

GEOLOGICAL AND NATURAL HISTORY SURVEY OF CANADA.

ALFRED R. C. SELWYN, LL.D., F.R.S., DIRECTOR.

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# PALÆOZOIC FOSSILS.

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VOL. III., PART I.

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BY

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

PALÆONTOLOGIST AND ZOOLOGIST, G. & N. H. S. C.

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Montreal:

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MARCH, 1884.

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The late Mr. E. Billings left no manuscript for Part II. of the second volume of "Palæozoic Fossils." It is therefore thought desirable to complete that volume as soon as practicable by a reprint of such of Mr. Billings' palæontological writings as are either entirely out of print, or were never issued by the Geological Survey.

The present publication, prepared by Mr. J. F. Whiteaves, forms the first part of a third volume. It is descriptive of fossils from the Guelph formation of Ontario, and is illustrated by eight lithographic plates and a few wood-cuts.

ALFRED R. C. SELWYN,  
*Director Geol. & Nat. Hist. Survey.*

GEOLOGICAL AND NATURAL HISTORY SURVEY OFFICE,  
Ottawa, February 25th, 1884.



## PALÆOZOIC FOSSILS.

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VOL. III.

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1. *On some new, imperfectly characterized or previously unrecorded species of fossils from the Guelph Formation of Ontario.*

The "Guelph Formation" is a purely local name which was originally suggested by Mr. Robert Bell in 1861 and first publicly adopted in the "Geology of Canada," published two years afterwards, as a designation for a series of highly fossiliferous dolomites which occupy a position between the Niagara and Onondaga Formations of the Silurian System as now restricted. The geographical distribution and lithological peculiarities of these dolomites are fully described in the concluding portion of the twelfth chapter of the volume cited, which also contains several lists of the fossils of the formation. The rocks in question are believed to form a "great lenticular mass" which extends in a north-westerly direction from the Niagara River to the Grand Manitoulin Island, and which attains its maximum development in Canada, both in thickness and geographical extent, in the central portion of the western peninsula of Ontario. In the United States the Guelph Formation has been recognized in Ohio and Wisconsin, and on the Atlantic coast of Canada its nearest equivalents would seem to be the limestones of L'Anse à la Barbe and L'Anse à la Vieille on the north side of the Baie des Chaleurs, and the sandstones of Back Bay, New Brunswick.

The lists of the fossils of this formation in the "Geology of Canada" contain, among others, the names of ten manuscript species, of which no descriptions or figures have ever been published, and which consequently it has been impossible to recognize. These are as follows :

Columnaria Galtensis.	Cyclonema Psyche.
Diphyphyllum irregulare.	" depressa.
Amplexus laxatus.	Pleurotomaria Huronensis.
Cyclonema Galtensis.	Murchisonia Tullia.
" Thysbe.	Cyrtoceras Jonesi.

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## ALCYONARIA.

## HELIOLITES INTERSTINCTUS, Linn.

Hespeler, T. C. Weston, 1867: a single specimen, identified by E. Billings.

## ZOANTHARIA TABULATA.

## HALYSITES COMPACTUS, Rominger.

Galt, Rev. Andrew Bell, 1846-50: Elora, R. Bell, 1861, and Mr. David Boyle, 1880: Hespeler, T. C. Weston, 1867.

Two average Canadian specimens of this species have been forwarded to Dr. Rominger, who has kindly examined them and confirms the correctness of their identification.

## ZOANTHARIA RUGOSA.

## CYSTOSTYLUS INFUNDIBULUS, Whitfield.

*Syringopora infundibula*, Whitfield. Ann. Rep. Geol. Surv. Wiscons. 1877, p. 79.  
*Cystostylus infundibulus*, Whitfield, Geol. of Wiscons. 1882, Vol. iv, p. 274, pl. 14, fig. 7.

New Hope, E. Billings, 1857: Elora, Mr. David Boyle: Durham, Mr. Joseph Townsend, 1883.

## PYCNOSTYLUS. (Gen. Nov.)

Internal structure very similar to that of *Amplexus*, the radiating septa being rudimentary and extending but a short distance from the inner surface of the outer wall, but the tabulæ, though well developed and complete, are entirely horizontal and neither bend upwards at the periphery nor "embrace each other with their reflexed margins."\*

Corallum compound, consisting apparently of an aggregation of numerous, slender, cylindrical or subcylindrical polyp stems, which divide by calicular gemmation at distant intervals into sets of three, four or more, ascending, sub-parallel, contiguous, flexuous branches. Structure of the calices previous to gemmation, and characters of the basal portion of the corallum unknown.

The above named genus is constituted for the reception of two spe-

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\* Min. Conch., vol. 1, p. 165.

cies of coral, one of which has already been partially described by Dr. H. A. Nicholson, on pages 66 and 67 of his report on the Palæontology of Ontario for 1875, as follows:

"The Guelph Limestones contain in abundance a species of coral, which I am unable to refer with certainty to its proper genus. Some specimens have the form of detached cylindrical tubes, irregular in their thickness, but varying in diameter from a line and a half to three lines. These tubes are flexuous, and furnished both with very well developed tabulæ, and with marginal septa in the form of strong longitudinal ridges. Examples of this kind present precisely the characters of the genus *Amplexus*, and I have been under the impression that they were referable to *Amplexus laxatus*, of Billings, a form which is quoted in the "Geology of Canada," as occurring in the Guelph Limestones, but the description of which I have been unable to consult."

"Other specimens, equally or more abundant, consist of numerous closely approximated tubes, similar in their structure to the above, and apparently forming part of a composite mass. This would lead one to separate these specimens from *Amplexus*, which contains only simple forms; but one would still be left uncertain where to place them. The genus to which such specimens are referable by their general form and mode of growth is *Diphyphyllum*; but they differ from this genus and agree with *Amplexus*, in the presence of complete tabulæ, (not a mere central tabulate area), and in the rudimentary condition of the septa. The same form occurs in the Corniferous Limestone, but I must at present leave its position unsettled."

PYCNOSTYLUS GUELPHENSIS. (N. Sp.)

Plate 1, figs. 1, 1a & 1b.

? *Amplexus laxatus*, Billings. 1863. "Geology of Canada," pages 340 & 342, but with no description nor figures.

*Amplexus* (?) sp. Nicholson. 1875. Palæontology of Ontario, p. 66.

Corallites long and slender, averaging from three to seven millimetres in diameter, and dividing uniformly at the same point into either three or four branches. Epitheca marked by transverse constrictions and re-elevations at irregular distances, but not longitudinally ribbed. Primary septa alternating with smaller secondary ones.

New Hope, E. Billings, 1857: Guelph, R. Bell, 1861: Hespeler, T. C. Weston, 1867: Elora, Mr. D. Boyle, 1880: Durham, Mr. J. Townsend.

A common and characteristic fossil of the Guelph Formation, to

which two manuscript names, unaccompanied by any description or figure, have been applied at different times by Mr. E. Billings. In the Museum of the Survey the species is labelled *Amplexus congregatus*, Billings, by that naturalist himself, the label being not written but printed. The same coral is called *Amplexus laxatus* in the latter part of the twelfth chapter of the "Geology of Canada." As both of these specific names would be singularly inappropriate for this coral as now understood, it is not thought desirable to perpetuate either.

Natural transverse sections of this species, (as in the original of fig. 1b, on plate 1) shew a quadripartite, and more rarely a tripartite division of the corallites. This appearance might be supposed to be the result of fission, rather than of calicular gemmation, but is really due to the coalescence of the inner walls of the corallites immediately after budding,—as in the case of the genus *Diphyphyllum*.

#### PYCNOSTYLUS ELEGANS. (N. Sp.)

Plate 1, figs. 2 & 2a.

Corallites attaining to a diameter of from thirteen to seventeen millimetres: increasing by calicular gemmation in such a manner as to divide into six or seven branches on the same plane: external surface regularly and longitudinally ribbed, the ribs alternating with the septa within: all the septa of uniform height and size.

Hespeler, T. C. Weston, 1867: Durham, Mr. J. Townsend.

The only specimen of this coral in which calicular gemmation is plainly visible is presented by figure 2 on plate 1. Part of this specimen is covered with rock, but on the exposed surface five buds are visible, one of which is an inch and a quarter long, while the other four are broken off at their bases. Judging by the diameter of the buds in proportion to that of the calyx from which they spring, it is probable that the entire cycle would consist of either seven or eight.

It is possible that the specimens for which the above name is provisionally suggested may prove to be portions of the basal extremity of *P. Guelphensis* denuded of their epitheca, but at present no intermediate examples between the two forms have been collected.

#### BRACHIOPODA.

SPIRIFERA PLICATELLA, Sowerby.

Durham, Mr. J. Townsend: three single valves.



ATRYPA RETICULARIS, Linn.

Hespeler, T. C. Weston, 1871: two specimens of the ordinary form and one small valve with few and distant nodulous ribs, resembling the variety figured by Davidson in the "Silurian Brachiopoda" (Pl. xiv., fig. 22,) as "approaching in character *A. aspera*."

MONOMERELLA OVATA. (N. Sp.)

Plate 2, fig. 1, & plate 8, figs. 1, 1a, 1b, & 1c.

Shell inequivalve, the ventral valve being much larger than the dorsal: outline ovate as viewed laterally, the greatest breadth being a little in advance of the middle: valves regularly convex or with a faint mesial impression on each: maximum thickness through the closed valves in some specimens equal to, and in others slightly exceeding their greatest breadth. Umbo of the ventral valve tumid, gibbous and prominently arched, its beak being curved strongly and abruptly inwards and down to the centre of the posterior margin of the hinge plate: umbo of the dorsal valve smaller than that of the ventral and not nearly so prominent nor so much curved. Surface marked by rather coarse, irregular and concentric lines of growth. Test very thick posteriorly, but gradually becoming much thinner towards the anterior margin.

Characters of the interior of the dorsal valve unknown. So far as they can be ascertained at present, the markings on the interior of the ventral valve are as follows: The outline of the hinge plate or cardinal area is crescentic or semi-circular, its posterior margin being broadly and convexly rounded and its anterior border correspondingly concave. The hinge itself is very broad, flat, and closely as well as concentrically striated. In some specimens, the breadth of the hinge area in the centre, and as measured from back to front, exceeds half an inch. The deltidium and deltidial slopes are obscurely indicated by a faint depression in the centre of the cardinal area, and by equally faint divaricating, impressed lines.

The cardinal facet is narrower than the hinge plate: the outer margin of the cardinal facet is concavely and rather deeply emarginated on both sides of the cardinal buttress: the exposed portion of the cardinal buttress extends from the centre of the front margin of the cardinal facet nearly as far as the inner margin of the anterior boundary of the platform, as a narrow and acutely pointed septum, whose altitude, as well as breadth diminishes rapidly towards the front: the platform, which is not vaulted, is feebly developed, obscurely defined and scarcely

raised above the lowest level of the valve posteriorly, and is bounded anteriorly by a moderately prominent, transverse, rounded ridge, which is curved shallowly towards the front margin, in the middle, or bent towards the front at a very obtuse and rounded angle. The muscular impressions are not distinguishable.

Length of the most perfect specimen along the median line, fifty-eight millimetres: maximum breadth, forty-three mm.: greatest thickness through the closed valves, forty-five mm.

Durham, Mr. J. Townsend: one perfect specimen, with the valves slightly displaced, and four detached ventral valves. Two of these separated valves have the interior completely filled with the matrix, and the others are so much worn or eroded inside that some of the characters of the interior of the ventral valve cannot be satisfactorily ascertained.

In all the previously described species of *Monomerella* the ventral valve is more or less flattened, its umbo and beak are erect, and its hinge area is distinctly triangular. The ventral valve of the present species, on the contrary, is remarkably tumid and inflated, its umbo is prominently arched, its beak incurved, and its cardinal area crescentic in outline. When its valves are closed *M. ovata* looks not at all unlike a *Pentamerus* of the type of *P. oblongus* or a large *Meristella* but the internal character of its ventral or pedicle valve seem to show that it is a true *Monomerella*.

#### MONOMERELLA OVATA, var. LATA.

Plate 2, figs. 2 & 2a; & plate 8, figs. 2 & 2a.

Ventral valve (the only one known at present) moderately convex, with or without a mesial depression: outline sub-circular: length and breadth about equal: umbo somewhat prominent, beak slightly incurved: surface concentrically striated: test thick.

Hinge area concavely arched in front, obscurely sub-angular in the centre behind: umbo double chambered: umbonal cavities wide and deep: lateral muscular scars of the platform rather large, rhombic ovate, longitudinally striated, and converging anteriorly but without meeting. Other characters as in the type of the species.

Durham, Mr. J. Townsend: two ventral valves with the test preserved, and a well preserved natural cast of the same valve.

The best specimens of all the species of Trimerellidæ which are described in the present paper have been sent for examination to Thomas Davidson, Esq., F.R.S., to whom the writer is indebted for valuable

suggestions in regard to their generic and specific affinities. From their nearly circular form and from other peculiarities, the writer had supposed that the three valves just described might possibly belong to a large form of *Monomerella orbicularis*, Billings, but Mr. Davidson is inclined to think that they should be regarded rather as a variety of *M. ovata*, a conclusion which has therefore been adopted here. Mr. Davidson is also of opinion that the internal markings of the present shell are more like those of *M. prisca*, Billings, than they are like those of *M. orbicularis*.

*RHYNOBOLUS GALTENSIS*. (Billings, Sp.)

Plate 2, fig. 1a, and plate 8, figs. 3 & 3a.

- Obolus Galtensis*, Billings.....1862, Pal. Foss., Vol I., p. 168, fig. 151.  
*Trimerella minor*, Dall.....1871, Am. Jour. Conch., Vol. VII., p. 83.  
*Rhynobolus galtensis*, Hall, .....March, 1871, (Teste Davidson). "Rep. on the State Cab. of Nat. Hist. preparations of Pal. New York."  
*Obolellina Galtensis*, Billings.....Dec. 1871, (Teste Davidson). Can. Nat., Vol. VI., N. S., p. 222. Also April, 1872.  
*Dinobolus galtensis*, Davidson & King.....1872, Rep. Meeting Brit. Ass.  
*Trimerella* [?] *galtensis*, Davidson & King..1874, Q. J. G. S., Vol. XXX., p. 151, Plate 18, fig. 13 & plate 19, figs. 4 and 4a.

This species, which as the above synonymy shews, has been placed in five different genera, has previously been described almost exclusively from casts of the interior of the shell.

Three ventral valves with the whole of the test preserved, and one dorsal valve of a *Rhynobolus* which is probably referable to *R. Galtensis* have recently been collected at Hespeler and Durham. Two of these ventral valves have their interiors completely filled with rock and the third has only the hinge area exposed, on the inner side; but the inside of the dorsal valve is fortunately empty.

The characters exhibited by these four specimens may be thus expressed: The shell is compressed convex and nearly lenticular in transverse section when the valves are closed: its outline as viewed laterally is ovate, the length is always greater than the breadth, and the maximum breadth is usually (but not invariably) a little in advance of the mid-length. The outer surface of both valves is marked by concentric and somewhat imbricating striæ of growth and the test is not very thick.

The ventral or pedicle valve has an almost erect but somewhat

obtusely pointed umbo, whose lateral margins are obliquely convex: its beak is small and very slightly incurved, and its hinge area is broad, as measured from its anterior to its posterior margin, and shallowly crescentic.

The dorsal or brachial valve is about as convex as the ventral, but its cardinal area is comparatively narrow from back to front: the crown of the crescent is regularly arched and parallel with the front margin of the cardinal area, and on each side the crescent terminates in a small subpyriform scar. The platform is scarcely raised above the lowest level of the valve posteriorly, and is bounded at the sides and in front by a V-shaped raised ridge, whose pointed base is directed forwards. The middle muscular scars of the platform are broadly rounded on their inner margins, which latter nearly touch each other in the centre. On their outer margins the middle scars are bounded by the posterior half of the V-shaped ridge which has already been described as forming the lateral and anterior boundary of the platform itself. The anterior muscular scars occupy or are placed upon a small sub-rhomboidal or somewhat lozenge-shaped area on the platform in front of the middle.

As compared with Messrs. Davidson's & King's figure of the pedicle valve of the "*Trimerella* (?) *Galtensis*" of their paper,\* the umbones and beaks of the ventral valves described above are not so much pointed nor so flatly conical in their lateral outline, and their cardinal areas are crescentic rather than triangular.

The markings on the interior of the dorsal valve from Durham described above are essentially the same as those on the mould of the brachial valve of the *Trimerella Galtensis* of Messrs. Davidson's & King's paper, though in the Durham specimen the crown of the crescent seems to be regularly rounded in the middle and not pointed.

The generic name *Rhynobolus* (Hall, 1871,) as applied to the present species, is adopted here in accordance with a suggestion to that effect recently made to the writer by Mr. Davidson. In a letter received in November, 1883, Mr. Davidson says:—"Although with much uncertainty this shell was placed by Prof. King and myself in the genus *Trimerella*, it is not a true *Trimerella* and should be removed from that genus. It is more closely allied to *Monomerella*, and perhaps it would be better to retain Prof. Hall's generic name of *Rhynobolus* for its reception."

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\* On the Trimerellidæ. Quart. Journ. Geol. Soc. Lond. Vol. XXX, pl. 18, fig. 13.

## LAMELLIBRANCHIATA.

GONIOPHORA CRASSA. (N. Sp.)

Plate 2, figs. 3, 3a, 3b, &amp; 3c.

Shell mytiloid or nearly semi-ovate in lateral outline, transversely elongated, length about twice the maximum height, narrow in front and widening behind, highest a little behind the middle. Valves obliquely sub-carinated or strongly angulated along their centre, the angulation extending in a curved line from the beaks to the posterior end of the base,—very convex and obliquely compressed both above and below the median angle, so that the outline of a transverse section through both when closed would be distinctly rhomboidal. Thickness through the valves, as measured on the median angle, somewhat exceeding their maximum height. Dorsal margin ascending gradually in nearly a straight line from the anterior terminal beaks to the upper portion of the commencement of the posterior end: posterior margin broadly and obliquely rounded or obliquely subtruncated, descending rather abruptly and forming a somewhat angular junction with the basal line below, but rounding evenly to the dorsal margin above. Ventral (or basal) margin nearly straight or slightly concave from the posterior end to a little in advance of the middle, then narrowing rather gradually upwards towards the beaks: umbones narrow, curved, carinated, overhanging the anterior end and extending downwards to the basal margin: beaks hooked, curved inwards and downwards, and margined beneath by a distinct groove.

Surface marked with numerous, closely disposed, fine raised striæ of growth, also by a few distant and much coarser concentric sulcations. Test very thick, especially in the umbonal region.

Anterior muscular impression subcircular and deeply excavated: posterior muscular impression more elongated, not excavated, obscurely defined, except above, where it is margined by a narrow and slightly raised ridge. Hinge of the left valve apparently furnished with a longitudinally elongated, raised tooth-like process, which runs nearly parallel to the upper margin of the anterior adductor impression, (which it partly bounds above), and nearly parallel also to the upper and outer edge of the hinge line, from which latter it is separated by a deep groove, which widens gradually behind.

Umbonal cavity (in one specimen at least) strongly concamerated, its cavity being divided off into a number of (at least eight or nine) exceedingly narrow chambers, by thin, successive and concentric laminae of shell.

Length of the largest specimen known, sixty millimetres; maximum height of the same, thirty mm.

Durham, J. Townsend: five fine specimens with the test preserved. Two casts of a shell which probably belong to this species were collected at Hespeler by T. C. Weston in 1867.

MEGALOMUS COMPRESSUS. (Nicholson & Hinde.)

*Megalomus compressus*, Nicholson & Hinde. Report on the Palæontology of Ontario, 1875; pp. 68, 69.

The above species or varietal form was described and figured from mere casts, but Mr. J. Townsend has recently collected fine specimens of it at Durham, with most and in some cases the whole of the shell beautifully preserved. The test of *M. compressus* is rather thick (about five millimetres in thickness on the umbones) especially in the umbonal region, and its outer surface is concentrically striated.

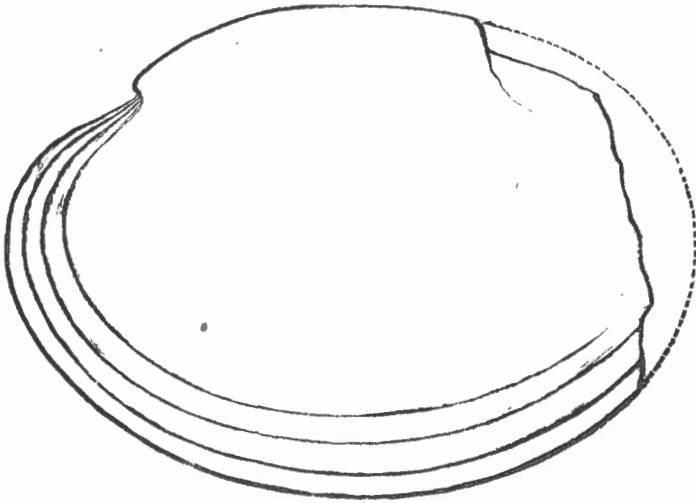


Fig. 1. *Megalomus compressus*, Nicholson & Hinde. Outline of left valve of a typical but possibly extreme variety, with most of the test preserved.

The character most relied upon as a means of distinguishing *M. compressus* from *M. Canadensis* is the lateral compression of the valves of the former. In *M. compressus* the thickness through the closed valves is stated to be "more than one third of their maximum height," whereas in *M. Canadensis* the convexity of the shell is about equal to its great-

est height. Moreover, in what appears to be a typical, though possibly an extreme form of *M. compressus*, with the test preserved; (an outline of which is represented in wood-cut, fig. 1) the umbo is compressed and comparatively narrow, the beak is curved very slightly downwards, there is no lunule, and the anterior end projects beyond the beaks as a broadly rounded lobe. Fig. 1e, on Plate lxii of the second volume of the Palæontology of New York, which is described by Prof. Hall as "a cast of a specimen" of *M. Canadensis* "somewhat distorted by pressure which has projected the lower anterior end somewhat beyond the beaks above," represents perfectly a normal and undistorted cast of this form of *M. compressus*.

In the most typical form of the true *M. Canadensis*, when the shell is preserved, the exceedingly broad and tumid umbones are anterior, terminal, and overhang the abrupt downward and backward slope of the lower part of the anterior end. The beaks, too, which in consequence of the enormous breadth of the umbones, are placed two-thirds of the way from the dorsal margin to the base, are recurved and strongly hooked, and under them there is a rather deeply excavated heart-shaped lunule whose width is greater than its height.

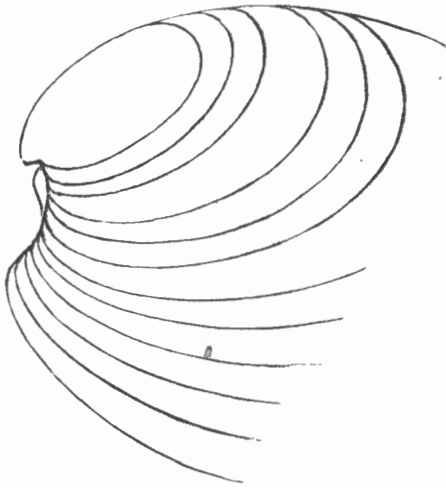


Fig. 2. Anterior end of left valve of a specimen of a *Megalomus* which is intermediate in character between *M. compressus* and *M. Canadensis*.

But between these two extremes there occur almost every intermediate gradation, both in the amount of convexity as compared with the height and in the outline of the shell, especially at the anterior end.



Thus, in some much compressed specimens which on that account would be referred to *M. compressus*, the umbones are terminal and overhang the anterior end, and there is a somewhat deeply excavated lunule, as in the typical *M. Canadensis*. The anterior half of a left valve of a *Megalomus* from Durham represented in the wood-cut, fig. 2, on the preceding page, belongs to a specimen which is almost exactly intermediate in its characters between *M. compressus* and *M. Canadensis*.

Connecting links between the two forms are so frequently found as to suggest the conclusion that *M. compressus* is only a variety of *M. Canadensis*, a view which is identical with that expressed in 1852 by Prof. Hall, who after examining a large number of examples of *Megalomus*, states that he is "unable to find any characters indicating more than a single species."

According to Dr. R. Bell, the first discoverer of this curious genus was his father, the Rev. Andrew Bell, then of Dundas, who sent specimens of the typical species to Prof. Hall in 1847 or 1848.

#### ANODONTOPSIS CONCINNA. (N. Sp.)

Plate 2, fig. 4, and plate 7, figs. 4 & 4a.

Small compressed—convex, about one-third longer than high, very inequilateral, outline subtrapezoidal: anterior end short, rounded and rather narrow, posterior end larger and wider, its upper and lower margins being nearly parallel, and its extremity somewhat obliquely truncated: dorsal margin straight and almost parallel behind, sloping rapidly and obliquely downwards in front: ventral margin nearly straight but slightly convex in the middle, rounding upwards very abruptly at the anterior end, and ascending to a much less height and in a very gentle curve to its subangular junction with the basal margin of the posterior extremity. Umbones broad and angulated behind, beaks small, not prominent, directed forwards and situated about half way between the centre of the shell and the outer boundary of the anterior end. Posterior area not distinctly defined, consisting of a very oblique, concave inflection of the valves bounded by a faint angulation which extends from the beaks towards the posterior end of the base, but which becomes nearly obsolete in the lower half of the shell.

Surface markings and hinge dentition unknown.

Length of the largest specimen collected, twenty-five millimetres: maximum height of the same, seventeen mm.

Galt, T. C. Weston, 1867: a cast of a right valve. Durham, Mr. J. Townsend: a perfect cast of both valves, which, however, are both

open and slightly displaced in the specimen, so that it is impossible to measure the exact convexity through the closed valves.

This specimen is very similar in shape to the *Anodontopsis angustifrons* of McCoy,\* from the Upper Ludlow rocks of Westmoreland, but its anterior margin is not so narrowly rounded and its dorsal margin is not arched posteriorly.

Genus ILIONIA, Billings.† 1875.

Canadian Naturalist, 2nd Series, Vol. viii., p. 301.

"The above generic name is proposed for such forms as *Tellina prisca* (Hisinger), *Anatina sinuata* (Hall), and the species herein described. All the specimens I have seen are internal casts, and the characters of the hinge line, therefore, cannot be given. The form is irregularly ovate, compressed or sub-lenticular; one extremity larger than the other; beaks turned towards the larger end, which is, therefore, supposed to be anterior. In all the species a concave depression commences on the umbones and extends downwards to the posterior ventral margin. A large sub-ovate muscular impression in the upper half of the posterior extremity." Billings.

ILIONIA CANADENSIS, Billings.

*Ilionia Canadensis*, Billings. 1875. Can. Nat., N. Ser., Vol. viii. p. 301.

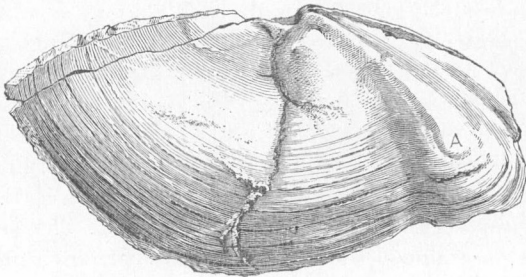


Fig. 3. "Left side of a cast of the interior of *I. Canadensis*."

\* British Palaeozoic Fossils in the Cambridge Museum. 1855. P. 271, pl. 1k, 14 and 15.

† As the original definition of this genus and of the typical species may not be readily accessible to the reader, they are reprinted here, with the figures which accompanied them.

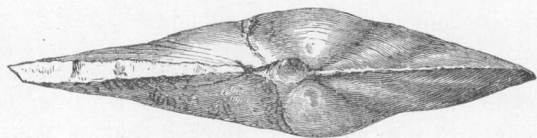


Fig. 4. "Dorsal view of the same."

Shell "transversely irregularly ovate; compressed, sub-lenticular; length about twice the greatest height; umbones situated a little behind the mid-length; ventral margin with a concave notch at about the posterior fourth of the whole length. In front of this notch the margin is uniformly convex, gradually sloping upwards nearly (if not quite) to the hinge line. The dorsal margin is not perfect in the specimen figured, but judging from the direction of the striae on the surface of the cast, it is nearly straight, or at the most only slightly convex in front of the beaks, and nearly parallel with the length of the shell, sloping slightly downwards. Behind the beaks it is gently convex, nearly straight, and slopes downwards to the narrowly rounded angle, the latter situated at about one-third the height of the shell. The margin of the beaks is compressed. Close under the beaks, in front, there appears to have been a short escutcheon.\* "From the umbones backwards for about six lines, a linear groove runs along close to the dorsal edge on each side. This may be related to the ligament.

The most projecting point of the anterior extremity appears to be situated considerably above the mid-height of the shell, near the hinge line. The posterior angle is below the mid-height.

Surface concentrically striated.

Length, three inches; greatest height a little in front of the mid-length, eighteen lines; greatest depth of both valves, just below the umbones, eight lines.

The specimen was collected by Sir W. E. Logan in the Upper Silurian rocks at Port Daniel on the Bay of Chaleurs." E. Billings.

Five badly preserved casts collected by Mr. T. C. Weston in 1867 from the Guelph limestones at Hespeler, have been identified with this species by Mr. E. Billings. A single specimen from Elora which is also referable to *I. Canadensis*, has been forwarded to the writer by Mr. David Boyle.

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\* The word "escutcheon" appears to be here used inadvertently instead of lunule. J. F. W.

## ILIONIA GALTENSIS. (N. Sp.)

Plate 3, figs. 1. 1a &amp; 1b.

Shell compressed, sinuated, most convex in the direction of a line which might be drawn from the beaks to the centre of the ventral margin, behind which faint prominence there is a broad, shallow depression, bounded posteriorly by an oblique and somewhat curved keel or narrow ridge, which extends from the beaks to the posterior end of the ventral margin, and marks out a laterally compressed posterior area. Length about one third (or less than one third) greater than the height; anterior end broader than the posterior, rounded and somewhat expanded at its upper and lower margins: posterior end narrowing above and below, and truncated almost vertically but somewhat concavely at its extremity. Dorsal margin nearly straight or slightly convex, and sloping very gently downwards behind the beaks, concave and somewhat ascending in front of them: ventral margin convex anteriorly, narrowing rather rapidly and concavely upwards posteriorly.

Umbones rather broad, subcentral and carinated behind: beaks small, appressed, not very prominent. Surface concentrically striated.

Length of a specimen from Galt, thirty-one millimetres: height of same, twenty-one mm.: thickness, eight mm. In another example, from Durham, the proportions are not quite the same, the length being twenty-eight mm., the height twenty-one mm. and the thickness eight.

Galt, Dr. R. Bell, 1861: Durham, Mr. Joseph Townsend. A single, nearly perfect but not very well preserved cast, with the mould in the rock from which it was taken,—from each of these localities.

The *Anatina sinuata* of Hall, which Mr. E. Billings regarded as the American type of his genus *Ilionia*, was described from two imperfect specimens in very poor condition. Judging by the figure of the best of these, the broad, non-sinuuated and presumably anterior end of *I. sinuata* is much longer than the abruptly contracted and narrow posterior end, and the beaks, which Prof. Hall says are "vertical or not perceptibly inclined to either side of the shell," are consequently placed at some distance behind the middle. In *I. Galtensis*, however, the anterior and posterior ends are about equal in length, and the beaks are subcentral and curve forwards.

## ILIONIA (?) COSTULATA. (N. Sp.)

Plate 2, fig. 5.

Shell compressed, very gently convex, nearly equilateral, transversely

subelliptical, twice as long as high: anterior end regularly but narrowly rounded, posterior end narrowing equally and rather abruptly at its extremity both above and below and subangular or somewhat pointed in the middle: superior border slightly convex in front, and descending with an extremely gradual curve behind: basal margin broadly rounded: beaks small, not very prominent, curved forwards and placed a little in advance of the mid-length. Surface marked with about twenty or twenty-one regularly disposed, equidistant, concentric ribs. Hinge dentition and muscular impressions unknown.

Length, twenty millimetres: height ten mm.

Elora, T. C. Weston, 1867: two moulds of the outer surface of the shell. Durham, Mr. J. Townsend: one mould. The description and figure are taken from a gutta percha cast of the mould collected by Mr. J. Townsend.

As the internal characters of this little shell are unknown, its generic position is quite uncertain. It is only provisionally placed in Billings' genus *Ilionia*.

## GASTEROPODA.

### SUBULITES COMPACTUS. (N. Sp.)

Plate 3, fig. 2, and plate 7, fig. 6.

Shell slender, subcylindrical or narrowly subfusiform, the length being approximately rather more than three times greater than the breadth: last whorl of the spire broader and more convex than any of the others: suture lightly impressed: body-whorl narrower than the preceding volution, at least in its dorsal aspect, cylindrical and somewhat constricted at and above the middle, decreasing unequally and rather rapidly in breadth below: base apparently truncated, with a moderately deep siphonal notch, which is bounded posteriorly by an oblique and not very prominently rounded keel, with a shallow depression behind it. Surface apparently smooth.

Approximate length from twenty to twenty-two millimetres: maximum breadth six mm. Durham, Mr. J. Townsend. A single cast, with the apex of the spire and a portion of the base broken off.

This is a much smaller species than the *Subulites ventricosus* of Hall, which is common in the Guelph Formation at Galt, Hespeler, Elora and Durham, or than the *S. terebraeformis* of Hall and Whitfield, from rocks of the same age in Ohio. From the former it differs also in its much more slender contour, and from the latter in its shorter and more closely coiled spire.

## LOXONEMA MAGNUM, Whitfield.

*Loxonema magna*, Whitfield. 1878. Ann. Rep. Geol. Surv. Wisc., 1877, p. 83.  
 " " " 1882. Geol. Wisc., Vol. 4, p. 317, pl. 24, fig. 1.

Galt: E. Billings, 1857: one imperfect specimen, consisting of two entire volutions, with the whole of the test preserved. Elora, T. C. Weston, 1867: a very perfect cast. Hespeler, T. C. Weston, 1867: one large but imperfect cast.

## CODONOCHEILUS.\* (Gen. Nov.)

Shell turreted, subfusiform or pupoid: volutions of the spire rather numerous, (about eight or nine in the typical species) compressed laterally and closely enrolled: outer half of the body-whorl produced obliquely outwards and downwards: lip thin and broadly expanded: aperture apparently nearly circular: umbilicus small or entirely closed: test thin.

The above genus is constituted primarily for the reception of a little shell which is abundant in the Guelph Limestones at some localities. Casts of it are of frequent occurrence at Durham, but not more than about a dozen specimens with the test preserved have been seen by the writer, and only one of these is full grown. In this specimen, which must be regarded as the type of the genus, the exact shape of the aperture cannot be ascertained, as the ventral surface of the shell is partly buried in the matrix. Although associated with purely marine organisms and therefore probably itself marine, the dorsal aspect of an adult example of *Codonocheilus*, with its subfusiform or pupoid spire, its obliquely spreading body-whorl and its expanded lip, is exceedingly similar in a general way to that of several genera of recent operculated land shells, such as *Megalomastoma*, *Cataulus*, and *Tomocyclus*. It is probable that the *Cerithium Helmerseni* of DeVerneuil, † from the Upper Silurian rocks, of Russia will prove to belong to this genus, but the body-whorl of that species is not preserved in the specimen figured.

## CODONOCHEILUS STRIATUM. (N. Sp.)

Plate 3, fig. 3.

Shell small, about twice as long as broad, subfusiform or somewhat pupoid, spire acutely conical or acuminate at the apex, and ven-

\* From *κωδων*, a trumpet, and *χειλος* a lip.

† "Geologie de la Russie d'Europe et des Montagnes de l'Oural," Vol. 2, p. 342, pl. 22, fig. 4.

tricose below: sutures narrow, linear and impressed: body-whorl, including the basal portion of the expanded outer lip, about one half the entire length: surface marked with minute striæ of growth which become rather strongly marked just behind the outer lip.

Dimensions of the most perfect specimen,—length, eleven millimetres; breadth, four and a half mm.; length of body-whorl, including the basal or anterior end of the outer lip, six m.m.

Hespeler, T. C. Weston, 1867. Two immature specimens with the test preserved, one of unusually large size. Edge Mills, Durham, abundant: Mr. J. Townsend.

#### HOLOPEA GRACIA. Billings.

Plate 3, fig. 4.

*Holopea Gracia* Billings. Palæozoic Fossils, Vol. 1, p. 159.

Not *Holopea Gracia*, Nicholson. (As of Billings). Rep. on the Pal. of the Prov. of Ontario, 1875, p. 72, pl. 3, fig 17.

The type of this species, which is a mere cast of the interior, and which from not having been figured appears to have been misunderstood, is represented on Plate 3. Two large specimens of a *Holopea* with the test preserved, which are almost certainly referable to *H. Gracia*, have recently been collected at Durham by Mr. J. Townsend. These, if correctly identified, shew, (1) that the species attained much larger dimensions than the type now figured; (2) that when the shell is preserved the umbilicus is completely closed; (3) that the surface markings consist of crowded and oblique raised striæ, which curve somewhat convexly backwards above the middle of the body-whorl, and concavely as well as more abruptly backwards at the base. In one of the Durham specimens, too, the apex of the spire is remarkably obtuse.

#### CYCLONEMA SULCATUM, Hall.

Plate 3, fig. 5.

*Cyclomena sulcata*, Hall. Pal. N. York, Vol. 2, p. 347, pl. 84, figs. 1, 1a-d.

This species was originally characterized by Prof. Hall from exfoliated casts, but the fine specimen collected by Mr. Townsend at Durham, and represented on Plate 3, has most of the test preserved on the last volution. The lower half of the body-whorl is marked by nine revolving raised ridges which are rather narrower than the spaces between them. These ridges are most prominent around the narrow



but deep umbilical depression, and become gradually more faintly marked until the two upper ones are nearly obsolete. Above, and next to the suture, there is a faint revolving and rather wide groove, which is succeeded by a broad smooth band. The whole surface of the body-whorl is also crossed by numerous oblique striæ of growth.

Although the words "umbilicus none" occur in the original definition of the genus *Cyclonema*,\* yet as the *C. sulcata* is distinctly described by Prof. Hall as having a small umbilicus, it is clear that this generic character will have to be modified so as to include species with a small umbilical perforation which does not expose any part of the inner whorls,—or else that the present species should be removed to some other genus, for which procedure there does not seem to be any sufficiently adequate reason. In the writer's judgment also, the *Trochonema pauper* of Hall and the *Cyclonema sulcata* of the same author ought not to be placed in different genera.

#### TROCHONEMA INORNATUM. (N. Sp.)

Plate 3, fig. 7.

Shell angularly turbinated, depressed, much broader than high; whorls from three to four, increasing very rapidly in size; spire step-shaped, moderately elevated, occupying rather less than one-half the entire height, its volutions flattened above and obliquely compressed at the sides; body-whorl flattened both above and below nearly at a right angle to the axis of the shell, and compressed laterally and somewhat concavely in the middle,—biangulated, its upper portion being distinctly shouldered, and its basal margin rather less distinctly so; umbilicus very small, or perhaps entirely closed when the whole of the test is preserved; aperture evenly rounded on the inner or columellar side and rather obscurely biangular externally. Test moderately thick; surface nearly smooth but marked by fine transverse lines of growth, which are distinctly insinuated on the superior angle of the body-whorl.

Breadth of the most perfect example collected, twenty-four millimetres; entire height of the same, twenty mm.; height of the spire only, nine mm.

Elora: R. Bell, 1861: one specimen, with most of the test preserved. Durham, Mr. J. Townsend: a single cast.

The best specimen has most of the shell broken away in the umbilical region, so that it is uncertain whether the base was imperforate or

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\*On page 89 of the second volume of the Palæontology of the State of New York.

narrowly umbilicated. It seems most probable that the latter was the case, but that the umbilical pit or cavity was too narrow to expose any portion of the inner whorls.

*EUOMPHALUS MACROLINEATUS*, Whitfield.

Plate 3, fig. 6.

*Euomphalus macrolineatus*, Whitfield. Ann. Rep. Geol. Surv. Wisc. for 1877, p. 82.

“ “ “ Geol. Wisc., vol. 4, p. 294, pl. 18, figs. 5 and 6.

Elora, T. C. Weston, 1867. Durham, Mr. J. Townsend. Two specimens, which appear to belong to the same species, were collected by Mr. R. Bell in the Upper Silurian Rocks of the Baie des Chaleurs, in 1862, one at L'Anse à la Barbe, and the other at L'Anse à la Vieille.

The types of *Euomphalus macrolineatus* from Wisconsin are described as being “subdiscoidal, with a depressed convex spire,” and the under side of its shell is said to be unknown. Not being able to decide positively, from description and figures alone, whether the Canadian specimens were specifically identical with that species or not, the nearly perfect example figured on plate 3 was sent to Prof. Whitfield for examination, who kindly reports on it as follows: “I can see no real difference between this and *E. macrolineatus*. The ribs are a little more distant, but not enough to be specific. My specimens were both impressions of the exterior, and much flattened, so that I considered it a *Euomphalus*. Your specimens differ from true *Cyclonema* in the aperture and umbilicus.” To the writer, these latter appear to be exactly congeneric with the *Cyclonema sulcatum* of Hall, which, however, may not be a true *Cyclonema*.

The characters of well-preserved and undistorted Canadian specimens which are here identified with *E. macrolineatus* on Prof. Whitfield's authority, may be thus defined. Shell turbate, a little broader than high, composed of about three volutions, which increase very rapidly in size: last whorl but one somewhat depressed above and laterally depressed below the broadly rounded shoulder, in such a manner as to give the shell a rather step-shaped outline: body-whorl occupying two thirds or more than one half the total height,—depressed above, inflated and ventricose below: umbilicus deep but narrow, its width being less than one fourth of the diameter of the base: aperture nearly circular, lip thin and simple. Surface marked by numerous, narrow, elevated revolving ridges, which are crossed by crowded and oblique striae of growth. On the upper and outer part of the body-whorl, the three revolving ridges nearest to the suture are comparatively wide apart, and are separated by shallowly concave grooves about four times as

wide as the ridges themselves: below this the revolving ridges are much more numerous and closely disposed, their breadth in the lower half of the body-whorl being fully equal to the width of the grooves between them.

Approximate height of the most perfect specimen, thirty-seven millimetres: maximum breadth of the same, forty-four mm.: height of the body-whorl of do., twenty-four mm.

The amount of elevation of the spire of Canadian examples of this species, as compared with the maximum breadth, varies considerably in different individuals.

*EUOMPHALUS GALTENSIS.*

Plate 3, figs. 9 and 9a.

Shell depressed and nearly discoidal, spire sunk slightly below the highest level of the body-whorl, breadth rather more than twice the height: volutions three, increasing very gradually in size, those of the spire shouldered and nearly rectangular: body-whorl biangulated, but with the basal angle somewhat rounded off,—depressed above, especially near the suture, compressed convex below and flattened laterally in the middle: umbilicus about one-third the diameter of the base, deep, step-sided and exposing part of the inner volutions: outer lip more or less acutely insinuated or notched on the superior angle, above and below which its margin is convexly curved, the insinuation being caused by the junction or partial intersection of these two convex curves. Surface markings unknown, with the exception of a few distant lines of growth on the body-whorl, which run parallel with the outer lip.

Dimensions of the specimen figured:—breadth, thirty-eight millimetres; height, seventeen mm.; width of umbilicus, about twelve mm.

Galt, E. Billings, 1857. Hespeler, T. C. Weston, 1867. Durham, Mr. J. Townsend. All the specimens obtained so far are either mere casts or else they have the test so much exfoliated that the finer surface markings are quite obliterated.

*STRAPAROLLUS CRENULATUS. (N. Sp.)*

Plate 3, fig. 8, 8a and 8b.

Shell turbate, compressed vertically, height one third less than the maximum breadth, whorls three to four: spire short, about one-third the entire height, somewhat conical, its volutions being obliquely rounded: suture excavated: body-whorl compressed vertically both

above and below, ventricose and inflated in the middle; umbilicus about one third the diameter of the base, very deep and exposing all the inner whorls up to the apex; mouth nearly circular but narrower above and very slightly emarginated or indented by the penultimate whorl: outer lip apparently thin and simple, convex above and obliquely convex below. Surface marked by a few narrow and not very prominent spiral ridges, which are crossed obliquely by numerous flexuous crenulated raised ridges or lamellæ. On the outer half of the body-whorl there are about seven or eight of these spiral ridges, four above, and either three or four below the middle. The upper ones, one of which is placed very close to the periphery, are distant and rather clearly defined, but the lower ones are close together and extremely indistinct. These latter, too, are exclusively confined to the outer portion of the base, and disappear altogether before reaching the umbilical margin.\* The crenulated raised lines, however, which cross the whorls obliquely, are as strongly marked in and around the umbilicus as they are on the central and upper portions of the body-whorl, and they are much more numerous as well as more closely disposed than the spiral ridges.

Maximum breadth of the largest specimen collected, forty-five millimetres: height of the same, about thirty mm.

Durham, Mr. J. Townsend: two specimens.

This shell would probably not be regarded as a true *Straparollus* by those who follow the nomenclature adopted by D'Orbigny, McCoy, DeKoninck and Stoliczka, but it accords fairly well with the characters of that genus as re-defined by Professors H. A. Nicholson † and James Hall. ‡ It seems to be closely allied to and is probably congeneric with the so-called *Euomphalus funatus* and *E. rugosus* of Sowerby, from the Wenlock limestone.

#### PLEUROTOMARIA PERLATA, Hall.

*Pleurotomaria perlata*, Hall. 1852. Pal. N. Y., Vol. II., p. 349, pl. 84, figs. 5a, b, c.

By some inadvertence this species is figured on page 341 of the "Geology of Canada" for 1863, as *Pleurotomaria solarioides*, Hall, which latter shell Prof. Whitfield believes to be a *Straparollus*.

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\* In figures 8a and 8b of Plate 3, the spiral ridges on the lower half of the body-whorl are rather incorrectly represented. They should be less distinct, closer together, and confined to the outer portion of the base.

† Manual of Palæontology, London. 1879. Vol. II., p. 24.

‡ Palæontology of the State of New York. 1879. Vol. V., part 2, p. 54.

## PLEUROTOMARIA OCCIDENS, Hall.

*Pleurotomaria occidens*, Hall. Twentieth Reg. Rep., p. 364, pl. 15. figs. 11 and 12.

Elora, T. C. Weston, 1857: one specimen, identified with the above species by E. Billings.

## PLEUROTOMARIA VALERIA, Billings.

Plate 4, figs. 1 and 1a.

*Pleurotomaria Valeria*, Billings. 1865. Pal. Foss., Vol. I., p. 169.

The type of this species, which is only a cast and which was not figured, has the whole of the spire buried in the matrix so that the basal surface and part of the body-whorl only are exposed. Two or three fine specimens with the test preserved have recently been collected at Durham by Mr. J. Townsend, the best of which is represented on plate 4, fig. 1a. These give a good idea of the characters and surface markings of the upper portion of the shell. On the spire the test appears to be nearly or quite smooth, but on the upper half of the last volution the sculpture consists of crowded and rather flexuous transverse striations. The species may be readily known by its depressed-turbinate form, its sub-angular whorls, its prominently and distinctly keeled periphery and its wide open umbilicus.

## PLEUROTOMARIA CYCLOSTOMA. (N. Sp.)

Plate 3, figs. 12 and 12a.

Shell conical, a little broader than high: whorls about five: spire moderately elevated, occupying about one half the entire height, its whorls flattened obliquely: last whorl but one bearing in its centre a narrow spiral band which is bordered on both sides by a thread-like and minute raised ridge: band quite obsolete in the first and second volutions, and nearly so in the third: suture indistinct. Body-whorl with the periphery angulated and carinated, the keel being narrow, acute, simple and prominent: band placed half way between the keel and the suture: base nearly flat, imperforate: aperture circular.

Body-whorl (and perhaps the lower portion of the spire) marked by crowded transverse striæ or lines of growth: on the upper part of the body-whorl these striæ appear to be insinuated convexly backwards towards and to the band, while on the lower face of the same whorl they radiate concavely backwards: the outer margin of the basal portion of the body-whorl also is marked by two or three faint spiral

grooves, one of which forms the anterior boundary of the keel which encircles the periphery.

Maximum height of the most perfect specimen collected, twenty-one millimetres: breadth of the same, twenty-five mm.

Durham, Mr. J. Townsend: two specimens, both with the test preserved.

One of the most curious features of this species is the extreme thickening of the shell on the periphery of the last volution, from which it results that although the outer lip is sharply carinated exteriorly, yet the mouth or aperture is almost exactly circular in outline. This peculiar character is seen also in the *Pterochelios primus* of Moore, from the English Lias, but in that genus the columella is much produced anteriorly, which is by no means the case with the present species.

*P. cyclostoma* appears to differ from *P. bispiralis* of Hall, from the Guelph formation, principally in its more obliquely flattened and less ventricose spire, its indistinct suture and its much narrower spiral band.

#### PLEUROTOMARIA DURHAMENSIS. (N. Sp.)

Plate 4, fig. 2.

Shell turbinate-conical, a little higher than broad; spire moderately elevated, about equal to the body-whorl in height, its upper portion distinctly acuminate; whorls eight or nine, the first five or six increasing very slowly in size and obliquely compressed but not angulated, the next two, which immediately precede the body-whorl, increasing much more rapidly both in height and breadth and rather strongly angulated below the middle: body-whorl angulated a little above the middle and obliquely flattened above the angle; base convex and evenly rounded; umbilicus about one third the diameter of the base and apparently deep. Surface markings unknown.

Height, twenty-six millimetres: breadth, twenty mm.

Durham, Mr. J. Townsend: a single but very perfect cast.

The general outline of this shell is not at all unlike that of the *Straparollina pelagica* of Billings, from the Quebec Group of Newfoundland, but in the latter species the whorls are said to be only five or six in number and the lower ones are not distinctly angulated.

#### MURCHISONIA HESPELERENSIS. (N. Sp.)

Plate 4, fig. 3.

Shell angularly turbinated, not much elongated, the length being about one third greater than the breadth: spire about equal to the

body-whorl in length: volutions six, the first, second and third ventricose and obliquely rounded, the fourth and fifth angulated in the middle: body-whorl rather obtusely angulated above the middle, rounded and ventricose below: umbilicus very small in the cast and probably closed altogether when the test is preserved: surface markings unknown.

Entire height of the specimen figured, twenty-eight millimetres: height of the spire only, fifteen mm.: maximum breadth, nineteen mm.

Hespeler, T. C. Weston, 1867: township of Glenelg, J. Townsend, 1883.

A longer and narrower shell than the preceding species, with fewer and more centrally angulated whorls and a narrower umbilicus. It appears to be more nearly allied to the *M. Mylitta* of Billings, from the same formation, of which it may prove to be an extreme variety. The differences between the two are as follows:—In *M. Mylitta* the whorls are four or five, the last whorl, which is the only one that is angulated, is two thirds of the entire length: in *M. Hespelerensis* there are six whorls (or between five and six) the fourth, fifth and six of which are distinctly angulated, and the body-whorl is about one half of the entire length.

#### MURCHISONIA CONSTRICTA. (N. Sp.)

Plate 4, fig. 4.

Shell turreted, spire long and slender, whorls numerous, probably about twelve, increasing slowly in size, the earlier ones flattened or faintly concave, the later ones bearing an obtuse spiral band or faint angulation at a distance of three-fourths their height from the suture above, and concavely constricted above the angulation: suture linear, moderately impressed: last volution short, less than one third the entire length, obtusely angulated a little above the middle, rather strongly concave above the angulation, rounded and ventricose below: base imperforate, but with a distinct groove on the inner and lower side of the thickened basal portion of the columella: aperture subovate, higher than wide and somewhat angular exteriorly: outer lip thin and simple: test rather thin: surface markings unknown.

Durham, Mr. J. Townsend. A single specimen, with eight whorls and most of the test preserved, but with its outer surface too much worn to show any of the sculpture.

This species appears to be most readily distinguishable from *M. Boylei*, Nicholson,\* which it closely resembles in form, by the different posi-

\* Report upon the Palæontology of the Province of Ontario. 1875. Page 71, pl. 3, fig. 1.



tion of its spiral band or angulation on the lower whorls of the spire, and by the much more strongly marked constriction of the same whorls above the angulation. In *M. Boylei* the spiral band is described as being situated a "little above the suture, causing the lower part of each whorl to project over the upper portion of the whorl next below,"\* while in *M. constricta* the spiral band, although situated below the middle, in the later whorls of the spire, is removed from the suture below by a distance equal to at least one-fourth the entire height of the whorl.

MURCHISONIA TURRITIFORMIS, Hall.

Plate 4, fig. 5.

*Murchisonia turritiformis*, Hall. Palæont. N.Y., Vol. II., p. 347, pl. 61, figs. 6a & 6b

The original description of this species is as follows: "Spire elongated, turritiform, composed of numerous flattened volutions: surface unknown; columella small. This species is readily distinguished by its flattened volutions, which, in the cast, present the marks of a carina near or a little below the centre. One specimen preserves five volutions, being imperfect at both extremities: the shell originally had probably not less than fifteen volutions." "Position and locality. In the limestone at Galt, Canada West."

The two imperfect casts upon which this species was based were obviously insufficient to enable its characters to be accurately defined. Much more perfect specimens of a *Murchisonia*, which certainly correspond better to the description and figures of *M. turritiformis* than to those of any other species of the same genus from the Guelph Formation, have since been collected at Galt, Elora, Hespeler and Durham, by Messrs. A. Murray, R. Bell, T. C. Weston, D. Boyle, and J. Townsend. One of these specimens, in the Museum of the Survey, is labelled *M. turritiformis* in the handwriting of Mr. E. Billings, while another and more perfect one is represented by figure 5 of plate 4. In all of these shells the whorls of the spire are encircled near but a little below their middle by a narrow and not very prominent, spiral band or obtuse angulation, which is scarcely strongly marked enough to leave its impress upon the cast. Above the band the whorls are slightly concave, and beneath it as slightly convex. On the outer half of the body-whorl the band is placed a little above the middle, and the base is rather strongly convex. The test seems to have been thin, and near the mouth its surface markings consist of fine and rather crowded

\* Report upon the Palæontology of the Province of Ontario, 1875, p. 71.

striations, which are insinuated convexly backwards both above and below towards and to the band. The shell increases very slowly in breadth; thus, in a specimen three inches and a quarter in length, which has between seven and eight of the whorls preserved, the greatest diameter at the smaller end is eleven millimetres, while that of the larger end, close to the aperture, is only twenty-five.

Prof. Whitfield, who has examined the specimens from which figure 5 on plate 4 was drawn, and compared it with Prof. Hall's types, thus expresses his opinion on the former. "This shell is intermediate between *M. turritiformis* and *M. longispira*, Hall. The apical angle is more acute than that of *M. turritiformis*, while the angle of the volution is here central and on that one is at the base of the volution. Compared with *M. longispira* the rate of increase in the diameter is about the same, also the angle on the whorl, but the length of the volutions in your shell is a little greater than in that species. One or two other specimens would probably unite Hall's two species as one."

#### MURCHISONIA CONRADI, Hall.

Plate 4, fig. 6.

*Murchisonia Conradi*, Hall. 18th Regents' Report, p. 344, pl. 15 (6.) fig. 19.

Three nearly perfect and well preserved specimens of a *Murchisonia* which should probably be regarded as a mere local variety of the above named species, have been collected at Elora by T. C. Weston and D. Boyle, one of which is represented on plate 4. They differ chiefly from the Wisconsin type of *M. Conradi*, as figured by Prof. Hall, in not being nearly as slender in their proportions, and in the blunter and less prominent carination of their whorls.

#### MURCHISONIA MACROSPIRA, Hall.

Plate 4, figs. 7 and 7a.

*Murchisonia macrospira*, Hall. Palæont. N. Y., Vol. II., p. 346, pl. 83, fig. 5.

This species was described from a mould of the interior of the shell obtained at Galt, Ont., a gutta-percha cast of which has been forwarded to the writer by Prof. Whitfield. As stated by Prof. Hall, the type specimen shews "the impression of four and a part of the fifth volution." A similar but in some respects more perfect mould from the same locality, which shews the impress of eight volutions, was collected by Mr. A. Murray in 1857, a gutta-percha cast of which is represented by figure 7 of plate 4. The original of figure 7a on the same plate is a

small specimen of *M. macrospira* collected by Mr. D. Boyle at Elora in 1880, and presented by him to the Museum of the Survey. It consists of three or three and a half whorls and has most of the test beautifully preserved. When perfect the type of the species figured by Prof. Hall must have had one volution more than the larger of the two specimens represented on plate 4.

From the two additional specimens figured, taken in connection with the type, it would appear that the shell must have consisted of about nine ventricose whorls, which increase rather rapidly in breadth in proportion to the total length, which latter may be roughly estimated at rather more than twice the greatest breadth of the body-whorl. The band or spiral carina, though distinct and well marked, is broad, rounded and not very prominent. On the earlier whorls of large individuals the band is obsolete: on the lower whorls of the spire it is subcentral, while on the outer half of the body whorl it is placed above the middle. The later whorls of the spire are more swollen and inflated below the band than they are above it. The surface markings consist of fine transverse striations, which are insinuated convexly backwards towards and to the band.

#### MURCHISONIA SOLUTA. (N. Sp.)

Plate 4, figs. 8 and 8a.

Shell elongated, slender, consisting of a spirally twisted calcareous tube which is nearly circular in transverse section, and which increases very slowly in diameter; whorls moderately numerous, free, disconnected and widely separated from the commencement, but very closely and compactly coiled laterally; last volution and last but one bearing a rounded and rather broad but not very prominent band or keel a little above the middle; aperture expanded on the columellar side; surface markings unknown.

Galt, Rev. Andrew Bell, 1846-50. Hespeler, T. C. Weston, 1867: one fragment. Elora, D. Boyle, 1880, and J. Townsend, three specimens. Durham, J. Townsend: four specimens.

All the specimens of this peculiar shell that have come under the writer's notice are casts which are imperfect either at one extremity or at the other. In the largest and finest example in the Survey collection, which is figured on plate 4 (figure 8), and which has the body whorl and the two preceding volutions preserved, the diameter of the cast of the shelly tube immediately behind the expansion of the aperture is seventeen millimetres, and that of its broken termination above, between

five and six. The last two whorls of this specimen are separated by a space equal to more than double the diameter of the thickest unexpanded part of the cast of the tube of which the body-whorl is composed. In another specimen, the original of figure 8a. on plate 4, in which four of the earliest whorls are preserved, the diameter of the cast is five millimetres at the largest and a little more than one millimetre at the smallest end, and the volutions are separated by spaces somewhat wider than the maximum diameter of the cast of the tube. It would appear, therefore, that the entire number of volutions is about seven or eight, and that the later whorls are rather more widely separated proportionately than the earlier ones.

Although it has been thought best to give a provisional name to the specimens above described, as a matter of convenience, it is not at all unlikely that they may prove to be monstrosities or abnormally developed individuals of some regularly formed species of *Murchisonia*, to which they may bear the same morphological relationship as the well-known but exceedingly rare scalariform varieties of the living *Helix aspersa* of Muller, figured by Moquin Tandon and Chenu, do to the ordinary form of that species. Of all the species of *Murchisonia* from the Guelph formation known to the writer, these singularly constructed shells seem to come nearest to *M. macrospira*, partly in the number and contour of their volutions, but more especially in the breadth and slight elevation of their rounded spiral band or carina. The fragment represented by figure 9 on plate 4 is a portion of a cast of a shell from Durham, which appears to be intermediate in its characters between *M. soluta* and some normally developed species of *Murchisonia*, perhaps *M. macrospira*. The whorls of this fragment, although free and disconnected, are still somewhat approximated, and its spiral keel is precisely like that of *M. soluta*.

The *Enomphalus circinalis* of Goldfuss is a good example of an almost completely uncoiled species of that genus, but its apical whorl is represented as being regularly spiral.

#### MURCHISONIA TROPIDOPHORA. (N. Sp.)

Plate 7, figs. 5 and 5a.

The above name is proposed for a remarkable shell, of which only one imperfect specimen is known to the writer, and for which a new genus may have to be constituted. This specimen has about one-third of the apical or posterior end broken off, and the remaining portion consists of a shelly tube which increases rapidly in diameter, especially near and at the aperture, and which is obliquely, spirally and tightly

twisted on itself rather than regularly coiled. The upper half of the volution bears two prominent, acute and distant, spiral keels, which are separated from each other by a broad concave groove. Above the upper keel, which forms a distinct shoulder to the volution, the surface is obliquely flattened or slightly concave, and below the second keel the surface is somewhat convex. At the base of the earlier half of the last volution there is a third keel, but on the later half of the same volution this basal keel is continued as the outer margin or boundary of the mouth on the columellar side, and ultimately becomes confluent with the basal portion of the outer lip. The aperture appears to have been nearly circular, and it is certainly broadly and effusely expanded at its base. In addition to the keels the exterior of the test, which seems to have been rather thick, is marked by very faint, fine and flexuous, transverse striæ of growth.

Durham, Mr. J. Townsend, 1883: a single specimen, with most of the test preserved but with the apical portion and part of the outer lip broken off,

It is at present doubtful whether this shell is a *Murchisonia*, allied to but perfectly distinct from the *M. helicteres* of Salter,—a second species of *Codonocheilus*, or, as already suggested, a new generic type. From *M. helicteres* it differs not only in the number and arrangement of its spiral keels, but also in the fact that although much drawn out in the direction of its length, the spiral tube of which it is composed is so tightly twisted on itself that its volutions are in contact throughout on their inner faces and not entirely free and disconnected.

The aperture of *M. tropidophora*, so far as known, seems very similar to that of *Codonocheilus*, but in the only species of that genus yet described all the volutions but the last are regularly spiral.

The circumstance that the basal keel at the commencement of the body-whorl in this species is continuous with the raised margin of the mouth on the columellar side and that it finally becomes confluent with the outer lip at the base of the shell, seems to the writer to be a unique feature among gasteropoda and one which strongly favours the idea that the present species may prove to be the type of a new genus.

Genus TRYBLIDIUM, Lindström. 1880.

*Fragmenta Silurica* (Stockholm), page 15.

“Testa e stratis fibrilloso-prismaticis, oculis minutissimis perforatis contexta, modice elevata, apice prope marginem anteriorem posito et plerumque detricto, ita ut strata testæ interna deteguntur. Impresiones musculares numerosæ, per sex paria in orbiculo elongate ordinatæ,

quorum anteriora maxima sunt et inter se continuatione angusta juncta. Species hujus generis nonnullis speciebus generis *Metoptomæ* secundum descriptiones et figuras a Billings in libro 'Canadian Organic Remains' (sic) vol. 1, page 87 cet., datas affines sunt. Generi *Nacellæ* Schum. e tribu *Patellidarum* quoad formam valde congruens, hocce genus siluricum impressiones musculorum ad instar *Olanæ* (*Patellæ*) *cochlearis* L. dispositas habet." Lindström.

As already partially suggested by Mr. Dall,\* it seems clear that of the nineteen species provisionally referred by E. Billings to Phillips' genus *Metoptoma*, in the first volume of the "Palæozoic Fossils" of Canada, not one of them really belong to that genus as now understood. As the name implies, in *Metoptoma* proper the widest end of the basal margin, which was supposed by Prof. Phillips to be the anterior end, is distinctly concave or notched, a character which is not possessed by any of the so-called species of *Metoptoma* from the Cambro-Silurian or Silurian rocks. In the writer's judgment *Metoptoma Quebecensis*, Billings, belongs to the genus *Palæacmæa* of Hall and Whitfield: *M. Niobe*, *M. Nycteis*, *M. Eubule*, *M. Erato*, and *M. Hyrie*, Billings, are typical species of *Tryblidium*, Lindström: *M. Trentonensis*, *M. Estella*, *M. instabilis* and *M. simplex*, Billings, appear to differ only from the generic characters of *Tryblidium* in that the outline of their basal margins is sub-circular rather than ovate: while the rest of the species described by Billings in the volume cited are probably types of two or three new and at present uncharacterized genera.

The Guelph Formation has yielded a single specimen of an interesting new species of *Tryblidium*, which may be thus described.

#### TRYBLIDIUM CANADENSE. (N. Sp.)

Plate 5, figs. 1 and 1a.

Shell patelliform, conical, much depressed: highest a little behind the middle (as viewed laterally), sloping rather abruptly downwards behind the most prominent point, and more gradually towards and down to the apex in front: sides obliquely convex: apex placed very near to the anterior end, but not quite terminal, pointed, incurved, but scarcely hooked, and depressed below the greatest elevation to a distance of rather more than one-half the entire height: base broadly ovate, narrowest under and in front of the apex: length greater than the breadth: maximum height less than half the breadth: muscular impressions not satisfactorily shown: surface marking unknown.

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\* In the American Journal of Conchology, vol. 6, p. 281. 1881.

Length, forty-five millimetres: breadth, thirty-eight mm.: maximum height, seventeen mm.: height of lower surface of apex from the base, seven mm.

Hespeler: T. C. Weston, 1867: a single but perfect cast of the interior of the shell.

SCENELLA CONICA. (N. Sp.)

Plate 5, figs. 2 and 2a.

Shell small, conical, moderately elevated, the height being equal to one-half the length of the aperture or base: sides slightly compressed: apex pointed, erect and almost central, but placed a little nearest to the narrowest end: base or aperture ovate or subovate in outline, about one-fifth longer than broad: surface markings and muscular impressions unknown.

Length of an average specimen, ten millimetres: breadth of the same, eight mm.: height, five mm.

Durham: J. Townsend: eight tolerably perfect but not very well preserved casts of the interior of the shell.

The genus *Scenella* of Billings has never been properly defined, and consequently ought either to be re-constituted or abandoned. The "obscure carina extending from the apex down one side to the margin," given as part of the diagnosis of *S. reticulata*, is not even a constant specific character, for there is no such keel on an exceptionally large specimen of that species from the typical locality in the Museum of the Survey. The surface ornamentation, too, upon which the genus was mainly based, is clearly of not more than specific importance.

The specimens from Durham described above are here placed provisionally in the genus *Scenella* on account of their very close resemblance in external form to *S. reticulata*, but the muscular impressions, which would probably afford the surest indications of the true affinities of both, are entirely unknown. They may, however, be referable to Whitfield's genus *Lepetopsis*.

In the second volume of the "Palæozoic Fossils" of Canada, on page 77, *Stenotheca pauper* and *Scenella reticulata* are described under the head of *Huronian* fossils, whereas both of these species are from the Menevian limestones of Conception Bay, Newfoundland, which directly overlie the black shales or slates of the "Acadian" Group or Lower Cambrian of that Island.

## OPERCULA OF GASTEROPODA.

Plate 3, figs. 10, 10a, 10b, and 11, and pl. 7, fig. 7.

Several specimens of the operculum or opercula of one or more species of holostomatous gasteropoda have been collected at Hespeler by Mr. T. C. Weston and at Durham by Mr. J. Townsend, the largest of which measures fully three quarters of an inch in its greatest diameter. These opercula are all calcareous, thick, circular in outline and multispiral. Though often perfect and well preserved, the sculpture of their outer surface is usually obscured and nearly covered by small portions of the tenacious matrix. So far they have never been found in place, so that it is quite uncertain to which species they belong or to how many.

In certain specimens (such as the one represented by figures 10, 10a and 10b of plate 3, which for convenience may be called No. 1) the outer side is conical and moderately elevated,—the height of the cone being usually rather less than one-half the diameter of its base,—the apex is subcentral, the whorls are sinistral and bounded externally with a thin, laminar, raised ridge, the spaces between the coils of which are obliquely striated across. On their inner sides (which, however, are possibly imperfect) they are gently concave, the central portion paucispiral and the outer obscurely annular.

In other individuals (such as the original of figure 11 on plate 3, which may be distinguished temporarily as operculum No. 2,) the outer side is much more compressed than that of No. 1, and might better be described as depressed convex rather than conical. The inner surface of No. 2 is nearly flat and marked with concentric annular striations, but there is a small pit in the centre, and a rather narrow, elevated and annular rim around its outer margin.

It is most probable that these opercula belong to shells of the genus *Euomphalus* or *Straparollus*, in the sense at least in which these words are used in this article, perhaps to *E. Galtensis* or *S. crenulatus*. Stoliczka says\* that the opercula of *Euomphalus* (which he regards as a synonym of *Straparollus*) "very much resemble those of *Torinia*, being thick and composed of numerous lamellar volutions," a description which would apply perfectly to those from Durham. On the other hand, the opercula of *Euomphalus funatus*, as figured by Bailey† are also very like the Durham specimens, and this similarity would rather favour the view that the latter may be the opercula of *Straparollus crenulatus*.

\* Paleontologia Indica. Cretaceous Fauna of Southern India, page 254.

† Figures of Characteristic British Fossils. vol. 1, plate 21, fig. 9.



## HETEROPODA.

## BUCANIA STIGMOSA (?) Hall.

Plate 5, figs. 3 and 3a, and pl. 8, fig. 4.

*Bucania stigmosa*, Hall. 1852. Palæont. N. York, vol. 2, p. 92, pl. 28, figs. 8, 8 a to e.

Galt: A. Murray and E. Billings, 1857: two casts of the interior of the shell. These agree perfectly with similar but better preserved casts from the Niagara Formation at Grimsby, Ont., in the Museum of the Survey, which have been identified with *B. stigmosa* by E. Billings, but in the absence of any knowledge of the shell of the Galt specimens their determination must be regarded as doubtful.

## TREMANTOTUS ALPHEUS, Hall.

*Bellerophon angustata*, Billings, as of Hall.....1863. Geol. Can., p. 344, fig. 352.

*Bucania Chicagocensis*, McChesney.....1860, New. Pal. Foss. Expl. of pl. 8, fig. 4.

*Tremantotus Alpheus*, Hall.....1864, Eighteenth Reg. Rep., p. 347, pl. 15, figs. 23 and 24.

*Bellerophon (Bucania) perforatus*, Winchell & Marcy. 1865 (?) Mem. Bost. Nat. Hist. Soc., vol. 1, p. 100, pl. 3, fig. 7.

*Tremantotus Alpheus*, Hall and Whi field.....1875, Pal. Ohio, vol. 2, pt. 2, p. 145, pl. 8, fig. 1.

Guelph: Hespeler, T. C. Weston, 1867 and 1871: Elora; Mr. D. Boyle, 1880: Durham; Mr. J. Townsend. Not uncommon.

As Professor Hall has pointed out,\* the specimen figured in the "Geology of Canada" as *Bellerophon angustatus* is no doubt referable to *T. Alpheus*, as are also a dozen other good specimens in the Survey Museum. But in justice to the memory of Mr. E. Billings, who was officially responsible for the palæontological part of the volume cited, it should not be forgotten that the "Geology of Canada" was published a year before the first description of *T. Alpheus* appeared in print. Moreover, it is by no means clear that *T. Alpheus* is sufficiently distinct from *Bucania angustata*. On the contrary it is highly probable that these two names have been given to the same species in different states of preservation. Prof. Hall states that *T. Alpheus* "bears some resemblance to *Bucania angustata*," \* \* "but differs in the more rotund volutions, and in the interrupted oblong nodes representing the perforations on the periphery, while that species is free from nodes or

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\* Eighteenth Reg. Rep., p. 347.

carina."\* The brief and rather vague description of *Bucania angustata*, by the same author, is as follows: "Volutions narrow, rounded on their sides, expanding near the aperture. The specimen figured is a rough cast in limestone, preserving no remains of surface markings. The volutions are less extended laterally than any other species of equal size known in our strata."†

Most of the specimens of *T. Alpheus* in the Museum of the Survey are, however, very strongly compressed at the periphery, and these agree perfectly in shape with Hall's figures and description of *Bucania angustata*. The "interrupted oblong nodes" on the periphery, which seem to be always present in casts of the adult shell of *T. Alpheus*, are said to be absent in *B. angustata*; but this statement may very well have been due to the accidental circumstance that the type and only specimen known of the latter species happens to be too imperfectly preserved to show them.

On page 304 of the second edition of the "American Palæozoic Fossils," Mr. S. A. Miller says that *T. Alpheus* is a synonym for *Bucania Chicagoensis*.

*ECCULIOMPHALUS CIRCINATUS.* (N. Sp.)

Plate 5, figs. 4, 4a, 4b, and 4c, and pl. 8, fig. 5.

Shell sinistral, composed of about one and a half free and disconnected spiral volutions, which are coiled nearly on the same plane and which increase rather rapidly in their dorso-ventral but more slowly in their lateral diameter; upper side somewhat flattened vertically or gently convex; periphery subangulated or narrowly rounded; under side rather strongly convex, subcarinated or more or less faintly subangulated in the middle, especially near the mouth; aperture ovately-triangular, inequilateral, unsymmetrical and higher than wide. Surface of the test densely striated across; upper side of the outer half of the last volution of the cast marked by two distant and nearly parallel spiral grooves, one of which is placed near the inner edge and the other about the middle. Posterior extremity, in one specimen at least, distinctly septate or chambered, the septa being simple, concave, and placed at distances of from one to two millimetres apart.

Galt, Rev. Andrew Bell, 1846-50: Galt and Hespeler, T. C. Weston, 1867: Elora, D. Boyle: Durham, Mr. J. Townsend.

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\* Eighteenth Reg. Rep., p. 347.

† Idem.

The condition in which this species is most frequently found is in that of not very well preserved casts of the interior of the shell. In such specimens the slight angulation of the periphery and of the centre of the lower side is often nearly or quite obsolete, and the outline of the aperture is subovate, the upper side being less convex than the lower. In two unusually well-preserved fragments of this species from Durham, however, which have most of the test preserved, the aperture is clearly subtriangular or ovately triangular in contour.

Prof. McCoy states\* that there are "no chambers" in shells of the genus *Ecculiomphalus*, but the present species is occasionally septate. Stoliczka places *Ecculiomphalus* in the Solaridæ, but its affinities appear to have been very near to *Machurea*.

## CEPHALOPODA.

### TROCHOCERAS DESPLAINENSE, McChesney.

Plate 5, fig. 5.

*Trochoceras Desplainensis*, McChesney. 1859, New Palæozoic Fossils, p. 68, pl. 8, fig. 1.

*Trochoceras Desplainense*, Hall.....Twentieth Reg. Rep., p. 359, pl. 16, figs. 8, 9 and 10.

Hespeler, T. C. Weston, 1867: two specimens, one a mould of the exterior of the outer whorl in a compact dolomite, and the other a cast of the interior of part of the body whorl.

### TROCHOLITES MULTICOSTATUS.

Plate 6, figs. 1 and 1a.

*Lituites multicostatus*, Whitfield. Geol. of Wisc., vol 4. 1882, p. 303, pl. 20, fig. 7.

Elora, R. Bell, 1861: Hespeler, T. C. Weston, 1867 and 1871: Durham, Mr. J. Townsend: six specimens in all. Three imperfect examples of a shell which is probably referable to this species were collected by T. C. Weston in 1867, from the Niagara formation at Grimsby, Ont.

The *L. multicostatus* of Whitfield, from the Niagara formation of Waukesha, Wisconsin, appears to have been described from distorted or abnormally compressed individuals, which did not show the position

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\* British Palæozoic Fossils. Page 301.

of the siphuncle. The volutions of the shell in that species are said to be "very gradually increasing in size throughout and probably circular in a transverse section when not compressed, but in the specimen used and figured are of very much greater diameter in a dorso-ventral direction than laterally, giving a rather acute dorsal keel; most likely due to compression, the specimen being imbedded in the rock parallel to the stratification."

The outline of a natural transverse section of a specimen from Hespeler, which in other respects agrees well with the description of *L. multicosatus*, is transversely sub-elliptical or subreniform, its dorso-ventral diameter is much less than its breadth laterally, its periphery is broadly rounded and somewhat flattened, and there is not the slightest indication of a keel. The siphuncle is small and situated in the centre of the inner margin of the whorls, and the species appears to be a true *Trocholites*, very closely allied to the *T. ammonius* of Conrad.

#### ORTHOCERAS CREBESCENS, Hall.

*Orthoceras crebescens*, Hall.....20th Reg. Rep. St. of N. Y., p. 354,  
pl. 19, figs. 1, 2, and 3.

*Orthoceras crebescens*, Hall and Whitfield. Pal. Ohio. Vol. 2, p. 148, pl. 9, fig. 2.

Hespeler, T. C. Weston, 1871: Elora, Mr. James Gladstone, 1876, and since presented by the Trustees of the Elora Public School Museum per Mr. David Boyle: Durham, Mr. J. Townsend.

The Hespeler specimen is a coarse cast of the greater part of the body chamber, measuring eight inches and a half in length by four and a quarter in breadth at the larger and three and a half at the smaller end. The fine example from Elora is entirely septate and is divided into fifteen chambers; it measures rather more than eight inches and a half in length by three and a quarter in breadth at the larger and two and a third at the smaller end.

#### ORTHOCERAS MEDULLARE, Hall.

*Orthoceras medullare*, Hall. Rep. Progr. Geol. Surv. of Wisconsin, 1859.  
" " " Twentieth Reg. Rep., p. 353, pl. 20.

Elora, collected by Mr. David Boyle in 1876, and since presented by the Trustees of the School Museum.

A large cast of the septate end of the shell, measuring about seven and a half inches in length, with a portion of the test preserved. The septa are distant about one-third the lateral diameter, and the siphuncle is partly exposed on one side of the small end.

## ORTHOCERAS CADMUS, Billings.

- Orthoceras cancellatum*, Hall ..... (not Eichwald.) 1852. Palæont. of the State of N. Y., Vol. II., p. 292, pl. 63, figs. 1 and 4a, b; and pl. 65, figs. 4a b.  
*Orthoceras Cadmus*, Billings. .... 1866. Cat. Sil. Foss. of Anticosti, p. 83.  
*Orthoceras subcancellatum*, Hall. .... 1877. Cat. of Am. Pal. Fossils, by S. A. Miller, p. 245.

Elora, T. C. Weston, 1867: a single fragment identified with the above-named species by E. Billings. The types of *O. Cadmus* are not from Anticosti, but from the Niagara formation at Grimsby, Ont.

## ORTHOCERAS ANNULATUM, Sowerby.

- Orthoceras annulatum*, Sowerby. .... 1818. Min. Conch. Tab. 133.  
*Orthoceralites undulatus*, Hisinger. . Anteckn. V., Tab. 4, fig. 6, Vet. Akad. Handlingar, Tab. 7, fig. 8.  
*Orthoceralites undulatus*, Hisinger. . Lethea Suecica, 1827, p. 28, Tab. 10, fig. 2.  
*Orthoceras annulatum*, Sowerby. .... Murchison's Silurian System and Siluria.  
 " " " .... Hall, Pal. N.Y., Vol. II., p. 293, pls. 64 and 65.  
 " " " .... " Twentieth Reg. Rep., p. 351, pl. 20, figs. 4 and 5.  
 " " " .... Hall and Whitf. Pal. Ohio, Vol. II., p. 147, pl. 9, fig. 1.  
*Orthoceras nodocostum*, McChesney. 1861. New Pal. Foss., p. 94.  
 " " " Trans. Chic. Ac. Nat. Sc., p. 53, pl. 9, fig. 5.  
*Orthoceras Laphami*, " 1861. New Pal. Foss., p. 91.

Hespeler, T. C. Weston, 1867: Elora, one specimen, presented by the Trustees of the School Museum through Mr. David Boyle.

This species is not uncommon in the Niagara formation at Grimsby and St. Catharines, Ont., and one example of it has been found in the "Chaleur Group" of L'Anse au Gascon in the Baie des Chaleurs.

## ORTHOCERAS DARWINI, Billings.

Plate 6, figs. 2 and 2a.

- Orthoceras Darwini*, Billings. 1862. Pal. Foss. Canada, Vol. I., p. 161.

The type of this species, which has not previously been figured, is a very imperfect and badly preserved cast of the interior of part of the septate end of the shell. The siphuncle is visible only on the terminal septum of the smaller end, whose supposed ventral surface is partly removed by weathering, so that some allowance should probably be made for Mr. Billings' qualified statement that the centre of its siph-

uncle "appears to be"....."6 lines from the dorsal and 3 lines from the ventral margin." At any rate, in the writer's judgment, the eccentricity of the siphuncle in this species, the only character by which it can be distinguished from the *Cyrtoceras Myrice* of Hall and Whitfield, is more apparent than real and is probably due to distortion or to the accidental and unequal erosion of the posterior end of the specimen. The shell of *O. Darwini* is gently curved as is that of *C. Myrice*, and the exterior of both is longitudinally grooved or fluted, the breadth of the grooves or furrows in each case being about one line.

#### CYRTOCERAS MYRICE, Hall and Whitfield.

Plate 6, figs. 3 and 3a.

*Cyrtoceras Myrice*. Hall and Whitf. 1875. Pal. Ohio, Vol. II., p. 149, pl. 8, fig. 9.

Two specimens of this species, in excellent condition, have been collected at Durham by Mr. Joseph Townsend, both of which are now in the Survey Museum. One is a cast of the interior of nearly the whole of the septate portion of the shell, while the other, the one figured on plate 6, shews the central and apparently moniliform siphuncle and concave constriction of the body-chamber. The position of the siph-part of the uncle was unknown in the typical Ohio examples of *C. Myrice*, which, as stated in the remarks on the previous species, is doubtfully distinct from *Orthoceras Darwini*.

#### CYRTOCERAS SEPTORIS, Hall.

*Gomphoceras septoris*, Hall.....1864, Eighteenth Reg. Rep., p. 350, figs. 9 and 10.

*Cyrtoceras septoris*, Hall and Whitfield. 1875, Pal. Ohio, vol. 2, p. 151.

Elora, R. Bell, 1861: A cast of the body chamber only, shewing the very peculiar aperture characteristic of this species.

#### PHRAGMOCERAS NESTOR, Hall, var CANADENSE.

Plate 7, figs. 1, 1a, and 1b.

*Phragmoceras Nestor*, Hall.....1867, Twentieth Reg. Rep. State of New York, p. 347, figs. 7 and 8.

*Phragmoceras Nestor*, Whitfield. Geology of Wisconsin, vol. 4, p. 301, pl. 19, fig. 3.

Shell somewhat compressed, apparently very little curved: septate end expanding rapidly in the dorso-ventral diameter, septa numerous, the four or five next to the body chamber averaging about five

millimetres in their distance apart, and as close together on the ventral or siphonal side as they are on the dorsal or anti-siphonal: siphuncle marginal or nearly so, moniliform and about eight millimetres broad in its greatest diameter on the septum next to the body-chamber. Chamber of habitation ovate in outline in transverse section, narrowest on the siphonal side, expanding very slowly in its dorso-lateral diameter and broadest in that direction at or a little below the mouth: maximum height of the same chamber in some specimens about equal to, and in others much less than, its greatest dorso-ventral diameter, its ventral side being always shorter than the dorsal. Aperture linear and narrowly contracted in the middle for a distance of a little more than an inch, expanded and nearly circular at both ends, the anti-siphonal expansion being much larger than the siphonal. Surface of the septate portion and of the posterior half of the chamber of habitation marked by very faint, longitudinal, rounded ribs.

Hespler, T. C. Weston, 1867: Elora, loaned by the Trustees of the School Museum per Mr. David Boyle: Durham, Mr. J. Townsend, 1883. A single cast from each of these localities, one of which is that of the body chamber only, showing the shape and position of the siphuncle, while the others are casts of the same chamber with from six to nine septate chambers attached. As the posterior end of each happens to be imperfect, it is difficult to estimate the exact amount of their curvature.

These specimens resemble the *P. Nestor* of Hall, from the Niagara Group of Wisconsin, much more closely than they do the *P. Hector* of Billings, from the Guelph Formation, especially in the shape of the aperture and in the contour of the chamber of habitation. They appear to indicate a mere local and stratigraphical variety of *P. Nestor*, which can most readily be discriminated from the type of that species by its much straighter form,—in consequence of which the edges of the septa are nearly equidistant all round,—and by its faintly ribbed outer surface. This latter character, however, does not seem to be constant, for the ribbing is only to be seen in places on two of the Canadian specimens, and not at all on a third. The cast from Elora, which on the whole should probably be regarded as belonging to this variety of *P. Nestor*, is not only perfectly smooth but its dorsal aperture is produced into a short tube.

A specimen in the Museum of the Survey which was collected by Dr. R. Bell in 1862 at L'Anse à la Barbe in the Baie des Chaleurs from rocks of nearly if not quite the same geological horizon as the Guelph Formation, can scarcely be distinguished from the typical form of *P. Nestor*.

## PHRAGMOCERAS PARVUM, Hall and Whitfield.

Plate 7, fig. 2.

*Phragmoceras parvum*, Hall and Whitfield. 1875, Pal. Ohio, vol. 2, p. 151, pl. 8 fig. 10.

Two imperfect casts of the chamber of habitation of a *Phragmoceras* have been collected at Hespeler, which resemble *P. parvum* in their small size and in the tubular prolongation of the ventral end of the aperture. These specimens appear to differ from the type of that species only in not being quite so much curved.

## ASCOCERAS TOWNSENDI. (N. Sp.)

Plate 6, figs. 4 and 4a.

Shell small, slightly compressed at the sides, regularly oval in transverse section, its septate portion conical and widening gradually as well as somewhat convexly upwards from an obtusely pointed base: chamber of habitation unknown, with the exception of a small portion of its decurrent extremity: test and surface markings of the test also unknown. Septa apparently three in number. The first or posterior septum crosses the dorsum at a distance of about one millimetre from the posterior end, then curves concavely upwards on each side and finally passes over the ventral edge at a distance of eleven millimetres from the posterior end. The second septum crosses the dorsum close to the first and runs closely parallel with it on each side in its upward and concave curve, after which it bends first convexly towards the dorsum, and then suddenly backwards towards the ventral edge, which it ultimately passes over at a distance of four and a half millimetres above the septum. On the immediate centre of the dorsum the third septum is about one millimetre distant from the second: then for some distance on each side, as far as the upward concave curve extends, the sutures of the third and second septum are confluent, after which the third septum also bends convexly towards the dorsum, and then rather abruptly backwards towards and to the ventral edge, which it finally crosses at a distance of four millimetres above the second septum. The siphuncle is visible only at the pointed or posterior end: it is very small, and at this point is situated close to the centre of the dorsal margin of the first air chamber. The ventral half of the first air chamber is marked by a transverse groove or constriction.

Durham, Mr. J. Townsend, 1883: a well preserved cast of the septate portion of the shell, with a small portion of the decurrent posterior



extremity of the body-chamber. Although the type specimen is not perfect, this curious and interesting little shell appears to be easily distinguishable from all other species of the genus by its compressed conical form, and by the peculiar arrangement of the septa. The writer desires to couple with it the name of its discoverer, Mr. Joseph Towns- end, of Durham, a zealous collector of the fossils of that locality, to whom the Museum of the Survey is indebted for many choice specimens, some of which are described and figured in the present paper.

## TRILOBITA.

### CERAURUS NIAGARENSIS, Hall.

*Ceraurus Niagarensis*, Hall. 1867. Twentieth Regents' Rep., p. 376, pl. 21, fig. 10.

Hespeler, T. C. Weston, 1867: two specimens of the glabella.

## EURYPTERIDA.

### EURYPTERUS BOYLEI. (N. Sp.)

Plate 7, Fig. 3.

Carapace moderately convex, broader than long, greatest breadth a little above the middle; semiovate, broadly rounded in front and squarely truncated behind; sides somewhat convex at their margin above, but straighter below; front and sides bordered by an elevated, narrow ridge, which is highest and most strongly marked on the posterior half of the sides. Eyes reniform, prominent, about four millimetres in the greatest diameter; nine mm. apart (as measured from the centre of their inner margins) and placed at a distance of six mm. from the anterior, and of seven mm. from the lateral margin. Ocelli not clearly indicated, but probably placed on or near a small rounded prominence or elevation, which is situated exactly in the middle of the space between the two eyes. Surface of the carapace apparently finely granulose, and ornamented with minute rounded tubercles, some of which are isolated and others confluent in sets of two or three.

Thoracic and caudal portions together consisting of twelve segments, exclusive of the telson or caudal spine; the first, second, third and

fourth thoracic segment each bearing on the median line a single, large and prominent, transversely elongated tubercle, which is arcuate or reniform at its base and somewhat bilobate at its summit. The lateral diameter of each of these tubercles greatly exceeds the longitudinal, and measuring at their base, the proportions of each tubercle may be thus approximately estimated; that on the first thoracic segment, lat. diam. four mm., long. diam. not quite one mm.; that on the third, lat. diam. nearly five mm., long. diam. rather more than one mm.; that on the third, lat. diam. five mm., long. diam., two mm.; and that on the fourth, lat. diam. five and a half mm., long. diam., three mm.

Telson produced into a gradually narrowing, slightly curved, and rather obtusely pointed linear spine, which seems to be triangular in transverse section.

Antennæ, endognaths and ectognaths unknown, as is also the nature of the surface markings of the test of the thoracic and caudal segments.

Entire length, including the telson, about seventy-five mm. (or three inches); length of carapace, twenty mm., greatest breadth of the same, twenty-seven mm.; length of telson, fifteen mm.

Elora, collected in 1881, by Mr. David Boyle, an intelligent and successful collector of the fossils of the Guelph formation for many years, to whom the writer begs to dedicate the species. The specimen figured, which has been kindly presented to the Museum of the Survey by the Trustees of the Elora School Museum, is an impression in a rather coarse-grained dolomite of the exterior of the upper surface of the carapace, with the whole of the thoracic and caudal segments in situ. Although the type and only specimen known is too imperfectly preserved to admit of as accurate a description as could be wished, the species, nevertheless seems to be sufficiently well characterized by the single large and peculiarly shaped tubercle placed on the median line of the upper surface of each of its four anterior thoracic segments.

## PLATE I.

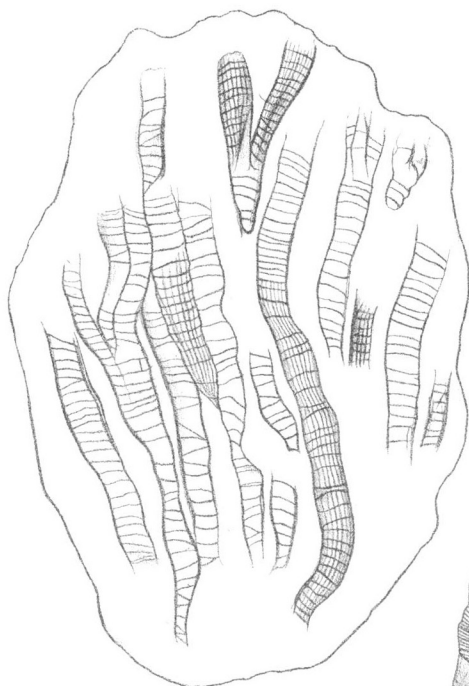
Unless otherwise stated, all the figures are of natural size.

### PYCNOSTYLUS GUELPHENSIS (page 3).

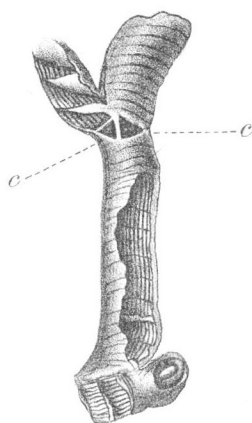
- Figure 1. . Portion of a hand specimen, shewing a natural longitudinal section of some of the corallites.
- " 1a. An isolated corallite of this species, which has divided above into four branches, two of which (c c) are broken off at their bases.
- " 1b. Piece of a natural transverse section of the corallites, shewing their quadripartite and more rarely tripartite division subsequent to gemmation.

### PYCNOSTYLUS ELEGANS (page 4).

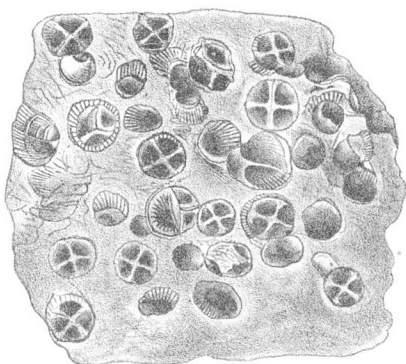
- Figure 2. Anterior end of a corallite of this species, showing its calycinal gemmation and ribbed outer surface.
- " 2a. Natural longitudinal section of a portion of a corallite, exhibiting the complete tabulæ and marginal septa.



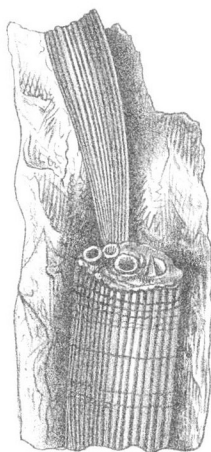
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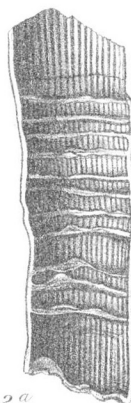
1a



1b



2



2a

## PLATE II.

### MONOMERELLA OVATA (page 5).

- Figure 1. Interior of a ventral or pedicle valve, partly restored. The proportions of this restoration are not quite correct, the cardinal facet being too broad and the platform too large as well as placed too far forwards. Additional figures of better specimens of this species and its variety are given on Plate 8.

### MONOMERELLA OVATA, VAR. LATA (page 6).

- Figure 2. Interior of the ventral or pedicle valve.  
" 2a. Exterior of the same specimen.

### RHYNOBOLUS GALTENSIS (page 7).

- Figure 1a. Exterior of the ventral or pedicle valve. This species also is further illustrated on Plate 8.

### GONIOPHORA CRASSA (page 8).

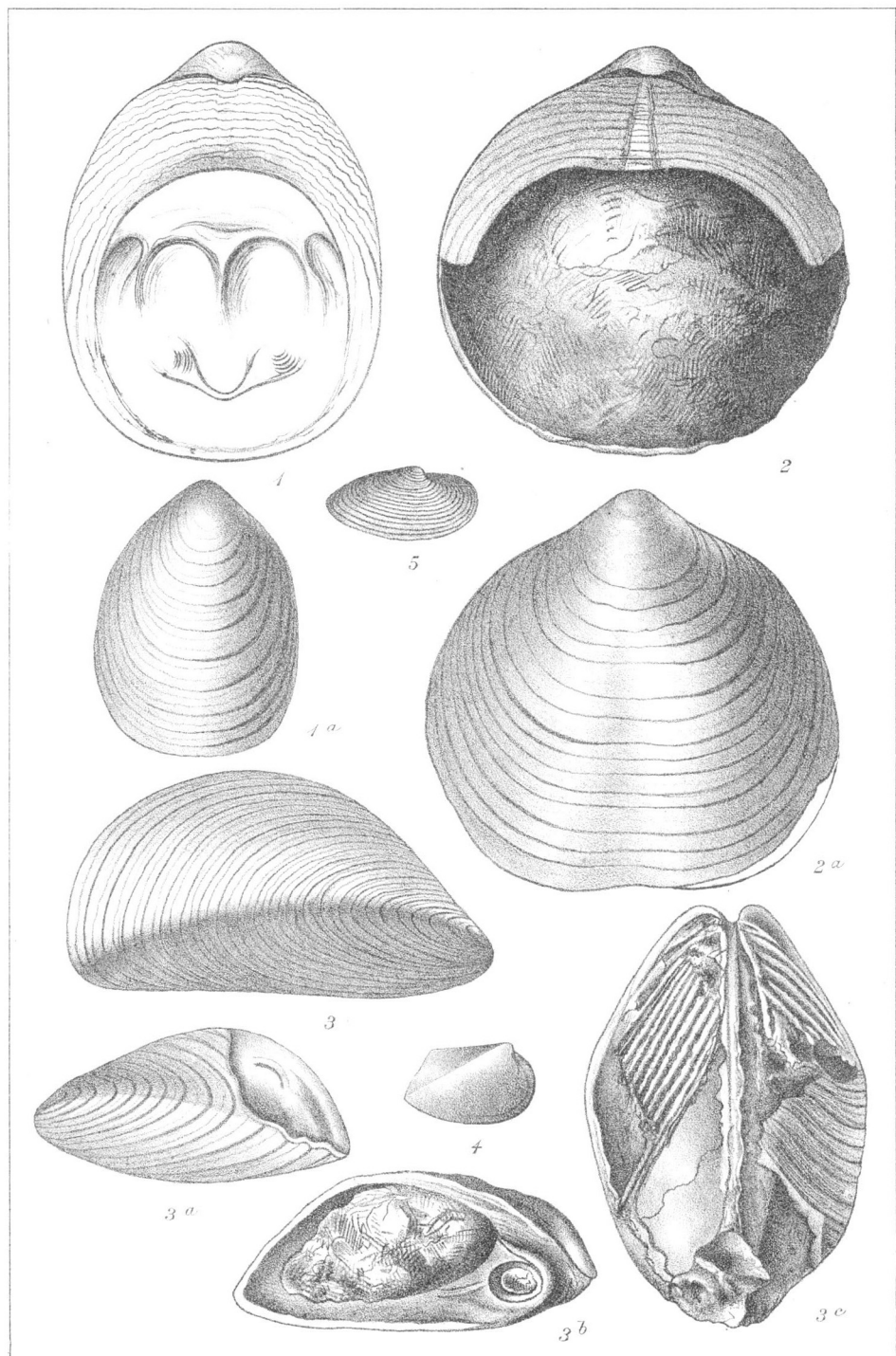
- Figure 3. Exterior of a left valve.  
" 3a. Exterior of a right valve.  
" 3b. Interior of a left valve.  
" 3c. Dorsal view of the closed valves, to show the concamerated structure of the inside of the anterior end.

### ANODONTOPSIS CONCINNA (page 12).

- Figure 4. Exterior of a cast of a right valve. As this figure is not very satisfactory, two additional illustrations are given on Plate 7.

### ILIONIA (?) COSTULATA (page 15).

- Figure 5. Side view of a right valve, taken from a gutta-percha impression of a mould of the exterior of the shell.



### PLATE III.

#### ILIONIA GALTENSIS (page 14).

- Figure 1. Left valve of a specimen from Durham.  
" 1a. Right " " " " "  
" 1b. Side view of a right valve, from Galt.

#### SUBULITES COMPACTUS (page 15).

- Figure 2. Side view, somewhat enlarged. This figure is not quite accurate, and another has accordingly been given on Plate 7.

#### CODONOCHEILUS STRIATUM (page 17).

- Figure 3. Side view of the most perfect specimen known, about twice the natural size.

#### HOLOPEA GRACIA, Billings (page 18).

- Figure 4. Side view of the type of the species.

#### CYCLONEMA SULCATUM, Hall (page 18).

- Figure 5. Specimen with most of the test preserved.

#### EUOMPHALUS MACROLINEATUS, Whitfield (page 20).

- Figure 6. Side view of a specimen from Durham.

#### TROCHONEMA INORNATUM (page 19).

- Figure 7. The most perfect specimen known to the writer.

#### STRAPAROLLUS CRENULATUS (page 21).

- Figure 8. Large specimen from Durham, as seen from above.  
" 8a. Side view of a smaller individual from Durham.  
" 8b. Basal aspect of the same.

#### EUOMPHALUS GALTENSIS (page 21).

- Figure 9. A nearly perfect cast, as seen from above.  
" 9a. Lateral aspect of the same specimen.

#### OPERCULA OF GASTEROPODA (page 33).

- Figure 10. View of operculum No. 1., as seen from above.  
" 10a. Side view of the same specimen.  
" 10b. Basal aspect of do.  
" 11. Base of operculum No. 2. A side view of this specimen is given on plate 7.

#### PLEUROTOMARIA CYCLOSTOMA (page 23).

- Figure 12. Side view of a specimen from Durham.  
" 12a. Another view of the same specimen, to show the circular aperture.

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PLATE III

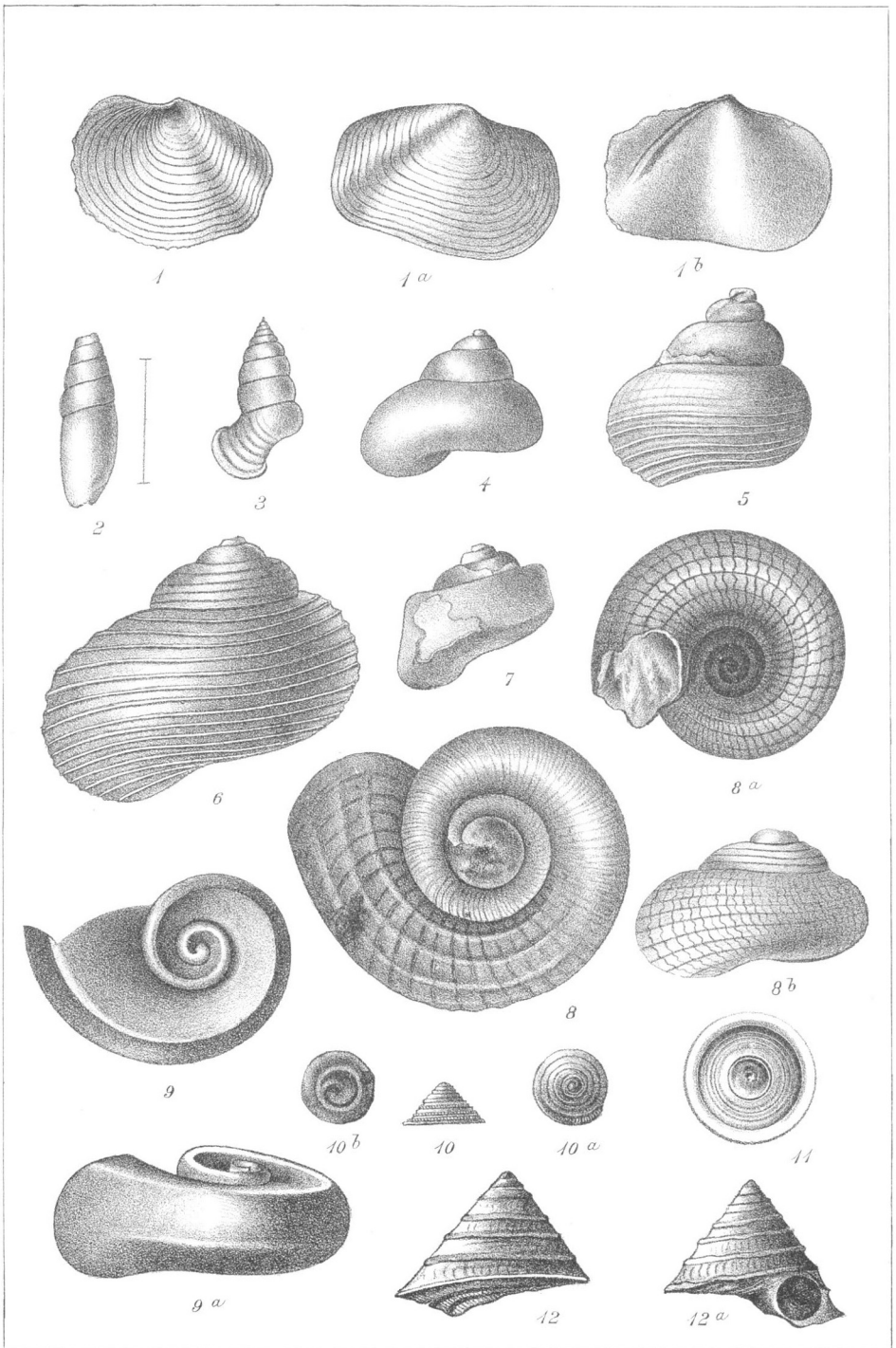




PLATE IV.

PLEUROTOMARIA VALERIA, Billings (page 23).

- Figure 1. Basal view of the type of the species.  
" 1a. Specimen from Durham, showing spire and test, which the type does not.

PLEUROTOMARIA DURHAMENSIS (page 24).

- Figure 2. An unusually perfect cast of the interior of the shell.

MURCHISONIA HESPELERENSIS (page 24).

- Figure 2. Lateral view of a cast.

MURCHISONIA CONSTRICTA (page 25).

- Figure 4. Specimen with the test preserved.

MURCHISONIA TURRITIFORMIS, Hall. Var. (page 26).

- Figure 5. The most perfect specimen in the Survey collection.

MURCHISONIA CONRADI, Hall (page 27).

- Figure 6. A stout form of this species, from Elora.

MURCHISONIA MACROSPIRA, Hall (page 27).

- Figure 7. Drawing of gutta-percha impression from a mould of the interior collected at Galt.  
" 7a. Small specimen from Elora, with the whole of the test preserved.

MURCHISONIA SOLUTA (page 28).

- Figure 8. Cast of the interior of the shell of this species, with the apical portion broken off.  
" 8a. Cast of the earlier whorls of the shell.

MURCHISONIA. Sp. Undt. (page 29).

- Figure 9. Fragment of cast of a shell with characters intermediate between *M. macrospira* and *M. soluta*,

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PLATE IV

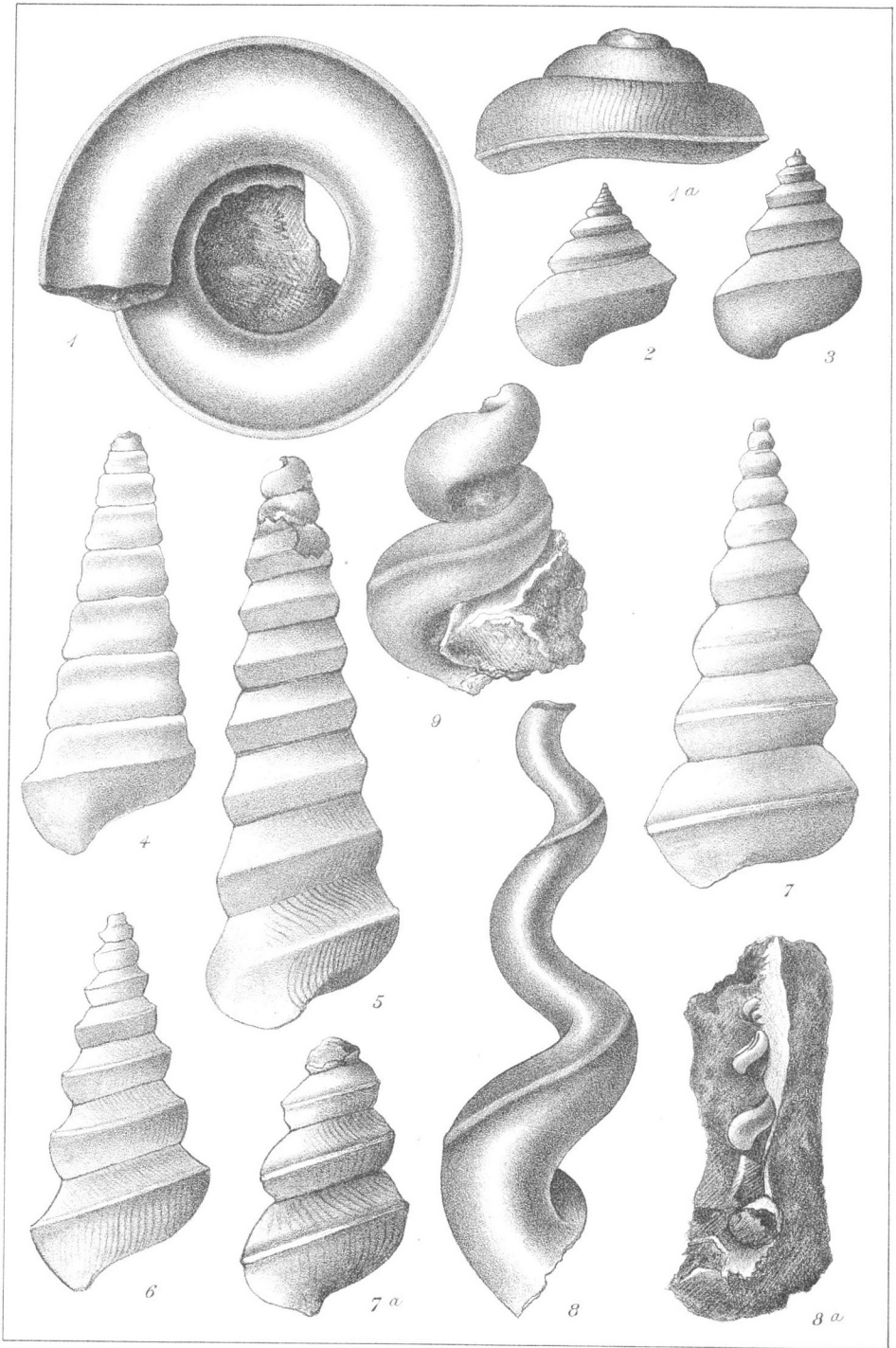


PLATE V.

TRYBLIDIUM CANADENSE (page 31).

- Figure 1. Cast of the interior, as seen from above.  
" 1a. Lateral view of the same specimen.

SCENELLA CONICA (page 32).

- Figure 2. Summit view of a cast.  
" 2a. Side view of the same.

BUCANIA STIGMOSA, (?) Hall, (page 34).

- Figure 3. Side view of a cast.  
" 3a. Another view of the same, to show the shape of the aperture and periphery. The periphery, however, is usually subcarinated, and the aperture more expanded, as shown on plate 8, fig. 4.

ECCULIOMPHALUS CIRCINATUS (page 35).

- Figure 4. Upper side of a cast of the interior, from Durham. The two grooves represented in this figure are too strongly defined, and they are entirely obsolete on the anterior half of the specimen.  
" 4a. Upper side of another cast, to show the septate character of the commencement of the volution.  
" 4b. Fragment with the test preserved, to show the surface ornamentation.  
" 4c. This was intended for an outline of a transverse section of the shell, near the mouth, but it is entirely incorrect. The true shape of a transverse section of the anterior end of the volution is given on plate 8, fig. 5.

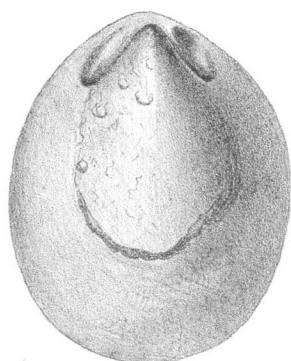
TROCHOCERAS DESPLAINENSE, McChesney, (page 36).

- Figure 5. Drawing from gutta-percha impression of a natural mould collected at Hespeler.

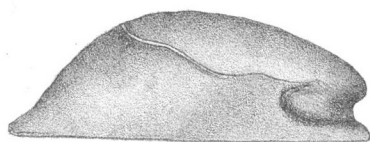
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PLATE V.



1



1 a



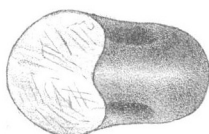
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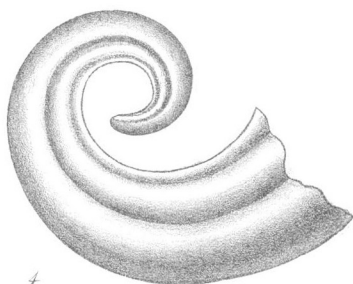
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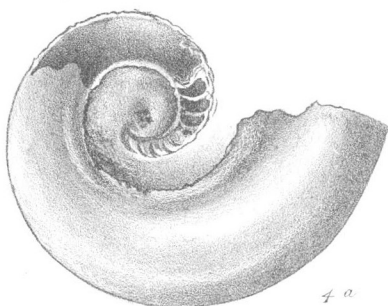
3



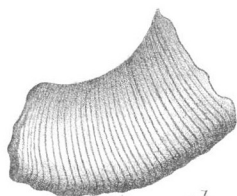
3 a



4



4 a



4 b



4 c



5

## PLATE VI.

### TRICHOCHOLITES MULTICOSTATUS, Whitfield, Sp. (page 36).

- Figure 1. Side view, taken from a gutta-percha impression of a natural mould of the exterior collected at Durham.
- " 1a. Septum of the same species, showing the position of the siphuncle.

### ORTHOCHOLITES DARWINI, Billings (page 38).

- Figure 2. The type of the species, from New Hope, which is laterally and abnormally compressed.
- " 2a. Smaller end of the same specimen, to show the outline of a transverse section at that point.

### CYRTOCHOLITES MYRICE, Hall & Whitfield (page 39).

- Figure 3. Specimen from Durham, for comparison with the preceding species.
- " 3a. View of a septum from the middle of the same specimen, which shows the size, shape and position of the siphuncle.

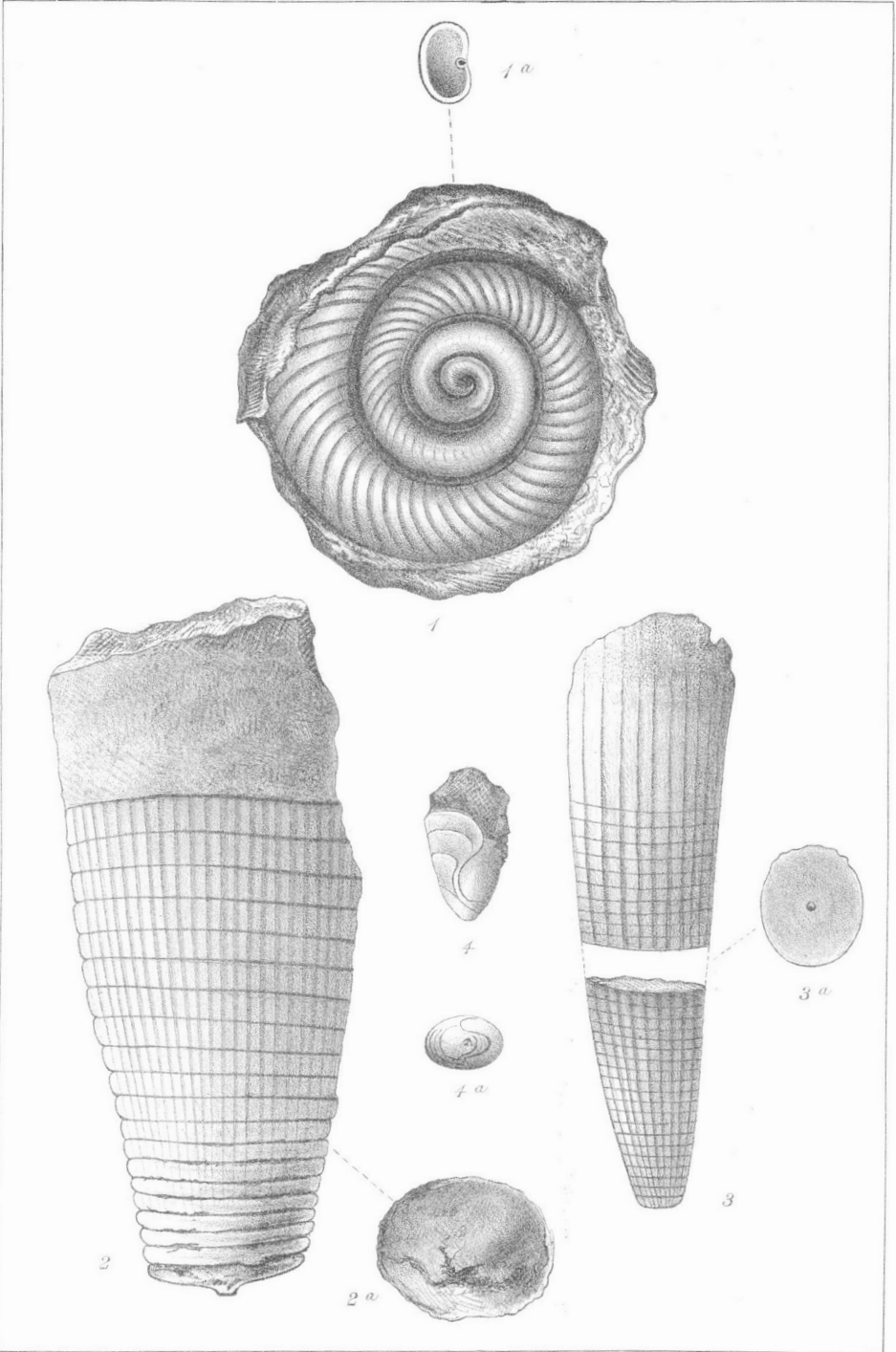
### ASCOCERAS TOWNSENDI (page 41).

- Figure 4. Side view of a cast of this species, from Durham.
- " 4a. View of smaller end of the same, to show the position of the siphuncle.

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PLATE VI.



## PLATE VII.

### PHRAGMOCERAS NESTOR, Hall. VAR CANADENSE, (page 39).

- Figure 1. Specimen from Durham, with part of the septate end preserved.  
" 1a. Cast of the chamber of habitation, from Hespeler.  
" 1b. Aperture of the last specimen, as seen from above.

### PHRAGMOCERAS PARVUM, Hall & Whitfield, (page 41).

- Figure 2. Cast of the chamber of habitation, from Hespeler.

### EURYPTERUS BOYLEI (page 42).

- Figure 3. Natural mould of the exterior of the species, from Elora.

### ANODONTOPSIS CONCINNA (page 12).

- Figure 4. Right valve of the ordinary form of the species.  
" 4a. Right valve of an unusually short and broad variety, from Galt.

### MURCHISONIA TROPIDOPHORA (page 29).

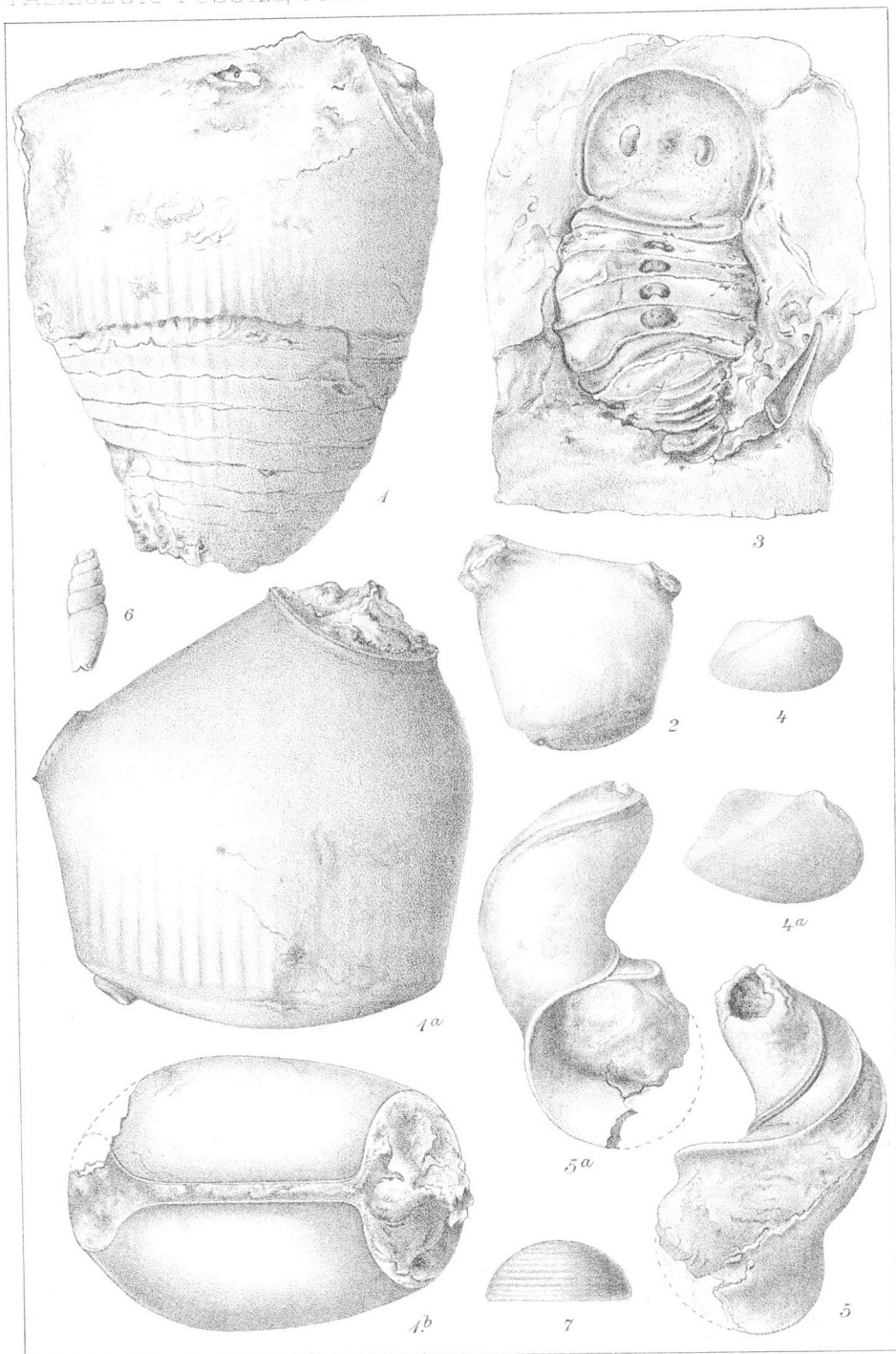
- Figure 5. Side view of the only specimen known to the writer.  
" 5a. Another view of the same, to show the aperture.

### SUBULITES COMPACTUS (page 15).

- Figure 6. Side view of a specimen from Durham, about twice the natural size.

### OPERCULUM OF GASTEROPOD (page 33).

- Figure 7. Side view of operculum No. 2.





## PLATE VIII.

### MONOMERELLA OVATA (page 5).

- Figure 1. Specimen with both valves.  
" 1a. Another view of the same.  
" 1b. Interior of a ventral or pedicle valve.  
" 1c. Portion of another ventral valve to show the deltidium and deltidial slopes.

### MONOMERELLA OVATA, VAR. LATA., (page 6).

- Figure 2. Interior of a ventral valve.  
" 2a. Natural cast of the interior of a ventral valve.

### RHYNOBOLUS GALTENSIS, Billings, Sp. (page 7).

- Figure 3. Interior of a dorsal or brachial valve.  
" 3a. A ventral or pedicle valve, to show the hinge area.

### BUCANIA STIGMOSA (?) Hall, (page 34).

- Figure 4. View of another specimen, to show the somewhat expanded aperture and sinus on the outer lip.

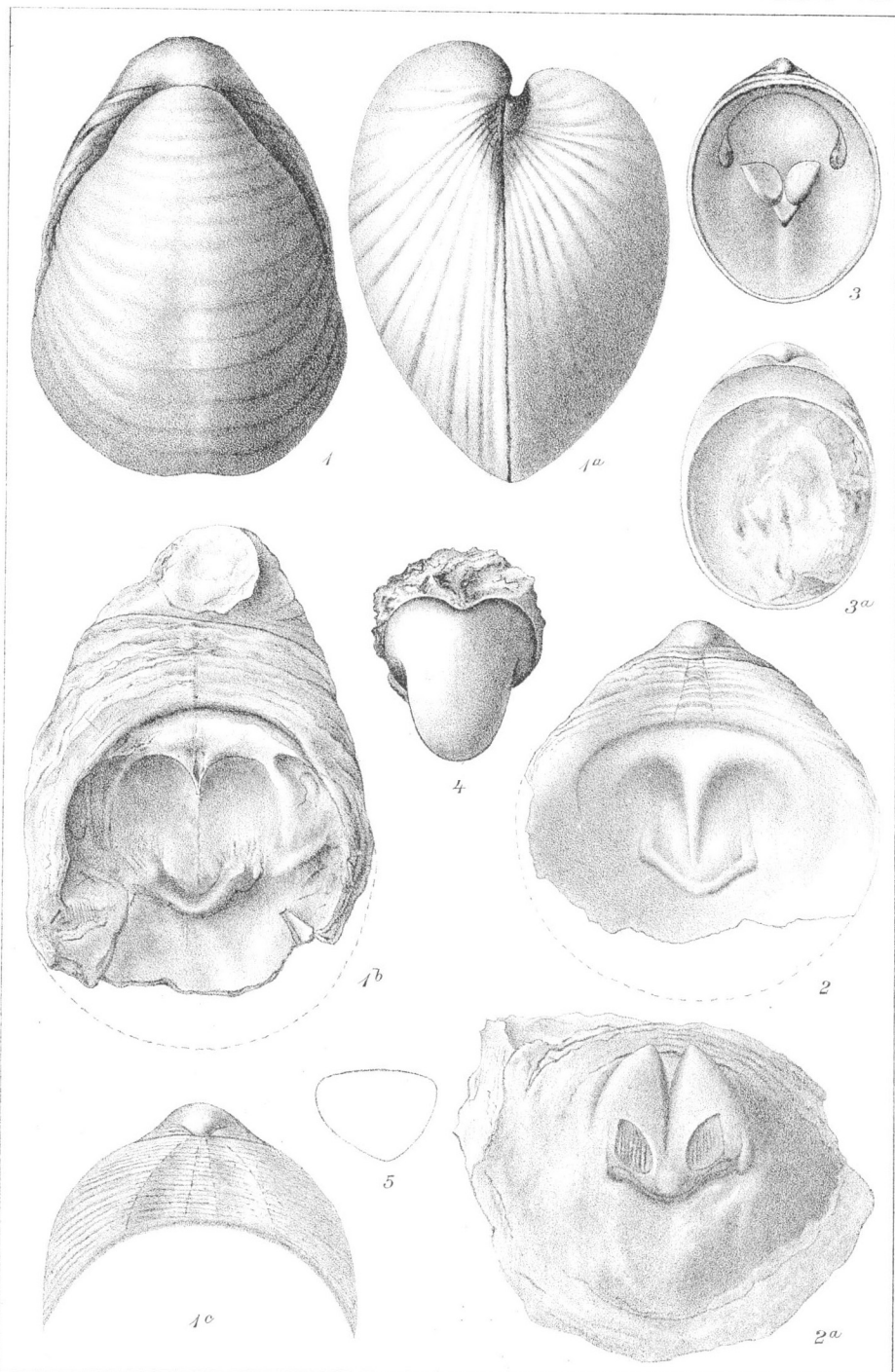
### ECCULIOMPHALUS CIRCINATUS (page 35).

- Figure 5. Outline of a transverse section of the shell near the aperture.

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PLATE VIII



L. M. Lambe, Del.

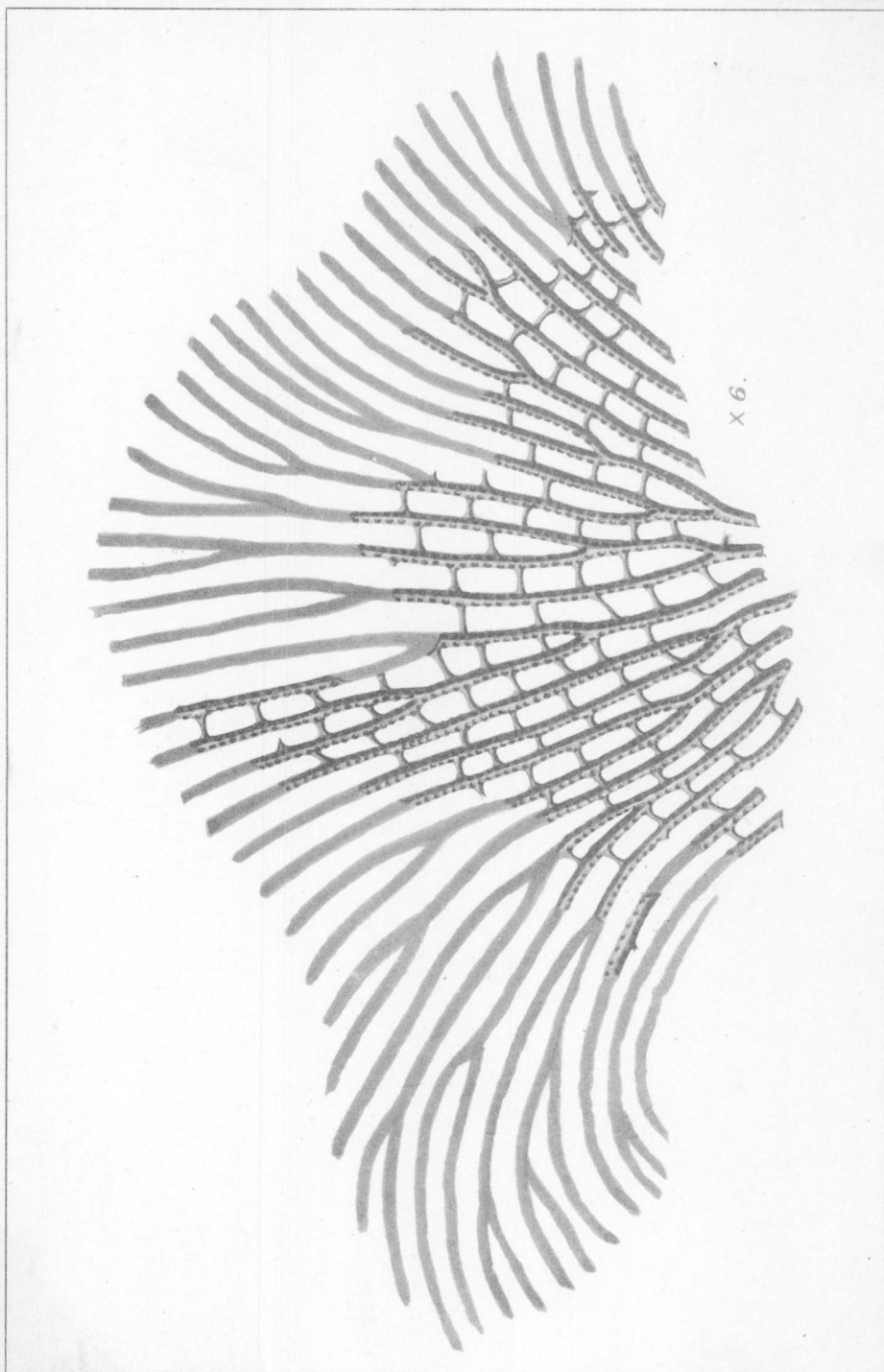
A. Morimer, Lith.

*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 tabulæ.
- " 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 (PYGMÆA ? 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.

### PHÆNOPORA KEEWATINENSIS (page 268).

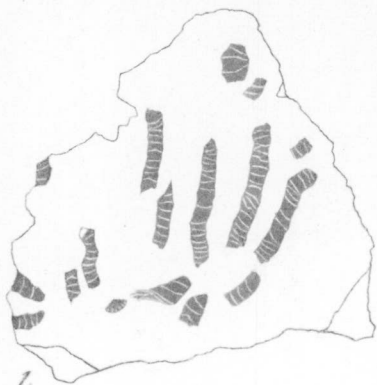
- Figure 6. The type and only known specimen of this species, a fragment of a zoarium, from the Silurian limestone on a small island in the northern Sutton Mill Lake; twice the natural size.
- " 6 a. Section of a portion of the same specimen; six times the natural size.

### 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 Ekwana 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.



2.



3.



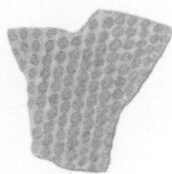
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5.



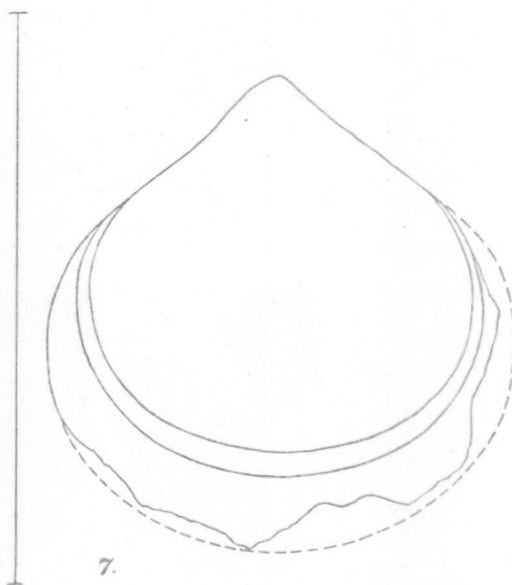
1a. X 6.



6a. X 6.



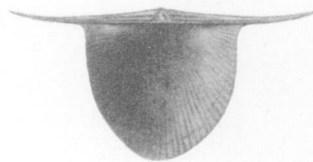
X 2. 6.



7.



8.



9.

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.
- " 3 a 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.
- " 4 a Front view of the same specimen, shewing the comparative convexity of both valves, and the well defined sinus in the ventral valve.
- " 4 b. Ventral view of the same specimen. All three figures, three times the natural size.

CAMAROTÆCHIA (?) WINISKENSIS (page 272).

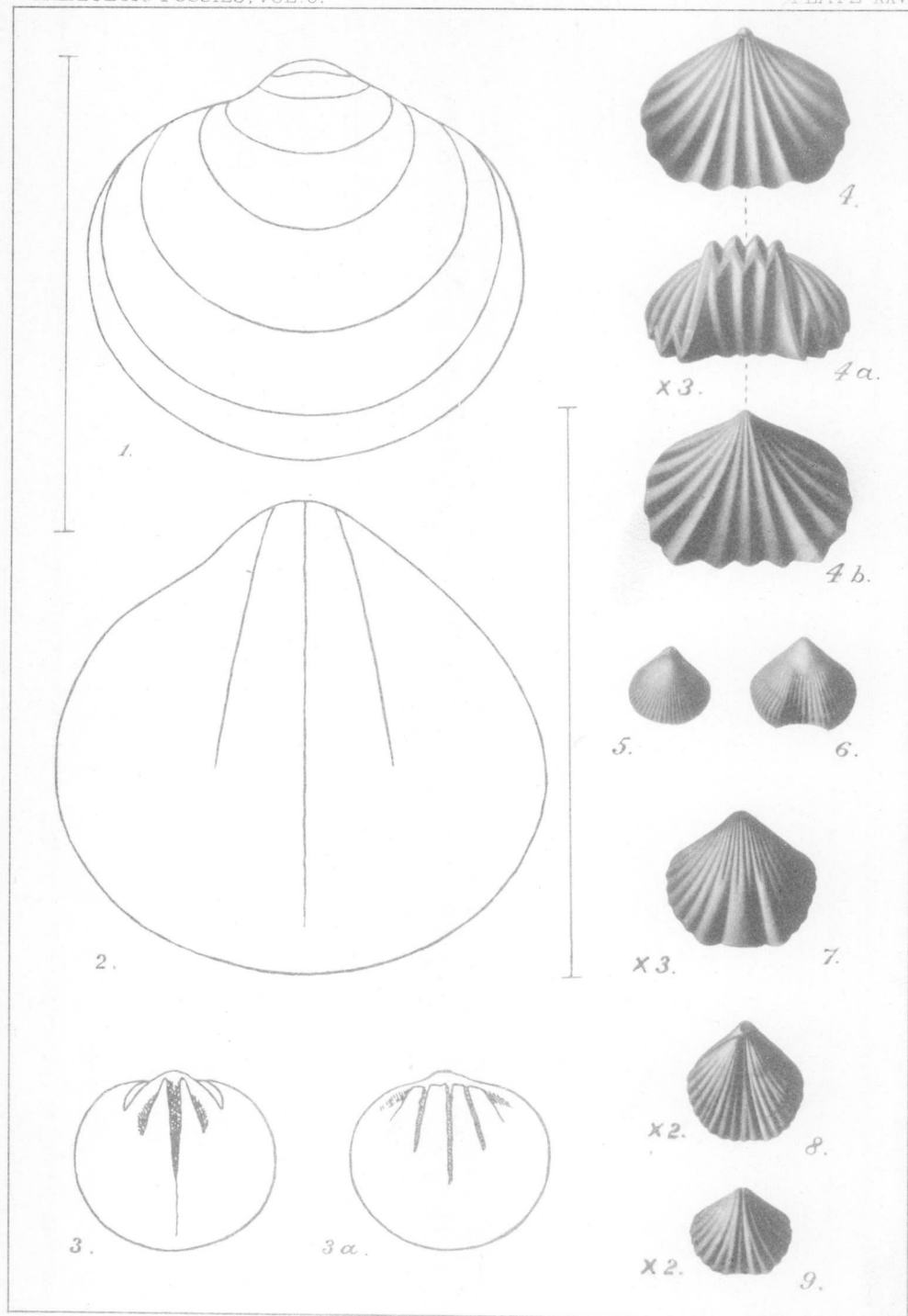
- Figure 5. Dorsal view of a small and evidently immature specimen from the Silurian limestone of the Winisk River, with both valves preserved.
- Figure 6. Exterior of the ventral valve of a large and apparently adult specimen, also from the Winisk River.

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 umbo 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).

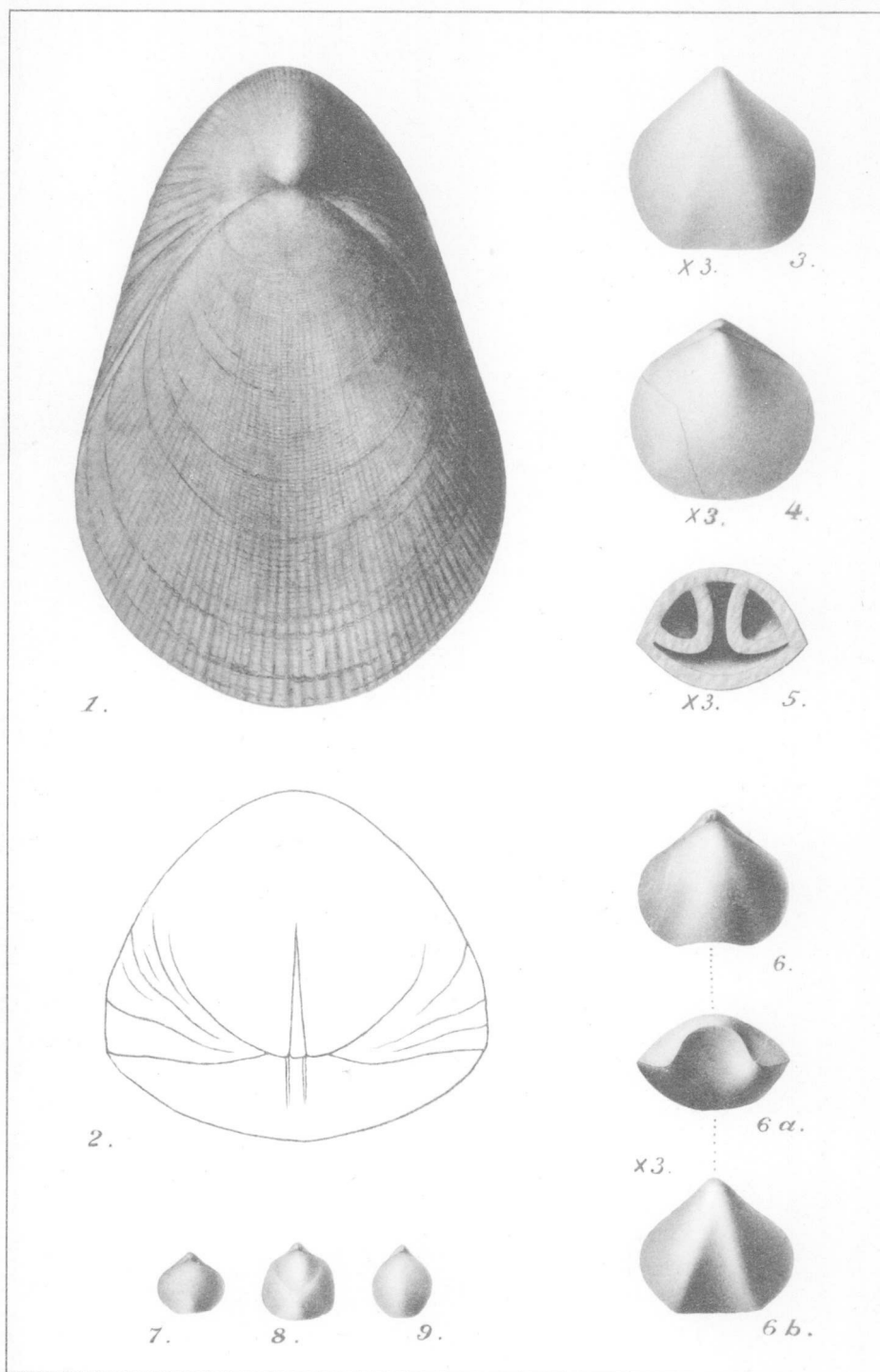
- Figure 3. Ventral view of a typical specimen of this species, from the Silurian limestone at the Winisk River.
- Figure 4. Dorsal view of another typical specimen, from the same locality.
- Figure 5. A specimen from the Winisk River, that has been broken in such a way as to shew a transverse section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

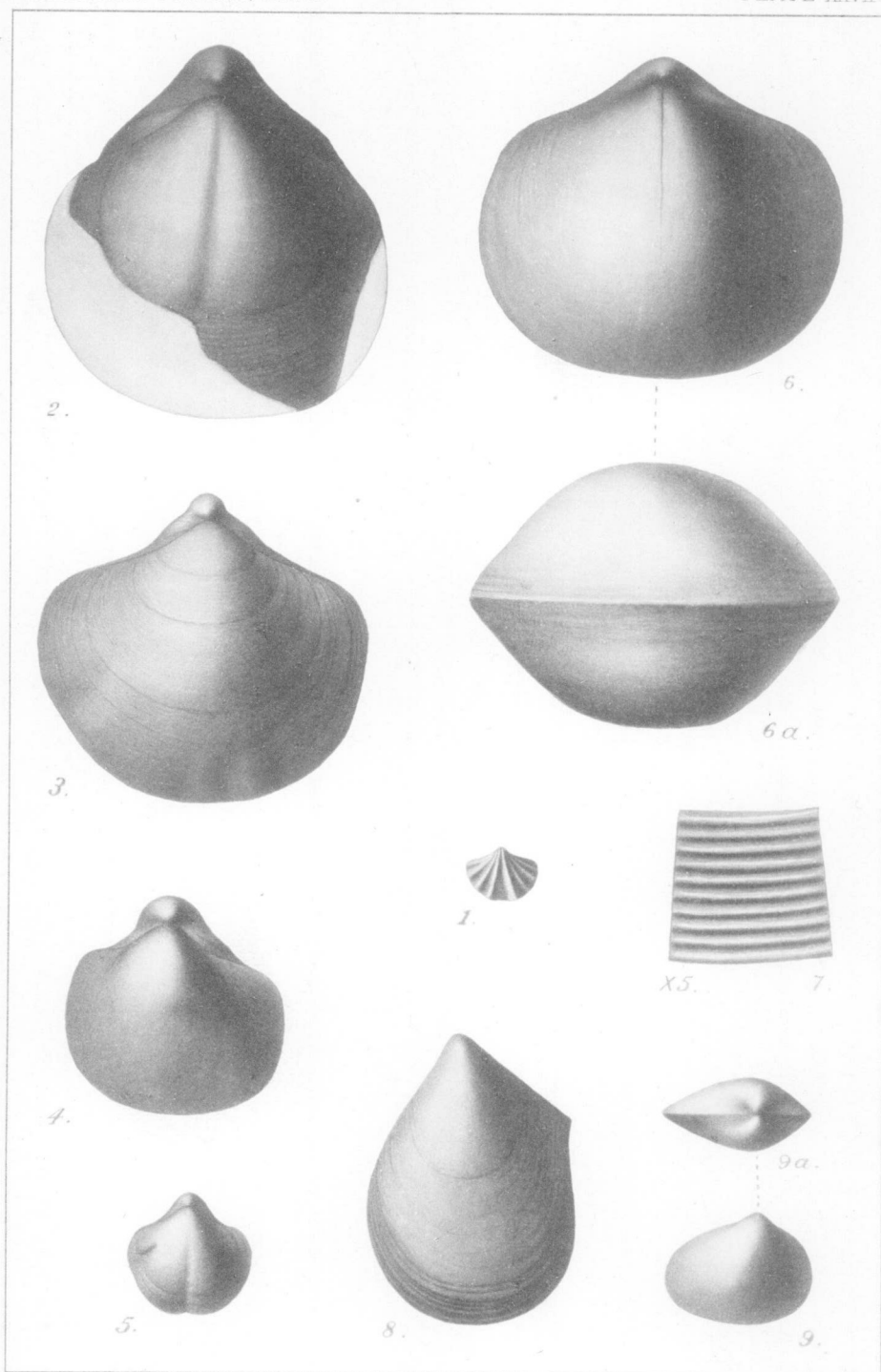
- Figure 6. Dorsal view of a large and presumably adult specimen of this species.  
" 6 a. Front view of the same specimen, shewing the unequal convexity of the two valves, and the absence of any mesial fold or sinus.  
Figure 7. Surface markings of part of the exfoliated test of a rather smaller specimen,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

### MYTILARCA 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.  
" 9 a. 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).

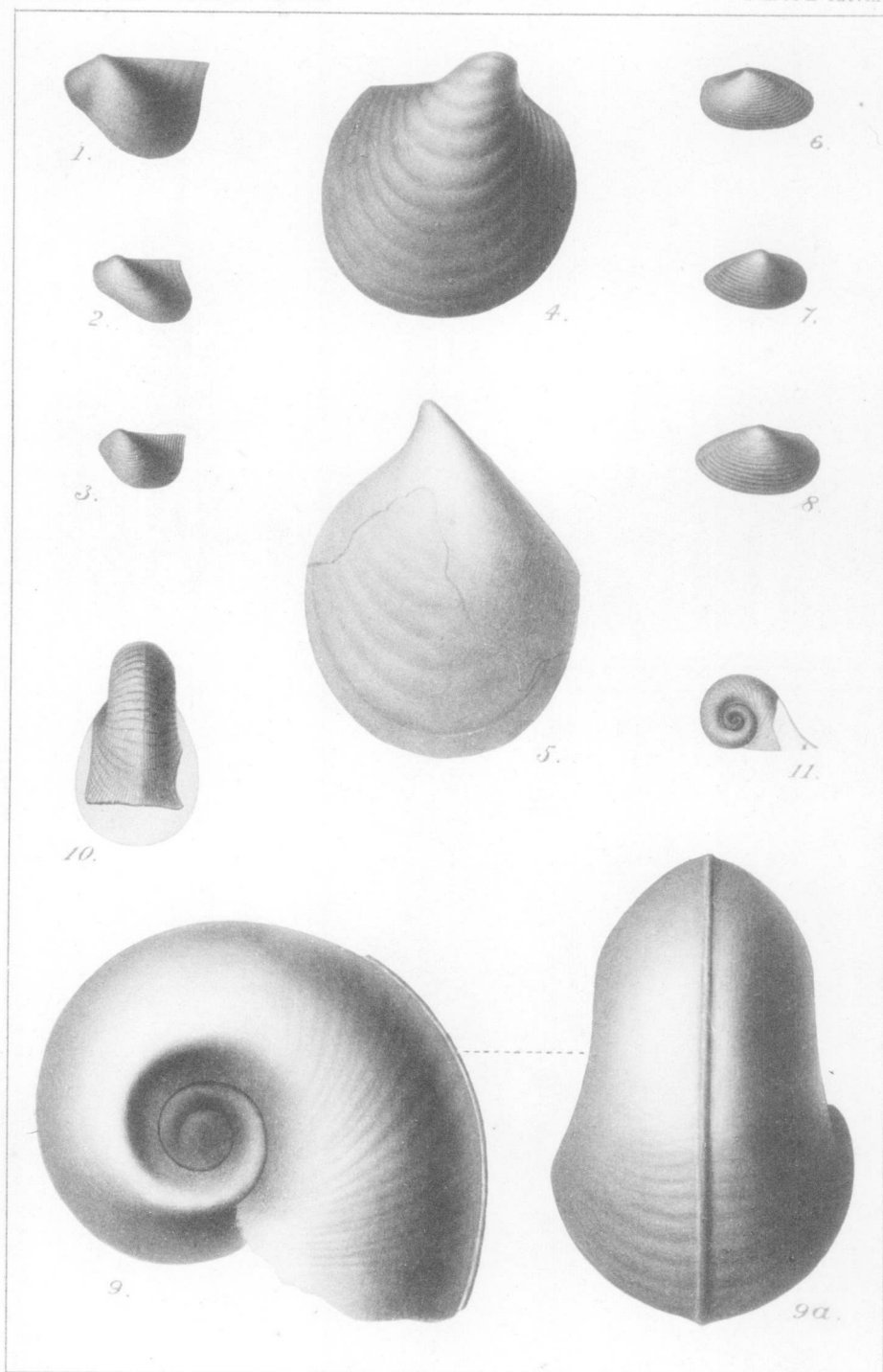
- Figure 6. Side view of the left valve of a shell of this species, from the rocks exposed at Ami Island.
- Figure 7. Side view of a right valve of a shell of this species, from the Silurian rocks at Long Point, Lake Winnipegosis.
- Figure 8. Side view of another right valve of a shell of this species,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



*PLATE XXIX.*

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

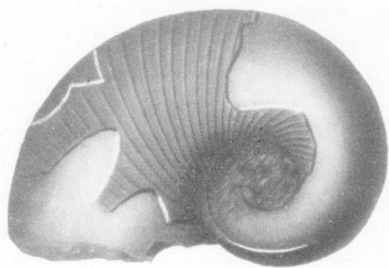
- Figure 5. Side view of a specimen of this species.  
" 5a. Another view of the same.

*PLATYCERAS COMPACTUM* (page 260).

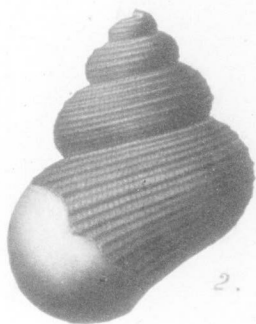
- Figure 6. Dorsal view of the largest and most perfect specimen known to the writer.

*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.



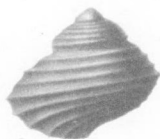
1.



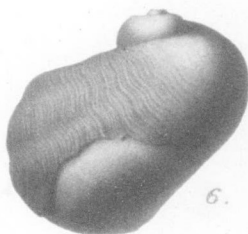
2.



3.



4.



6.



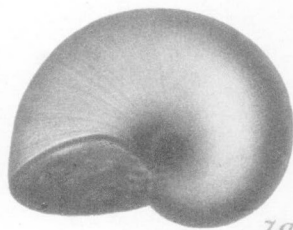
5.



5a.



7.



7a.



## 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).

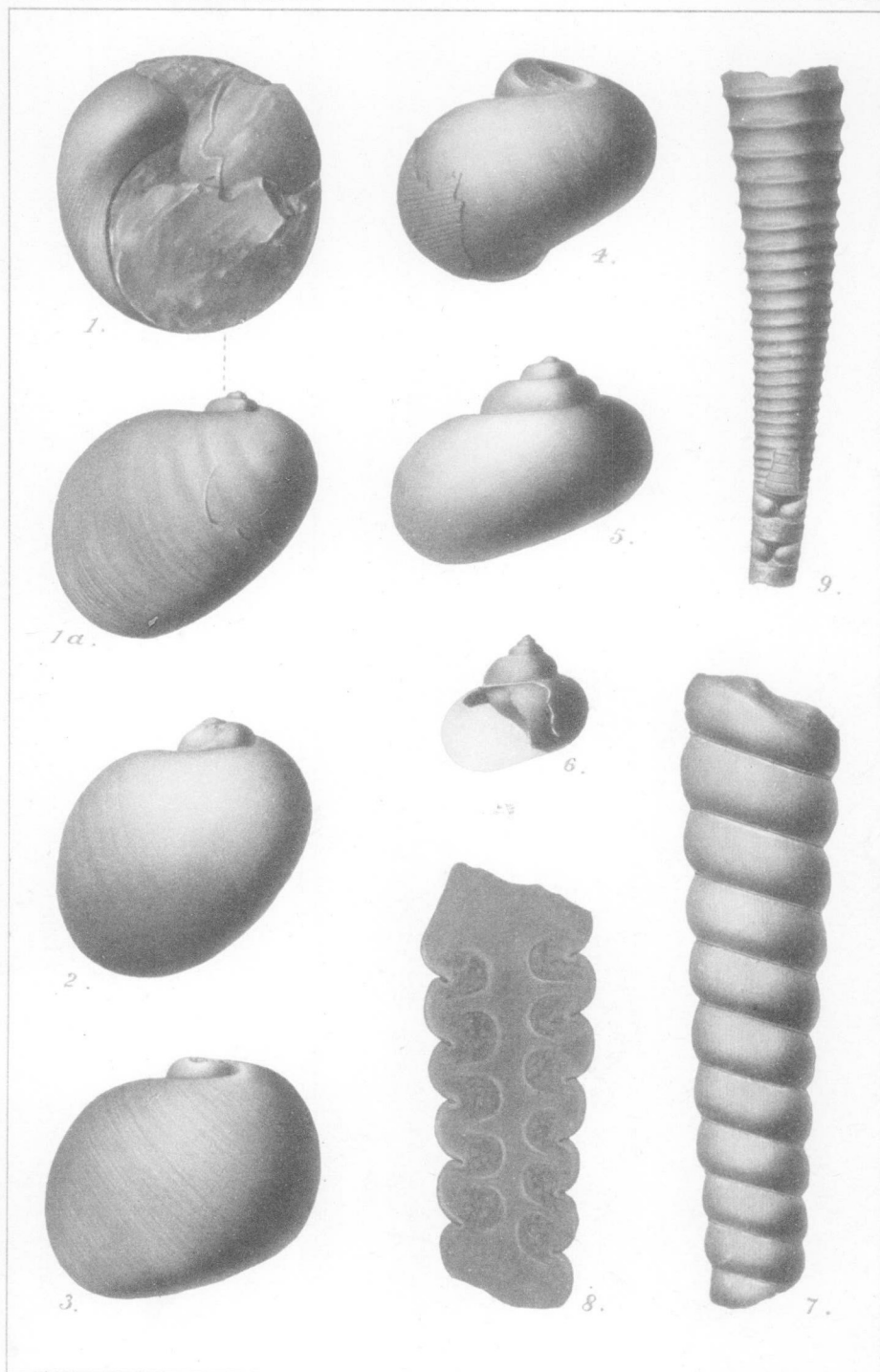
- Figure 4. Dorsal view of an imperfect cast of the interior of a shell of this species, from the Ekwan River, with a small portion of the test preserved at the anterior end of the last volution.
- Figure 5. Similar view of a cast of the interior of the shell of a specimen, from the Ekwan, that is probably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

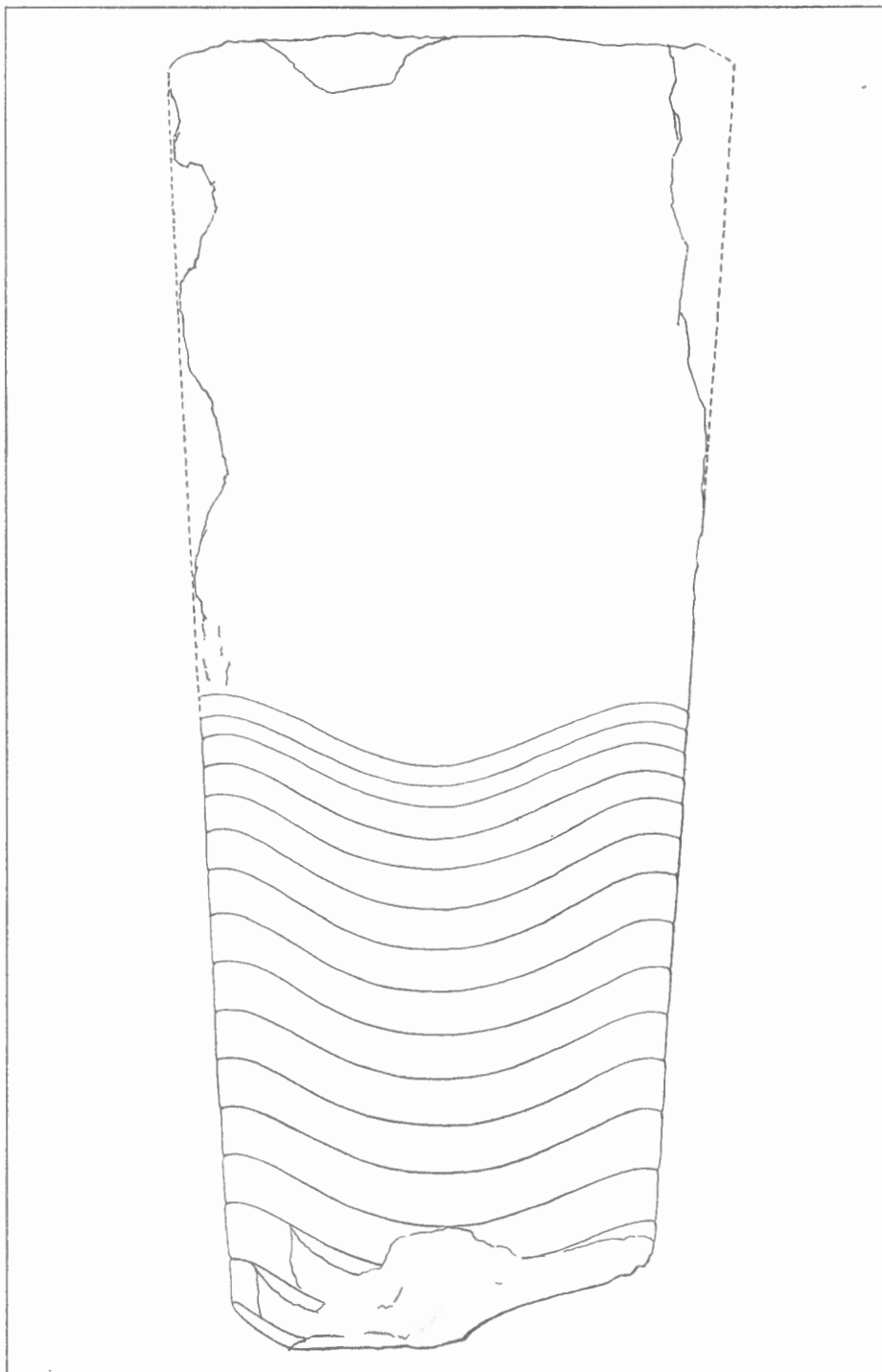
Outline of the exposed portion of an imperfect cast of the interior of the shell of a specimen of this species, from Stonewall, presented by Mr. Donald Gunn. This cast has fifteen septal chambers and a considerable portion of the body chamber preserved, and shows the curved sutural lines on the flattened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

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Geological Survey Department, Canada.

PALÆOZOIC FOSSILS, VOL. 3.

PLATE XXXI.



*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.

## Geological Survey Department, Canada.

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PLATE XXXII

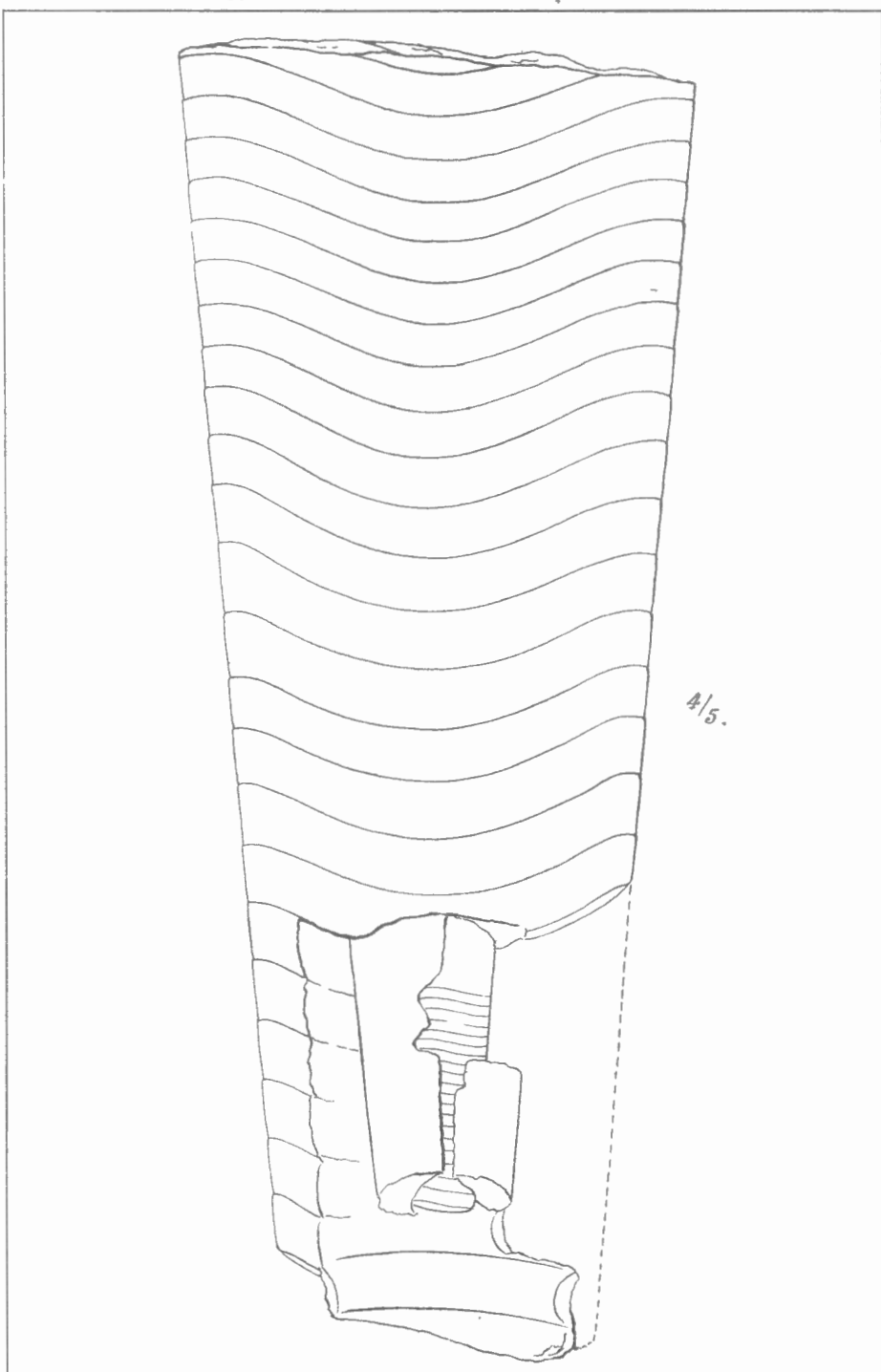


PLATE XXXIII.

ORTHOCERAS 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.
- " 1 a. 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.

SPYRO CERAS BEAUPORTENSE (page 323).

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

ORTHOCERAS WALPOLENS (page 324).

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

ORTHOCERAS HAGERSVILLENS (page 325).

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

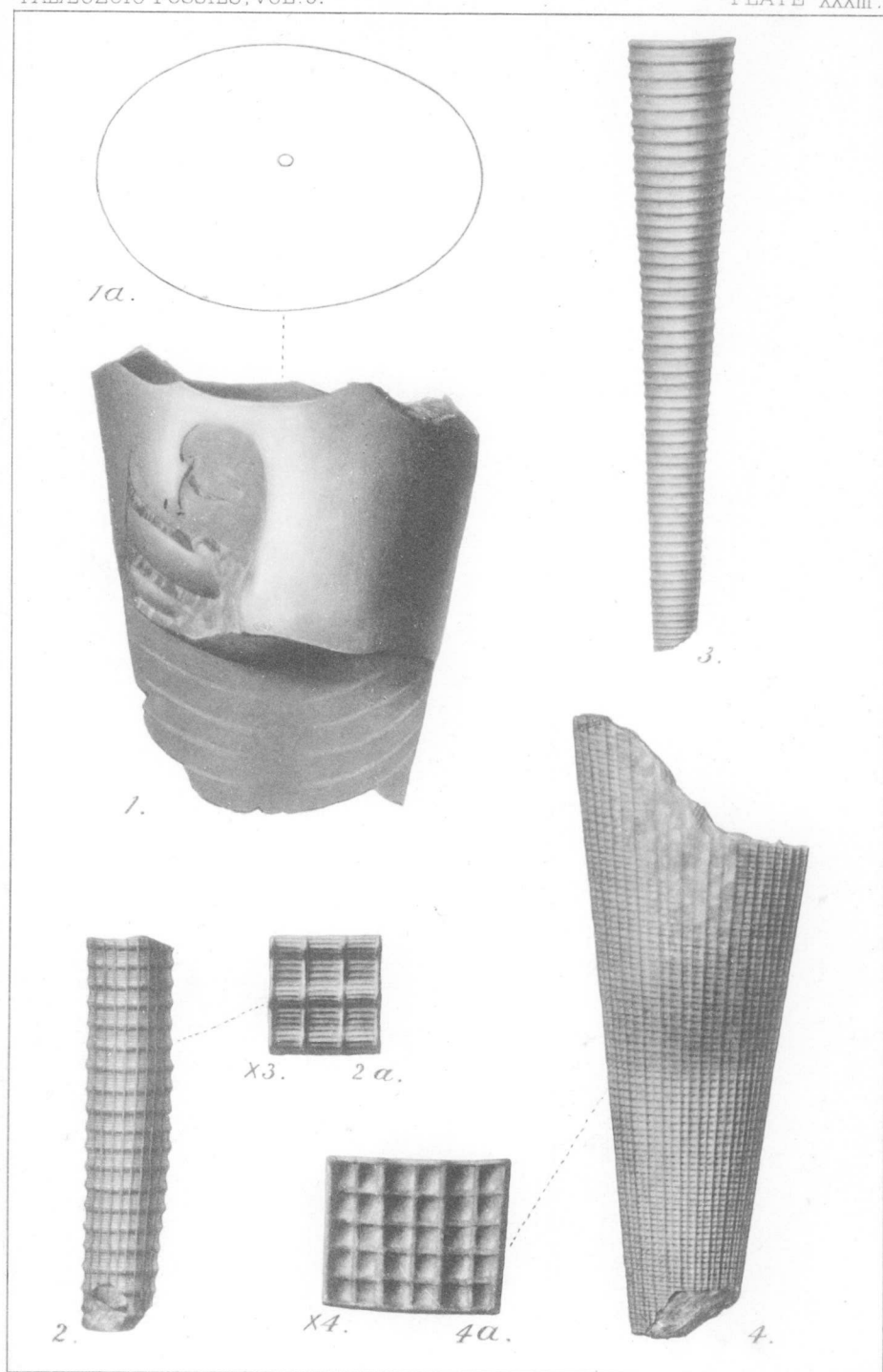




PLATE XXXIV.

(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.

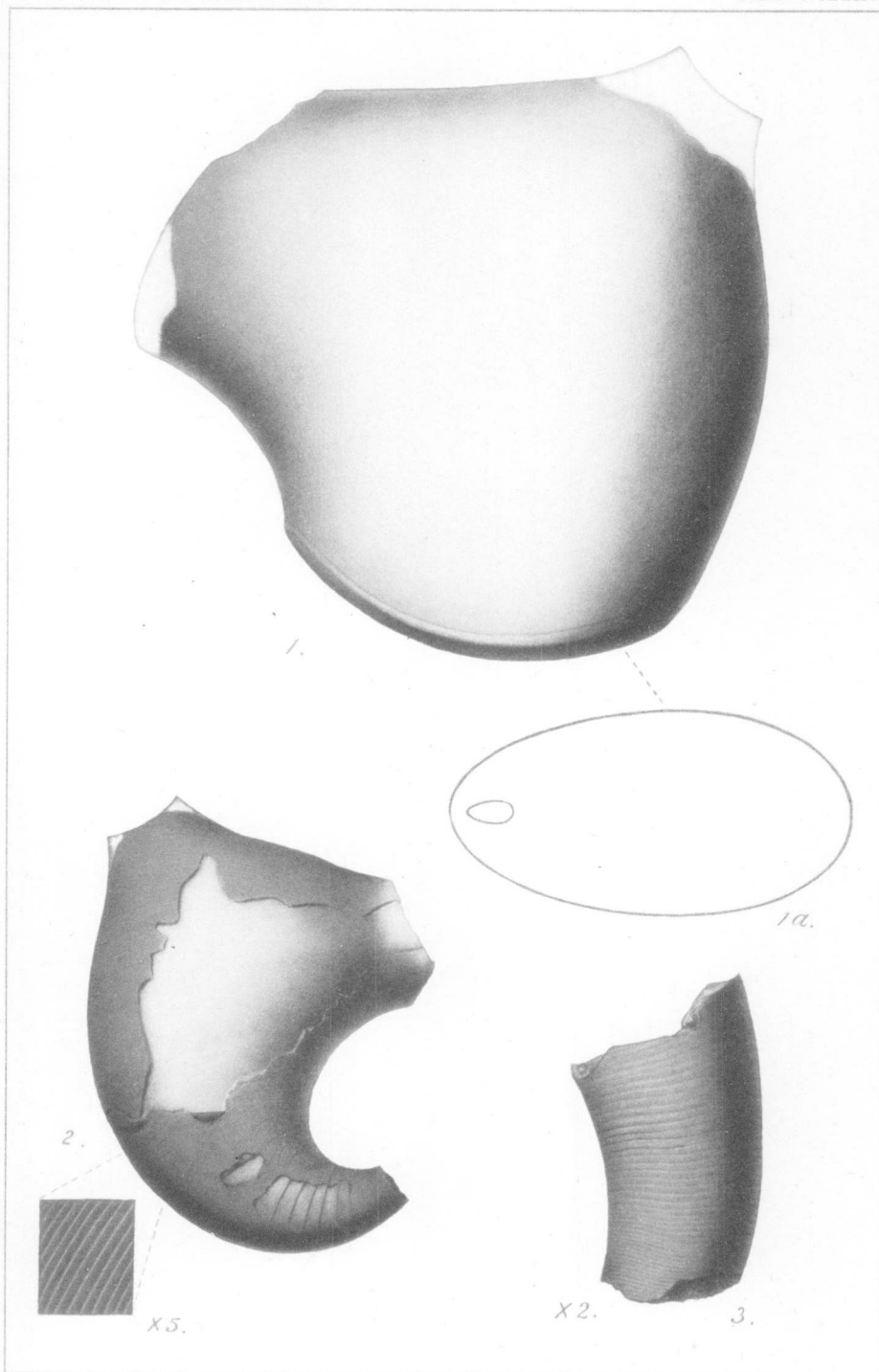


PLATE XXXV.

CYRTOCERAS QUEBECENSE (page 315).

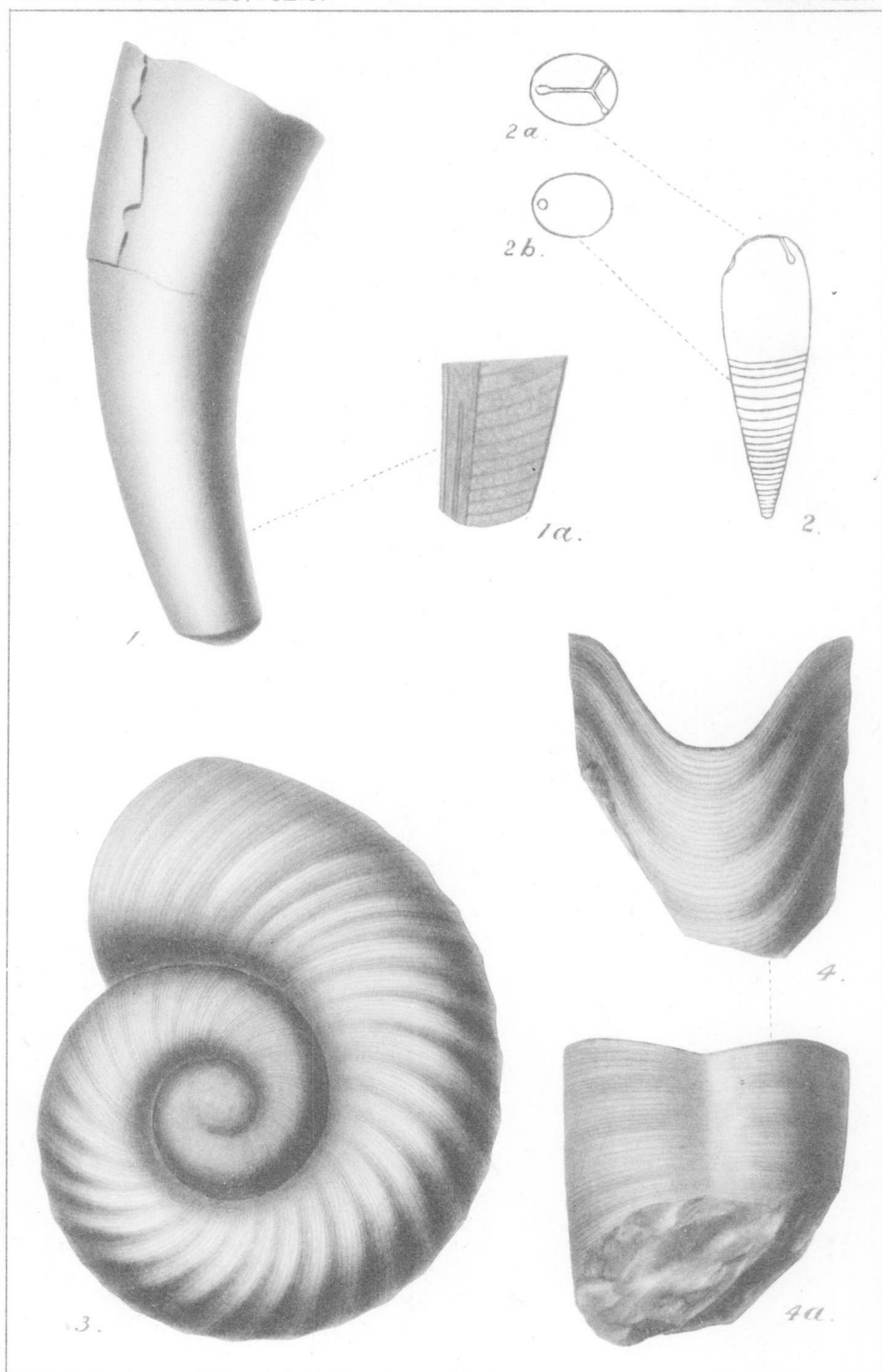
- Figure 1. Side view of the only specimen known to the writer, from the Levis limestone at Pointe Levis.
- " 1 a. Longitudinal section of a small piece of the narrower end of the same, shewing part of the large, cylindrical, dorsal and marginal siphuncle, and the cut edges of some of the rather closely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

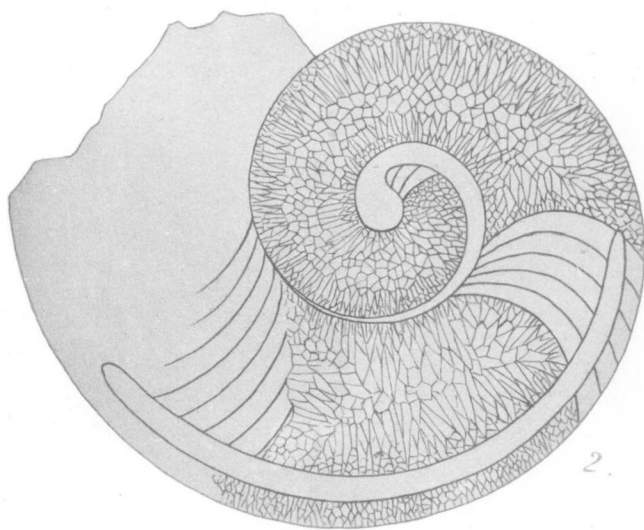
- Figure 3. Side view of an unusually perfect, well preserved and apparently adult specimen of this species, from the Black River (?) limestone at the Falls of the St. Charles River at Indian Lorette, collected by Mr. Weston in 1898.
- " 4. Ventral side of part of the nearly or quite free anterior end 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).

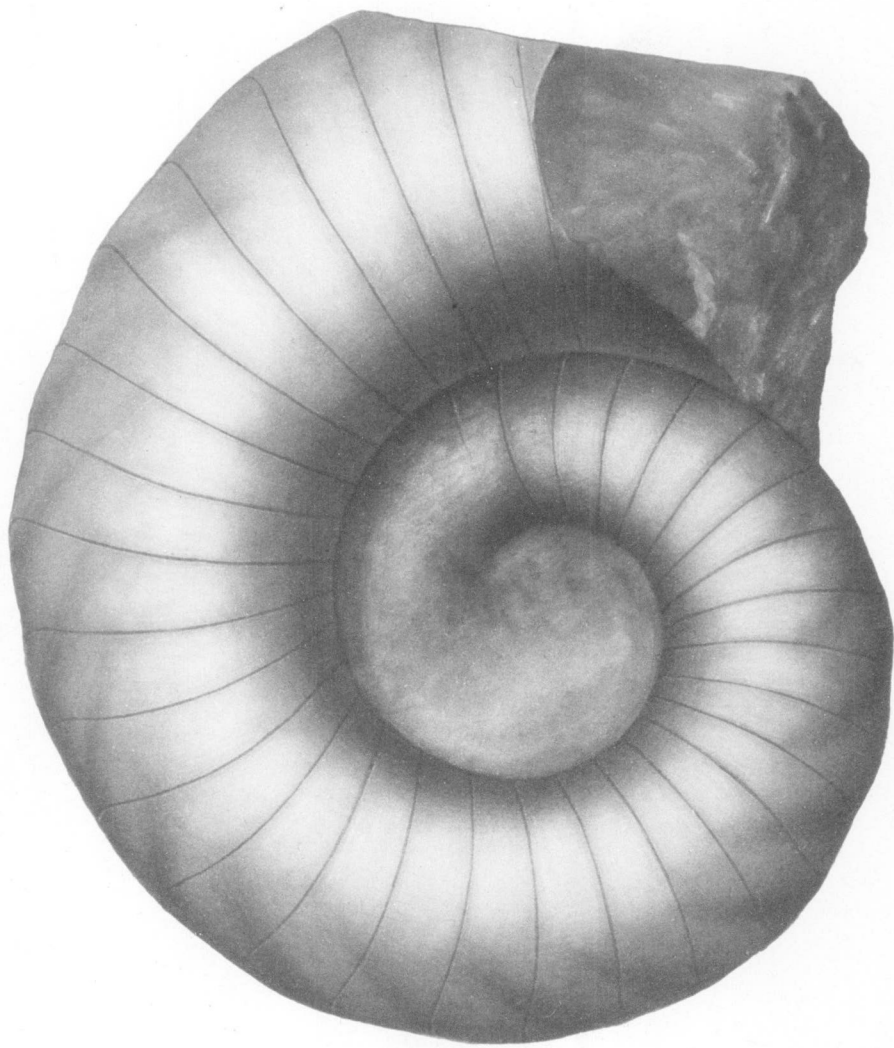
- Figure 1. Side view of one of the types of this species, from the Chazy limestone at the "bay above Clear Water Point," on the north shore of the Gulf of St. Lawrence, opposite to the Mingan Islands. The test is broken off of most of the body chamber, and that of the inner volution is slightly restored 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.





*PLATE XXXVIII.*

*BARRANDEOCERAS SUBCOSTULATUM* (page 310).

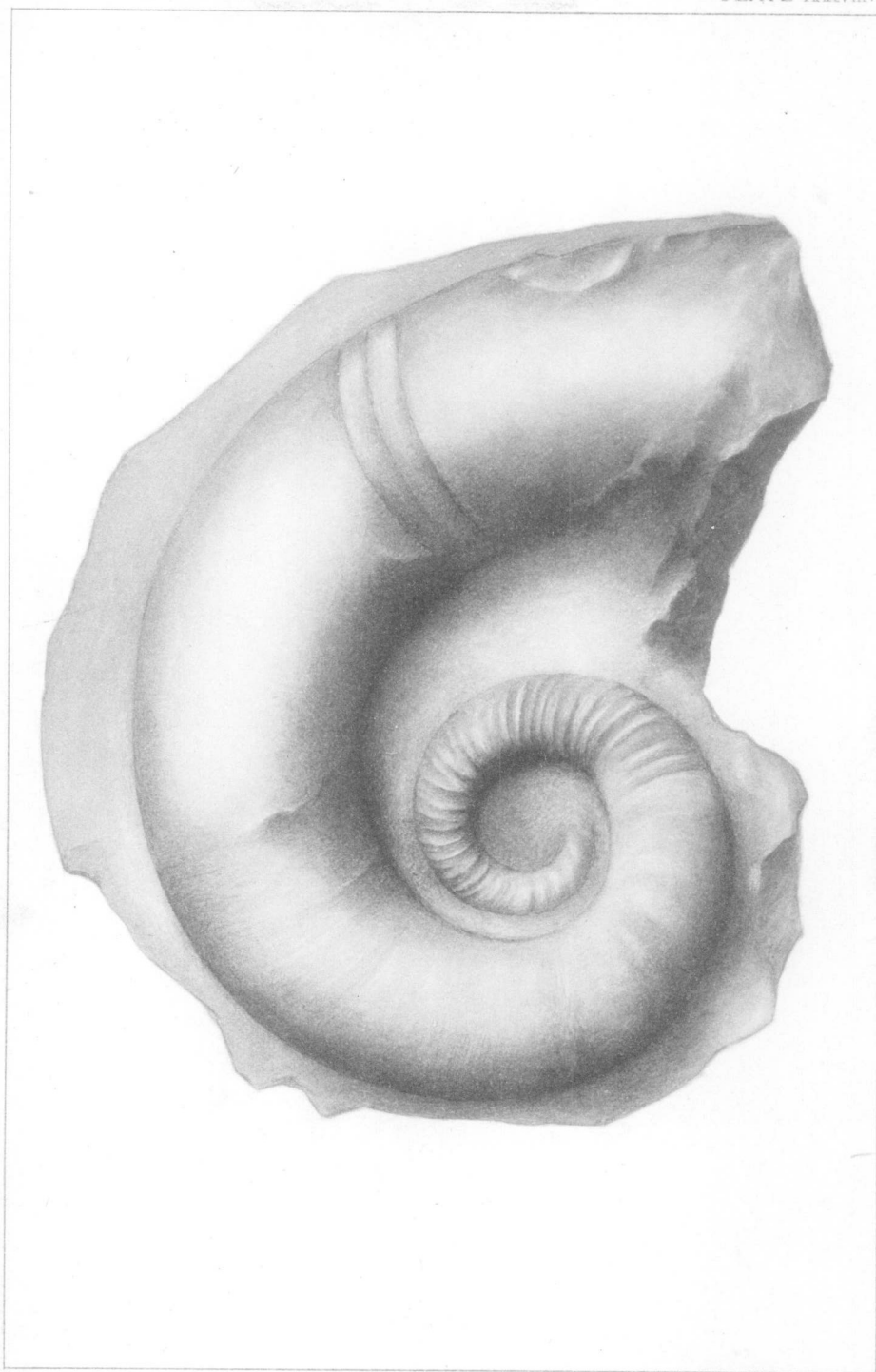
Side view of the type and only known specimen of this provisional species, from the Black River limestone at Wolfe Island, near Kingston, which was presented to the Museum of the Survey by Professor James Fowler in 1888.

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

Geological Survey Department, Canada.

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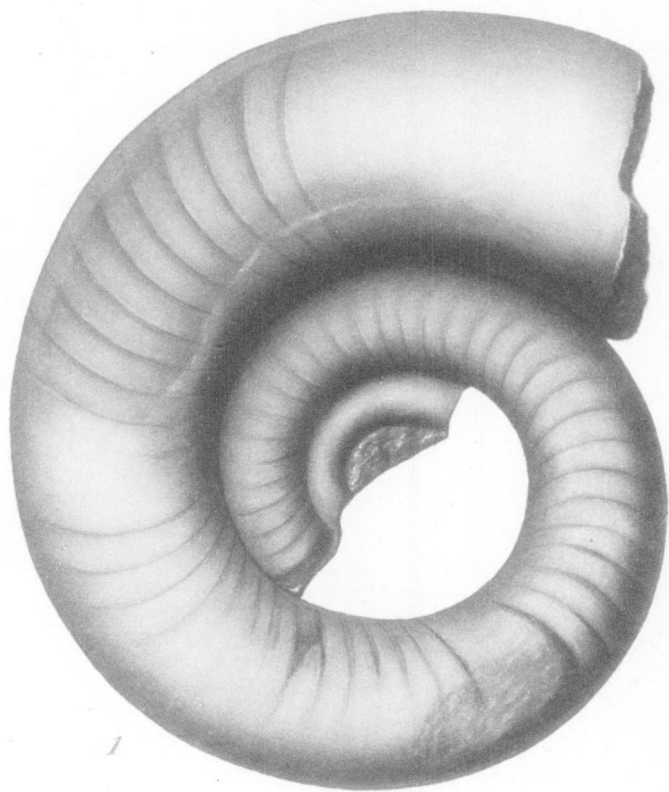
PLATE XXXVIII.



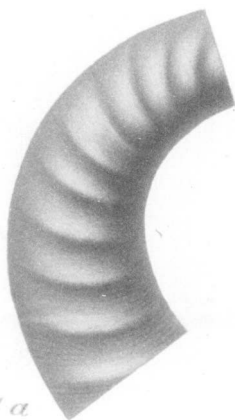
*PLATE XXXIX.*

*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.



1



1a



1b

## PLATE XL.

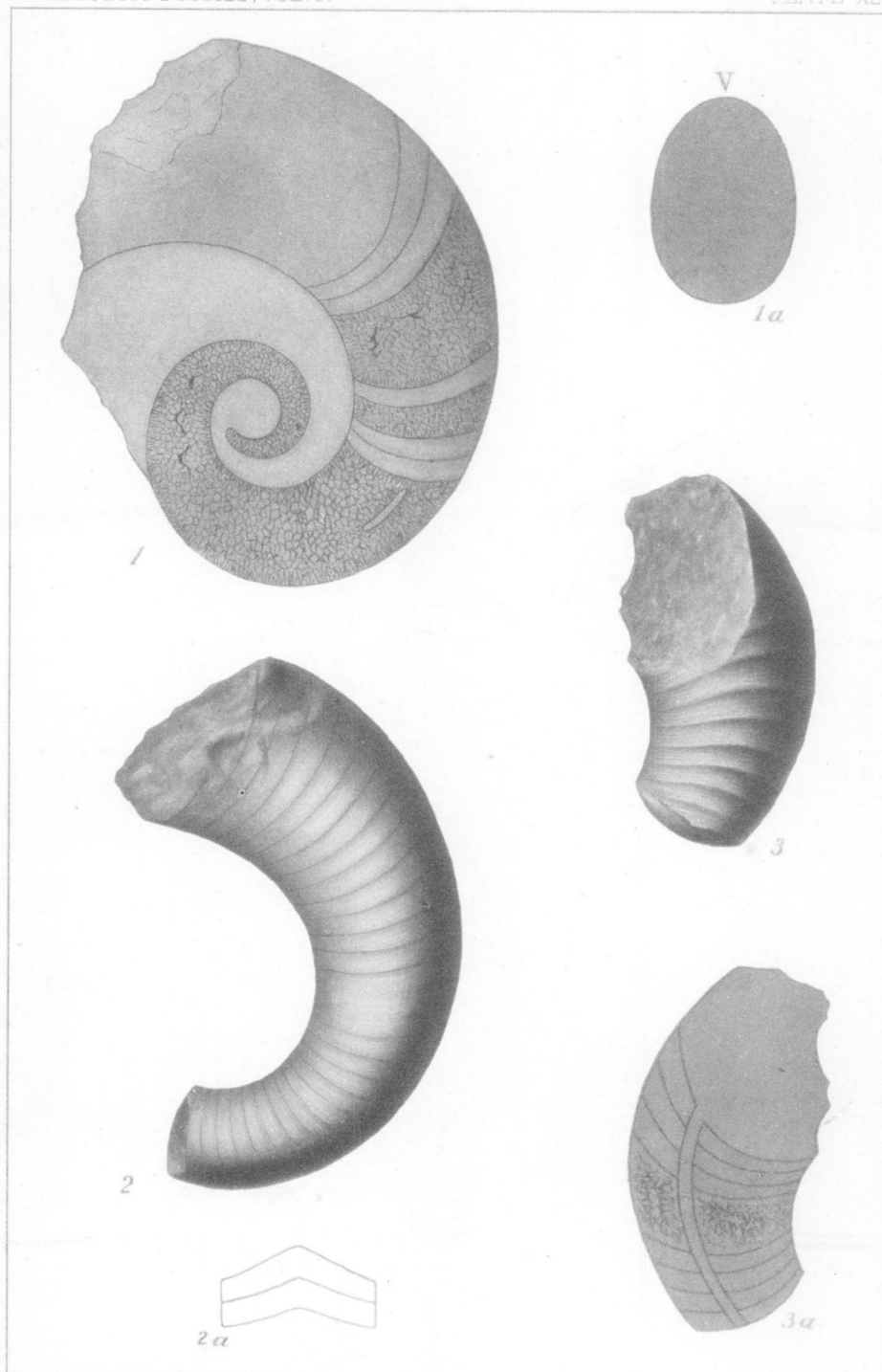
(The specimens figured on this plate are from the Black River limestone at La Petite Chaudiere Rapids, on the Ottawa River, near Ottawa city.)

### 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 *Barrandeoceras 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.

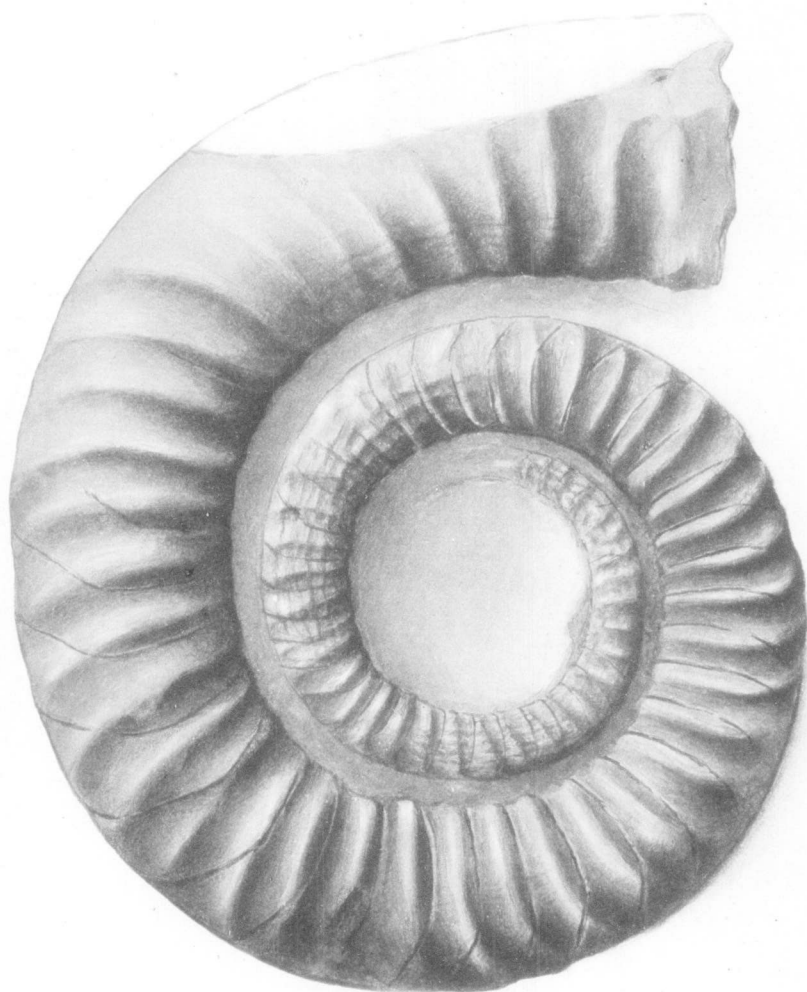


*PLATE XLI.*

**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.





*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 Ekwan 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 Ekwan 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.

