posterior boundary has been obliterated."

ANOMALOCARIS CANADENSIS, sp. nov.

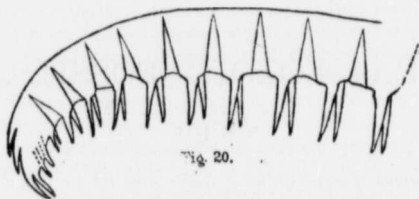


Fig. 20. *Anomalocaris Canadensis*.—Outline of a specimen in which nine of the abdominal segments are preserved, besides the caudal segment. Natural size.

"Body, inclusive of the tail, elongated, slender, decreasing slowly in size from the anterior to the posterior end, rather strongly curved posteriorly and nearly straight anteriorly, the length of the portion preserved varying in different specimens from nine to ten centimetres (as measured at about the midheight and following the curve of each), and the height or depth at the imperfect anterior end, from twelve to seventeen millimetres, exclusive of the ventral appendages. Body or abdominal segments, which, in all the specimens collected are abnormally flattened laterally, a little higher or deeper than long, broader above than below, the pair of ventral appendages proceeding from each, nearly equal in height or depth to the segment itself. These appendages are straight and prolonged downward at almost a right angle to the main axis of the body, for although there is a slight divergence in each pair, neither are directed distinctly backward nor forward. Between each pair of segments there is evidence of a wedge-shaped or very narrowly triangular lateral area or interval, which is broadest or widest below and does not seem to extend quite to the dorsal margin. At the posterior end the segmentation is very obscurely defined. Caudal spines, which are simple, slender, longitudinally elongated and acutely pointed, averaging six millimetres in length by about one mm. in breadth at the base: the three pairs of spines about equal in length, though the two lateral ones are placed farther forward than the central and terminal pair. Surface markings entirely unknown.

"This genus and species are based upon upwards of fifty specimens collected from a band of shale of Middle Cambrian age, at Mount Stephen, near Field station on the Canadian Pacific Railway. Two of these specimens were collected by Mr. R. G. McConnell, of the Geological Survey of Canada, in 1888, and the remainder by Dr. H. M. Ami, of the same

Survey, in 1891. The species seem to have been somewhat gregarious in its habits when living, for upwards of twenty specimens of it are exposed on the surface of a large slab of shale collected by Dr. Ami at this locality, and fourteen upon that of another. It is associated with numerous species of trilobites, brachiopoda, etc., most of which have been described by Dr. Carl Rominger and Dr. C. D. Walcott. All the specimens of *A. Canadensis* are crushed quite flat laterally and occur as obscurely defined and extremely thin impressions of the body segments, with the tail, the latter usually a little twisted, on each of the surfaces exposed by splitting pieces of the shale.

The generic name *Anomalocaris* (from ἀνωτόμαζ, unlike,—καρπός, a shrimp, i.e., unlike other shrimps) is suggested by the unusual shape of the uropods or ventral appendages of the body segments and the relative position of the caudal spines."

This description was followed by a brief discussion of the supposed relations of *Anomalocaris* to other genera of Phyllocarida, but it is not thought necessary to reproduce this discussion here, as Professor T. Rupert Jones and Dr. Henry Woodward have expressed the opinion* that *Anomalocaris* is probably not a Phyllocarid. The affinities of this genus are still uncertain. In the first volume of his Text Book of Palaeontology, published in 1900, Dr. C. R. Eastman places it provisionally in the Family Branchiopodidae of the Order Branchiopoda.

B. FROM THE CAMBRO-SILURIAN ROCKS OF QUEBEC AND ONTARIO.

B. I. FROM THE LEVIS FORMATION OF QUEBEC.

CYRTOCERAS QUEBECENSE, Whiteaves.

Plate 35, figs. 1 and 1 a.

Cyrtoceras Quebecense, Whiteaves.....1898. Ottawa Naturalist, vol. XII, p. 120.

"Shell elongate conical, increasing very slowly in thickness and not much curved; dorsum slightly compressed, venter and sides rounded. Siphuncle large, cylindrical, dorsal and marginal; septa apparently rather closely approximated.

"Length of the only specimen collected, which is imperfect at both ends, about seventy-five millimetres, or three inches; thickness of the same about eleven mm. at the smaller end, and nearly thirty at the larger.

"Levis limestone at Pointe Lévis, opposite Quebec City; a single specimen, which seems to be quite distinct from all the species of *Cyrtoceras*

* In the tenth Report of the Committee on "The Fossil Phyllozoa of the Palaeozoic Rocks," in the Report of the British Association for the Advancement of Science for 1893.

from that locality, described by E. Billings in the first volume of 'Palaeozoic Fossils.'

B. 2. FROM THE TRENTON LIMESTONE OF QUEBEC AND ONTARIO.

STEGANOBLASTUS OTTAWAENSIS, Whiteaves

- Astrocystites Ottawaensis*, Whiteaves 1897. *Canad. Rec. Sci.*, vol. VII, p. 287, with the text figures here reproduced.
Steganoblastus Ottawaensis (inadvertently written *Canadensis*), Whiteaves 1898. *Idem*, p. 395.
Steganoblastus Ottawaensis, Bather 1900. *Treatise on Zoology*, edited by E. Ray Lankester. Part III, The Echinoderma, pp. 209 and 210, figs. VII, 1 and 2.

The following is a copy of the original figures and description of *Astrocystites*, from the "Canadian Record of Science" for January, 1897, published in July of that year, but with the numbers of the figures altered to suit this publication.

ASTROCYSTITES OTTAWAENSIS.



Figs. 21, 21a, and 22. *Astrocystites Ottawaensis*. Fig. 21. "Side view of a nearly perfect specimen, shewing the small plates surrounding and perhaps covering the anus, on the left side of one of the ambulacral areas, at A, and the peculiar sculpture of part of the calyx, natural size." Fig. 21 a. "Summit view of the same specimen, also of the natural size." Fig. 22. "Radial plate on the left of the anal region of another specimen, twice the natural size, to shew the peculiar shape and sculpture of this plate, also the overlap by the distal portion of one of the ambulacral areas above, and the modification of the upper margin of the plate on the anal side: A—relative position of the anus."

"Body or 'crown' of the organism globose, almost spherical but narrowing rapidly below into a very short, slender column or stem, and somewhat five-sided as seen from above.

"Calyx or dorsal cup broadly conical and entire below the midheight, but divided above into five large, pointed and slightly incurved, sepaloïd lobes, with rather oblique and slightly convex sides, by the decurrent portions of the ambulacral areas. The greater part of one of these lobes, as seen at A," in fig. 21, "is occupied with a cluster of minute plates which surround and either partially or wholly cover the anal opening.

"Surface of the calyx marked by small, short, branching grooves, which radiate from the centre and anastomose at the margins of large plates of irregular shape. The exact outlines of some of these plates are not clearly defined in any of the three specimens that the writer has seen, but two of the latter have part of the calyx crushed in such a way as to shew parts of the margins of at least two of the radials and of one of the basals. Judging by these indications of the outlines of the plates and by the peculiar sculpture of others, the composition of the calyx would seem to be essentially as follows. In the undivided and lower moiety of the divided portion there appears to be a circlet of large subpentagonal and presumably basal plates, immediately above the column. On the surface of these plates the branching grooves radiate upward and outward, but not backward, and, consequently, only the front and part of the lateral margins of each of these plates is minutely sinuated. Next to these supposed basal plates and alternating with them there is a circlet of five large radials. These radials are irregular in outline, but their margins are minutely sinuated all round, except in the middle of the summit, where each of these plates is overlapped by the distal portion of the ambulacral area, as shewn in fig. 22. On each side of the anal region the upper and inner portions of the margin of each of the two radials that partially bound it, are slightly modified, as also shewn by fig. 22, in which A represents the relative position of the middle of the anal region. In the upper and lobate portion of the calyx there appears to be a comparatively small and presumably interradial plate, whose outline it is not yet possible to define precisely, in or near the middle of each of four of the lobes, the corresponding part of the fifth lobe being occupied by the group of small plates which surround and apparently cover the anus.

"The summit or entire surface above the calyx, is exclusively occupied with five large linear lanceolate, radiating ambulacral areas, which extend a little beyond and below the midheight and alternate, at and near the centre, with five small narrowly elongated, subtriangular, almost bottle-shaped plates. The ambulacral areas consist of well defined grooves, which are partially and perhaps in perfect specimens were wholly roofed over with two rows of small, transversely elongated and alternately arranged covering plates, from the centre of the summit, where they interlock and probably cover the presumably subtegmenal mouth. In the only specimens known to the writer these plates roof over the ambulacral grooves, from the middle of the summit, for distances varying from one-half to fully two-thirds of the entire length of each groove, but always, at least, as far outward as to the bases of the small alternating subtriangular plates. On some of the ambulacral grooves only eight covering plates can be counted on each side, in a longitudinal direction, but on others there

are as many as fourteen on each side. In the latter case the circumstance that several of the outermost covering plates are crushed down into the ambulacral grooves leads to the inference that the grooves may have been almost or completely roofed over in perfect specimens. A central area at the summit, in which the ambulacral areas or covered inner ends of the ambulacral grooves are everywhere in close contact with the small alternating subtriangular plates, is bounded by the bases of the latter. Outside of this area the ambulacral areas suddenly become more widely divergent, and their grooves are bordered on each side by a prominent raised rim. At the outer end of each of the ambulacral areas, where the covering plates have been removed or are absent, there is a longitudinal row of marginal pores on the inner surface of the raised rim which bounds the groove on both sides, as shewn in fig. 22, and the whole of the outer declivity or downward slope of the rim is transversely corrugated or ribbed.

"When examined with a lens, the whole surface of the calyx, of the covering plates of the ambulacral grooves and of the small subtriangular plates which alternate with the inner ends of the ambulacral areas at the summit, is seen to be densely pitted or perhaps perforated.

"Two specimens of this species, both collected by Mr. John Stewart in 1886 from the Trenton limestone at Division St., Ottawa, are in the Museum of the Geological Survey of Canada, and an imperfect specimen from the same locality has been kindly lent to the writer by Mr. Walter R. Billings. All three of these specimens, when found, were almost completely covered with a very tenacious shaly limestone, and although they have been both carefully and skillfully cleaned, it is just possible that some of the covering plates of the ambulacral grooves may have been accidentally removed in the cleaning. At present, also, it is not possible to ascertain from either, whether the dense pitting of so large a portion of their surface is caused by "conjugate" pores or not. It is only proper to add that the general outlines of the plates of which the calyx is composed in this species, were first suggested to the writer by Mr. W. R. Billings, who, as is well known, has devoted much time to the study of the crinoids and cystideans of the Trenton limestone of the Ottawa valley.

"*Astrocystites* would seem to be most nearly related to *Asteroblastus*, Eichwald, and is probably referable to the same family, though it clearly differs from that genus in several important particulars. Thus, a comparison of the plates of which the calyx is composed in these two genera shews that, although they have much the same shape and style of sculpture, yet those of *Asteroblastus* are both small and very numerous, while those of *Astrocystites* are large and comparatively few in number. The anal region of *Astrocystites*, too, is lateral and well defined, but no indications of

any such region have yet been observed in *Asteroblastus*. The summit, also, is very differently constructed in these two genera. In *Asteroblastus* there is a central oral aperture, immediately surrounded by five apical plates, and the ambulacral areas, which are comparatively broad and short, do not reach to the centre. No traces of the oral aperture are visible anywhere on the summit of *Astrocytites*, the mouth of that genus being apparently subtegmina, and the ambulacral areas, which are long and narrow, extend to the centre, where their covering plates interlock.

"The ambulacral areas of *Astrocytites* are somewhat like those of *Blastoidocrinus*, but, in the latter genus (which is still known only from the few fragments collected by E. Billings from the Chazy limestone of the Island of Montreal and its immediate vicinity, and from the imperfect specimens from the "Orthoceratitenkalk" of Pulkowa, Russia, described and figured by Friedrich Schmidt) the spaces between them are completely filled with the large deltoids, which, according to E. Billings "extend the whole length of the pseudambulacra."

"There are, also, apparently, some points of resemblance between *Astrocytites*, and *Cystoblastus*, Volborth, but in Zittel's description of the latter genus, which is the only one that the writer has access to, there are said to be two pectinated rhombs in the calyx, whereas no traces of such structures have been observed in the dorsal cup of *Astrocytites*.

"In 1874* Schmidt expressed the opinion that *Blastoidocrinus*, *Asteroblastus*, *Mesites* and *Cystoblastus* are all cystidea which may be regarded as intermediate in their characters between that class and the blastoids, and it is quite clear that these are the genera to which *Astrocytites* is most closely allied. 'Blastoids,' writes Dr. Charles Eastman, in the first volume of his Translation of Zittel's Text-book of Palæontology, published in 1896, 'have not been recognized, as such, up to the present time, in strata lower than the Silurian; but it is possible that several genera occurring in the Ordovician of North America and Russia (*Blastoidocrinus*, *Asteroblastus*, etc.), which are now referred to the Cystids, may eventually be transferred to the Blastoidea.' In that event, *Astrocytites* would, of course have to be included in the same category. On the other hand, Etheridge and Carpenter, on page 129 of their 'Catalogue of the Blastoidea in the Geological Department of the British Museum,' published in 1886, say distinctly 'we have no certain evidence of the existence of true Blastoidea anterior to the Upper Silurian period. For we much doubt, as we have explained in the previous chapter, whether the problematical *Blastoidocrinus* from the Lower Silurian of Canada and Russia can properly be referred to this group." Nicholson and Lyddeker, in the

* "Mémoires de l'Académie Impériale des Sciences de St.-Petersbourg, VIIe Série, tome XXI, p. 25."

first volume of their 'Manual of Palaeontology,' published in 1889, follow Johannes Muller's classification of the Cystoidea, and divide the class 'into the three orders, of the Aporitidae, Diploporitidae and Rhombiferi, according as the calycine plates are imperforate, are pierced by yoked pairs of pores indiscriminately distributed, or have their pores arranged in pore-rhombs.' Of these three orders, *Astrocystites* would seem to be most probably referable to the Diploporitidae." Figures 21, 21a & 22 of this paper are reproductions of original drawings by Mr. L. M. Lambe.

A few months later, in a postscript to this paper, published in the Canadian Record of Science for July, 1897, but which was not issued until January, 1898, the generic name *Astrocystites* was changed to *Steganoblastus*, at the suggestion of Dr. F. A. Bather, who thought that it was too near to *Asterocystis*, Haeckel (1896).

The specimens upon which *S. Ottawaensis* were based have since been studied somewhat exhaustively by Dr. Bather, whose general conclusions thereon are summarized in part III, chapter XII, of the "Treatise on Zoology," edited by Dr. E. Ray Lankester, and published in 1900. Dr. Bather thinks that *Steganoblastus* is more nearly related to *Edrioaster* than to *Asteroblastus*, and makes it the type of a new family, which he calls Steganoblastidae, and places in the class Edrioasteroidea of E. Billings. The family and genus are thus described, and the typical species figured (but with other numbers) by Dr. Bather, on pages 209 & 210 of the volume cited.

"FAMILY 4. STEGANOBLASTIDÆ. Edrioasteroidea, with a rigid theca composed of plates relatively larger and thicker than in other families of this class; these include elements comparable to the R R and B B of Blastoidea; B B attached to a stem, probably short; ambulacra descend into the radials. Genus—*Steganoblastus*, Whiteaves (1897, originally described as *Astrocystites*, name preoccupied), Ordovician, Canada" (figs. 23 and 24). "The remarkable resemblance to *Asteroblastus*, insisted on by its founder, suggested the reference of *Steganoblastus* to the Protoblastoidea (Bather, 1899); but the ambulacra are now known to have essentially the same structure as in *Edrioaster*, while the absence of brachioles may be maintained with confidence. Theca piriform, its plates strongly marked with axial folds, and consisting of: B B (5, sutures not clear); R R, 5, alternating with B B, and receiving the distal ends of the ambulacra; interambulacrals, one large one and an uncertain number of smaller ones, in each interradius; 5 slightly pitted plates of spear-head shape, stretching up between the ambulacra to the oral pole and simulating O of Crinoidea or Δ of Blastoidea, but perhaps being only proximal covering-plates. The anus pierces one interambulacrum, and slightly disturbs the pentamerous symmetry of the theca. From the mouth 5 ambulacra stretch about half-way down the theca; the adambulacrals (side-

or flooring-plates) appear almost ankylosed, but the pores between them are very clear, and one can trace the original median line of suture; the ambulacra or covering plates were stout, at least in the proximal

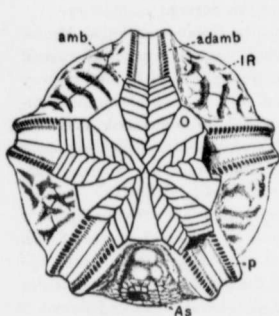


Fig. 23.

Steganoblastus ottawaensis, slightly restored from the type-specimens, and x 3 diam. 23, oral surface; 24, from l. post. radius. *adamb*, adambulacra or side-plates; *amb*, ambulacra or covering plates, mostly removed; *As* anus surrounded by small plates; *B*, basal; *IR*, large median inter-radial; *O*, 6 orals or proximal ambulacra; *p*, pores between side plates; *R*, radial; *St*, fragment of stem.

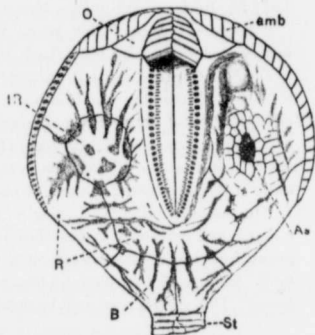


Fig. 24.

regions, where they seem to have combined with the spear-head plates to form a solid roof over mouth and food-grooves. Stem small, round, with lumen less than half the diameter. Fifty years ago *Steganoblastus* would have been described as a generalized or synthetic type, with Cystid, Blastoid, Crinoid and Asteroid affinities; it is simpler to regard it as a specialized Edrioasteroid, in which features common in stalked genera of other classes have been evolved independently under similar conditions of existence."

MATHERIA BREVIS, Whiteaves.

Matheria brevis, Whiteaves. May, 1903. Ottawa Naturalist, vol. XVII, p. 33, figs. 1 and 1 a; and Geol. Mag. for Aug., 1903, N. S., Dec. IV, vol. X, p. 358, figs. 1 and 1 a.

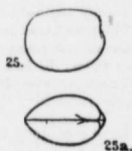
"The genus *Matheria* was described by E. Billings in 1858, in the third volume of the Canadian Naturalist and Geologist. It was based upon a single species, the *M. tener* of Billings, a small lamellibranchiate or pelecypodous bivalve, from the Trenton limestone of Lake St. John, P.Q. *Matheria* appears to be most nearly related to *Cyrtodonta* and

Vanuzemia, and is now included in the family Cyrtodontidae, Ulrich, of the order Prionodesmacea, Dall. The types of *M. tener*, which were collected by Mr. J. Richardson and Dr. R. Bell in 1857, at Blue Point, on Lake St. John, are still in the Museum of this Survey.

"A second species of this genus, from the Trenton shales of Minnesota, was described by Mr. Ulrich in 1892, under the name *M. rugosa*, in the Nineteenth Annual Report of the Geological and Natural History Survey of Minnesota. And, in his report on the Lower Silurian Lamellibranchiata of Minnesota, published in 1897, in volume three, part two, of the final Report on the Geology of Minnesota, Mr. Ulrich expresses the opinion that the *Modiolopsis recta* of Hall, from the Niagara limestone of Wisconsin and Illinois, is also a *Matheria*.

"In the Museum of the Geological Survey there are a few specimens of a fourth and previously undescribed as well as unfigured species of this genus, from the Trenton limestone of Ottawa, collected many years ago by E. Billings and labelled by him with the manuscript name *Matheria brevis*. This species may now be defined and characterized as follows.

MATHERIA BREVIS.



Matheria brevis. Fig. 25. Side view of the most perfect specimen collected, in outline, and showing the marginal contour of the right valve. Fig. 25 a. The same specimen, as seen from above, to show the amount of convexity of the closed valves. Both of these figures are of the natural size.

"Shell small, inflated and regularly convex, but not quite as wide as high, suboval or oblong subquadrate, about one-third longer than high and very inequilateral. Anterior side very short, narrow and consisting of a small rounded lobe below the beaks, on each side; posterior side longer, and a little wider, in the direction of its height; posterior end vertically subtruncate at its midheight, rounding abruptly into the cardinal margin above and into the ventral margin below. Ventral margin gently convex but curving upward more abruptly and rapidly at the posterior than at the anterior end; superior border almost straight and nearly horizontal; umbones depressed, anterior, very nearly but not quite terminal; beaks incurved.

"Surface markings not at all well preserved in either of the specimens collected, but apparently consisting of fine concentric lines of growth. Hinge dentition and muscular impressions unknown.

"Approximate dimensions of the specimen figured: maximum length, fifteen millimetres; greatest height, eleven mm.; maximum width, or thickness through the closed valves, nearly nine mm.

"Trenton limestone, Ottawa, E. Billings: four nearly perfect but badly preserved specimens.

"*M. brevis* can be distinguished at a glance from *M. tener*, *M. rugosa* and *M. recta*, by its comparatively short, tumid and regularly convex valves."

SPYROCERAS BEAUPORTENSE, Whiteaves. (Nom. nov.)

Plate 33, figs. 2 and 2 a.

Orthoceras Beauportense, Whiteaves. 1898. Ottawa Naturalist, vol. XII, p. 11f.

"Shell rather below the medium size, longicone, straight and tapering so gradually that the few specimens which the writer has seen are almost cylindrical. Surface marked by low, rounded, narrow transverse annulations, with numerous minute and close-set, transverse thread-like raised lines between and upon them, all of which are crossed by small and narrow but comparatively distant longitudinal ribs or ridges. The transverse annulations average from two and a half to three millimetres apart, at their summits, and are separated by shallow depressions nearly twice as wide as themselves. The longitudinal ribs or ridges are equidistant, uniform in size, and, on an average, about one millimetre and a half apart. The crossing of these ribs by the transverse annulations makes a very regular and rectangular reticulation, which is plainly visible to the naked eye, but the crowded transverse raised lines cannot be well seen without the aid of a lens. Internal structure and shape and relative position of the siphuncle unknown.

"Trenton limestone at Parent's quarry, Beauport, near Quebec City, D. N. St. Cyr, 1888: one well preserved testiferous specimen not quite two inches in length and with a considerable portion of its surface buried in the matrix. A similar specimen, but with the whole of the outer surface visible, from the same locality, has been lent to the writer by the authorities of Laval University.

"This finely sculptured shell seems to be closely allied to the *O. pseudocalamiteum* (Quenstedt) Barrande,"* which Hyatt says is a *Dawsonoceras*, "but it wants the intermediate longitudinal ridges characteristic of that species." It apparently belongs to Barrande's 'Group 6' of the genus

* *Système Silurien de la Bohême*, tome II, texte 3, 1874, p. 261, pl. 217, fig. 8; pl. 222, figs. 11 and 12; pl. 228; pl. 236, figs. 11-16; et pl. 361, figs. 15-17.

Orthoceras, which Hyatt includes in his genus *Spyroceras*. Its surface ornamentation "appears to be decidedly different from that of any of the small annulated species of *Orthoceras* from the Trenton limestone of the State of New York described and figured by Hall in the first volume of the Paleontology of that State. *O. bilineatum*, Hall, is a much larger and more robust species, with coarser annulations and two series of longitudinal ridges or linear elevations.

"In *O. clathratum*, Hall, the longitudinal markings are very minute and crowded, and are said to consist of 'sharp elevated lines distant $\frac{1}{18}$ of an inch,' or very little more than half a millimetre apart. There are, also, no comparatively coarse and distant longitudinal ribs or ridges in *O. textile*, Hall, and in that species the transverse annulations are represented as both prominent and angular.

(*Orthoceras Westoni*, which was described in the same paper as *O. Beauportense*, and which has not been figured, is based upon a specimen from the Trenton limestone at Montreal, which the writer now thinks to be part of the siphuncle of an *Endoceras*. The "distant and very obliquely flattened annulations" of the exterior of this specimen are probably septal rings, like those of a *Piloceras*, and the obscure indication of a supposed siphuncle, as exposed in a transverse fracture, is probably part of the endosiphuncle.)

C. FROM THE DEVONIAN ROCKS OF ONTARIO.

ORTHO CERAS WALPOLENSE, Whiteaves.

Plate 33, fig. 3.

Orthoceras Walpolense, Whiteaves. 1898. Ottawa Naturalist, vol XII, p. 125.

"Shell small, longicone, straight, slender and increasing very slowly in thickness, slightly and perhaps abnormally compressed. Test unknown; surface of the cast marked by thin, acute, transverse, annular ridges, which are much narrower than the grooves between them. Septa, and shape of the siphuncle, unknown.

"The largest specimen known to the writer was collected many years ago by J. De Cew in the Corniferous limestone of lot 6, concession 14, of the township of Walpole. It is about eighty-four millimetres ($3\frac{1}{4}$ inches) in length, by six mm. in thickness at the smaller end and about fourteen at the larger. Near the smaller end there are about ten annulations and near the larger end about six, in a length of ten mm. The only other specimen that the writer has seen, is a fragment about an inch and a half in length, from the same formation, and labelled lot 42, concession 1, Cayuga, which is probably referable to this species. It has about eight annulations in a length of ten mm., at the larger end.

"*O. Thestor*, Hall,* is described as having proportionately finer annulations, and *O. Idmon*, Hall, (†) judging from the figure, is almost cylindrical."

ORTHO CERAS HAGERSVILLENSE, Whiteaves.

Plate 33, figs. 4 and 4 a.

Orthoceras Hagersvillense, Whiteaves 1895. Ottawa Naturalist, vol. XII, p. 126.

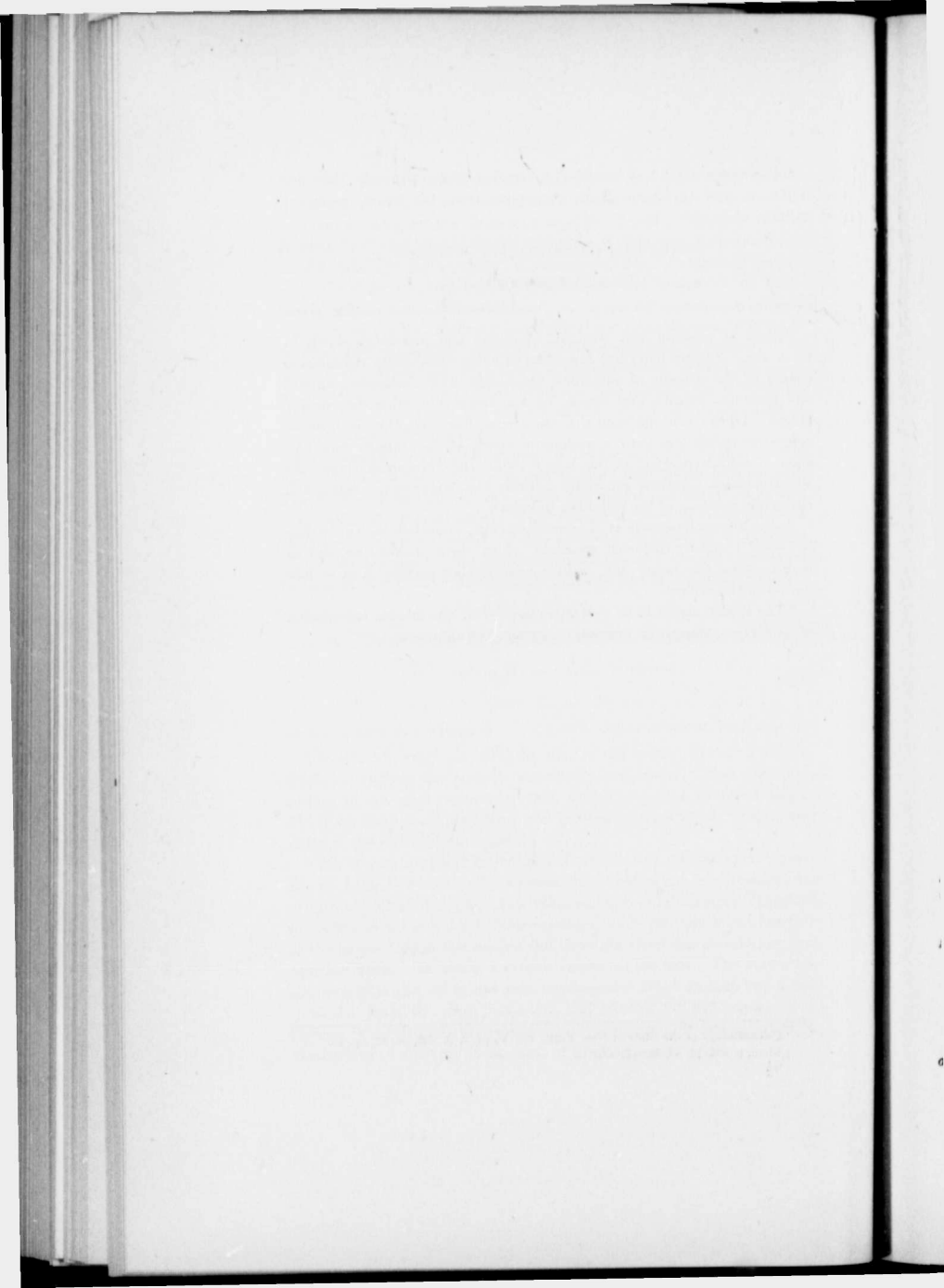
"Shell of medium size, straight, longicone and increasing slowly in thickness. Surface markings consisting of a fine rectangular reticulation caused by the crossing of numerous equidistant and continuous, minute and close-set, longitudinal ridges, by transverse but otherwise similar ridges. In the only specimen that the writer has seen, the longitudinal ridges are rather less than a millimetre apart at the smaller end, and about a millimetre apart at the larger; while the transverse ridges are slightly closer together, especially towards the larger end. Septa, and shape and position of the siphuncle unknown.

"Corniferous limestone at Hagersville," Ont., collected by the writer in 1890: a slightly distorted specimen, about three inches long, and an inch broad at the larger end, with a considerable portion of its surface buried in the matrix.

"The species seems to be well characterized by the minute reticulation of its surface, though its internal characters are unknown."

* Paleontology of the State of New York, vol. V, pt. 2, p. 302, pl. 82, fig. 18.

† Idem, p. 302, pl. 43, figs. 11 and 12.



GEOLOGICAL SURVEY OF CANADA.

PALÆOZOIC FOSSILS.

VOL. III.

8. Revised list of the fossils of the Guelph formation of Ontario.

By J. F. WHITEAVES.

ANTHOZOA.

TETRACORALLA.

PYCNOSTYLUS GUELPHENSIS, Whiteaves.

PYCNOSTYLUS ELEGANS, Whiteaves.

ZAPHRENTIS. Species undeterminable.

HEXACORALLA.

FAVOSITES GOTHLANDICUS, Lamarck.

(FAVOSITES FORBESII, Edwards and Haime.

In his second report on the Paleontology of the Province of Ontario, Professor H. A. Nicholson gives Hespeler as a locality for this species, but it is doubtful if this coral has ever been found in the Guelph formation of Ontario. Mr. Lambe, *Contr. Canad. Paleont.*, vol. IV, pt. I, pp. 8-10, regards *F. Forbesii* as a Corniferous fossil, and as a synonym of *F. basalticus*, Goldfuss.)

FAVOSITES HISINGERI, Edwards and Haime.

FAVOSITES POLYMORPHUS (Goldfuss) Billings.

SYRINGOPORA INFUNDIBULA, Whitfield.

- Springopora infundibula*, Whitfield 1877. *Ann. Rep. Geol. Surv. Wisconsin.*, p. 79.
Cystostylus infundibulus Whitfield 1882. *Geol. Wisconsin.*, p. 274, pl. 14, fig. 7.
" " Whiteaves 1884. This volume, pt. I, p. 2; and (1895) pt. II, p. 49.
Syringopora infundibula, Lambe 1899. *Contr. Canad. Paleont.*, vol. IV, pt. I, p. 53.

OCTOCORALLA.

HALYSITES CATENULARIA, L.

Mr. Lambe (op. cit., p. 68) regards *H. agglomeratus*, the *Catenipora agglomerata* of Hall, as a synonym of *H. catenularia*.

HALYSITES COMPACTUS, Rominger.

This species seems to be quite distinct from *H. agglomeratus* or *H. catenularia*.

HELIOLITES INTERSTINCTUS (L.).

HYDROMEDUSÆ.

HYDROIDA.

CLATHRODICTYON OSTIOLATUM, Nicholson.

CLATHRODICTYON FASTIGIATUM, Nicholson.

LABECHIA. Species undeterminable.

STROMATOPORA GALTENSIS (Dawson).

STROMATOPORA ANTIQUA, Nicholson and Murie.

STROMATOPORELLA. Species undeterminable.

BRACHIOPODA.

TRIMERELLA GRANDIS, Billings.

TRIMERELLA ACUMINATA, Billings.

TRIMERELLA OHIOENSIS, Meek.

TRIMERELLA BILLINGSII, Dall.

TRIMERELLA DALLI, Davidson and King.

RHINOBOLUS GALTENSIS (Billings).

RHINOBOLUS. Species uncertain.

MONOMERELLA PRISCA, Billings.

MONOMERELLA ORBICULARIS, Billings.

MONOMERELLA OVATA, Whiteaves.

MONOMERELLA OVATA LATA, Whiteaves.

MONOMERELLA DURHAMENSIS, Whiteaves.

MONOMERELLA. Species uncertain.

STROPHOMENA. Species undeterminable.

ORTHIS. Species undeterminable.

PENTAMERUS OBLONGUS, Sowerby.

Schuchert (Synops. Amer. Foss. Brachiop., p. 305) regards *P. bisinuatus*, McChesney, as a mere synonym of *P. oblongus*.

CONCHIDIUM OCCIDENTALE, Hall.

Pentamerus occidentalis, Hall.....1852. Pal. N. York, vol. II, p. 341, pl. 79, figs. 1 and 2; and of other U.S. and Canadian palaeontologists, including the writer, in this volume, pt. II, p. 65.

- Conchidium (?) occidentalis*, Hall and Clarke. 1894. Pal. N. York, vol. VIII, pt. II, pl. 67, figs. 1-5.
Conchidium occidentale, Schuchert. 1897. Synops. Amer. Foss. Brach., p. 187.

CLORINDA VENTRICOSA (Hall).

- Pentamerus (Barrandella) ventricosus*, Hall. 1893; and, this volume, pt. II (1895) with the synonymy and references there given.
Barrandella ventricosa, Hall and Clarke. 1894. Pal. N. York, vol. VIII, pt. II, pl. 71, figs. 4-10; and pl. 84, fig. 46.
Clorinda ventricosa, Schuchert. 1897. Synops. Amer. Foss. Brach., p. 185.

This species has been recorded by the late Professor H. A. Nicholson (1875, Rep. Palaeont. Prov. Ontario, p. 67) as having been found in the Guelph formation at Hespeler and Elora, but the writer has never seen an authentic Canadian specimen of it.

RHYNCHONELLA PISA, Hall and Whitfield.

ATRYPA RETICULARIS (L).

ATRYPA ASPERA (Schlotheim.)

SPIRIFER RADIATUS (Sowerby).

If Schuchert is correct in stating, on page 402 of his "Synopsis", that the *S. plicatella* of authors = *S. radiatus*, the specimens referred to as *S. plicatella*, on page 62 of the second part of this volume, are probably *S. radiatus*.

SPIRIFER CRISPUS (Hisinger).

WHITFIELDDELLA HYALE (Billings).

MOLLUSCA.

PELECYPODA.

MEGALOMUS CANADENSIS, Hall.

MEGALOMUS COMPRESSUS, Nicholson and Hinde.

PTERINEA. Species undeterminable.

AMPHICELIA NEGLECTA (McChesney).

CONOCARDIUM. Species undeterminable.

GONIOPHORA CRASSA, Whiteaves.

ILIONIA CANADENSIS, Billings.

ILIONIA (?) COSTULATA, Whiteaves.

Probably a new generic type, but the few specimens collected shew no indications of the hinge line or muscular impressions.

ANODONTOPSIS CONCINNA, Whiteaves.

PROLUCINA GALTENSIS, Whiteaves.

- Ilionia Galtensis*, Whiteaves.....1884. This volume, pt. I, p. 15, pl. 3, figs. 1, 1 a, and 1 b, and (1895) pt. II, p. 68, pl. 15, fig. 3.

This species is evidently congeneric with the *Tellina prisca* of Hisinger, which E. Billings referred to *Ilionia*, in his original description of that genus in 1874. Dr. W. H. Dall, however, in 1896, made *T. prisca* the type of his subgenus *Prolucina*, and, in a letter to the writer, dated December 26, 1905, refers to the former as an "undoubted Lucinoid." It would therefore appear that *T. prisca* and *Ilionia Galtensis* are both probably Lucinoids and referable to the subgenus *Prolucina*; and that the name *Ilionia* proper may have to be restricted for the present to *I. Canadensis*, Billings, and *I. sinuata*, (Hall).

GASTEROPODA.

SCENELLA CONICA, Whiteaves.

ARCHINACELLA CANADENSIS? (Whiteaves).

- Tryblidium Canadense*, Whiteaves.... 1884. This volume, pt. I, p. 31, pl. 5, figs. 1 and 1 a.
Capulus Canadensis, Whiteaves..... 1895. Idem, pt. II, p. 69, pl. 11, fig. 1.
Archinacella Canadensis, Ulrich and Scofield. 1897. Geol. and Nat. Hist. Surv. Minn., Final Rep., vol. III, pt. II, p. 829.

BELLEROPHON SHELBIENSIS, Clarke and Ruedemann.

- Bucania stigmosa* (?) Hall. Whiteaves. 1884. This volume, p. I, pt. 34, pl. 5, figs. 3 and 3 a; and pl. 8, fig. 4.
Bellerophon. Species undeterminable. Whiteaves. 1895. Idem, pt. II, p. 70.
Bellerophon Shelbiensis, Clarke and Ruedemann. 1903. N. York State Mus., Mem. 5, p. 51, pl. 5, figs. 13-19.

TREMATONOTUS ANGUSTATUS (Hall).

EUOMPHALOPTERUS VALERIA (Billings).

- Pleurotomaria Valeria*, Billings.....1865. Geol. Surv. Canada, Paleoz. Foss., vol. I, p. 169.
 " " Whiteaves....1884. This volume, pt. I, p. 23, pl. 4, figs. 1 and 1 a; and (1895) pt. II, p. 71, pl. 11, figs. 2 and 3. Probably = *Euomphalopterus alatus* (Wahlenberg).

EUOMPHALOPTERUS VELARIS. Whiteaves.

- Pleurotomaria velaris*, Whiteaves.....1895. This volume, pt. II, p. 72, pl. 11, figs. 4, and 4 a.

EUOMPHALOPTERUS HALEI (Hall). Var.

- Pleurotomaria Halei*, Hall. Var. Whiteaves. 1895. This volume, pt. II, p. 73, pl. 10, figs. 2 and 2 a.

EUOMPHALOPTERUS ELORA (Billings).

- Pleurotomaria Elora*, Billings..... 1862. Geol. Surv. Canada, Palæoz. Foss.,
vol I, p. 154, fig. 135.
" " Billings.....1863. Geol. Canada, p. 343, fig. 348.
" " Whiteaves..... 1895. This volume, pt. II, p. 74, pl. 11, figs.
5 and 6.

This species is here referred to *Euomphalopterus* on the authority of Dr. E. O. Ulrich, who, in a letter to the writer, dated January 20, 1906, writes that it "has all the essential characteristics of that genus." "The only difference," he adds, "that I can see is that the peripheral wing instead of being entire is broken up into a series of spines. These spines may very well represent the 'lunule' that, if my memory is not at fault, occur in *E. alatus* between the two thin sheets forming the alation. A subgenus, possibly, should be erected to signalize this departure from the usual type."

LOPHOSPIRA CONRADI (Hall).

- Murchisonia Conradi*, Hall.....1864. Eighteenth Regent's Rep. New York. St.
Cab. Nat. Hist., p. 344, pl. 15 (6), fig. 19.
" " Whiteaves. 1884. This volume, pt. I, p. 27, pl. 4, fig. 6.

This and the three following species are referred to *Lophospira* on the authority of Dr. Ulrich.

LOPHOSPIRA XANTHIPPE (Billings).

- Murchisonia Xanthippe*, Billings.....1862. Geol. Surv. Canada, Palæoz. Foss., vol.
I, p. 155, fig. 137.
" " Whiteaves.....1895. This volume, pt. II, p. 80.

LOPHOSPIRA MYLITTA (Billings).

- Murchisonia Mylitta*, Billings.....1862. Geol. Surv. Canada, Palæoz. Foss., vol. I,
p. 157, fig. 140.
" " Whiteaves.....1895. This volume, pt. II, p. 79.

LOPHOSPIRA HESPELERENSIS, Whiteaves.

- Murchisonia Hesperensis*, Whiteaves 1884. This volume, pt. I, p. 24, pl. 41, fig.
3; and (1895) pt. II, p. 79.

LOPHOSPIRA GUELPHICA (nom. prov.)

- Murchisonia*. (Species uncertain). Whiteaves. 1895. This volume, pt. II, p. 79, pl. 12,
fig. 3.

LOXOPLOCUS SOLUTUS (Whiteaves).

- Murchisonia soluta*, Whiteaves 1884. This volume, pt. I, p. 28, pl. 4, figs.
8 and 8a.
Murchisonia tropidophora, Whiteaves..... 1884. Idem, p. 29, pl. 7, figs. 5 and 5a.
Loxoplocus solutus, Fischer 1885. Man. de Conchytiol., etc., p. 847.
" " Whiteaves 1895. This volume, pt. II, p. 84, pl. 12,
figs. 7 and 8.

PHANEROTREMA OCCIDENS (Hall).

- Pleurotomaria occidens*, Hall 1867. Twentieth Reg. Rep. N. York St. Cab. Nat. Hist., p. 364, pl. 15, figs. 11 and 12.
 " " Whiteaves 1884. This volume, pt. I, p. 23; and (1895) pt. II, p. 77.
Phanerotrema occidens, Ulrich and Scofield. 1897. Geol. and Nat. Hist. Surv. Minn., Final Rep., vol. III, pt. II, p. 952.

LIOSPIRA PERLATA (Hall)

- Pleurotomaria perlata*, Hall 1852. Pal. N. York, vol. II, p. 349, pl., 84, figs. 5 a, b, c.
Pleurotomaria solarioides, Billings (probably by inadvertence) 1863. Geol. Canada, p. 341, figs. 347, a and b.
Pleurotomaria perlata, Whiteaves 1884. This volume, pt. I, p. 22; and (1895) pt. II, p. 75.

" In judging of this species I have nothing to build on save Hall's original figures. These pass very well for a large species of *Liospira*. Unless you have material showing differences in the band or elsewhere, I should suggest referring the species to that genus. It is to be noted that Hall recognized its resemblance to *L. lenticularis*." Ulrich, in a letter to the writer, dated January 20, 1906. The species is still only known from mere casts of the interior of the shell.

EOTOMARIA GALTENSIS (Billings).

- Pleurotomaria Galtensis*, Billings 1862. Geol. Surv. Canada, Palæoz. Foss., vol. I, p. 154, fig. 136; and (1863) Geol. Canada, p. 334, fig. 349.
 " " Whiteaves 1895. This volume, pt. II, p. 75, pl. 11, fig. 7.
Eotomaria galtensis, Clarke and Ruedemann. 1903. N. York St. Mus., Mem. 5, p. 70, pl. 10, figs. 10-12.

EOTOMARIA DURHAMENSIS (Whiteaves).

- Pleurotomaria Durhamensis*, Whiteaves ... 1884. This volume, pt. I, p. 24, pl. 4, fig. 2; and (1895) pt. II, p. 77.
Eotomaria durhamensis, Clarke & Ruedemann. 1903. N. York St. Mus., Mem. 5, p. 68, pl. 10, fig. 17.

CLATHROSPIRA DEIOPEIA (Billings).

- Pleurotomaria Deiopeia*, Billings 1862. Geol. Surv. Canada, Palæoz. Foss., vol. I, p. 155.
 " " Whiteaves 1895. This volume, pt. II, p. 75, pl. 12, fig. 1.

This species is here provisionally referred to the genus *Clathrospira*, at the suggestion of Dr. Ulrich.

HORMOTOMA WHITEAVESII, Clarke and Ruedemann.

- Loxonema magnum* (Whitfield) Whiteaves. 1884. This volume, pt. I, p. 17.
Loxonema magnum, Whitfield. Var. *Whiteavesi*. 1895. Idem, pt. II, p. 87, pl. 13, fig. 2.
Hormotoma Whiteavesi, Clarke & Ruedemann. 1903. N. York St. Mus., Mem. 5, p. 72, pl. 8, figs. 5 and 9.

The memoir last cited is a descriptive and illustrated monograph of the "Guelph Fauna in the State of New York." One of the new species that is described and figured therein is this *Hormotoma*, and its describers say that they "have little doubt that the Guelph shell figured by Whiteaves (specimens are from Galt, Hespeler and Elora) as *Lox. magnum* is specifically identical with, if smaller, than the New York specimens of *Horm. Whiteavesi*." The three specimens from Ontario that were referred to *Loxonema magnum* are badly preserved and do not shew the surface markings, but the numerous Rochester specimens of *H. Whiteavesi* are remarkably well preserved, and shew both the lines of growth and the slit-bard very clearly.

CELOCAULUS, Ehlert.

- Celocaulus*, Ehlert.....1887. Extr. Bull. Soc. d'Etud. Scient. d'Angers, p. 20 (teste Ulrich); non *Celocaulus*, Hall, 1887.
Celidium, Clarke and Ruedemann.....1903. N. York St. Mus., Mem. 5, pp. 65-67.

CELOCAULUS (!) VITELLIA, (Billings).

- Murchisonia Vitellia*, Billings1862. Geol. Surv. Canada, Paleoz. Foss., vol. I, p. 156, fig. 138.
 " " Nicholson.....1875. Rep. Pal. Prov. Ont., p. 3, fig. 6.

This shell is rather doubtfully referred to *Celocaulus*, on the authority of Clarke and Ruedemann, who on page 67 of their memoir on the Guelph Fauna in the State of New York, imply that *M. Vitellia* is a *Celidium*, which, as previously stated, is a generic name that they prefer to *Celocaulus*. The gutta percha impression of a natural mould of the exterior of the shell of a specimen from Galt, upon which this species was based, does not show whether the axis is perforate or not. To the writer, *M. Vitellia* looks more like a species of *Lophospira*.

CELOCAULUS MACROSPIRA (Hall).

- Murchisonia macrospira*, Hall.....1852. Pal. N. York, vol II, p. 346, pl. 83, fig. 5.
Murchisonia Logani, Hall1852. Idem., p. 346, pl. 84, figs. 4 a and 4 b.
Murchisonia macrospira, Billings.....1863. Geol. Canada, p. 339, fig. 334.
 " " Nicholson1875. Rep. Pal. Prov. Ontario, p. 70, pl. 3, fig. 9.
 " " Whiteaves1884. This volume, pt. I, p. 27, pl. 4, figs. 7 and 7a.
Murchisonia Logani, Whiteaves1895. This volume, pt. II, p. 80.
Murchisonia macrospira, Whiteaves1895. Idem, p. 81.
Celocaulus Logani, Ulrich and Scofield.....1897. Geol. and Nat. Hist. Surv. Minn., Final Rep., vol. III, pt. II, p. 1020
Celidium macrospira, Clarke and Ruedemann 1903. N. York St. Mus., Mem., 5, p. 65, pl. 7, figs. 2-8; and pl. 10, fig. 13.

CÆLOCAULUS BIVITTATUS (Hall).

- Murchisonia bivittata*, Hall. 1852. Pal. N. York, vol. II, p. 345, pl. 83, figs. 1 a and 1 b.
 " " Billings. 1863. Geol. Canada, p. 339, fig. 343.
 " " Nicholson. 1875. Rep. Pal. Prov. Ontario, p. 70, pl. 3, fig. 7, but not fig. 8.
 " " Whiteaves. 1895. This volume, pt. II, p. 82, pl. 12, figs. 5 and 6.
Celocaulus bivittatus, Ulrich and Scofield. 1897. Geol. and Nat. Hist. Surv. Minn., Final Rep., vol. III, pt. II, p. 1020.

CÆLOCAULUS LONGISPIRA (Hall).

- Murchisonia longispira*, Hall. 1852. Pal. N. York, vol. II, p. 345, pl. 83, figs. 2 a and 2 b.
 " " Nicholson. 1875. Rep. Pal. Prov. Ontario, p. 70, pl. 3, figs. 11 and 12.
 " " Whiteaves. 1895. This volume, pt. II, p. 83.
Celocaulus longispira, Ulrich and Scofield. 1897. Geol. and Nat. Hist. Surv. Minn., Final Rep., vol. III, pt. II, p. 1020.

CÆLOCAULUS TURRITIFORMIS (Hall).

- Murchisonia turritiformis*, Hall. 1852. Pal. N. York, vol. II, p. 347, pl. 83, figs. 6 a and 6 b.
 " " Nicholson. 1875. Rep. Pal. Prov. Ontario, p. 70, pl. 2, fig. 10.
 " " Whiteaves. 1884. This volume, pt. 1, p. 26, pl. 4, fig. 5; and (1895) pt. II, pl. 12, fig. 4.
Celocaulus turritiformis, Ulrich and Scofield. 1887. Geol. and Nat. Hist. Surv. Minn., Final Rep., vol. III, pt. II, p. 1020.

CÆLOCAULUS ESTELLA (Billings).

- Murchisonia Estella*, Billings. 1862. Geol. Sur. Canada, Paleoz. Foss., vol. I, p. 157, fig. 139.
 " " Whiteaves. 1895. This volume, pt. II, p. 83.

Dr. Ulrich writes that he is "inclined to unite *C. Estella* with *C. turritiformis*."

TURRITOMA, Ulrich and Scofield.

- Turritoma*, Ulrich and Scofield. 1897. Geol. and Nat. Hist. Surv. Minn., Final Rep., vol. III, pt. II, p. 959.

TURRITOMA BOYLEI (Nicholson).

- Murchisonia Boylei*, Nicholson. 1875. Rep. Pal. Prov. Ontario, p. 71, pl. 3, fig. 1.
 " " Whiteaves. 1895. This volume, pt. II, p. 81.
Turritoma Boylei, Ulrich and Scofield. 1897. Geol. and Nat. Hist. Surv. Minn., Final Rep., vol. III, pt. II, p. 953.

TURRITOMA CONSTRICTA (Whiteaves).

- Murchisonia constricta*, Whiteaves. 1884. This volume, pt. I, p. 25, pl. 4, fig. 4; and (1895) pt. II, p. 82.
Turritoma constricta, Ulrich and Scofield. 1897. Geol. and Nat. Hist. Surv. Minn., Final Rep., vol. III, pt. II, p. 959.

MURCHISONIA BILLINGSANA, Miller.

- Murchisonia Hercyna*, Billings. 1862. Geol. Surv. Canada, Paleoz. Foss. vol. I, p. 158, fig. 141; but not *M. Hercyna*, Roemer, 1843.
Murchisonia billingsana, S. A. Miller. 1889. N. Amer. Geol. and Paleont., p. 411.

The best specimens in the Museum of the Survey are the type specimen of *M. Hercyna* figured by E. Billings, which he collected at Galt in 1857, and a slightly smaller one from Elora, collected by Mr. T. C. Weston in 1867. These are the only specimens known to the writer upon which any portion of the test is preserved. Both of them have recently been examined by Dr. Ulrich, who writes as follows in regard to them, in a letter dated April 7, 1906. "As is proved beyond the shadow of a doubt by the peripheral portion of the smaller specimen, this is not a *Murchisonia*, nor even one of the Pleurotomariidae. It is no less certain that it is congeneric with *Trochus Kolmodini* and *T. Wisbyensis*, Lindström. Indeed it is closely allied specifically to these Gotland shells, especially to the former. Whether Lindström was justified in referring these species to *Trochus*, or not I have not decided, though inclined to doubt it." In the writer's judgment, the reference of *M. Billingsana* to the Linnæan genus *Trochus*, as now defined, would be almost as unsatisfactory as its original reference to *Murchisonia* has proved to be. Its surface markings are remarkably similar to those of *Holopea Harmonia*, Billings.

PLEUROTOMARIA BISPIRALIS, Hall.

In their memoir on the Guelph Fauna in the State of New York, Clarke & Ruedemann regard this species as a *Lophospira*. Ulrich, however, dissents from this conclusion and gives the following reasons for his dissent, in a letter dated January 20, 1906. "*P. bispiralis*, Hall. As figured by Clarke and Ruedemann (pl. 10, figs. 7 and 8) this species cannot justly fall under *Lophospira*. Its relations seem to me to be altogether different, the band as represented being distinctly concave instead of convex. The characters shown in figs. 7 and 8 recall *Eotomaria* on the one hand (whorls too full below) and the aberrant *Plethospira* recently distinguished as *Ulrichospira* by Miss Donald. Without good specimens I hesitate to decide its position. Clarke and Ruedemann's figure 6, if the drawing is correct, seems to me to represent something quite different.

The general form, direction of the lines of growth and absence of a distinct, concave band, suggest *Eunema* very strongly. Figure 6 (Clarke and Ruedemann, pl. 10) seems to me to be the true *P. bispiralis*, 7 and 8 apparently something new." Figure 9 on the same plate, which Ulrich does not refer to in these notes, seems to the writer to be also quite different from figure 6.

PLEUROTOMARIA VIOLA, Billings.

In a letter dated April 7, 1906, Dr. Ulrich expresses the opinion that the type of this species, which is figured on Plate 12, fig. 2, of the second part of this volume, is a "*Poleumita* near *P. discors* (Sowerby). It is, however," he writes "as you say, a wretched cast, and better specimens, if you could satisfy yourself that they were really the same species, might show quite different affinities, with *Trochonema*, for instance. My opinion is based (1) on the general form of the shell and whorls, which is not unlike that of the higher varieties of *P. discors*; (2) on the broad retral bend of the under side of the lip; and (3) on the indications, obscure it is true, of revolving ridges."

PLEUROTOMARIA CYCLOSTOMA, Whiteaves.

"This certainly is an extraordinary type, though its relations are not so far to seek as may appear at first sight. Despite the well-developed slit-band, I am still of the opinion that it does not belong to the Pleurotomariidae. Its nearest relatives, however, are among Gotland species referred to *Pleurotomaria* by Lindström. One of these, (*P. planorbis*, Hisinger) I have already removed to the Euomphalidae under the new generic name *Hisingeria*. (See Minnesota report). The other relatives are Lindström's *P. pretexta* and *P. togata*. In the *Hisingeria* we have a narrow yet distinct slit-band, but the type is distinguished generically from *P. cyclostoma* by its planorbiform shell and narrower and more simple band. The *P. pretexta* group agrees better with your shell in general aspect and in the position of the carina, that corresponds to the band in *P. cyclostoma*, but the much better developed, and more sharply defined and concave instead of convex character of the band, together with the closed umbilicus on your species, constitutes sufficient ground for generic separation. In short, I would establish a new genus for *P. cyclostoma*, another for *P. pretexta*, et alii, and provisionally refer both, with *Hisingeria*, to the Euomphalidae. Undoubtedly all of these shells are related to *Euomphalopterus*, which I have referred, I fear erroneously, to the Raphistomidae." Ulrich, in letter dated March 19, 1906.

PLEUROTOMARIA TOWNSENDII, Whiteaves.

The type of this species, which was described on page 77 of the second

part of this volume, as a "natural mould of the exterior of the shell", etc., would be more correctly described as a well preserved hollow, testiferous specimen, that has been broken longitudinally in such a way as to expose the concave inner surface of about one half of each of the five volutions. Its characters are clearly indicative of a new generic type, which there is not sufficient material to define satisfactorily.

EUOMPHALUS GALTENSIS, Whiteaves.

EUOMPHALUS INORNATUS, Whiteaves.

EUOMPHALUS CIRCINATUS, Whiteaves.

STRAPAROLLUS HIPPOLYTE, Billings.

STRAPAROLLINA DAPHNE, Billings.

POLEUMITA, Clarke and Ruedemann.

- Euomphalus* (pars) Sowerby. 1814. Min. Conch., vol. I, p. 97; et auct.
Polytropis, DeKoninck. 1881. Faun. Carbonif., vol. II, pt. 3, p. 107.
 But not *Polytropis*, Sandberger, 1874.
Oriostoma (pars) Lindström. 1884. Silur. Gastrop. and Pterop. Gotland, p. 156. But apparently not *Oriostoma*, Munier Chalmas, 1876. Journ. Conch., vol. XVI, p. 103.
Omphalotrochus, Lindström. 1884. Op. cit., p. 156. But not *Omphalotrochus*, Meek, as now understood.
Horiostoma, Fischer. 1885. Manuel de Conchyliologie, etc., p. 813.
Omphalotrochus, Eastman. 1900. Text-book Palaeont., vol. I, p. 447. Not *Omphalotrochus*, Meek, 1864.
Poleumita, Clarke and Ruedemann. 1903. N. York St. Mus., Mem. 5, p. 59.
Polytropina, Donald (Miss Jane). 1905. Quart. Journ. Geol. Soc. London, vol. LXI, p. 575.

POLEUMITA SULCATA (Hall).

- Cyclonema sulcata*, Hall. 1852. Pal. N. York, vol. II, p. 347, pl. 34, figs. 1, a-d.
 " " Billings. 1863. Geol. Canada, p. 343, figs. 350, a, b.
Cyclonema sulcatum, Whiteaves. 1884. This volume, pt. I, p. 18, pl. 3, fig. 5.
Polytropis sulcatus, Whiteaves. 1895. Idem, pt. II, p. 89, pl. 13, figs. 9 and 9 a.
Poleumita (?) *sulcata*, Clarke and Ruedemann. 1903. N. York St. Mus., Mem. 5, p. 62, pl. 10, figs. 1-4.

As stated on page 259, this species still seems to the writer to be congeneric with the *Cyclonema carinatum* of Lindström (the *Turbo carinatus* of Sowerby) which Ulrich says is a *Gyronema*. Ulrich, however, who is the founder of the genus *Gyronema*, is not of that opinion, and in a letter dated April 13, 1906, writes as follows on this point. "*P. sulcata* is a *Poleumita* and not a *Gyronema* because of its subcircular mouth, the association of opercula with it, the greater directness with which the lines of growth cross the under side of the volutions and the fact that the

strongest of the revolving ridges occur in the umbilical region (comp. *Oriostoma globosum* as figured by Lindström). The features mentioned are not all of generic scope, the last especially indicating specific alliances."

POLEUMITA MACROLINEATA (Whitfield).

- Euomphalus macrolineatus* (Whitfield) Whiteaves. 1884. This volume, pt. I, p. 20, pl. 3, fig. 6.
Polytropis macrolineatus (Whitfield) Whiteaves. 1895. Idem, pt. II, p. 91.

But Clarke and Ruedemann think that the Canadian specimens that have been identified with this species can "hardly with safety be referred to the large, very coarsely ridged shell which Whitfield describes as *Euomphalus macrolineatus*, from the dolomites at Manitowoc, Wisconsin."

POLEUMITA CRENULATA (Whiteaves).

- Straparollus crenulatus*, Whiteaves.....1884. This volume, pt. I, p. 21, pl. 3, figs. 8, 8 a and 8 b.
Polytropis crenulatus, Whiteaves.....1895. Idem, pt. II, p. 91.
Poleumita crenulata, Clarke and Ruedemann...1903. N. York St. Mus., Mem. 5, p. 64, pl. 9, figs. 9, 11, 16-24.

POLEUMITA DURHAMENSIS, Whiteaves.

- Polytropis Durhamensis*, Whiteaves...1895. This volume, pt. II, p. 91, pl. 14, figs. 1 and 2.

POLEUMITA PARVULA, Whiteaves.

- Polytropis parvulus*, Whiteaves.....1895. Idem, pt. II, pl. 13, figs. 10 and 10 a.

CODONCHILUS STRIATUS, Whiteaves.

PYCNOMPHALUS SOLARIOIDES (Hall.)

LOXONEMA BOYDII, Hall.

HOLOPEA HARMONIA, Billings.

HOLOPEA GUELPHENSIS, Billings.

HOLOPEA GRACIA, BILLINGS.

HOLOPEA (?) OCCIDENTALIS, Nicholson.

SUBULITES COMPACTUS, Whiteaves.

CYRTOSPIRA VENTRICOSA (Hall).

- Subulites ventricosus* (Hall) Whiteaves.....1895. This volume, pt. II, p. 96.
Cyrtospira ventricosa, Ulrich and Scofield....1897. Geol. and Nat. Hist. Surv. Minn., Final Rep., vol. III, pt. II, p. 1073.

OPERCULA.

Several detached multispiral and paucispiral opercula, of unknown genera and species.

CEPHALOPODA.

ORTHO CERAS CREBESCENS, Hall.

ORTHO CERAS SELWYNI, Billings.

KIONOCERAS CANCELLATUM (Hall).

KIONOCERAS MEDULLARE (Hall).

- Orthoceras medullare*, Hall.....1860. Rep. Progr. Geol. Surv. Wiscons. for 1859, p. 4; and (1867) Twentieth Rep. Reg. N. York St. Cab. Nat. Hist., p. 353, pl. 20 (11) figs. 1 and 2.
- " " Whiteaves.....1884. This volume, pt. I, p. 37; and (1895) pt. II, p. 99.
- Kionoceras medullare*, Clarke & Ruedemann. 1903. N. York St. Mus., Mem. 5, p. 86, pl. 10, fig. 23.

KIONOCERAS DARWINI (Billings).

- Orthoceras Darwini*, Billings.....1862. Geol. Surv. Canada, Paleoz. Foss., vol. I, p. 161.
- Cyrtoceras Myrice*, Hall and Whitfield.. . . .1875. Geol. Surv. Ohio, Paleont., vol. 2, pt. 2, p. 149, pl. 8, fig. 9.
- Orthoceras Darwini*, Whiteaves.....1884. This volume, p. 38, pl. 6, figs. 2 and 2 a.
- Cyrtoceras Myrice*, Whiteaves.....1884. Idem, p. 39, pl. 6, figs. 3 and 3 a.
- Orthoceras Darwini*, Foord.....1888. Cat. Foss. Cephal. Brit. Mus., pt. I, p. 76, fig. 8.
- " " Whiteaves.....1895. This volume, pt. II, p. 100.
- Kionoceras Darwini*, Clarke and Ruedemann. 1903. N. York St. Mus., Mem. 5, p. 84, pl. 10, fig. 22; pl. 11, fig. 6; and pl. 12, figs. 1-8.

DAWSONOCERAS ANNULATUM, Sowerby,

VAR. AMERICANUM, Foord.

- Orthoceras annulatum*, var. *Americanum*,
Foord.....1888. Cat. Foss. Cephal. Brit. Mus., pt. I,
pp. 56 and 57.
- Orthoceras annulatum*, var. *Americanum*,
Whiteaves.....1895. This volume, pt. II, p. 101, which
see for a list of synonyms of this shell,
with references.
- Dawsonoceras annulatum*, var. *Americanum*,
Clarke and Ruedemann.....1903. N. York St. Mus., Mem. 5, p. 81,
pl. 10, figs. 19-21; and pl. 11, fig. 1.



- GOMPHOCERAS SEPTORIS, Hall.
 ASCOCERAS TOWNSENDI, Whiteaves.
 CYRTOCERAS ARCTICAMERATUM, Hall.
 CYRTOCERAS ORODES, Billings.
 PHRAGMOCERAS HECTOR, Billings.
 PHRAGMOCERAS NESTOR, Hall,
 var. CANADENSE, Whiteaves.
 PHRAGMOCERAS PARVUM, Hall and Whitfield.
 TROCHOCERAS DESPLAINENSE, McChesney.
 DISCOCERAS GRAFTONENSE, Meek and Worthen.

CRUSTACEA.

OSTRACODA.

- LEPERDITIA BALTHICA, Hisinger,
 var. GUELPHICA, Jones.
 LEPERDITIA PHASEOLUS, Hisinger,
 var. GUELPHICA, Jones.

TRILOBITA.

- CALYMENA NIAGARENSIS, Hall.
 CERAURUS NIAGARENSIS, Hall.
 ILLENUS ABOYNENSIS, Whiteaves.
 PROETUS. Species undeterminable.

EURYPTERIDA.

- EURYPTERUS BOYLEI, Whiteaves.

GEOLOGICAL SURVEY OF CANADA.

PALÆOZOIC FOSSILS.

VOL. III.

By J. F. WHITEAVES.

APPENDIX.

ERRATA ET CORRIGENDA.

PART I.

Page 5.

Line two from top, for "1871"—read 1867.

Page 7.

Line eleven from top, for "Plate II, fig. 1a; and pl. VIII, figs. 3 and 3 a."; read—Plate VIII, fig. 3.

Fig. 1a on Plate II, and fig. 3 a on Plate VIII, as shewn by Hall and Clarke (Pal. N. York, vol. VIII, Brachiopoda I, expl. pl. 4. D, figs. 3 and 4); and as partially stated in part II of this volume, p. 58, represent the exterior and interior of the supposed brachial valve of an undetermined species of *Monomerella*.

Page 37.

Line six from bottom.

And Pt. II, p. 99, line seven from top.

In a letter dated October 30th, 1883, Mr. David Boyle writes that the specimen of *Orthoceras medullare* referred to on page 37 of the first part of this volume, as having been collected by him at Elora in 1876, was "given to him by a stone mason, Mr. G. Sinclair, of Elora, who collected it from a quarry in Guelph town."

PART II.

Page 45.

Line ten from bottom, for "which are neither enumerated or described," read—which are either enumerated or described.

And on the bottom line (foot note) for "Bandet 10," read—Bandet 9.

Page 46.

Line twelve from top, for "in 1878-75," read— in 1878-85.

Page 47.

Line six from top, for "figs. 9, 9 a-d," read—figs. 5, 5 a-d.

Page 48.

Line nineteen from top, for "1864", read—1884; and, line seventeen from bottom, for "1889", read—1890.

Page 50.

In the list of synonyms of *Favosites Gothlandica*, cancel the references to "Billings. 1859. Canad. Journ., N. S., vol. IV, p. 90"; and to "Nicholson. 1874. Rep. Pal. Prov. Ont., p. 45."

Page 58.

Line twenty from top, for "this volume, pt. I, pl. 8, fig. 3 a," read—this volume, pt. I, pl. 2, fig. 1; and pl. 8, fig. 3 a.

Line seventeen from bottom, for "Plate 7 fig. 3 a," read—Plate 8, fig. 3a.

Page 113.

"STREPTELASMA RUSTICUM, Billings (Sp.)"

Mr. Lambe ("Contr. Canad. Palæont., vol. IV, pt. II, p. 114) thinks that these specimens from Stony Mountain should be referred to the *Petraia latuscula* rather than to the *P. rustica* of Billings, and that they should be called *Streptelasma latusculum*. On the other hand, in an unpublished M.S. list of the fossils collected at that locality by Dr. R. W. Ells in 1875, Mr. Billings refers to the Zaphrentidæ as "*Petraia*, two new sp.," and does not identify any of them with his *P. rustica* or *P. latuscula*.

Page 115.

For "HOMOTRYPELLA GRACILIS, Nicholson. (Sp.)"—read :—
BYTHOPORA GRACILIS, Nicholson. (Sp.)

And add to the references :—

Bythopora gracilis, Nickles and Bassler....1900. Bull. U. S. Geol. Surv., No. 173, p. 185.

Page 116.

For "MONOTRYPELLA QUADRATA, Rominger. (Sp.)"—read :—
RHOMBOTRYPA QUADRATA, Rominger. (Sp.)

And add to the references :—

Rhombotrypa quadrata, Ulrich & Bassler...1904. Smithson. Miscel. Collect. (Quarterly Issue) vol. 47, No. 1470, p. 44.

Page 119.

Line fourteen from top, for "p. 3," read—p. 111.

Page 121.

Line twenty from bottom, for "p. 18," read—p. 168.

Page 122.

For "PLEUROTOMARIA BICINCTA, Hall. (Sp.);" read:—

LOPHOSPIRA BICINCTA, Hall. (Sp.)

And add to the references:—

Lophospira bicincta, Ulrich and Scofield.....1897, Geol. and Nat. Hist. Surv. Minn.,
Final Rep., vol. III. pt. II, p. 964.

Page 128.

For "CHEIRURUS ICARUS, Billings." read:—

CERAURUS ICARUS, Billings. (Sp.)

And, to the list of trilobites from the "Lower Beds" at Stony Mountain, add the following:—

PTERYGOMETOPUS CALLICEPHALUS, Hall. (Sp.)

A well preserved and nearly perfect cephalon, collected by Professor J. Hoyer Panton in 1884, and now in the Museum of the Survey.

PART III.

Page 151.

Line two from top, for "regularity," read—angularity.

Page 152.

For "DIPHYPHYLLUM STOKESI, Edwards and Haime. (Sp.);" read:—

COLUMNARIA STOKESI, Edwards and Haime. (Sp.)

In 1900, in the second part of his "Revision of the Genera and Species of Canadian Palæozoic Corals" (Contr. Canad. Palæont., vol. IV) Mr. Lambe expressed the opinion that the specimens from Lower Fort Garry that were referred to *D. Stokesi*, are identical with the *Palaophyllum rugosum* of Billings, and that they should be called *Columnaria rugosa*. Three years later (in the second fasciculus of the "Palæontologia Universalis," p. 29 d) Dr. Walcott says that there "seems to be no doubt that *Columnaria Thomi*, Hall, and *Diphyphyllum Stokesi*, Whiteaves, are species of *Cyathophyoides*, "which, it may be added, is probably not generally distinct from *Columnaria*. If, however, the specimens from Lower Fort Garry are identical with the "*Lithostroton Stokesi*" of Milne-Edwards and Haime, from Lake Winnipeg, it would seem that they

should be called *Columnaria Stokesii*.

Page 153.

Line nine from bottom, for "1886," read—1881; and line eight from bottom, for "57," read—57 c.

Page 155.

Line six from top, for "*Porites*," read *Protarea*.

Page 183.

Line ten from top, for "original", read—marginal.

Page 193.

For "SOLENOSPIRA PAGODA (Salter) var. OCCIDENTALIS." read :—

ECTOMARIA PAGODA (Salter) var. OCCIDENTALIS.

According to Miss Donald (Quart. Journ. Geol. Soc. Lond., 1899, vol. 55, p. 253) *Solenospira* (Ulrich, 1897) is a synonym of *Ectomaria*, (Koken, 1896).

Page 204.

For "ENDOCERAS (NARTHECOCERAS) CRASSISIPHONATUM, Whiteaves". read :—

NARTHECOCERAS CRASSISIPHONATUM, Whiteaves. (Sp.)

Page 205.

For "ENDOCERAS (NARTHECOCERAS) SIMPSONI, Billings. (Sp.)" read :—

NARTHECOCERAS SIMPSONI, Billings. (Sp.)

Page 210.

For "ACTINOCERAS (DEIROCERAS) PYTHON, Billings (Sp.)" read :—

DEIROCERAS PYTHON, Billings. (Sp.)

For "ACTINOCERAS (SACTOCERAS?) CANADENSE, Whiteaves," read :—

PARACTINOCERAS CANADENSE, Whiteaves. (Sp.)

This species is the type of the subgenus *Paractinoceras*, Hyatt, 1900.

Page 213.

For "ORTHO CERAS ANELLUS, Conrad." read :—

SPYRO CERAS ANELLUS, Conrad. (Sp.)

In Bulletin 49 of the New York State Museum, Paleontologic papers 2 (December, 1901) p. 39, Ruedemann refers *Orthoceras bilineatum*, Hall,

O. anellus, Conrad, and *O. laqueatum*, Hall, to Hyatt's genus *Spyroceras*.

Page 214.

For "TRIPTEROCERAS SEMIPLANATUM, Whiteaves (Sp.," read :—

JOVELLANIA SEMIPLANATA, Whiteaves.

The reference of *Orthoceras semiplanatum* to Hyatt's genus *Tripteroceas* has not proved satisfactory, as the siphuncle of the former is known to be cylindrical, while that of the latter is said to be nummuloidal. For the present *O. semiplanatum* may be provisionally referred to *Jovellania*, as redefined by Foord, who says that its siphuncle is "generally nummuloidal" rarely cylindrical.

Page 236.

For "CHEIRURUS PLEUREXANTHEMUS, Green," read :—

CERAURUS PLEUREXANTHEMUS, Green.

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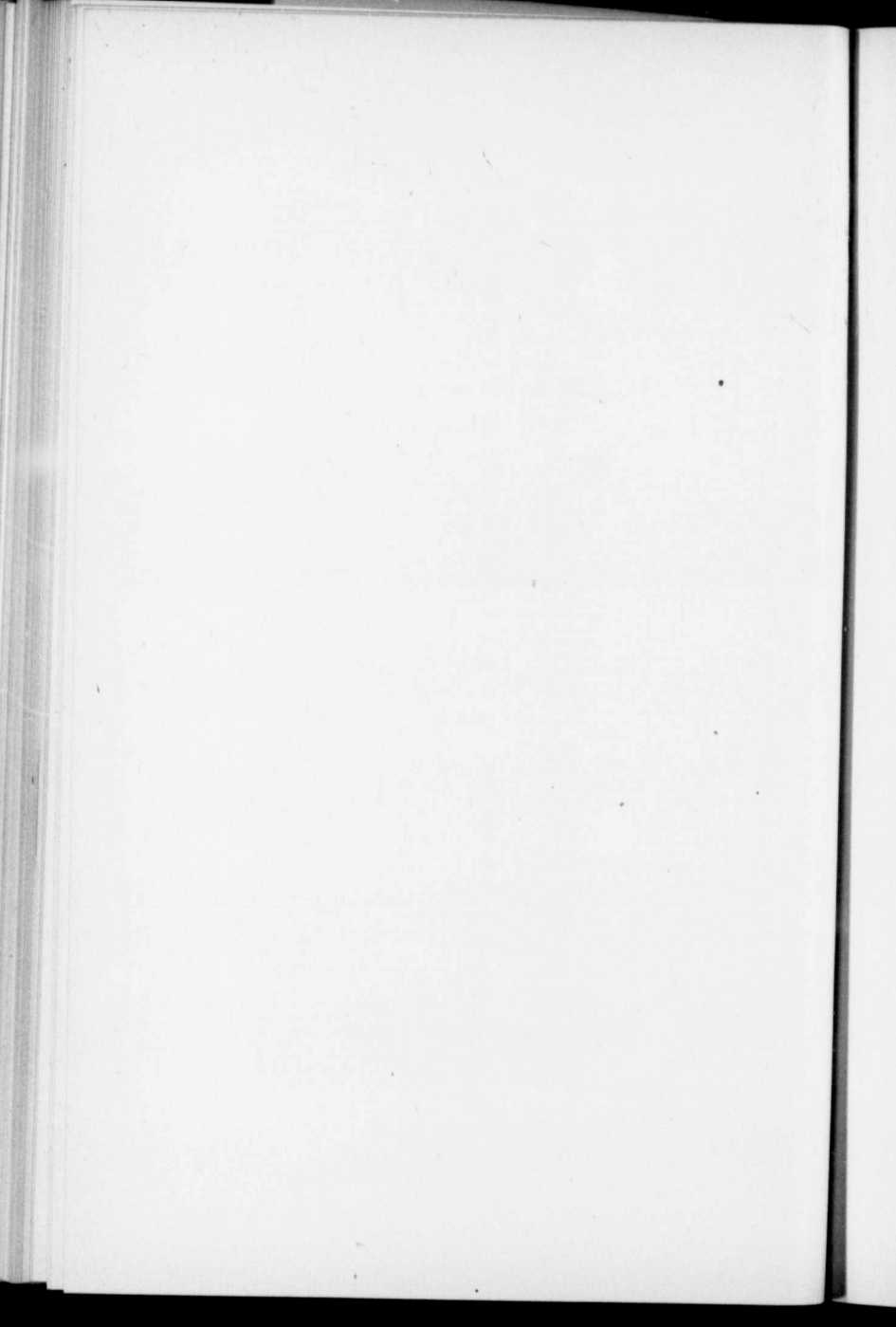
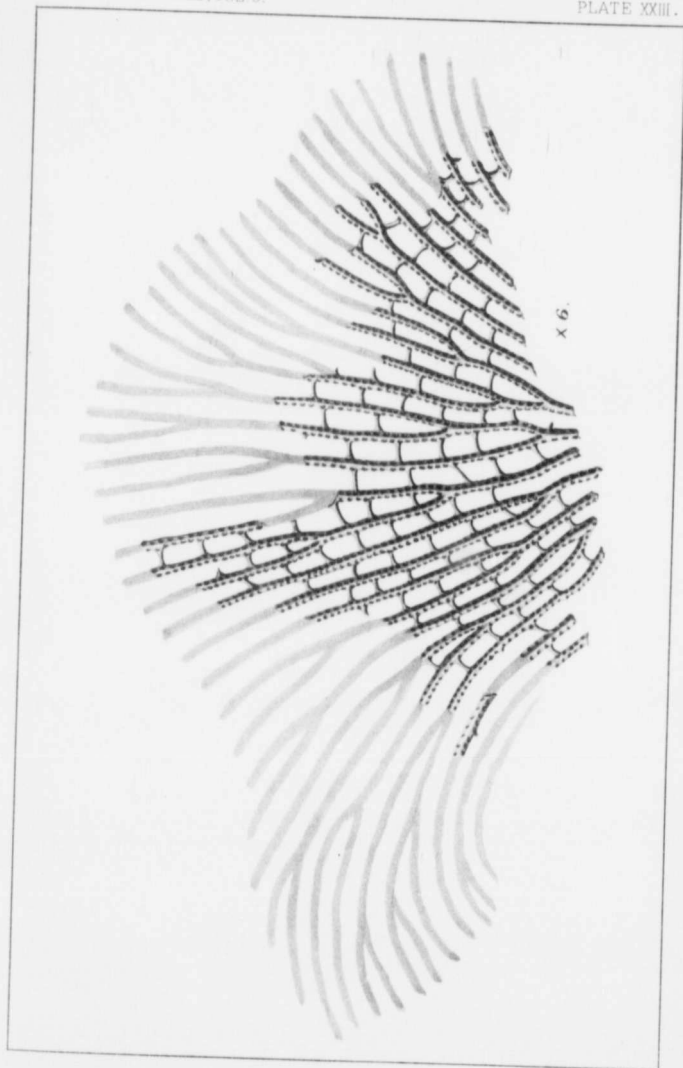


PLATE XXIII.

Unless otherwise stated, the figures in each of these plates are of the natural size, and reproductions of original drawings by Mr. G. S. Barkentin.

FENESTELLA SUBARCTICA (page 249).

The type and only specimen of this species known to the writer, from the Silurian limestone of the Ekwan River, shewing the celluliferous side of an imperfect zoarium, six times the natural size, and slightly restored.



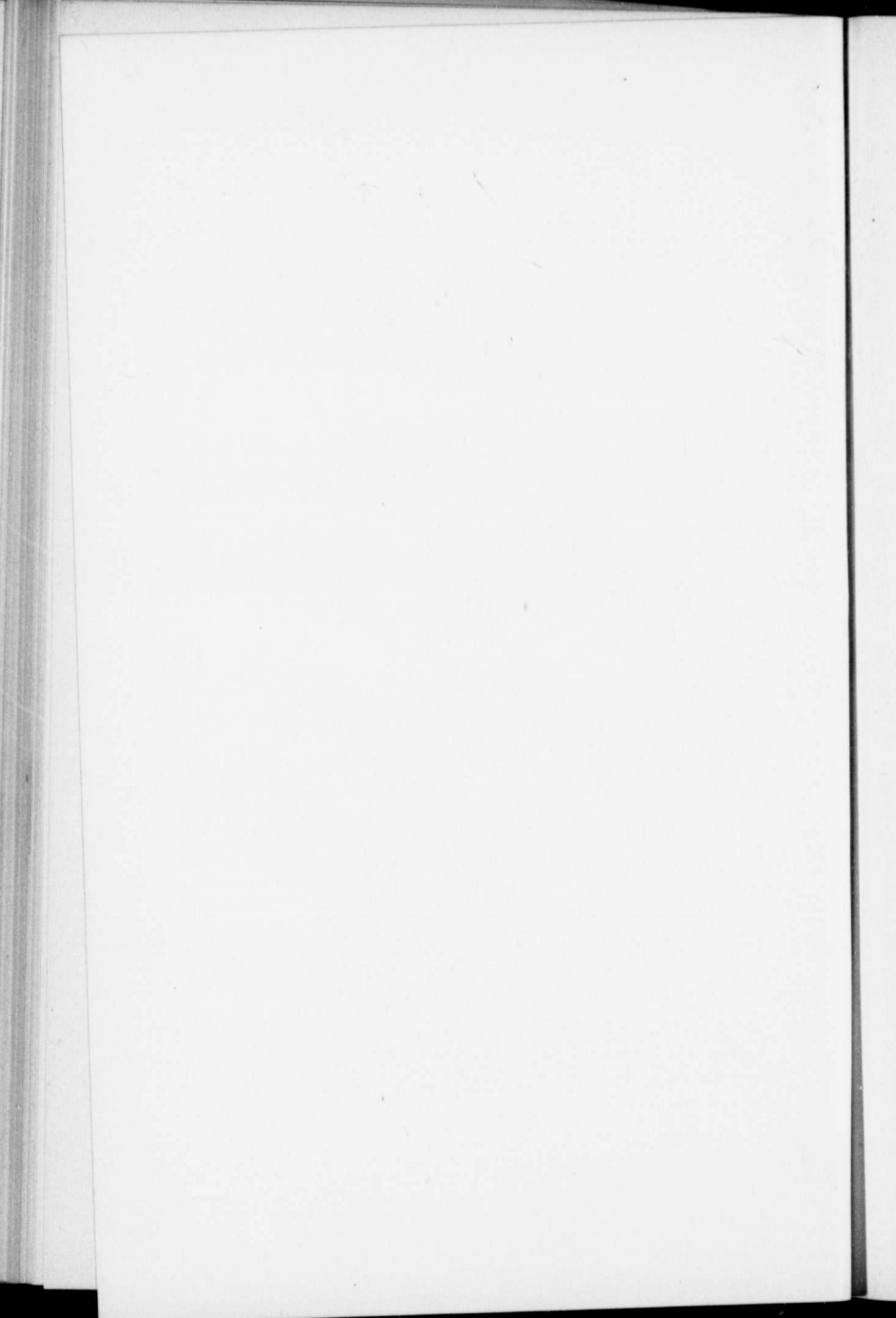


PLATE XXIV.

APHYLLOSTYLUS GRACILIS (page 279).

- Figure 1. Small piece of Silurian limestone from Stonewall, Manitoba, shewing a longitudinal section of part of the corallum of a specimen of this species, the nearly cylindrical shape of the corallites, and the transverse tabulae.
- " 1 a. Portion of one of the corallites of the same specimen, six times the natural size, to shew the septal spines on the surface of the interior.

PETRAIA (PYGMAEA ? VAR.) OCCIDENTALIS (page 291).

- Figure 2. Summit of a large specimen of this coral, as exposed on the weathered surface of a small piece of Silurian limestone from the Grand Rapids of the Saskatchewan.
- " 3. Similar view of a smaller specimen, on the same piece of limestone.
- " 4. Side view of another small specimen, from the Grand Rapids, shewing the exterior of the corallum, apparently minus the epitheca.
- " 5. Longitudinal section of a small specimen, exposed on the weathered surface of the same piece of limestone as the originals of figs. 2 and 3.

PHENOPORA KEEWATINENSIS (page 268).

- Figure 6. The type and only known specimen of this species, a fragment of a zoarium, from the Silurian limestone on a small island in the northern Sutton Mill Lake; twice the natural size.
- " 6 a. Section of a portion of the same specimen; six times the natural size.

TRIMERELLA EKWANENSIS (page 249).

- Figure 7. Outline of a nearly perfect pedicle valve of a shell of this species, from the Silurian rocks of the Ekwan River, slightly restored, and reduced in size. The vertical line on the right shews the actual length of the valve.
- From a drawing by Mr. C. F. King.

STROPHEODONTA ACANTHOPTERA (page 285).

- Figure 8. Ventral view of a specimen of this species, shewing the exterior of the whole of the convex ventral valve. The drawing was made from a wax impression of a natural mould of the exterior of a ventral valve, on a loose piece of limestone picked up on the beach on the north-east side of Lake Winnipegosis by Mr. D. B. Dowling in 1888.
- " 9. Another specimen of the same species from the Silurian limestone at Long Point, Winnipegosis, collected by Mr. J. B. Tyrrell in 1889.
- Both figures of this species are from drawings by Mr. L. M. Lambe.



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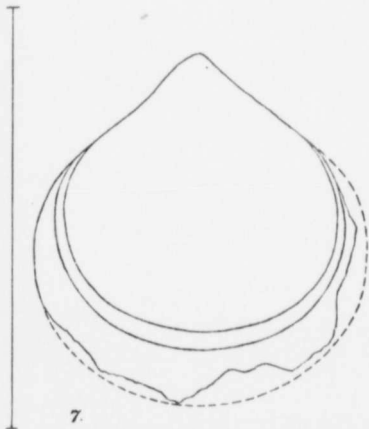
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6a. X 6.



X 2. 6.



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PLATE XXV.

TRIMERELLA EKWANENSIS (page 249).

- Figure 1. Outline of a brachial valve of a specimen of this species, from the Silurian limestone of the Ekwan River, with part of the test preserved and slightly reduced in size. The vertical line on the left shews the actual length.
- Figure 2. Outline of a cast of the interior of a large brachial valve of a shell of this species, from the same limestone, slightly restored, and reduced a little in size. The vertical line on the right shews the actual length.
- Both of the figures of this species are from drawings by Mr. C. F. King.

TRIMERELLA BOREALIS (page 250).

- Figure 3. Outline of the supposed dorsal side of a cast of the interior of both valves of a specimen of this species, from the Ekwan River, shewing the impress of the brachial valve, and slightly restored.
- " 3a Outline of the supposed ventral side of the same specimen, shewing the impress of the pedicle valve.
- The two figures of this species, also, are from drawings by Mr. C. F. King.

CAMAROTÆCHIA EKWANENSIS (page 252).

- Figure 4. Dorsal view of the type of this species, a well preserved cast of the interior of both valves of a specimen from the Ekwan River, shewing the shape and surface markings of the dorsal valve, and the beak of the ventral.
- " 4a Front view of the same specimen, shewing the comparative convexity of both valves, and the well defined sinus in the ventral valve.
- " 4b Ventral view of the same specimen. All three figures, three times the natural size.

CAMAROTÆCHIA (?) WINISKENSIS (page 272).

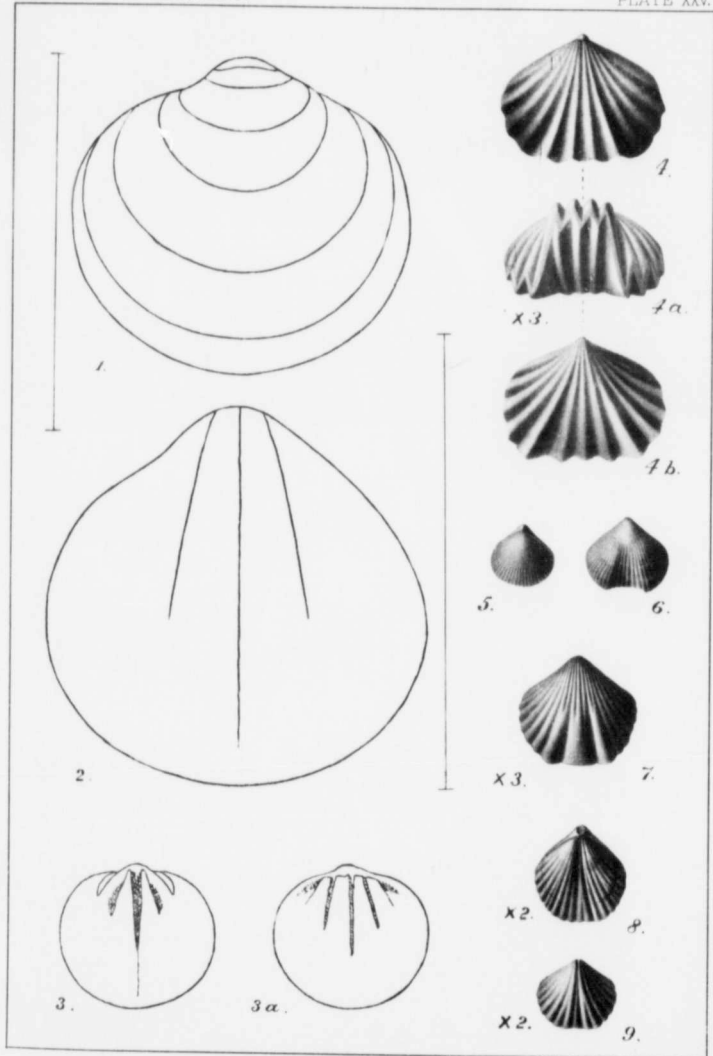
- Figure 5. Dorsal view of a small and evidently immature specimen from the Silurian limestone of the Winisk River, with both valves preserved.
- Figure 6. Exterior of the ventral valve of a large and apparently adult specimen, also from the Winisk River.

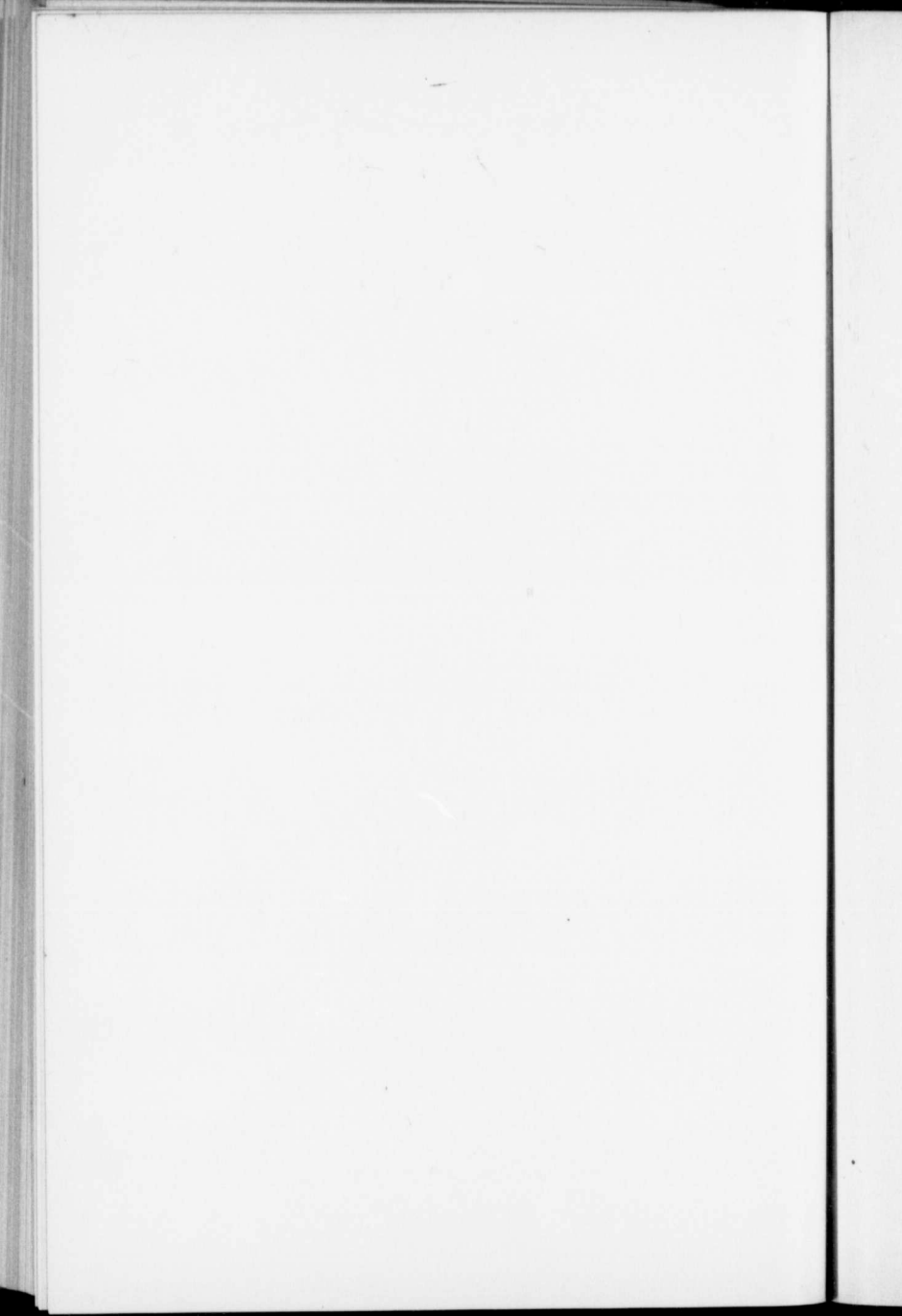
CAMAROTÆCHIA COALESCENS (page 272).

- Figure 7. Ventral side of the best specimen of this species known to the writer, from the Winisk River; three times the natural size.

RHYNCHOSPIRA LOWI (page 277).

- Figure 8. Dorsal view of a specimen of this species, from the Silurian limestone of the Fawn River, shewing the whole of the dorsal valve, and the unbo and perforate beak of the ventral.
- Figure 9. Exterior of the ventral valve of another specimen from the same locality. Both figures twice the natural size.





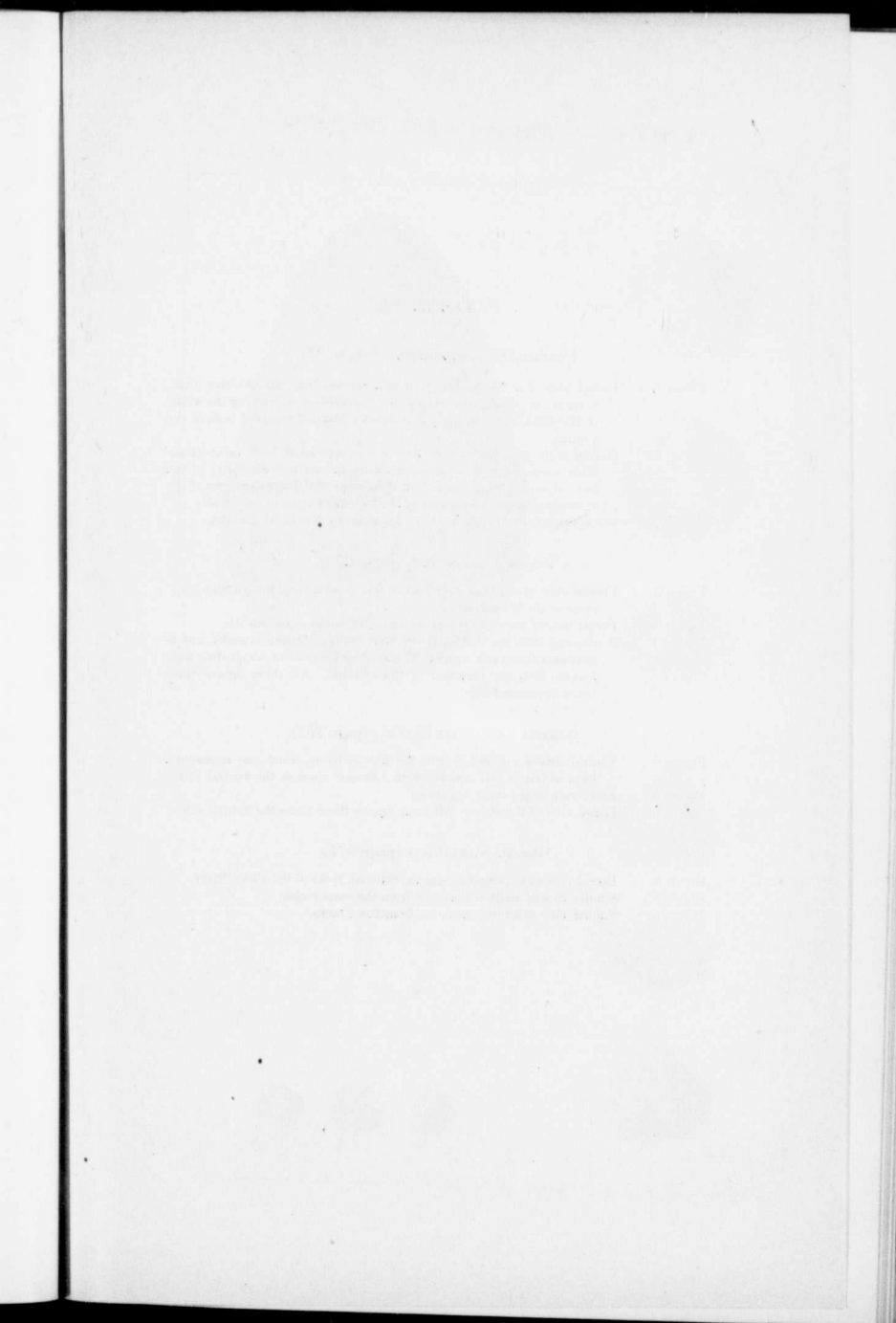


PLATE XXVI.

CONCHIDIUM DECUSSATUM (page 293).

- Figure 1. Dorsal view of a fine specimen of this species, from the Silurian limestone at the Grand Rapids of the Saskatchewan, shewing the whole of the dorsal valve, and the prominent umbo and recurved beak of the ventral.
- Figure 2. Outline of the posterior end of a cast of the interior of both valves of another specimen of this species, shewing the relative convexity of the two valves, the length and other characters of the mesial septum of the ventral valve, and the nature of the two short septa in the dorsal.
- Both figures of this species are from drawings by Mr. L. M. Lambe.

GLASSIA VARIABILIS (page 273).

- Figure 3. Ventral view of a typical specimen of this species, from the Silurian limestone at the Winisk River.
- Figure 4. Dorsal view of another typical specimen, from the same locality.
- Figure 5. A specimen from the Winisk River, that has been broken in such a way as to shew a transverse section of the closed valves at about their mid-length, with the direction of the spiralis. All three figures three times the natural size.

GLASSIA VARIABILIS (?) Var. (page 252).

- Figure 6. Ventral view of a specimen from the Ekwon River, which may represent a local variety of this species, with a deeper sinus in the ventral valve.
- Figure 6 a. Front view of the same specimen.
- " 6 b. Dorsal view of the same. All three figures three times the natural size.

GLASSIA VARIABILIS (page 277).

- Figure 7. Dorsal view of a specimen from the Silurian rocks of the Fawn River.
- Figure 8. Similar view of another specimen from the same rocks.
- Figure 9. Similar view of a third specimen from these rocks.

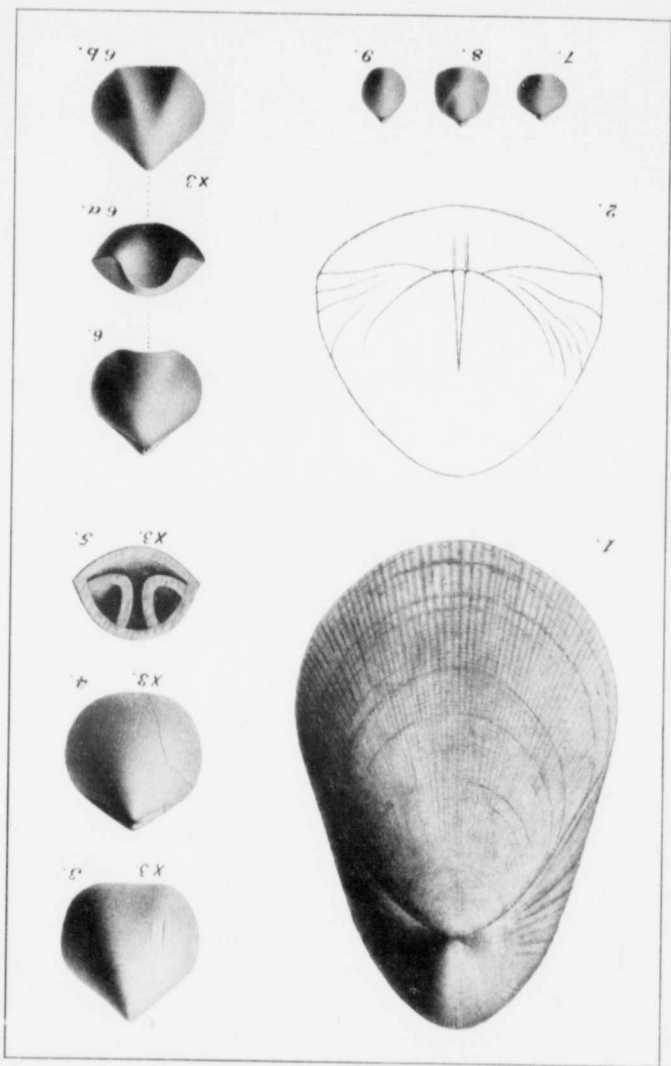
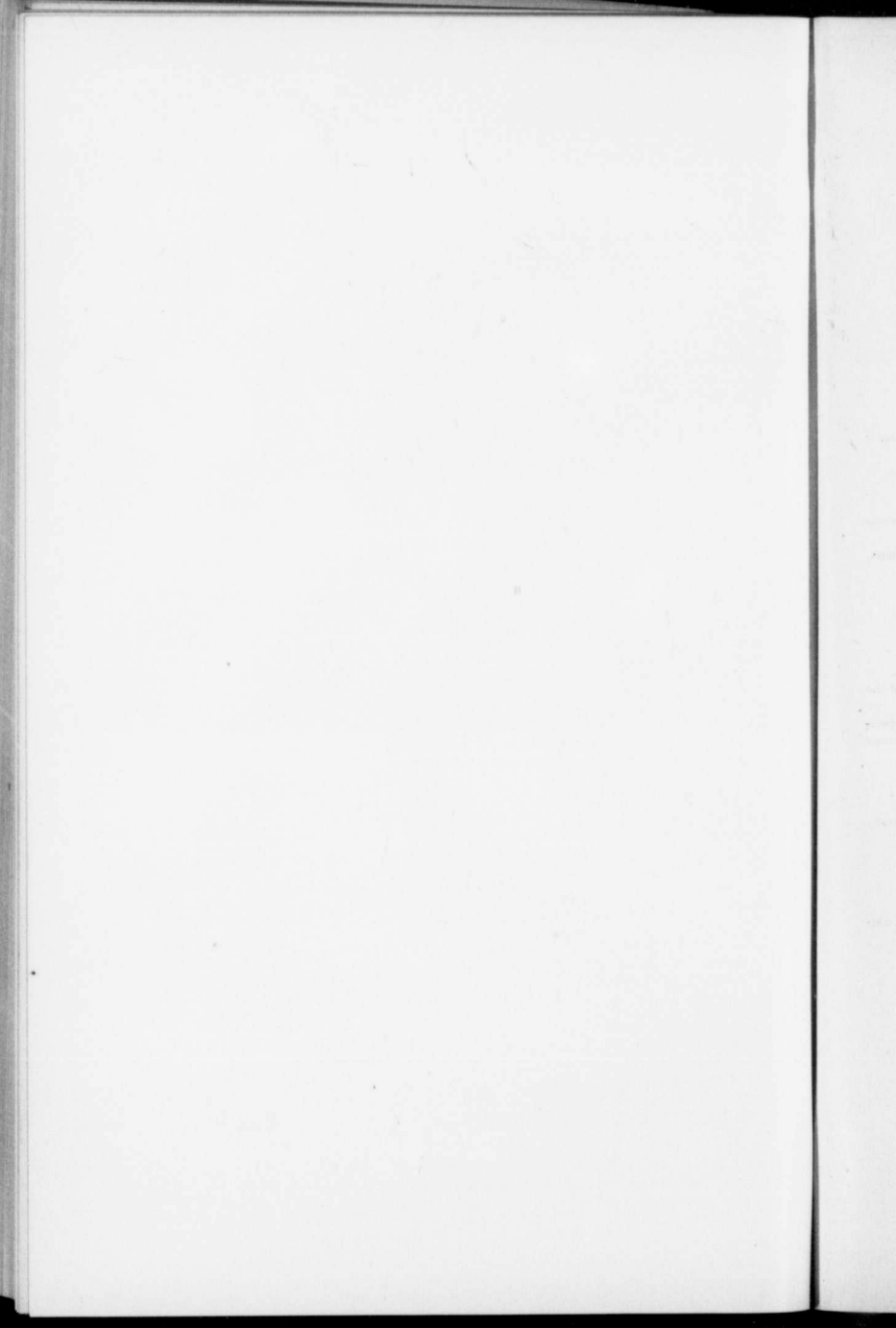


PLATE XVI.

PALÆOZOIC FOSSILS, VOL. 3.

Geological Survey Department, Canada.



THE UNIVERSITY OF CHICAGO
DEPARTMENT OF CHEMISTRY

REPORT OF THE COMMITTEE ON THE
PROGRESS OF CHEMISTRY

FOR THE YEAR 1911

PRESENTED TO THE FACULTY

BY THE COMMITTEE ON THE PROGRESS OF CHEMISTRY
CONSISTING OF

W. B. BAKER, CHAIRMAN

AND

W. R. BOYD

AND

W. H. C. FREW

CHICAGO, ILL., 1912

PLATE XXVII.

(With the exception of figure 7, all the specimens figured on this plate are from the Silurian rocks of the Ekwan River.)

SPIRIFER CRISPUS (?) Var. (page 253).

- Figure 1. Ventral view of a small *Spirifer*, with narrow and angular ribs, that is thought to be possibly a local variety of *S. crispus*.

RETICULARIA SEPTENTRIONALIS (page 253).

- Figure 2. Dorsal view of a large but imperfect specimen of this species, that was evidently a little longer than wide, when perfect.
Figure 3. Dorsal view of a more perfect but rather smaller specimen of this species, that is a little wider than long.
Figure 4. Dorsal view of a nearly perfect but much smaller specimen.
Figure 5. Dorsal view of a still smaller specimen.

MERISTINA (?) EXPANSA (page 245).

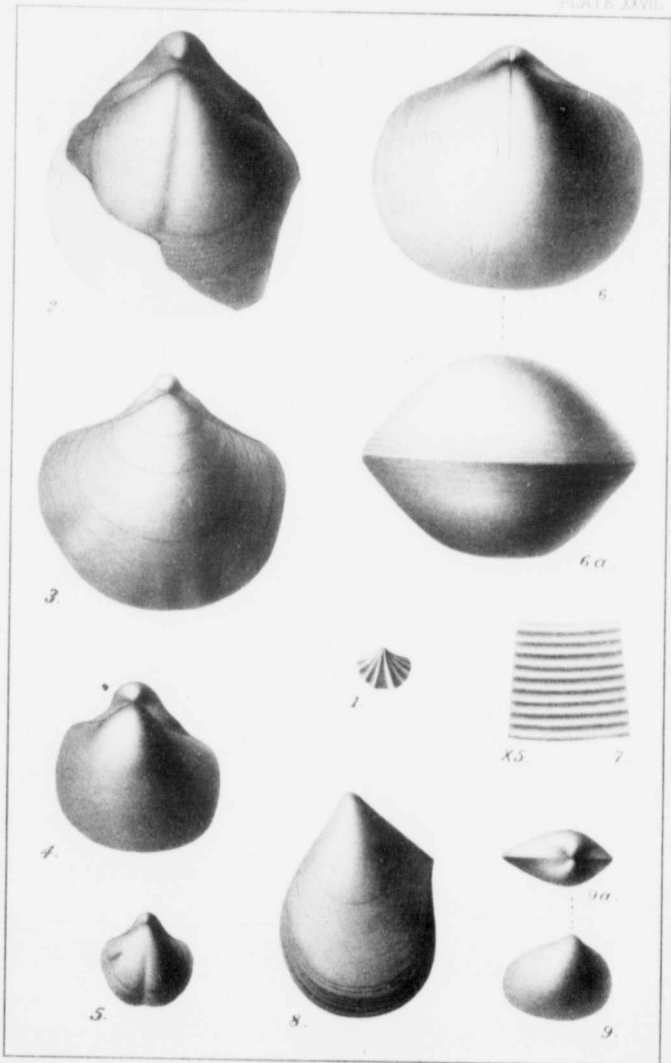
- Figure 6. Dorsal view of a large and presumably adult specimen of this species.
" 6a. Front view of the same specimen, shewing the unequal convexity of the two valves, and the absence of any mesial fold or sinus.
Figure 7. Surface markings of part of the exfoliated test of a rather smaller specimen, from the Silurian rocks of the Attawapiskat River; five times the natural size.

MYTLARCA PERNOIDES (page 255).

- Figure 8. Side view of the type and only known specimen of this species, a testiferous left valve.

CTENODONTA SUBOVATA (page 256).

- Figure 9. Side view of the only specimen known to the writer.
" 9a. The same specimen, as viewed from above, shewing the amount of convexity of the closed valves.



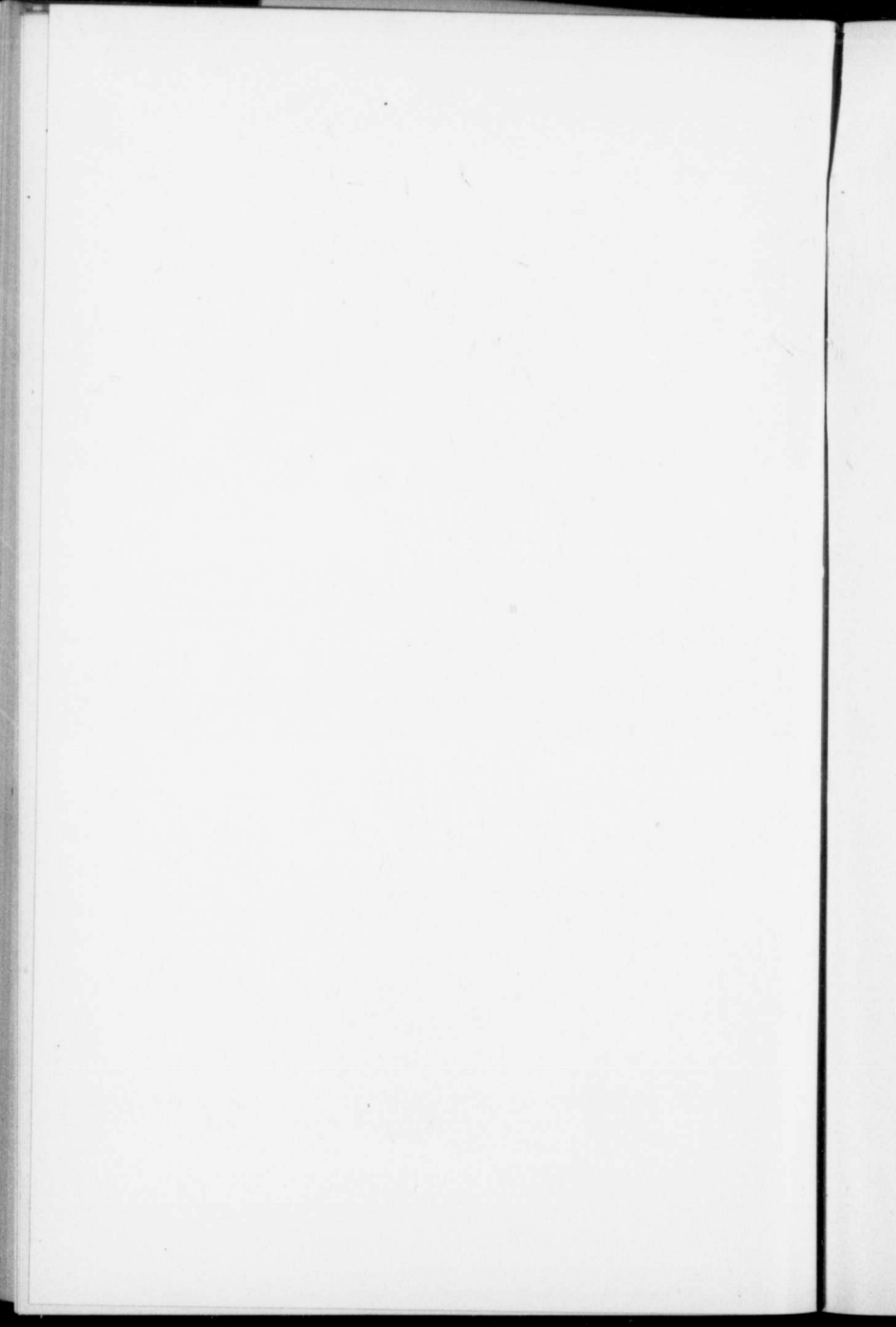


PLATE XXVIII.

PTERINEA OCCIDENTALIS (page 287).

- Figure 1. Side view of a cast of the interior of a left valve of a specimen of this species, from the Silurian limestone at Ami Island, near the north-east shore of Lake Winnipegosis.
- Figure 2. Similar view of a cast of the interior of a left valve of a specimen of this species, from the Grand Rapids of the Saskatchewan.
- Figure 3. Side view of the testiferous left valve from Swan Lake, at the head of Shoal River, Manitoba, referred to on pages 287 and 288.

AMBONYCHIA UNDULATA (page 254).

- Figure 4. Side view of a cast of the interior of a right valve of a specimen of this species, from the Ekwan river limestone.

AMBONYCHIA SEPTENTRIONALIS (page 255).

- Figure 5. Side view of the left valve of a cast of the interior of both valves of a shell of this species, from the Ekwan River limestone.

ILIONIA (?) *PARVULA* (page 288).

- Figure 6. Side view of the left valve of a shell of this species, from the rocks exposed at Ami Island.
- Figure 7. Side view of a right valve of a shell of this species, from the Silurian rocks at Long Point, Lake Winnipegosis.
- Figure 8. Side view of another right valve of a shell of this species, from Long Point.

MEGALOMPHALA ROBUSTA (page 257).

- Figure 9. Side view of a large specimen of this species, from the Ekwan River limestone.
- " 9a. Peripheral view of the same.

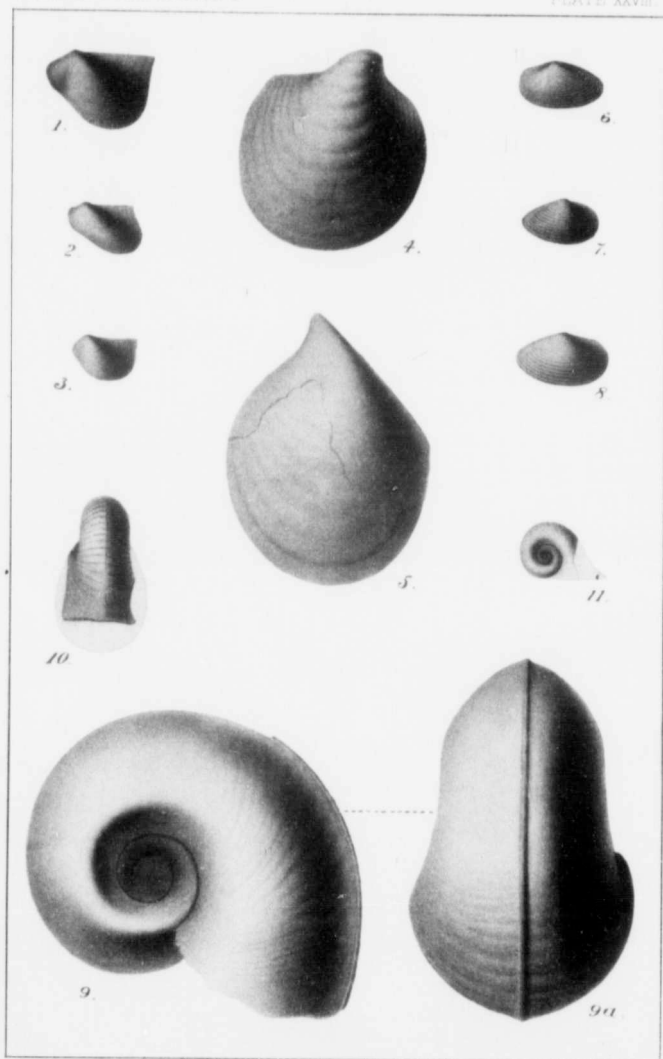
SALPINGOSTOMA BOREALE (page 258).

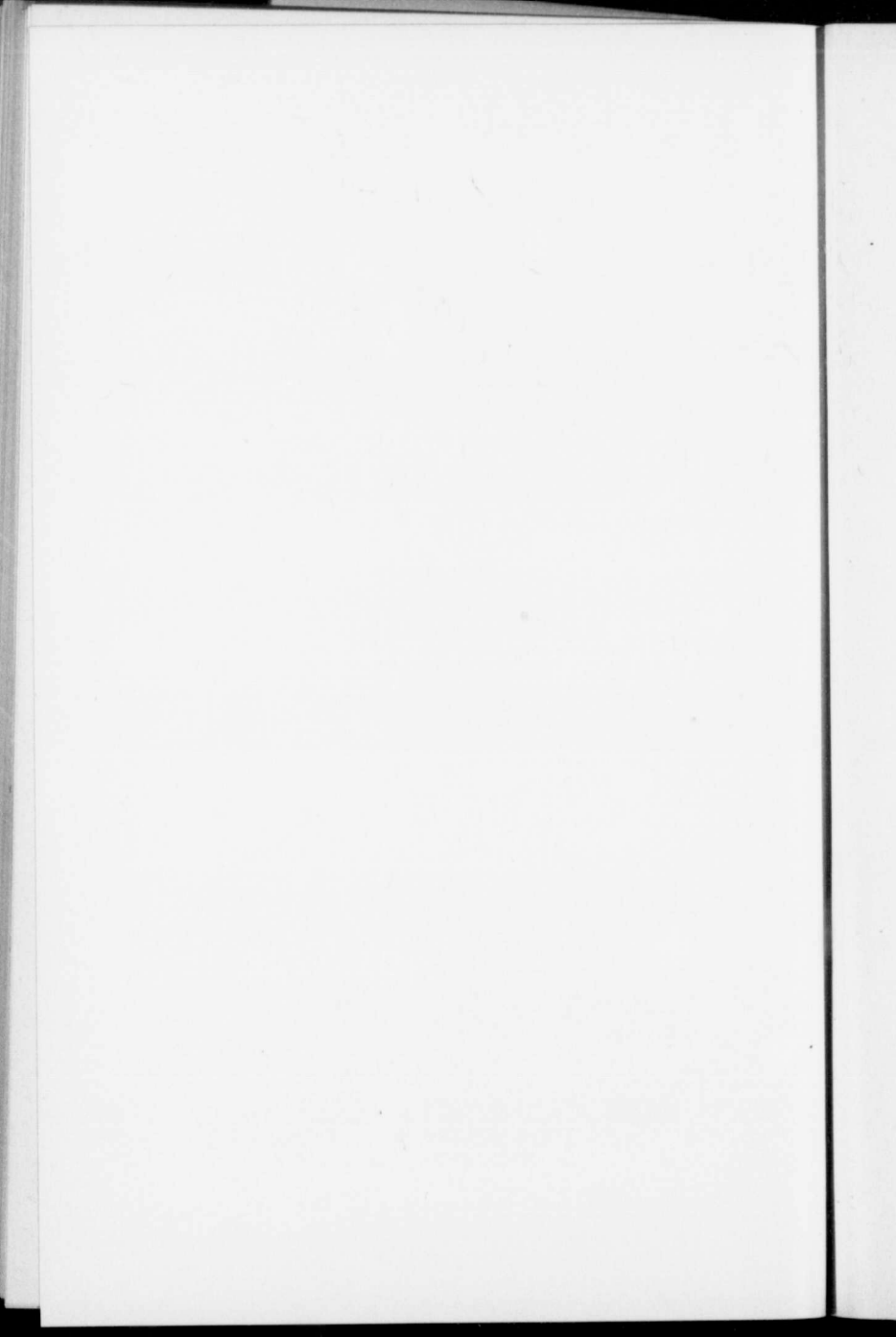
- Figure 10. Peripheral view of the largest specimen collected, from the Ekwan River limestone.
- Figure 11. Side view of a smaller specimen, also from the Ekwan River.

Geological Survey Department, Canada.

PALEOZOIC FOSSILS, VOL. 3.

PLATE XXVII.





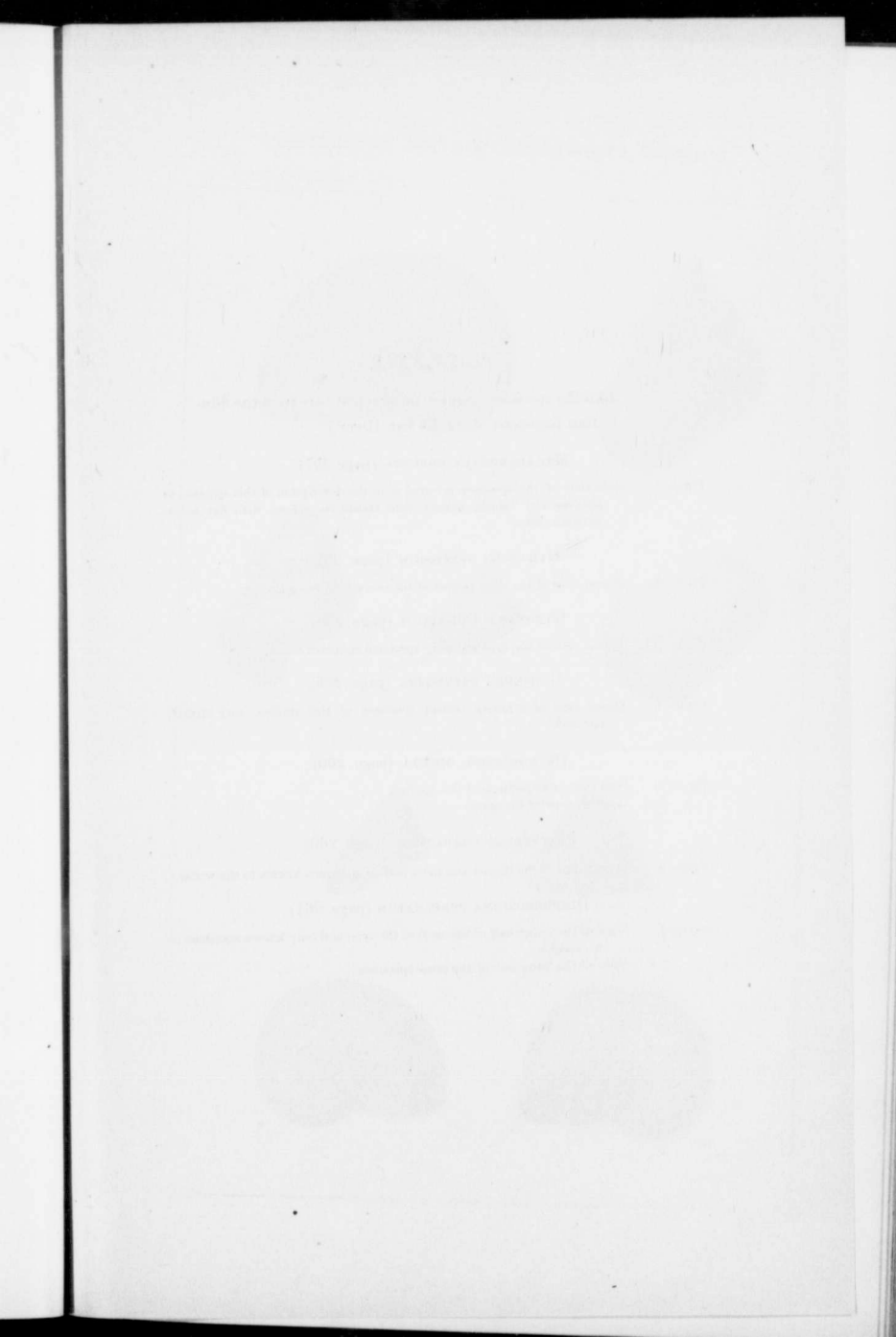


PLATE XXIX.

(All the specimens figured on this plate are from the Silurian limestone of the Ekwan River.)

MEGALOMPHALA ROBUSTA (page 257).

- Figure 1. Side view of the specimen referred to in the description of this species, as shewing the "small, narrow, thin transverse ridges, with flat spaces between them."

GYRONEMA SPECIOSUM (page 258).

- Figure 2. Dorsal view of the more perfect of the two specimens collected.

GYRONEMA DOWLINGII (page 259).

- Figure 3. Dorsal view of the type and only specimen collected.

GYRONEMA BREVISPIRA (page 259).

- Figure 4. Dorsal view of a nearly perfect specimen of this species, very slightly restored.

ORTHONYCHIA OBTUSA (page 260).

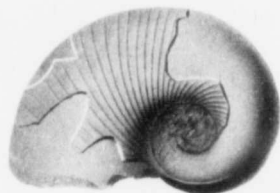
- Figure 5. Side view of a specimen of this species.
" 5a. Another view of the same.

PLATYCERAS COMPACTUM (page 260).

- Figure 6. Dorsal view of the largest and most perfect specimen known to the writer.

DIAPHOROSTOMA PERFORATUM (page 261).

- Figure 7. View of the upper half of the shell of the type and only known specimen of this species.
" 7a. View of the lower half of the same specimen.



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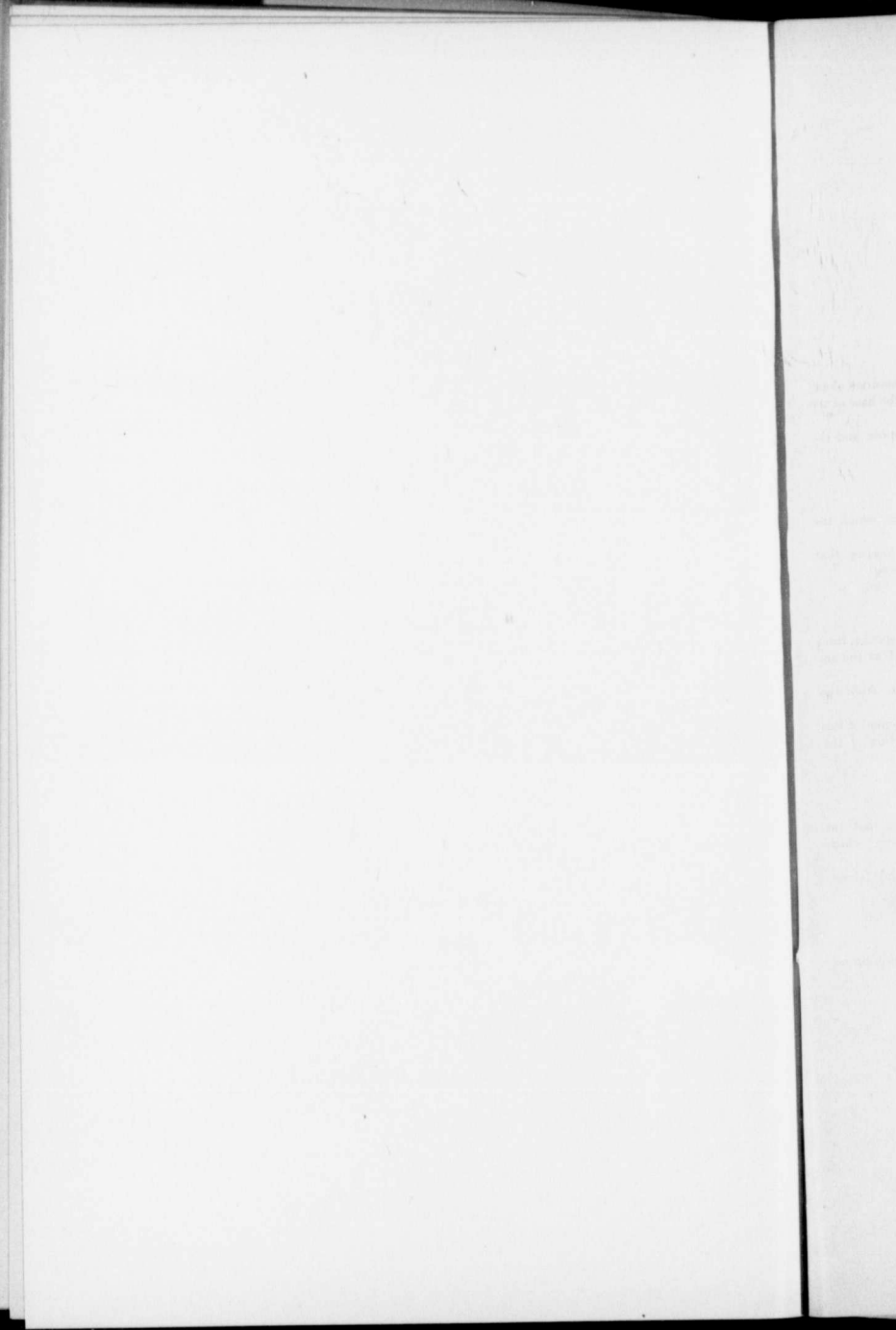




PLATE XXX.

STROPHOSTYLUS AMPLUS (page 262).

- Figure 1. Ventral view of a specimen of this species, from the Ekwan limestone, shewing the large size of the aperture and other characters of the base of the shell.
- " 1 a. Dorsal view of the same specimen, shewing the small, short spire, and the large outer volution.

STROPHOSTYLUS INFLATUS (page 262).

- Figure 2. Dorsal view of the large specimen from the Ekwan River, from which the original description of this species was made.
- Figure 3. Similar view of a "large testiferous specimen" from the same locality, that is referred to in the text as "probably referable to this species."

STROPHOSTYLUS FILICINCTUS (page 263).

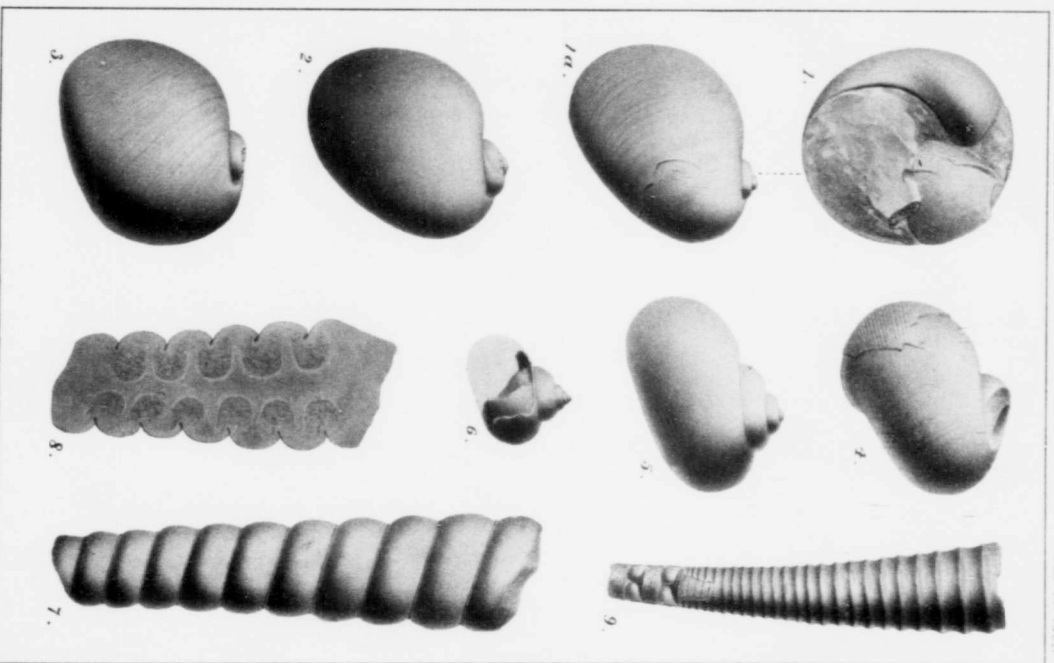
- Figure 4. Dorsal view of an imperfect cast of the interior of a shell of this species, from the Ekwan River, with a small portion of the test preserved at the anterior end of the last volution.
- Figure 5. Similar view of a cast of the interior of the shell of a specimen, from the Ekwan, that is probably referable to this species.
- Figure 6. Dorsal view of a cast of the interior of the shell of a small specimen of this species, also from the Ekwan River, with a considerable portion of the test preserved.

ACTINOCERAS KEWATINENSE (page 246).

- Figure 7. Side view of the best specimen of the siphuncle of this species that the writer has seen, from Rainy Island, in the Attawapiskat River, which shews ten of the siphuncular constrictions.
- Figure 8. Longitudinal section of another portion of a siphuncle from Rainy Island, shewing indications of "organic deposits" therein.

SPYRO CERAS MERIDIONALE (page 281).

- Figure 9. Side view of the type and only known specimen of this species, from Stonewall, Manitoba.



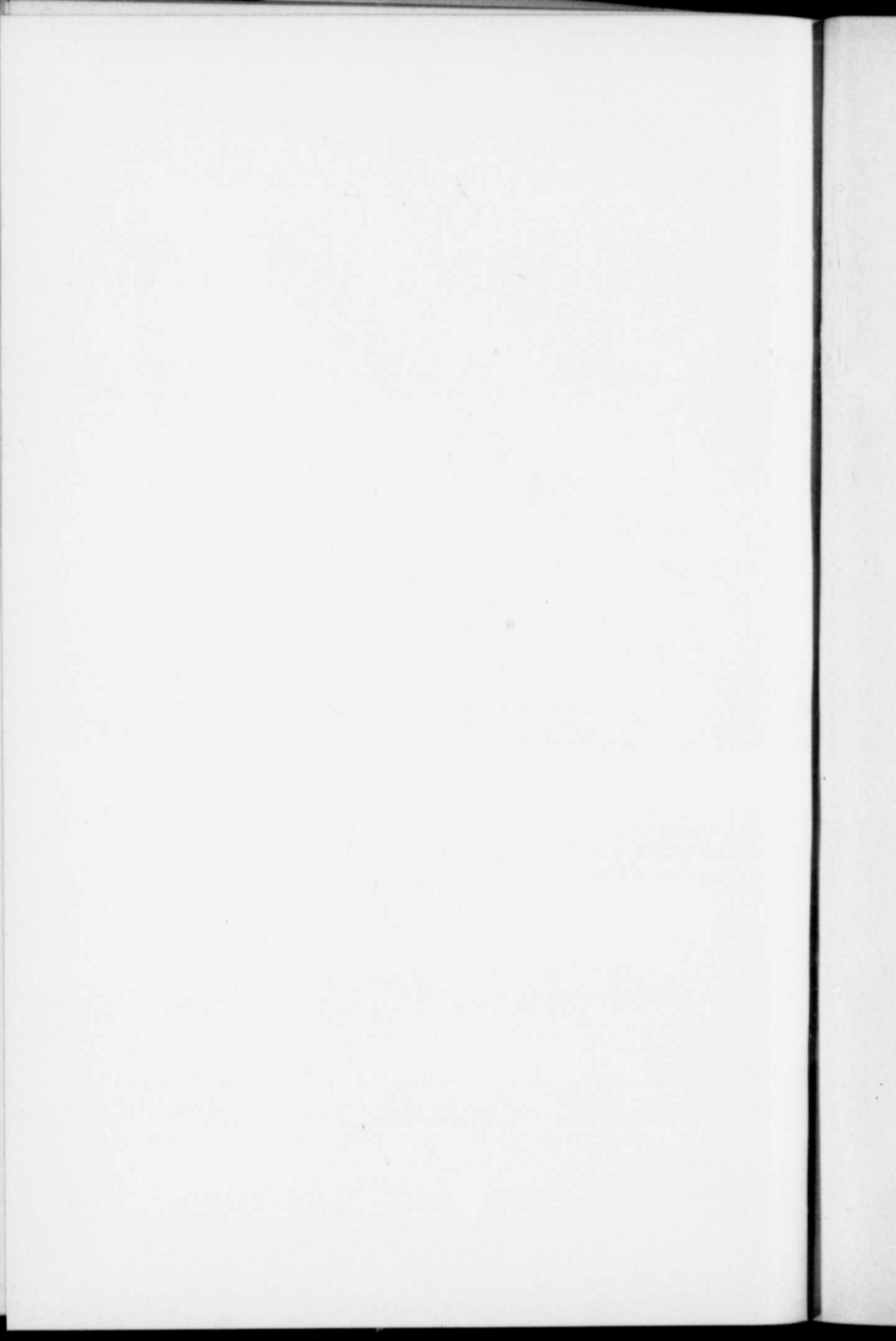


PLATE XXXI.

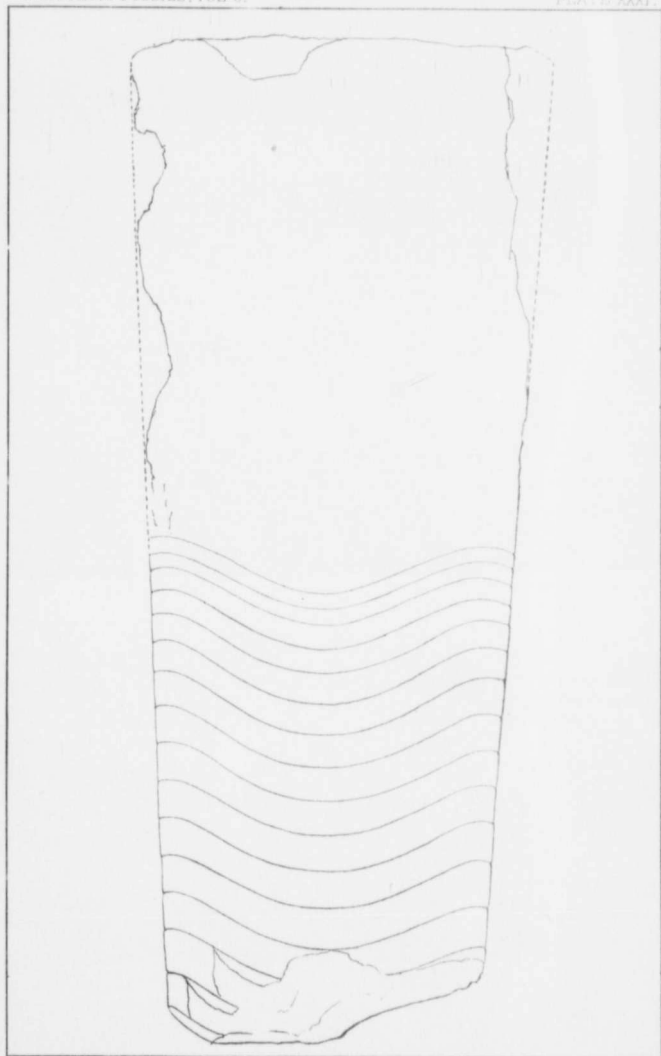
TRIPLEUROCERAS ROBSONI (page 281).

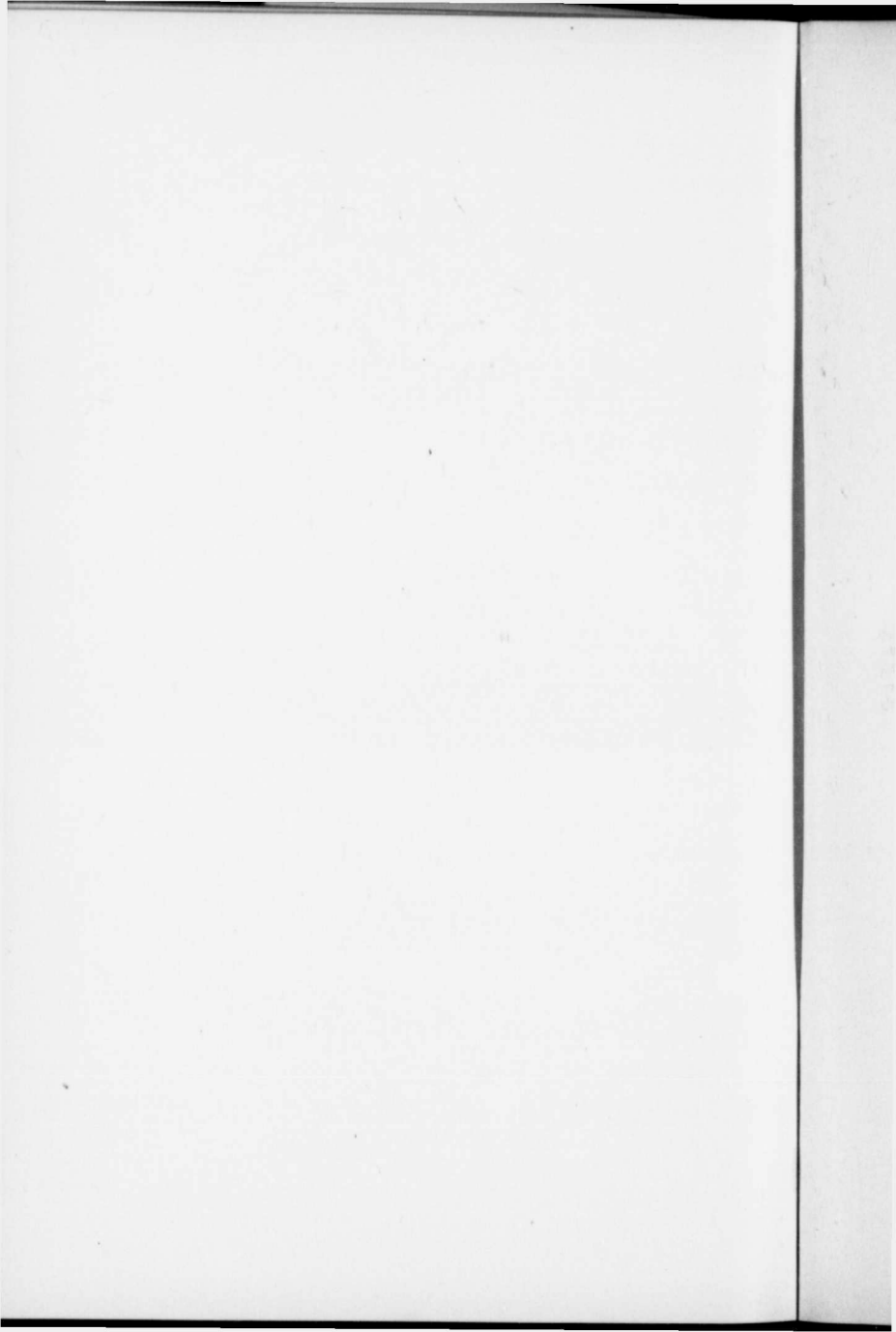
Outline of the exposed portion of an imperfect cast of the interior of the shell of a specimen of this species, from Stonewall, presented by Mr. Donald Gunn. This cast has fifteen septal chambers and a considerable portion of the body chamber preserved, and shows the curved sutural lines on the flattened and presumably abdominal side. The figure is very slightly reduced in size, but not more so than by about one-eighth of an inch.

Geological Survey Department, Canada.

PALÆOZOIC FOSSILS, VOL. 3.

PLATE XXXI





WILLY STARR

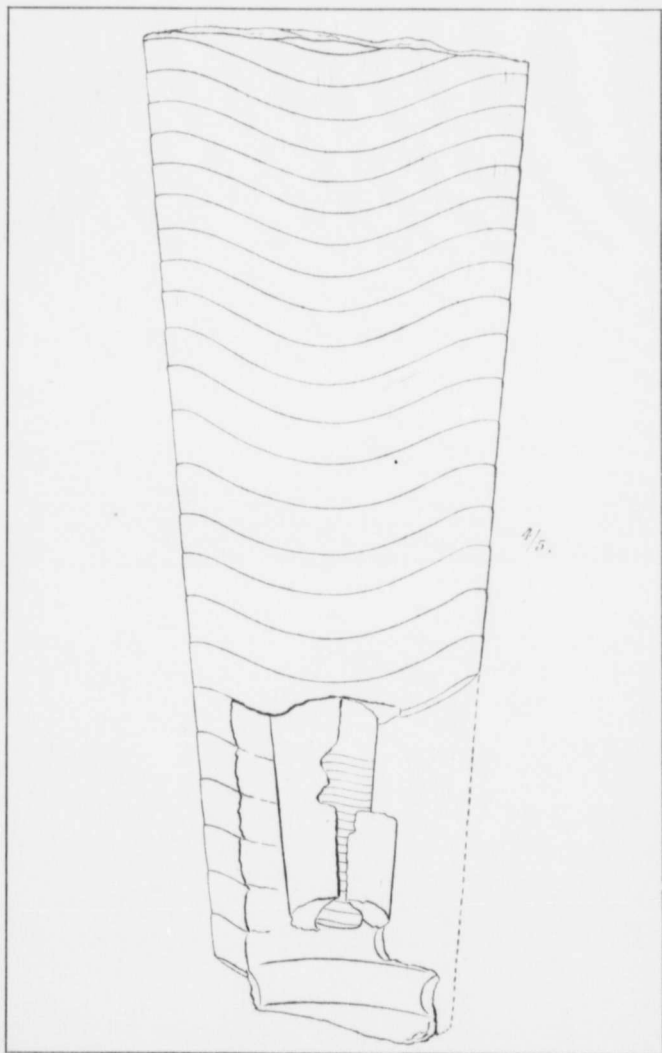
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PLATE XXXII.

TRIPLEUROCERAS ROBSONI (page 281).

Outline of a cast of the interior of most of the septate portion of the shell of a large specimen of this species from Stonewall, presented by Mr. W. H. Robson, four-fifths of the natural size. In the original of this figure, twenty-four septal chambers are either wholly or partially preserved, and the curved sutural lines on the flattened and presumably abdominal side are well shown.



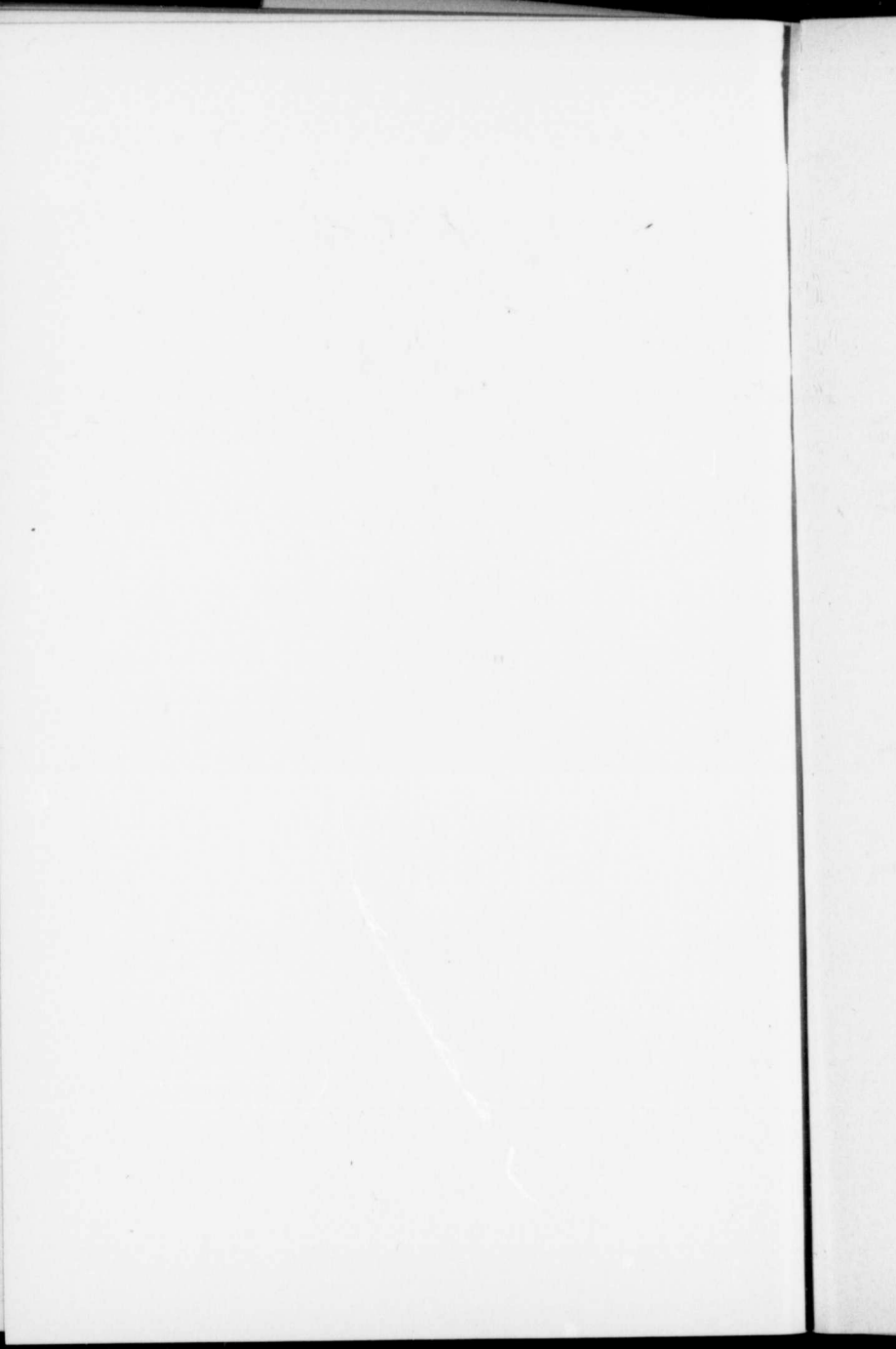


PLATE XXXIII.

ORTHO CERAS EKWANENSE (page 265).

- Figure 1. Side view of the type and only known specimen of this species, from the Ekwan River. At the smaller end a piece has been cut out, but the longitudinal section thus obtained shews only the cut edges of some of the septa, but no traces of the siphuncle.
- " 1a. Outline of the larger end of the same specimen, shewing the nearly elliptical shape of the cross section, and the central position of the apparently small siphuncle.

SPYROCERAS BEAUPORTENSE (page 323).

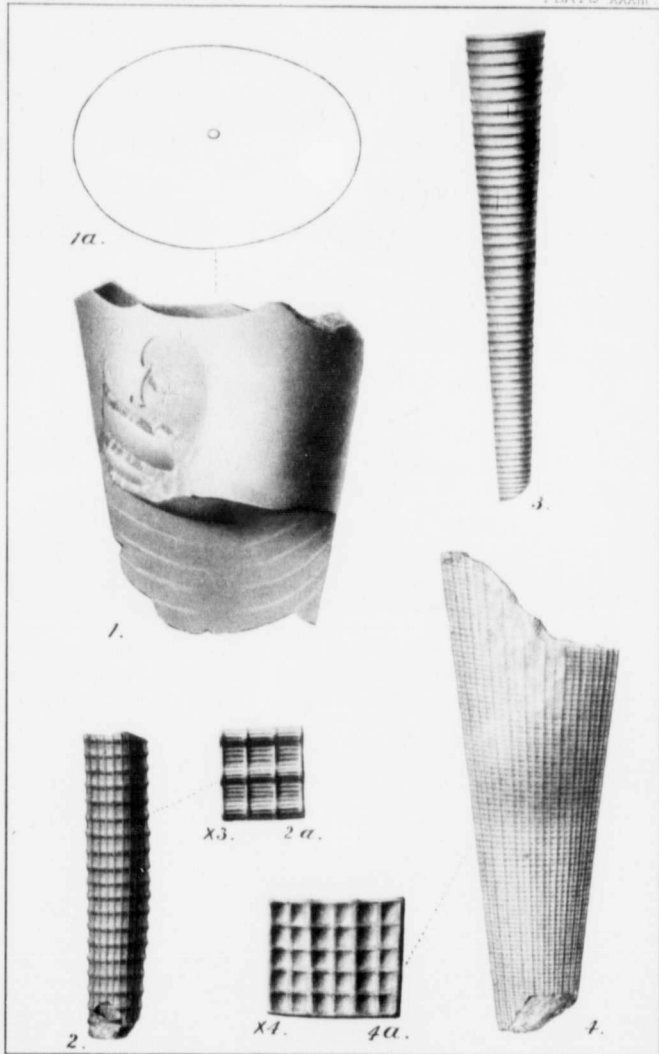
- Figure 2. Side view of a specimen of this species, from the Trenton limestone at Beauport, P.Q.
- " 2a. Portion of surface of the same specimen; three times the natural size.

ORTHO CERAS WALPOLENSE (page 324).

- Figure 3. Side view of the type and only known specimen of this species, from the Corniferous limestone at Walpole, Ont.

ORTHO CERAS HAGERSVILLENSE (page 325).

- Figure 4. Side view of the type and only known specimen of this species, from the Corniferous limestone at Hagersville, Ont.
- " 4a. Portion of the outer surface of the same; four times the natural size.



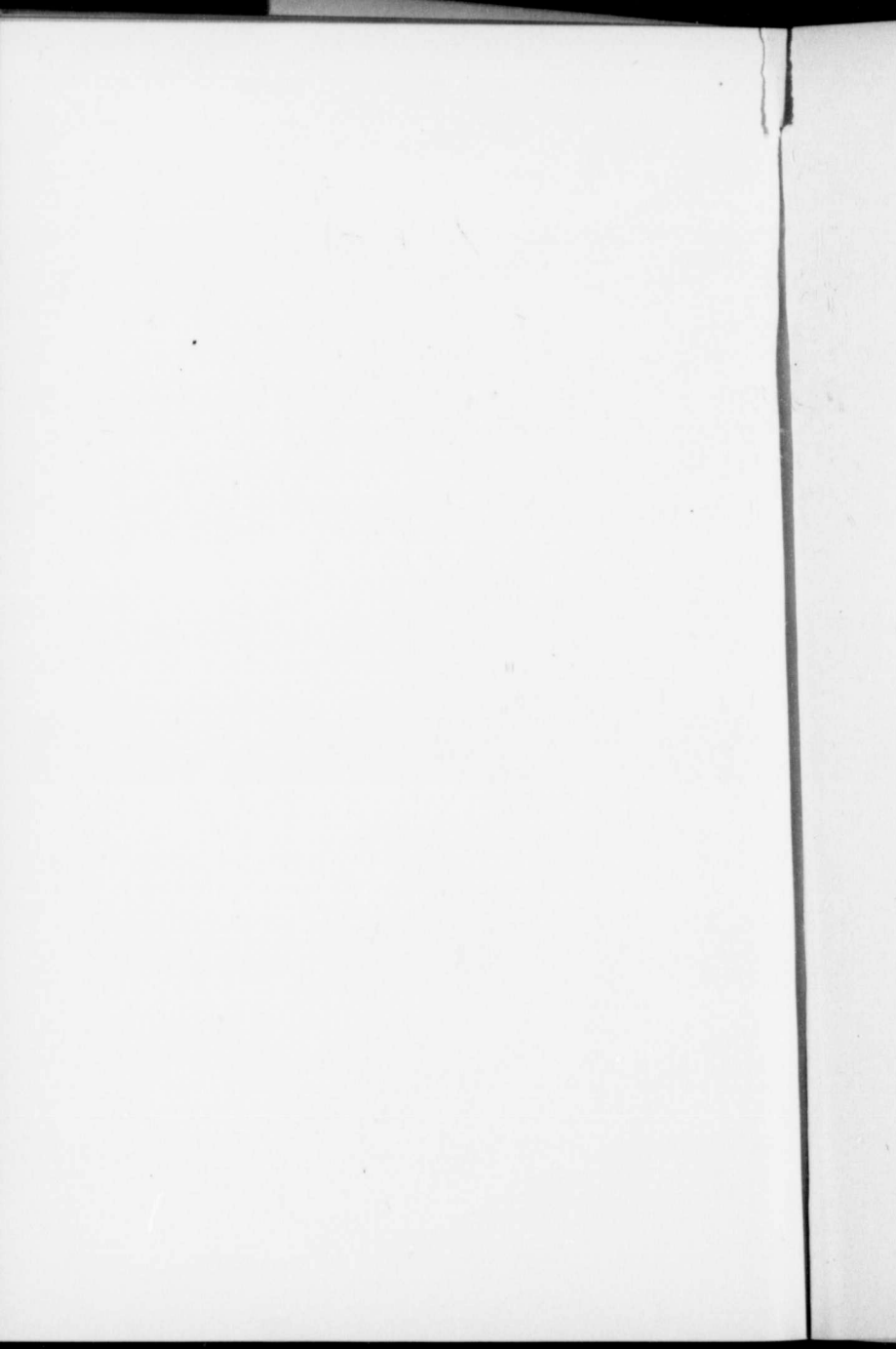
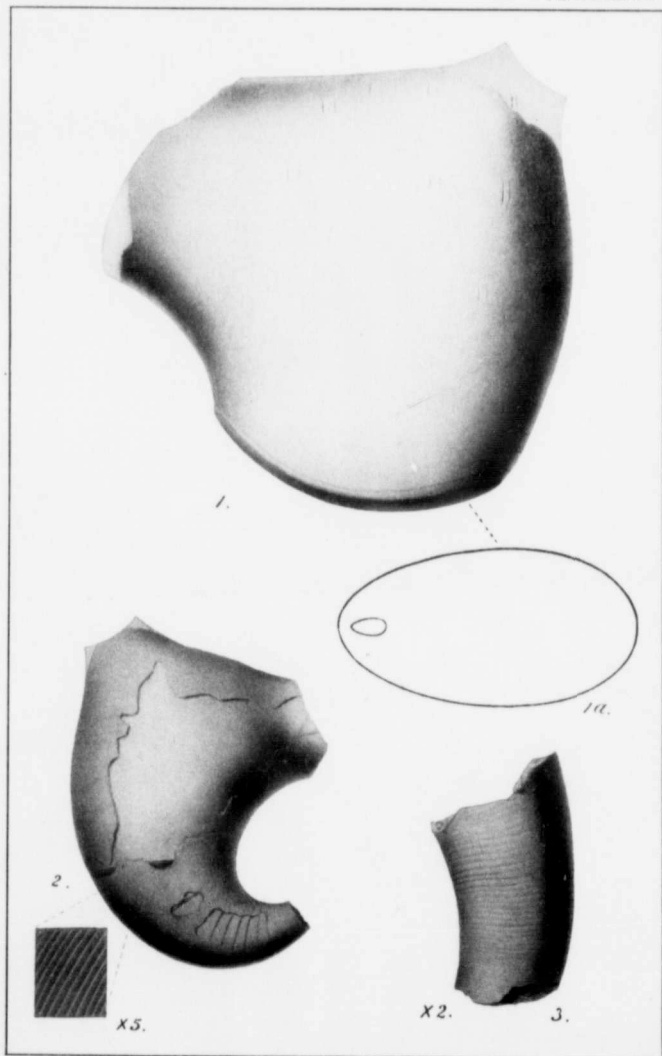


PLATE XXXIV.

(All the specimens figured on this plate are from the Ekwan River limestone.)

PHRAGMOCERAS LINEOLATUM (page 265).

- Figure 1. Side view of a cast of the interior of the body chamber of a large specimen of this species.
- " 1 a. Outline of the smaller end of the same specimen, shewing the narrow, ovately elliptical contour at that end, and the imprint of the dorsal and nearly marginal siphuncle.
2. Side view of a smaller but more perfect specimen of this species, with a considerable portion of the test preserved. Part of the surface markings are represented, five times the natural size.
- " 3. Side view of a testiferous fragment of the posterior end of a specimen of this species; twice the natural size.



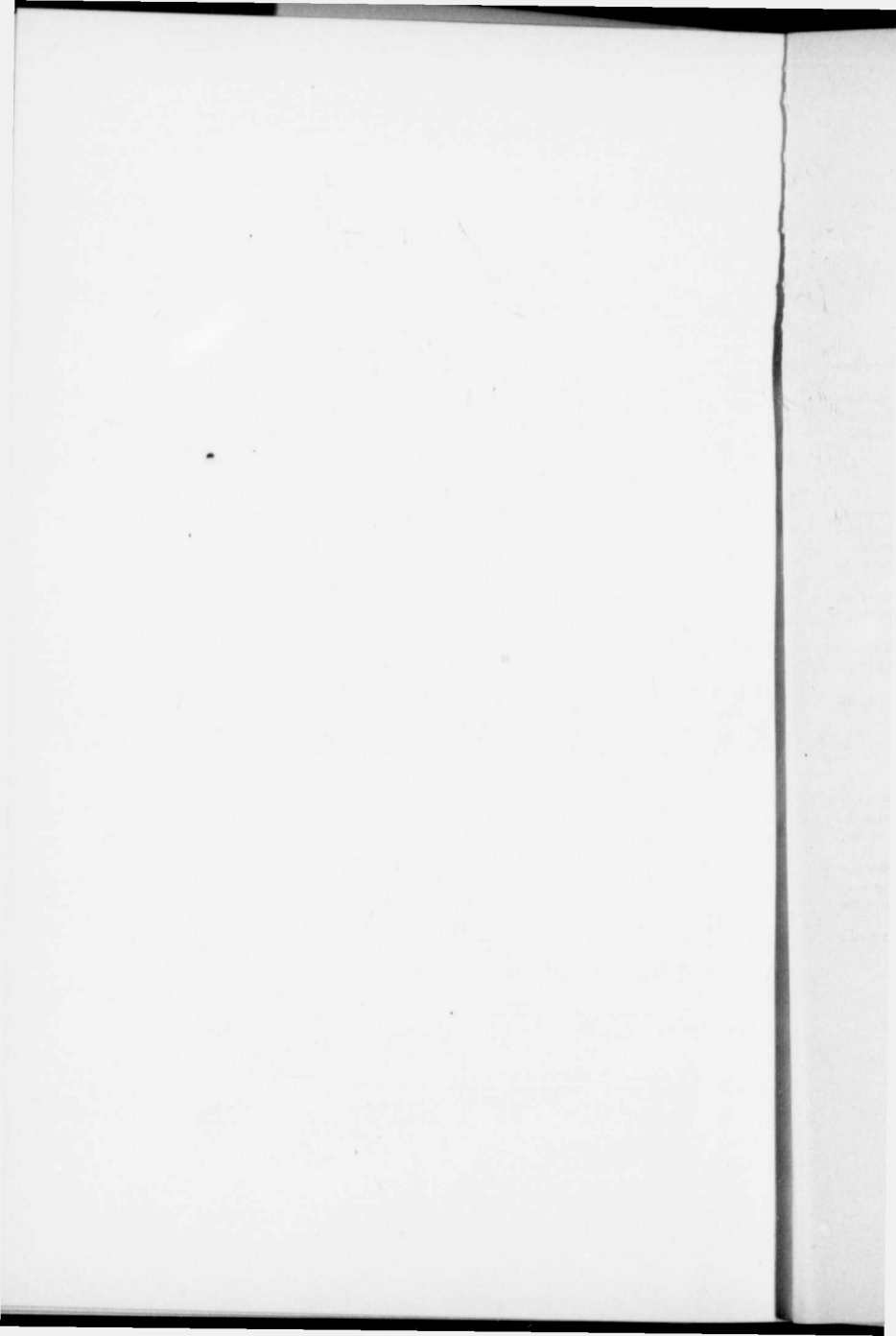




PLATE XXXV.

CYRTOCERAS QUEBECENSE (page 315).

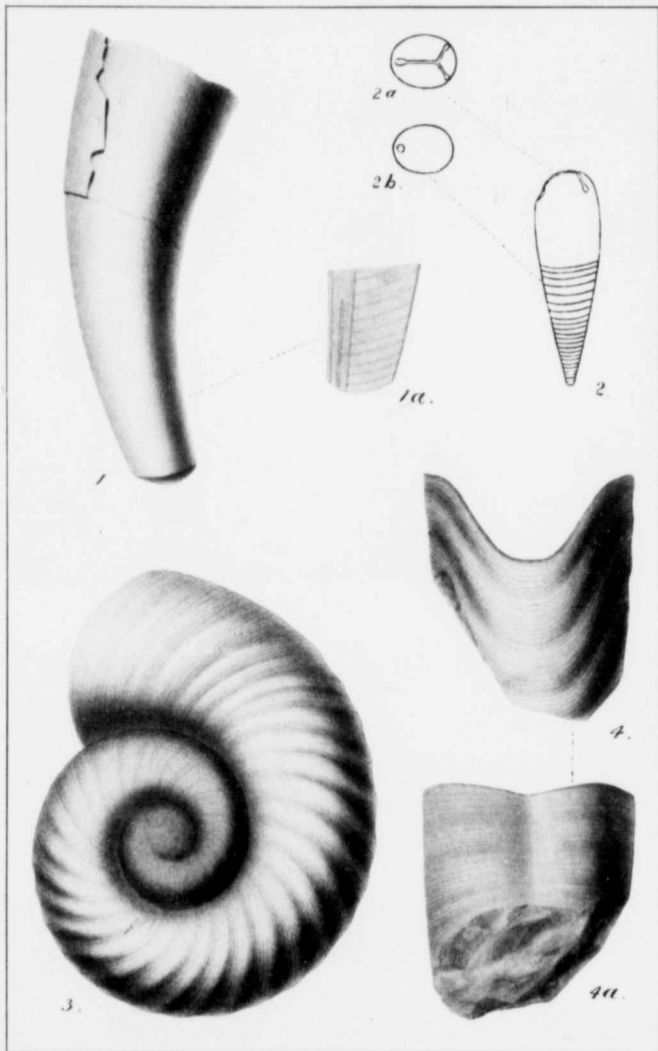
- Figure 1. Side view of the only specimen known to the writer, from the Levis limestone at Pointe Levis.
- " 1 a. Longitudinal section of a small piece of the narrower end of the same, shewing part of the large, cylindrical, dorsal and marginal siphuncle, and the cut edges of some of the rather closely approximated septa.

GOMPHOCERAS PARVULUM (page 296).

- Figure 2. Diagrammatic outline of an entire specimen, the details taken from several specimens, some of which are natural moulds of the exterior, or casts of the interior of the body chamber, and others casts of the interior of the septate portion of the shell; all from the Silurian limestone at the Grand Rapids of the Saskatchewan.
- " 2 a. Outline of the anterior end of a wax impression of a natural mould of the exterior of the body chamber of a specimen of this species from Grand Rapids, shewing the Y-shaped aperture.
- " 2 b. Outline of one of the septa of a specimen of this species, from the same locality,—near the body chamber, to shew the relative position of the siphuncle.
- The three figures of this species are from original drawings by Mr. L. M. Lambe.

PLECTOCERAS HALLI (page 302).

- Figure 3. Side view of an unusually perfect, well preserved and apparently adult specimen of this species, from the Black River (?) limestone at the Falls of the St. Charles River at Indian Lorette, collected by Mr. Weston in 1898.
- " 4. Ventral side of part of the nearly or quite free anterior end of another and rather larger specimen of this species, collected by Mr. Weston at Lorette in 1898, shewing the comparatively deep ventral sinus of the outer lip.
- " 4 a. Dorsal view of the same specimen, shewing the nearly straight dorsal margin of the inner lip, and a faint dorsal furrow.





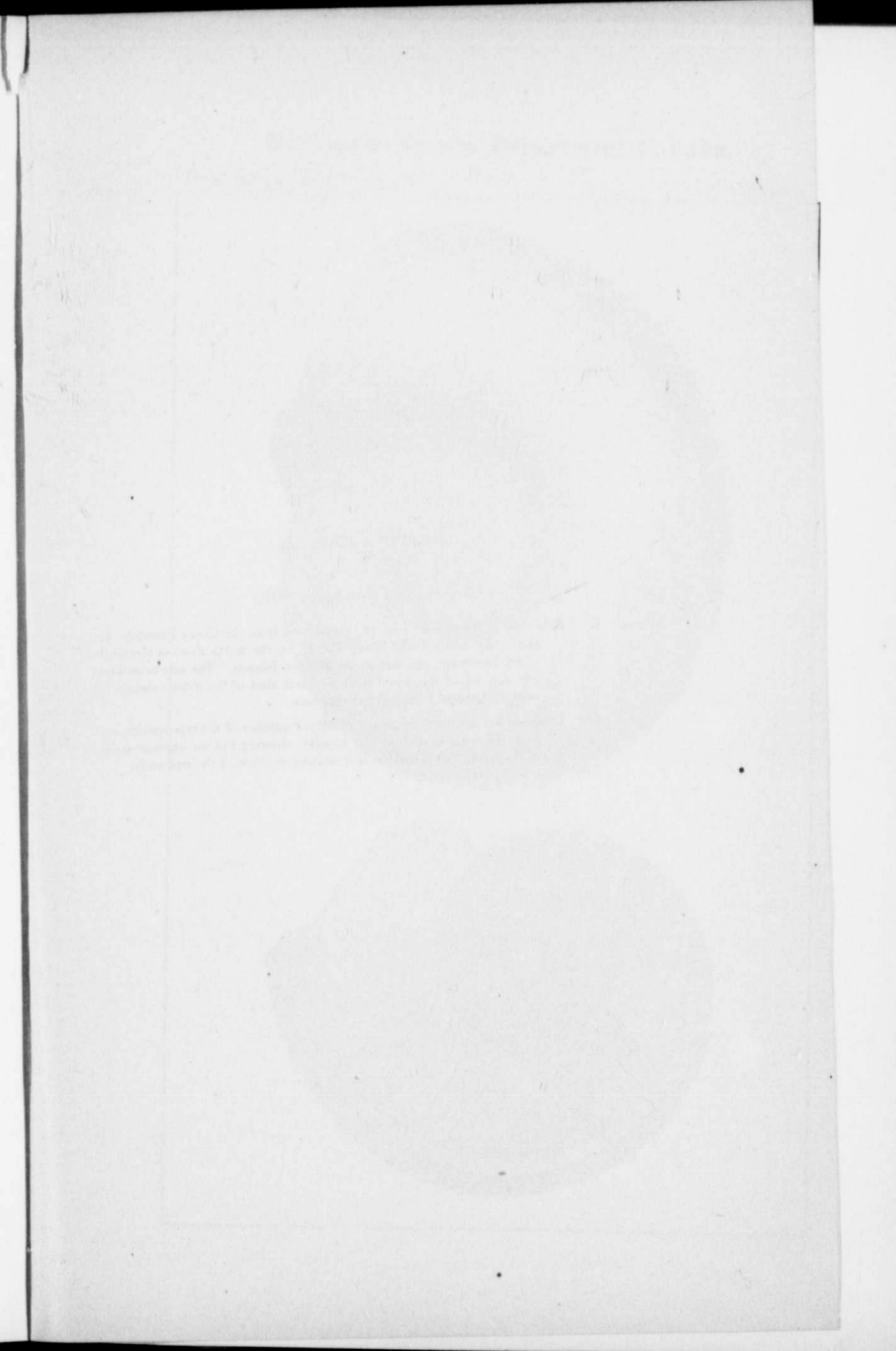


PLATE XXXVI.

PLECTOCERAS JASON (page 301).

- Figure 1. Side view of one of the types of this species, from the Chazy limestone at the "bay above Clear Water Point," on the north shore of the Gulf of St. Lawrence, opposite to the Mingan Islands. The test is broken off of most of the body chamber, and that of the inner volution is slightly restored from another specimen.
- Figure 2. Longitudinal section through the middle of another of the type specimens, from the same formation and locality, shewing the cut edges of some of the septa, and the shape and relative position of the siphuncle.

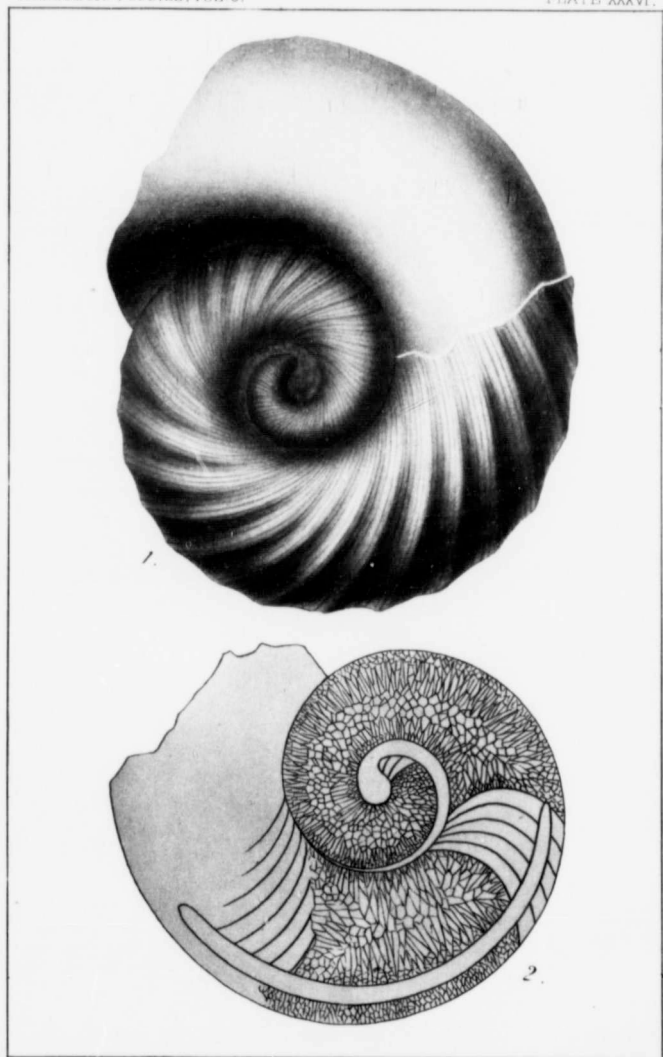






PLATE XXXVII.

PLECTOCERAS (?) *UNDATUM* (page 305).

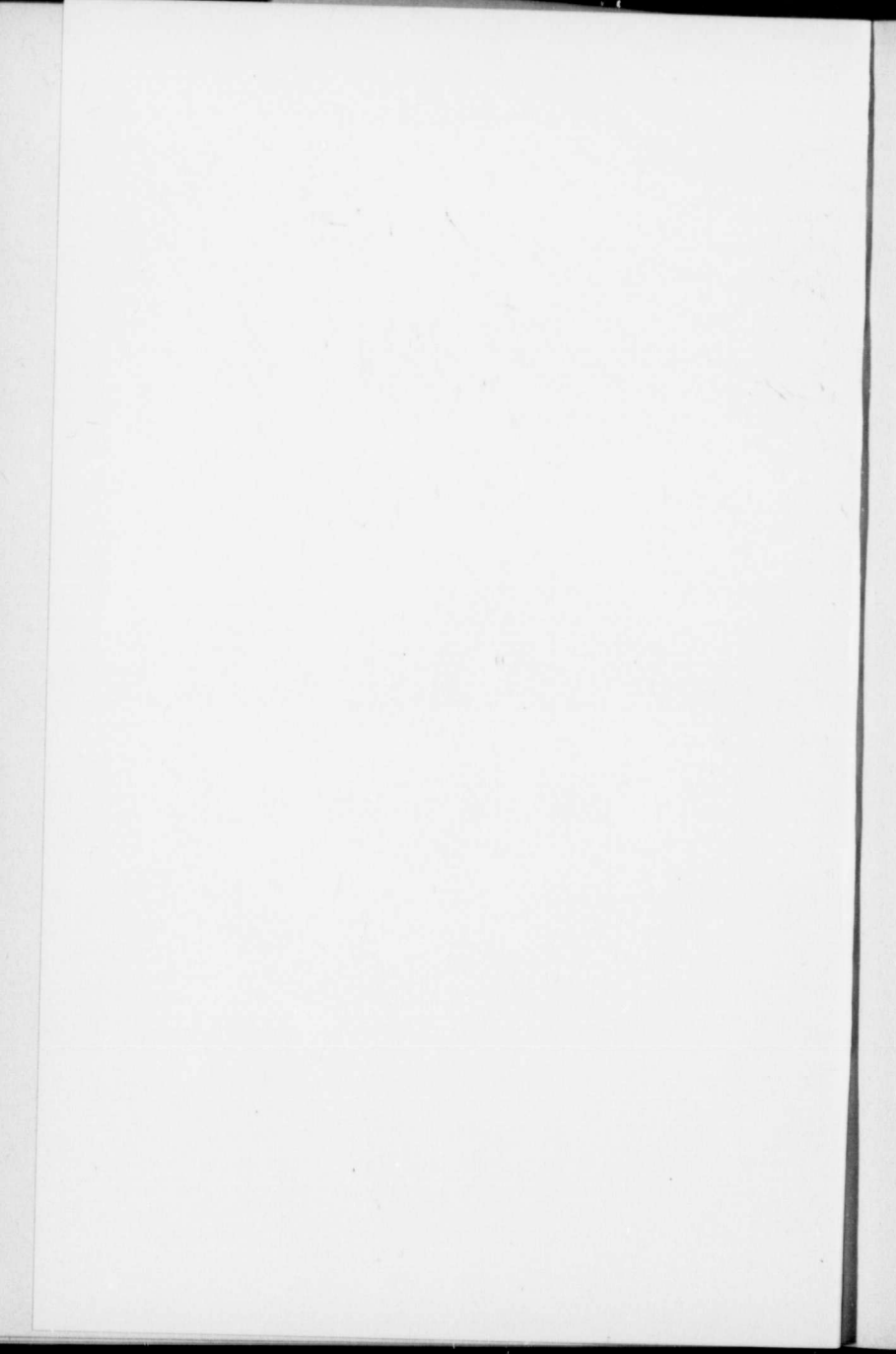
Side view of a cast of the interior of the septate portion of a large shell that is probably referable to this species, from the Black River limestone at Kingston, Ont. This specimen was acquired for the Museum of the Survey in 1902, in exchange, from the authorities of Queen's University.

Geological Survey Department, Canada.

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PLATE XXXVII.





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DEPARTMENT OF CHEMISTRY
CHICAGO, ILLINOIS
1914

PLATE XXXVIII.

BARRANDEOCERAS SUBCOSTULATUM (page 310).

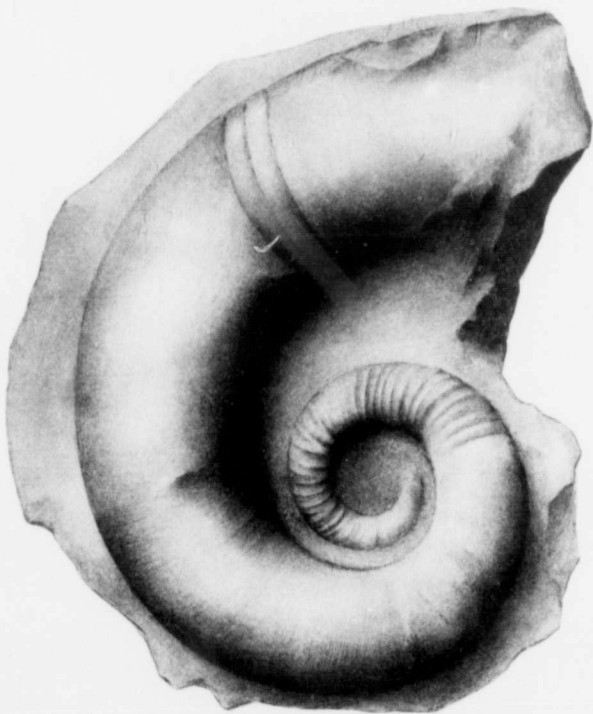
Side view of the type and only known specimen of this provisional species, from the Black River limestone at Wolfe Island, near Kingston, which was presented to the Museum of the Survey by Professor James Fowler in 1888.

The figure is a reproduction of a drawing by Mr. F. E. Calderon.

Geological Survey Department, Canada.

PALÆOZOIC FOSSILS, VOL. 3.

PLATE XXXVIII



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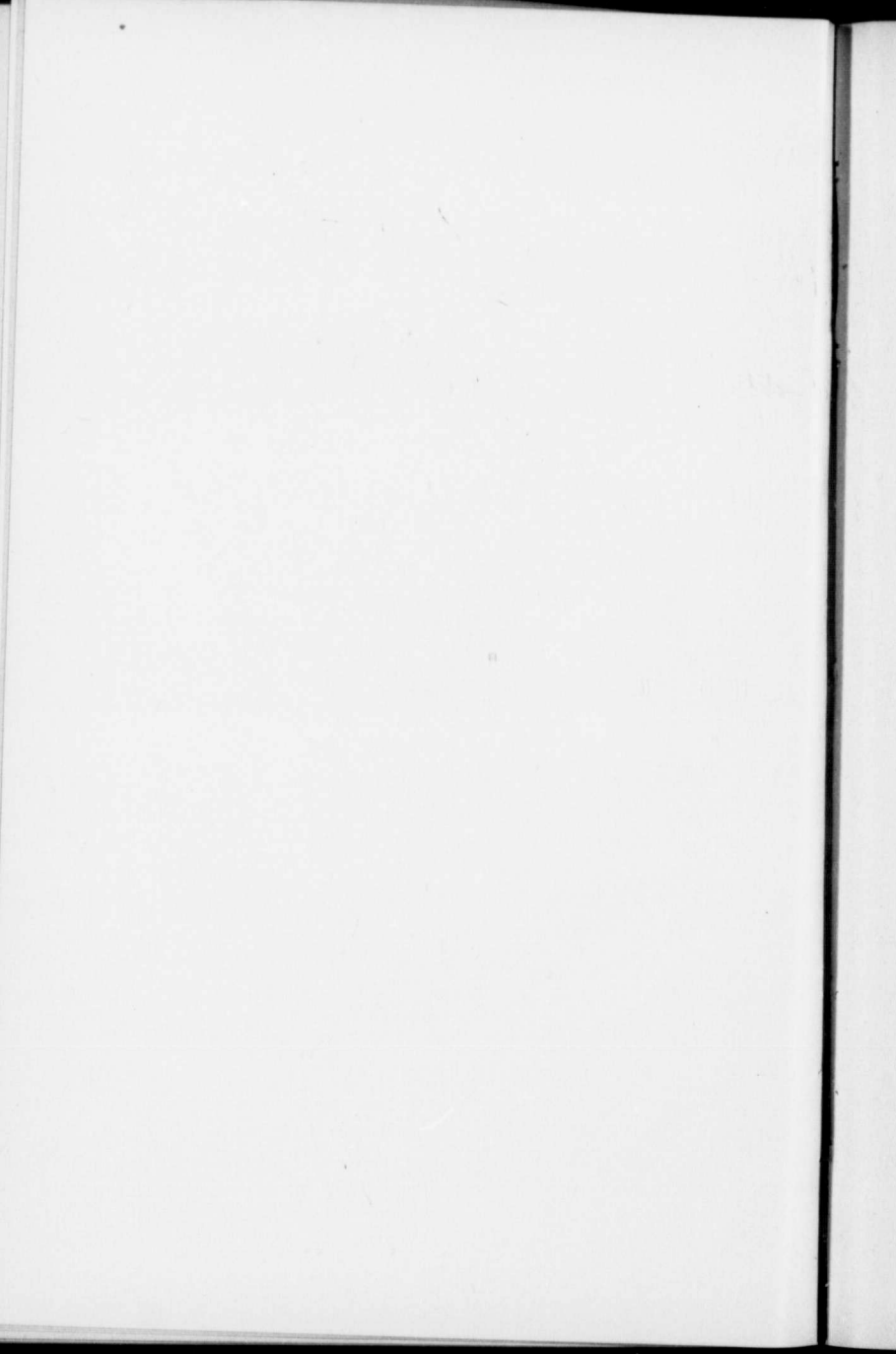


PLATE XXXIX.

BARRANDEOCERAS NATATOR (page 308).

- Figure 1. Side view of the type and only known specimen of this species, which is little more than an imperfect cast of the interior of the shell, from the Chazy limestone at the Mingan Islands.
- " 1 a. Part of the other side of the same specimen, with the test preserved, and shewing the surface markings.
- " 1 b. Outline of a transverse section of part of the same specimen, shewing the lateral compression, and the position of the siphuncle; V being the venter.



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1a



1b



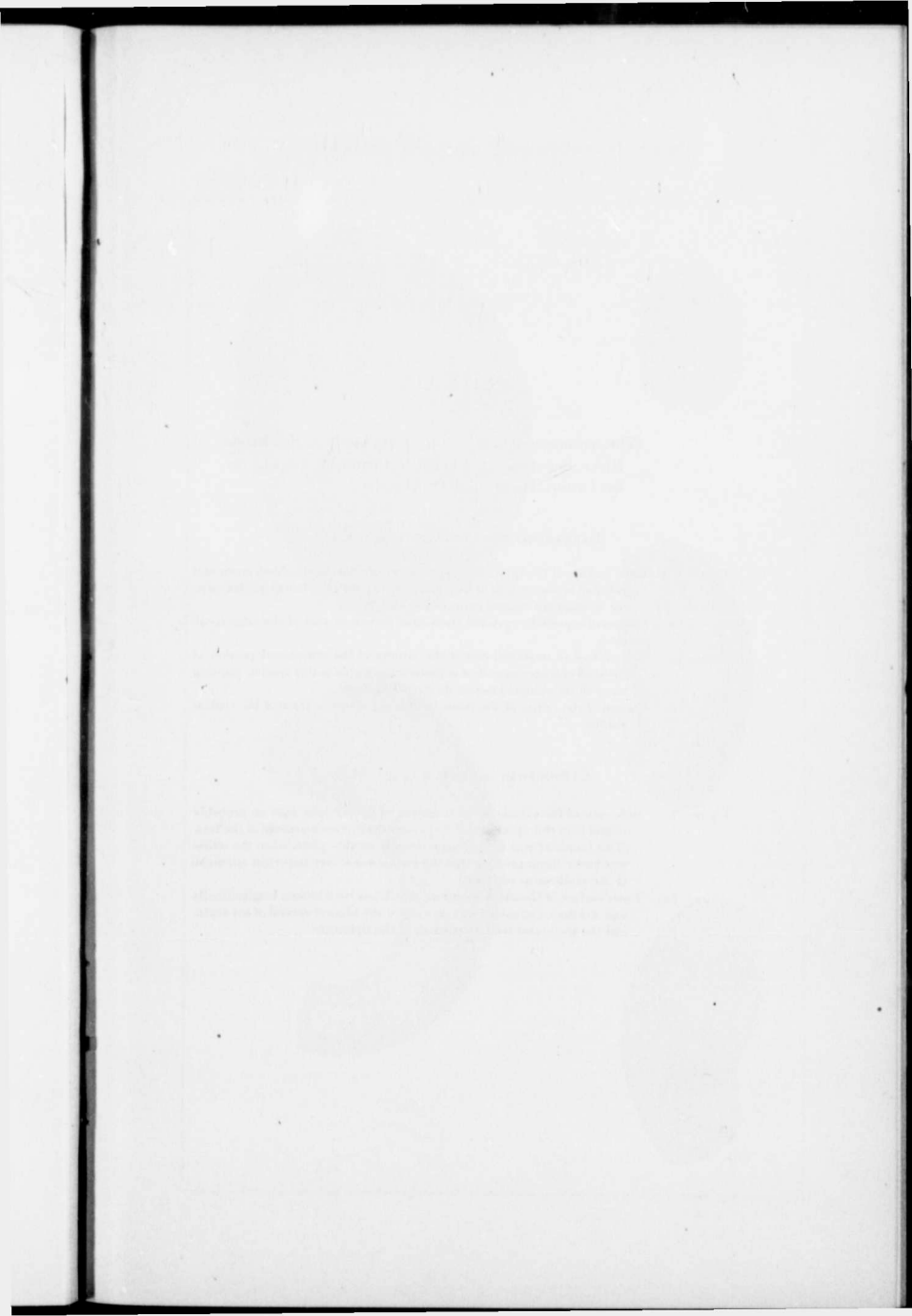


PLATE XL.

(The specimens figured on this plate are from the Black River limestone at La Petite Chaudiere Rapids, on the Ottawa River, near Ottawa city.)

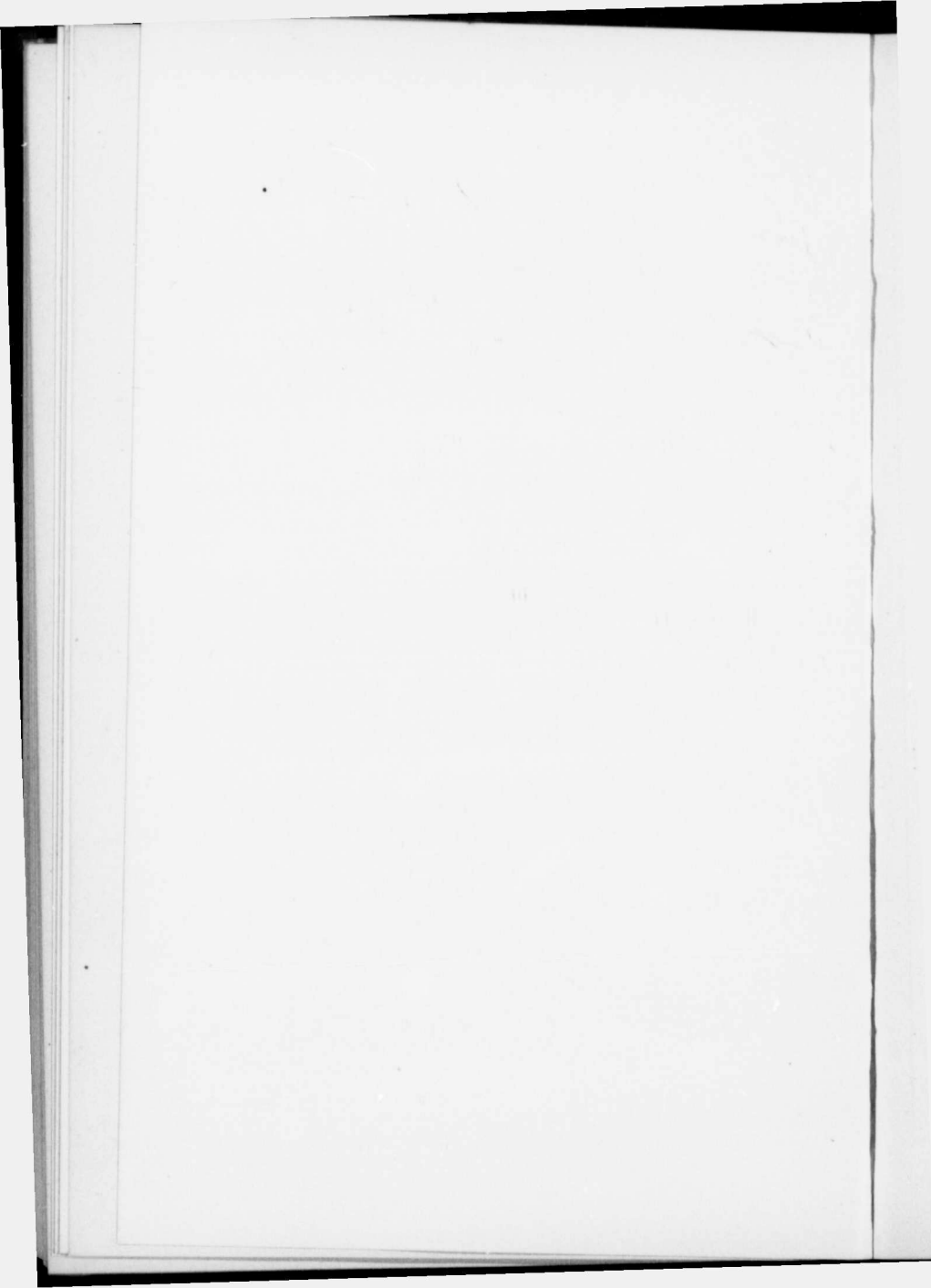
BARRANDEOCERAS VAGRANS (page 311).

- Figure 1. Inner surface of the type of this species, which has been rubbed down and polished in such a way as to exhibit an "artificial polished section passing through the central plane of the whorls."
" 1 a. Outline of a partially restored transverse section of part of the same specimen.
- Figure 2. Side view of an imperfect cast of the interior of the chambered portion of the shell of a specimen that is probably referable to this species, shewing many of the sutural lines on its convex surface.
" 2 a. Portion of the venter of the same, in outline, shewing three of the ventral saddles.

CYRTOCERAS SINUATUM (page 312).

- Figure 3. Side view of the exterior of a fragment of a specimen that is probably referable to this species, and that shews the surface markings of the test. (This fragment was figured inadvertently on this plate, when the writer was under the impression that the former was a very imperfect specimen of *Barrandoceras vagrans*.)
" 3 a. Inner surface of the same fragment, which has been broken longitudinally and weathered in such a way as to shew the edges of several of the septa, and the shape and relative position of the siphuncle.





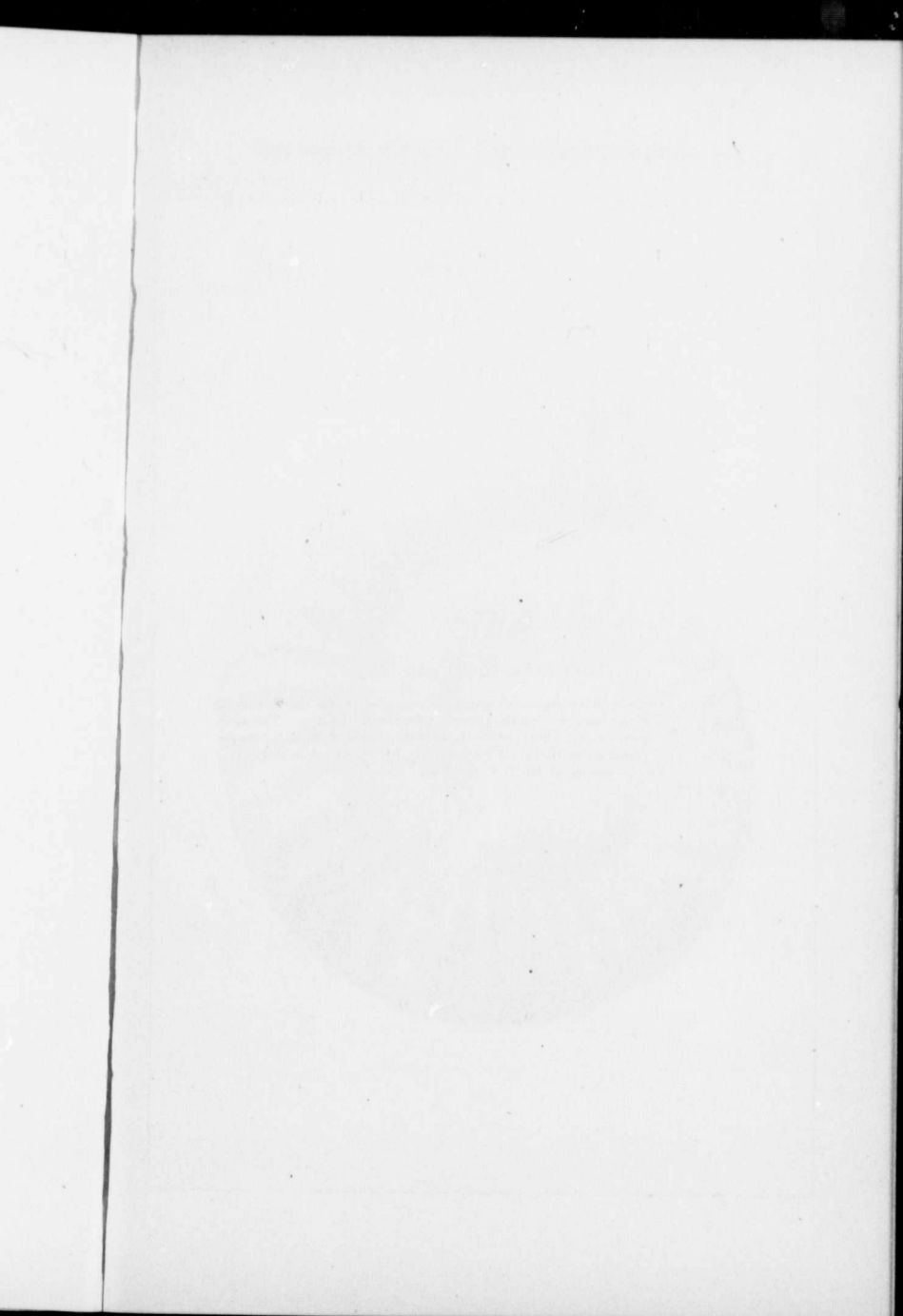


PLATE XLI.

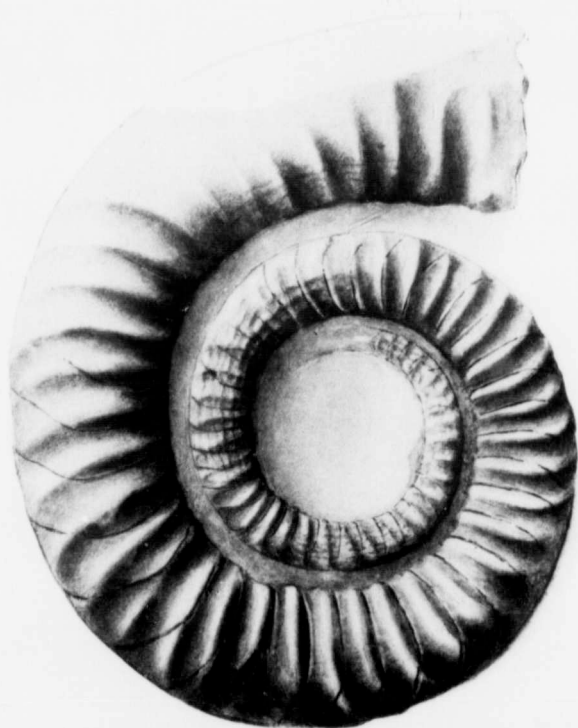
TROCHOCERAS INSIGNE (page 282).

Side view of the largest and most perfect specimen of this species that the writer has seen, from the quarries at Stonewall, Manitoba. This specimen, which is a well-preserved cast of the interior of the shell, was presented to the Museum of the Survey by Mr. John Gunn in 1897.
From a drawing by Mr. F. E. Calderon.

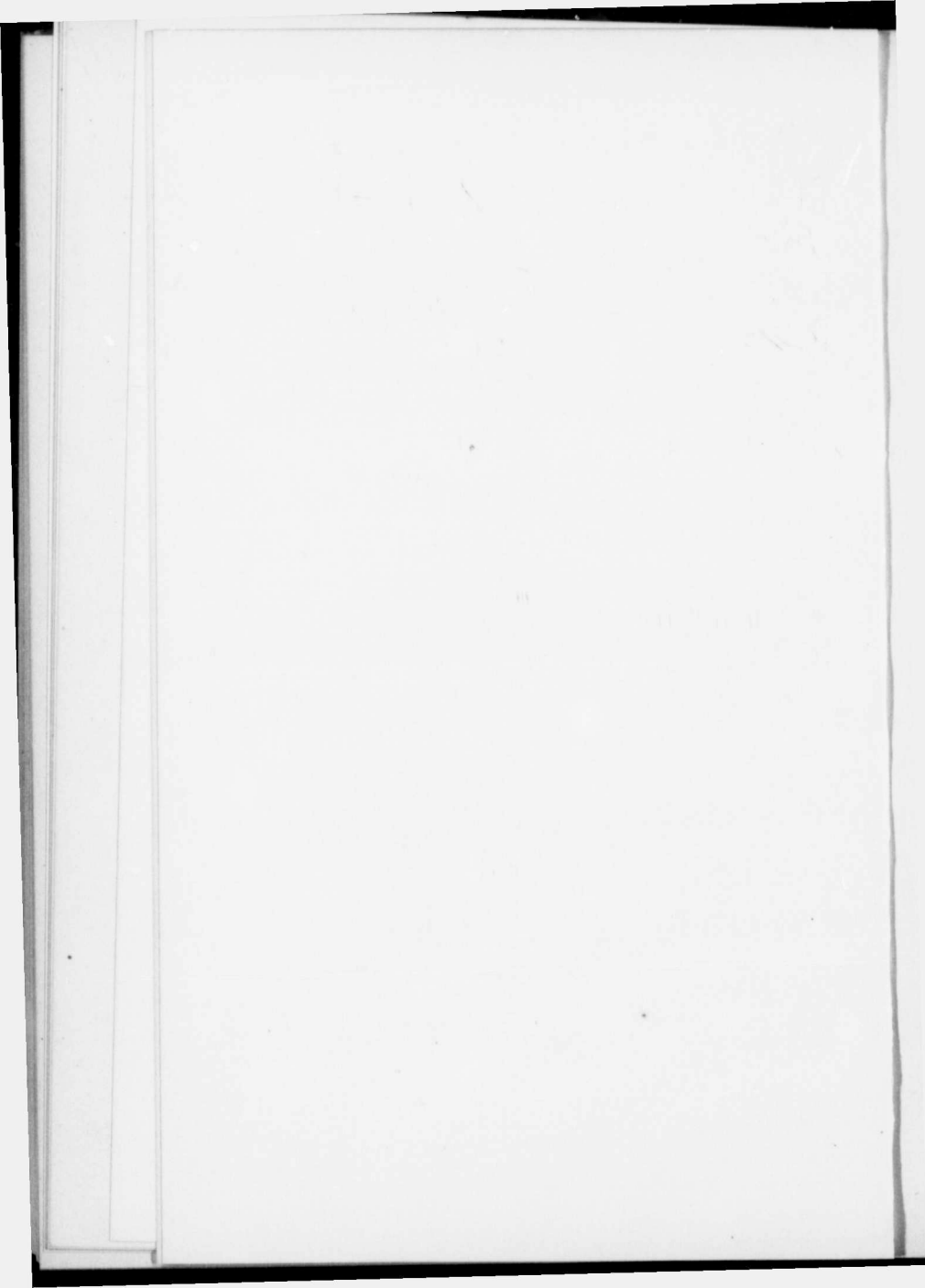
Geological Survey Department, Canada.

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PLATE XII.



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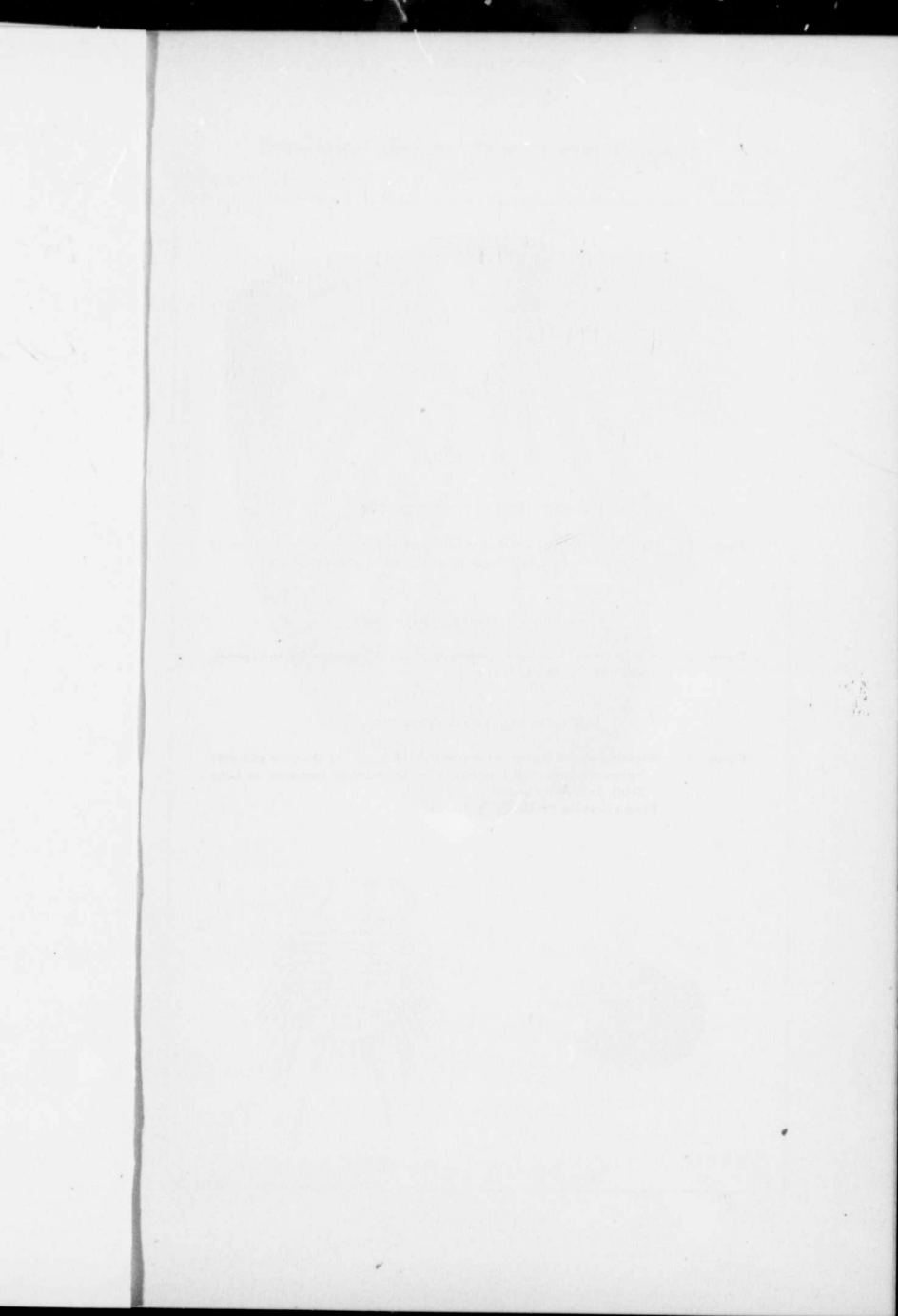


PLATE XLII.

BRONTEUS EKWANENSIS (page 266).

- Figure 1. Exterior of the dorsal surface of an imperfect pygidium of a specimen of this species, from the Ekwon River limestone, slightly restored.

BRONTEUS AQUILONARIS (page 267).

- Figure 2. Similar view of a nearly perfect pygidium of a specimen of this species, also from the Ekwon River.

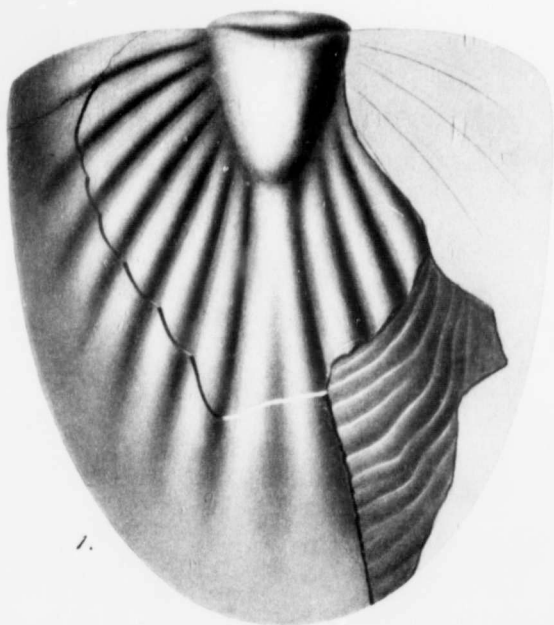
ACIDASPIS PERARMATA (page 289).

- Figure 3. Slightly restored outline of the entire dorsal surface of the type and only known specimen of this species, from the Silurian limestone at Long Point, Lake Winnipegosis.
From a drawing by Mr. L. M. Lambe.

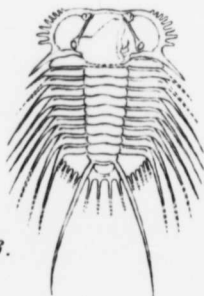
Geological Survey Department, Canada.

PALEOZOIC FOSSILS, VOL. 3.

PLATE XLII



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