GEOLOGICAL SURVEY OF CANADA

GEORGE M. DAWSON, C.M.G., LL.D., F.R.S., DEPUTY HEAD AND DIRECTOR

PALÆOZOIC FOSSILS

VOL. III., PART II.

2. Revision of the fauna of the Guelph formation of Ontario, with descriptions of a few new species

3. Systematic list, with references, of the fossils of the Hudson River or Cincinnati formation at Stony Mountain, Manitoba

BY

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

Palæontologist and Zoologist to the Survey

OTTAWA

PRINTED BY S. E. DAWSON, PRINTER TO THE QUEEN'S MOST EXCELLENT MAJESTY

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The present Report, which forms the second part of the third volume of "Palæozoic Fossils" now in course of publication by this Survey, consists of two papers, viz.: (2) a revision of the fauna of the Guelph formation of Ontario, with descriptions of a few species, and (3) a systematic list, with references, of the fossils of the Hudson River or Cincinnati formation at Stony Mountain, Manitoba.

The drawings for the seven plates illustrative of the first of these papers, were made from nature by Mr. L. M. Lambe, F.G.S., the artist to the Survey, and reproduced on stone by Mr. O. E. Prud'homme.

GEORGE M. DAWSON.

GEOLOGICAL SURVEY DEPARTMENT,
OTTAWA, July 8th, 1895.

PALÆOZOIC FOSSILS.

VOL. III.

2. Revision of the fauna of the Guelph formation of Ontario, with descriptions of a few new species.

By J. F. Whiteaves.

Since the first part of this volume was written, quite a number of fossils from this formation have been acquired by the Survey, most of which were collected by Mr. Joseph Townsend, of Toronto. Some of these fossils are much better specimens than had hitherto been obtained, of species that were already insufficiently characterized, others are new to this formation in Ontario, and a few appear to have been previously undescribed. Of late years particular attention has been given to the collecting of natural moulds of the exterior of shells of gasteropoda, etc., from this formation, as it has been found that gutta percha impressions of such moulds often give much more information about the exact shape and surface markings of the shell than can be derived from mere casts of the interior. Quite a number of these natural moulds have recently been obtained from a small exposure on the south bank of the Grand River at Belwood, formerly called Douglas or Garafraxa, in the township of West Garafraxa, seven miles north-east of Fergus. Several of the figures on the plates which accompany this paper are drawn from impressions of such moulds. These impressions were skilfully and most successfully made by Mr. L. M. Lambe, to whom the writer is indebted for valuable assistance in ascertaining the characters of some of the more critical species which are neither enumerated or described in this Report.

The publication of many special monographs and papers, and notably that of Lindström's beautifully illustrated memoir "on the Silurian gastropoda and pteropoda of Gotland,"* has thrown so much new light upon the fossils of the Silurian (Upper Silurian) rocks, that it is now thought practicable to attempt a revision of the entire fauna of the Guelph formation as developed in Ontario, based not merely upon the new material collected, but upon all the specimens in the Museum of the Survey.

*Kongl. Svenska vetenskaps-academiens Handlingar, Bandet 10, No. 6. Stockholm, 1884

In the earlier days of the Survey's operations, the fossils of this formation were collected—at Galt by A. Murray in 1847, by Professor James Hall in 1848, by E. Billings, assisted by John (not James) Richardson, in 1857, by Dr. R. Bell in 1861, and by T. C. Weston in 1867; at Guelph by E. Billings in 1857; at New Hope (now called Hespeler*) by E. Billings in 1857, by T. C. Weston in 1867 and 1871; at Elora by Dr. R. Bell in 1861, and by T. C. Weston in 1867. Some of the fossils of the Guelph formation in the Museum of the Survey were collected by Mr. David Boyle at Elora between the years 1876 and 1881, and a large number of unusually fine specimens, upon which both this and the preceding part of the present volume are largely based, were collected by Mr. Townsend in the vicinity of Durham in 1878-75, and since then at Elora, Belwood, etc.

For the information of those who may not be familiar with the literature of the subject, it may be well to state that the earliest descriptions of the fossils of this formation in Canada are contained in the second volume of the Palæontology of the State of New York, published in 1852 and in pages 154-169 of the first volume of "Palæozoic Fossils" published by the Survey in 1862 and 1865. In the former, fifteen species were described and figured by Professor James Hall, and, in the latter, twenty-one additional species were described by E. Billings, sixteen of which are figured. Between 1865 and the date of publication of the first part of this volume (1884), descriptions of a few more fossils from the Guelph formation of Ontario have appeared in various publications, but it will not be necessary to refer to these descriptions or publications any further here, as the name of each species in the following systematic list will be accompanied with full references to the memoirs or papers in which it has been described or quoted. The classification followed in this list is for the most part that adopted by Zittel in his Handbuch der Palæontologie, but the gasteropoda are arranged in accordance with the order followed in Lindström's monograph of the Silurian gastropoda, etc., of Gotland.

In 1888 rocks containing numerous specimens of a coral apparently identical with *Pycnostylus Guelphensis*, and of a Stromatoporoid apparently referable to *Clathrodictyon ostiolatum*, and therefore probably of the age of the Guelph formation, were discovered by Mr. J. B. Tyrrell at Davis Point, on the eastern shore of Lake Manitoba. At the meeting of the American Association for the Advancement of Science at Rochester, N. Y., in 1892, Professor Albert L. Arey exhibited quite a large series of fossils characteristic of the Guelph formation, which were collected in the immediate vicinity of that city.

*The name New Hope was formally and officially changed to Hespeler in July, 1858.

ALCYONARIA.

HELIOLITES INSTERSTINCTUS, L.

Madrepora interstincta, Linnæus .....1767. Syst. Nat., ed. 12, p. 1276.
Heliolites interstincta, Edwards & Haime. 1855. Brit. Foss. Corals, p. 249 (which see for a list of synonyms of European specimens), pl. 57, figs. 9, 9, *a-d*.
" " Billings.....1863. Geol. Canada, p. 305, fig. 301.
Heliolites interstinctus, Rominger.....1876. Geol. Surv. Mich., Foss. Corals, p. 11, pl. 1, fig. 1.
" " S. A. Miller.....1889. N. Am. Geol. & Palæont., p. 192, fig. 181.

Hespeler, T. C. Weston, 1867 : two imperfect and badly preserved specimens, which were identified with this species by E. Billings. In the "Geology of Canada" (1863) *H. interstinctus* had previously been recorded as occurring in the Niagara limestone at Thorold and Owen Sound, Ontario, and in rocks of about the same geological horizon at Port Daniel, in the Baie des Chaleurs.

HALYSITES CATENULARIA, L.

Tubipora catenularia, Linnæus.....1767. Syst. Nat., ed. 12, p. 1270.
Catenipora labyrinthica, Goldfuss.....1826. Petref. German., vol. I., p. 75, pl. 25, fig. 5.
Halysites catenularia, Edwards & Haime..1855. Brit. Foss. Corals, p. 270 (which see for a full list of synonyms of European specimens, up to that date), pl. 64, figs. 1, 1, *a-c*.
Catenipora escharoides, Hall.....1852. Pal. N- York, vol. II., p. 127, pl. 35, figs. 1, 1, *a-i*.
Halysites catenulatus, Billings.....1863. Geol. Canada, p. 305, fig. 303.
Halysites catenularia, Nicholson.....1875. Rep. Pal. Prov. Ont., p. 51, figs. 24, *a-b*.
Halysites catenulata, Rominger.....1876. Geol. Surv. Mich., Foss. Corals, p. 77, pl. 29, figs. 1, 2 and 4.
Halysites catenulatus, var. *labyrinthicus*, Whitfield. Geol. Wiscons., vol. IV., 1882, pp. 271-72, pl. 13, fig. 7.
" " S. A. Miller.....1889. N. Am. Geol. & Palæont., p. 191, fig. 180.

Guelph, E. Billings, 1857 ; Elora, Dr. R. Bell, 1861 ; Hespeler, T. C. Weston, 1867 ; and Durham, J. Townsend, 1878-1882. In the Geology of Canada, *H. catenulatus* is said to have been found in the Black River limestone of the Ouatchouan River, Lake St. John, P.Q. ; in the Hudson River formation at the west end of the island of Anticosti ; in all the divisions of the "Anticosti Group" of that island ; and, in the Niagara

limestone, near Thorold, Owen Sound, the Manitoulin Islands, Rockwood and Isthmus Bay (Lake Huron); at Lake Temiscamang, Dudswell and Port Daniel. The specimens in the Museum of the Survey from most of these localities belong to the large tubed or typical form of the species which Prof. Whitfield suggests (op. cit.) should be called *H. catenulatus* var. *labyrinthicus*, but some of those collected at Lake St. John by Mr. James Richardson in 1857 or by Mr. Walter McOuat in 1871, and at Port Daniel by Sir W. Logan in 1843, represent the small tubed form or dimorphic variety which Edwards and Haime described and figured as the *Halysites escharoides* of Lamarck.

Since 1863, characteristic examples of the typical form of *H. catenularia* have been collected by Dr. R. Bell (in 1879) at the second and third limestone rapids of the Nelson River, Keewatin, and it has been found to be abundant in the Trenton limestone of the Red River valley, in Manitoba (at East Selkirk and Lower Fort Garry), of the western shore of Lake Winnipeg and of many of the islands in that lake. Specimens of the typical form of the "chain coral" and of the variety with extremely small corallites (*H. catenulatus* var. *microporus*, Whitfield) were collected by Prof. A. P. Coleman in 1864, in the Silurian (Upper Silurian) rocks of the north-east shore of the Columbia River, near Donald. Mr. McConnell obtained the typical form in 1886 at several localities "along the central and more elevated parts of the Beaverfoot Range of the Rocky Mountains and its continuations," in rocks which are well exposed between Palliser and Golden, on the line of the Canadian Pacific Railway. Mr. Tyrrell collected it in 1889 in rocks apparently of the age of the Niagara limestone, on the Saskatchewan River at and below Cedar Lake. It has been found near the Neigette River, six or seven miles east of Rimouski village, in the province of Quebec, by Mr. Weston in 1880, and at Lake Metapedia by Prof. L. W. Bailey in 1888.

Halysites agglomeratus, Hall.

Catenipora agglomerata, Hall.....1843. Geol. Rep. 4th Distr. N. York: tables of fossils, No. 22, fig. 2.

" " Hall.....1852. Pal. N. York, vol. II., p. 129. pl. 35, figs. 2, *a-g*.

Halysites agglomerata, Nicholson...1875. Rep. Pal. Prov. Ont., p. 51, figs. 24, *c-d*, and p. 66.

Guelph, Prof. H. A. Nicholson (op. cit., p. 66).

Halysites agglomeratus, var. compactus.

Halysites compactus, Rominger....1876. Geol. Surv. Mich., Foss. Corals, p. 78 pl. 29, fig. 3.

" " Whiteaves...1884. This volume, pt. 1, p. 2.

Galt, Rev. A. Bell, 1846-50; Elora, Dr. R. Bell, 1861; and Hespeler, T. C. Weston, 1867. In the specimens from these localities the corallites are circular in outline and closely approximated, but they are irregularly disposed and do not form continuous lines or loops. The distances between adjacent corallites are usually not much greater than their own diameter, which averages about two millimetres.

ZOANTHARIA.

TETRACORALLA.

PYCNOSTYLUS GUELPHENSIS, Whiteaves.

Pycnostylus Guelphensis, Whiteaves. 1884. This volume, p. 3, pl. 1, figs. 1, 1*a* and 1*b*.

Abundant at Guelph, Hespeler, Elora and Durham; the names of the collectors of the specimens and the dates at which the specimens were collected having been already given on the third page of the first part of this volume. The genus *Pycnostylus*, of which *Orthopœdium*, Schluter, 1889, is probably a synonym, differs from *Amplexus* only in the circumstance that it grows in colonies of compound and apparently fasciculated corallites.

PYCNOSTYLUS ELEGANS, Whiteaves.

Pycnostylus elegans, Whiteaves..1884. This volume, pt. 1, p. 4, pl. 1, figs. 2 and 2*a*.

Hespeler, T. C. Weston, 1867; Durham, J. Townsend, 1878-85; apparently much rarer than the preceding species.

ZAPHRENTIS. Species undeterminable.

Specimens of a species of *Zaphrentis*, which are too imperfect to be satisfactorily identified, but which are apparently allied to and possibly identical with the *Z. Racinensis* of Whitfield,* from the Niagara limestone of Wisconsin, were collected at Guelph by Dr. R. Bell in 1861, at Hespeler by Mr. T. C. Weston in 1871, at Elora by Mr. David Boyle in 1880, and at Durham by Mr. Joseph Townsend between the years 1879 and 1882. Most of these specimens from Ontario are mere casts of the interior of the calyx of the coral, in a bad state of preservation.

CYSTOSTYLUS INFUNDIBULUS, Whitfield.

Syringopora infundibula, Whitfield...1877. Ann. Rep. Geol. Surv. Wiscons., p. 79.

Cystostylus infundibulus, Whitfield...1882. Geol. Wiscons., vol. IV., p. 274, pl. 14, fig. 7.

" " Whiteaves...1874. This volume, pt. 1, p. 2.

*Geology of Wisconsin, vol. IV. (1882), p. 277, pl. 14, figs. 1 and 2.

As already stated, on the second page of the first part of this volume, this species has been collected in the Guelph formation at New Hope (= Hespeler), Elora and Durham.

HEXACORALLA.

Favosites Gothlandica, Lamarck.

Favosites Gothlandica, Lamarck.....1816. Hist. des An. sans Vert., vol. II., p. 206.
Calamopora Gothlandica, Goldfuss.....1829. Petr. Germ., pl. 26, figs. 3*a*, 3*b*, 3*c*, 3*e* (cæt. exclusis).
Calamopora favosa, Goldfuss.....1829. Ibid., pl. 26, figs. 2*a*, 2*c*.
Favosites Gothlandica, Edw. & Haime 1851. Polyp. Foss. Terr. Palæoz., p. 232, and (1854) Brit. Foss. Cor., p. 256, pl. 60, figs. 1 and 1*a*.
Favosites Goldfussi, Edw. & Haime.....1851. Polyp. Foss. Terr. Palæoz., p. 235, pl. 20, fig. 3, and (1853) Brit. Foss. Cor., p. 214, pl. 47, figs. 3, 3*c*.
Favosites Niagarensis, Hall.....1851. Pal. N. York, vol. II., p. 125, pl. 34*A*, bis., fig. 4.
Favosites favosa, (?) Hall.....1851. Ibid., p. 126, pl. 34*A* bis., fig. 5.
Favosites Gothlandica, Billings.....1859. Canad. Journ., n.s., vol. IV., p. 99.
" " " .....1863. Geol. Canada, p. 305, fig. 302.
" " Nicholson.....1874. Rep. Pal. Prov. Ont., p. 45.
Favosites favosa, Nicholson.....1875. " " " " 51.
" " " .....1875. Palæont. Ohio, vol. II., p. 229.
Favosites favosus, Rominger.....1876. Geol. Surv. Mich., Foss. Cor., p. 20, pl. 4, figs. 1-4 and pl. 5, fig. 2.
Favosites Gothlandica, Nicholson.....1879. Tab. Cor. Palæoz. Per., p. 46, pl. 1, figs. 1, 3 and 5.

In the "Geology of Canada" this species is stated to occur in the Guelph formation at Galt, Hespeler, Elora and Fergus, and Prof. H. A. Nicholson cites it as from Hespeler, in his second Report on the Palæontology of the Province of Ontario. There are, however, no examples of the typical form of *F. Gothlandica*, with large corallites, from the Guelph formation, in the Museum of the Survey, and the only specimen that the present writer has seen from that formation in Ontario which can be at all satisfactorily identified with *F. Gothlandica*, is a small colony collected at Galt by Dr. R. Bell in 1861, in which the largest corallites do not exceed two millimetres in their maximum diameter.

Favosites Forbesii, Edwards & Haime.

Favosites Forbesii, Edw. & Haime..1851. Polyp. Foss. Terr. Pal., p. 238.
" " " " ..1855. Brit. Foss. Cor., p. 258, pl. 60, figs. 2, 2, *a-g*.
" " Nicholson .....1879. Tab. Cor. Palæoz. Per., p. 56, pl. 1, fig. 7, and pl. 2, figs. 1, 1*a* and 1*b*.

This species is mentioned by Professor H. Alleyne Nicholson, in his second Report on the Palæontology of Ontario, as having been found at Hespeler, but it is not included in any of the lists of fossils from the Guelph formation in the "Geology of Canada," and the writer has failed to recognize it in any of the later collections received by the Survey.

Favosites Hisingeri, Edwards & Haime.

Favosites Hisingeri, Edw. & Haime..1851. Polyp. Foss. Terr. Pal., p. 240, pl. 17, figs. 2, 2, *a-b*.
Astrocerium venustum, Hall .....1852. Pal. N. York, vol. II., p. 120, pl. 34, figs. 1, *a-j*.
Favosites Hisingeri, Edw. & Haime..1855. Brit. Foss. Cor., p. 259, pl. 61, figs. 1, 1*a* and 1*b*.
Favosites venusta, Nicholson..... 1875. Rep. Pal. Prov. Ontario, p. 65.
Favosites venustus, Rominger.....1876. Geol. Surv. Mich., Foss. Cor., p. 22, pl. 5, fig. 3.

Galt, Dr. R. Bell, 1861; Hespeler, T. C. Weston, 1867; Elora, Dr. R. Bell, 1861, T. C. Weston, 1867, and D. Boyle, 1880; Durham, J. Townsend, 1878-82. Most of the specimens from these localities are so highly dolomitized that the more minute internal structures of the corallites are obliterated, but the spiniform septa are well preserved in a specimen from Lot 16, Concession 1 of Bentick, and the mural pores in specimens from Durham.

In the Geology of Canada (1863) *F. Hisingeri* is recorded as occurring in the Niagara limestone at Thorold and Drummond Island, also in rocks of about the same age at Port Daniel, in the Baie des Chaleurs. It has recently been recognized by Mr. L. M. Lambe in collections made by Mr. James Richardson, in 1856, at the Jumpers and Cormorant Point, Anticosti, and by Mr. T. C. Weston, in 1865, at Wall's Cove, Anticosti.

Favosites polymorpha (Goldfuss) Billings.

Favosites polymorpha (Goldfuss) Billings...1863. Geol. Canada, pp. 340 and 342.
" " Nicholson.1875. Rep. Pal. Prov. Ont., p. 65.

Hespeler, Elora and Fergus, E. Billings; Hespeler and Elora, Professor H. A. Nicholson.

The corallites of the few specimens of a Favosite with a branching corallum that the writer has seen from the Guelph formation at these and other localities in Ontario, are polygonal, unequal in size and thin walled. These specimens clearly do not belong to the genus *Pachypora* and their specific relations are obscure. They are here provisionally referred to *F. polymorpha* in accordance with the identifications of Billings and Nicholson.

HYDROMEDUSÆ.

HYDROIDA.

CLATHRODICTYON OSTIOLATUM, Nicholson.

Stromatopora ostiolata, Nicholson..... .....1873. Ann. Nat. Hist., ser. 4, vol. XII., p. 90, pl. 5., figs. 1 and 1*a*.

" " " .....1874. Rep. Pal. Prov. Ont., pl. 1, figs. 1 and 1*a*.

" " " .....1875. Rep. Pal. Prov. Ont., p. 63.

" " " .....1878. Journ. Linn. Soc., vol. XIV., pl. 2, figs. 1 and 2.

Clathrodictyon (*Stromatopora*) *ostiolatum*, Nicholson..1886. Mon. Brit. Stromatop., pt. 1, p. 14.

Clathrodictyon ostiolatum, Nicholson.....1887. Ann. Nat. Hist., ser. 5., vol. XIX., p. 11, pl. 3, figs. 1-3.

The specimen upon which this species was based was collected by Mr. John Wilkie at Guelph, not later than the year 1873, but a few specimens which have been identified with *C. ostiolatum* by Professor Nicholson and which are now in the Museum of the Survey, were collected by Mr. David Boyle at Elora in 1880, and by Mr. Joseph Townsend at Durham in 1884.

CLATHRODICTYON FASTIGIATUM, Nicholson.

Clathrodictyon fastigiatum, Nicholson..1886. Mon. Brit. Stromatop., pt. 11, p. 43, fig. 3.

" " " ..1887. Ann. Nat. Hist., ser. 5, vol. XIX., p. 8, pl. 2, figs. 3 and 4.

" " " ..1888. Mon. Brit. Stromatop., pt. 2, p. 152, pl. 19, figs. 1-5.

Glenelg Township, six miles from Durham, J. Townsend, 1884: five specimens, which have been examined and named by Professor Nicholson.

LABECHIA. Species undeterminable.

Durham, J. Townsend, 1884: a few specimens of the cænosteum of an apparently undescribed species of this genus, which are too imperfect and too badly preserved to admit of a sufficiently accurate description of their distinctive characters.

STROMATOPORA GALTENSIS, Dawson. (Sp.)

Cænostroma Galtense, Dawson.....1875. Life's Dawn on the Earth, p. 160.

" " " .....1879. Quart. Journ. Geol. Soc., Lond., vol. XXXV., p. 52.

Stromatopora Galtensis, Nicholson..1891. Mon. Brit. Stromatop., p. 173.

Hespeler, T. C. Weston, 1867 : one specimen. Prof. Nicholson, who has examined a portion of this specimen, says (op. cit.) that its minute structure "is practically destroyed by dolomitization, but all its general characters would lead to the belief that it is very closely related to *Stromatopora typica*, Rosen, and is probably identical with it." He further states that *Cœnostroma constellatum* of Spencer,* from the Niagara limestone near Hamilton, does not appear to be any way distinguishable as regards its general characters from *C. Galtense*, Dawson," and that he is "strongly disposed to think that it is really identical with *S. typica*, Rosen. If the above view should prove to be correct, then *Cœnostroma Galtense*, Dawson, and *C. constellatum*, Spencer, must be considered as synonyms of *S. typica*, Rosen."

STROMATOPORA ANTIQUA, Nicholson and Murie.

Pachystroma antiqua, Nicholson & Murie..1878. Journ. Linn. Soc., vol. XIV., p. 224, pl. 4, figs. 2-5.
Stromatopora antiqua, Nicholson.....1886. Mon. Brit. Stromatop, pt. 1, p. 17, pl. 5, figs. 8-11.

Durham, J. Townsend, 1884 : one specimen, which is now in the Museum of the Survey.

STROMATOPORELLA. Species undeterminable.

Durham, J. Townsend, 1884 : two specimens, which are too imperfect to admit of their specific relations being satisfactorily ascertained.

BRACHIOPODA.

TRIMERELLA GRANDIS, Billings.

Trimerella grandis, Billings.....1862. Geol. Surv. Canada, Pal. Foss., vol. I., p. 166, figs. 151, *a-b*.
" " Dall.....1870. Am. Journ. Conch., vol. II., pt. 2, p. 160 and (1871) vol. VII., p. 82.
" " Davidson & King.1874. Quart. Journ. Geol. Soc. Lond., vol. XXX., p. 144, pl. 13, figs. 2 and 3.
" " Nicholson.....1875. Rep. Pal. Prov. Ont., p. 67, and p. 68, fig. 37.
" " Hall .....1892. Pal. N. York, vol. VIII., pt. 1, pls. 4*A*, figs. 1 and 2, and 4*B*, figs. 2, 3, 4 and 5.

Casts of the interior of shells of this species are abundant at Galt, Guelph, Elora, Hespeler and Durham, but the writer has seen only one specimen in which any portion of the test is preserved. This is an imperfect pedicle valve collected at Durham by Mr. J. Townsend in 1883, which shows part of the exterior of the test and most of the characters

*Bulletin No. 1 of the University of the State of Missouri, p. 48, pl. 6., fig. 11.

of the interior of that valve. It is much flattened exteriorly, and its surface is nearly smooth, possibly as a result of weathering prior to fossilization. Its beak is erect, and its "cardinal area" and "deltidium" are not flattened obliquely backward and receding, as those of the *T. Lindstrœmi* from Gotland are. Its interior does not present any additional characters to those of Davidson and King's restoration of the pedicle valve of *T. grandis* on Plate 13, fig. 2c, of their paper on the Trimerellidæ (op. cit.), but the platform vaults are apparently a little longer in proportion to the entire length of the valve.

Trimerella acuminata, Billings.

Trimerella acuminata, Billings.....1862. Geol. Surv. Canada, Pal. Foss., vol. I., p. 167 and p. 168, fig. 151.
" " Davidson & King..1874. Quart. Journ. Geol. Soc. Lond., vol. XXX., p. 146, pl. 15, figs. 4-7, and pl. 16, figs. 1 and 2.
" " Nicholson.....1875. Rep. Pal. Prov. Ont., p. 68, fig. 36.
" " Hall.....1892. Pal. N. York, vol. VIII., pt. 1, pl. 4 B, fig. 6.

This species has been collected at the same localities as *Trimerella grandis*, and almost invariably in the same condition, viz., as casts of the interior of the shell. A large but very imperfect pedicle valve of a specimen of *T. acuminata*, with part of the test remaining, though in a very bad state of preservation, was, however, collected at Hespeler in 1867 by Mr. T. C. Weston. It has most of the beak broken off, as well as a large portion of one side of the valve, and shows little more than that the surface of the test is marked by concentric lines of growth, at irregular intervals.

Trimerella Ohioensis, Meek.

Plate 10, figs. 1 and 1a.

Trimerella Ohioensis, Meek.....1871. Am. Journ. Sc. & Arts, Ser. 3, vol. I., p. 315.
" " Dall.....1871. Am. Journ. Conch., vol. VII., pt. 2, p. 83.
" " Meek.....1873. Rep. Geol. Surv. Ohio, vol. I., pt. 2, p. 183, fig. *a*, and pl. 16, figs. 1, *a-c*.
" " Davidson & King..1874. Quart. Journ. Geol. Soc. Lond., vol. XXX., p. 153, pls. 16, figs. 3-7, and 19, figs. 1 and 2.
" " Hall.....1892. Pal. N. York, vol. VIII., pt. 1, p. 35, pl. 4A, figs. 3-9.

"Guelph limestone, Canada? one valve, E. Billings." Dall. The writer has either not seen or has failed to recognize the specimen referred

to by Dr. Dall, but the unusually perfect specimen represented on Plate 10, which was collected at Durham by Mr. J. Townsend in 1884, is probably the pedicle valve of a variety of *T. Ohioensis*. The interior of this valve, however, is so completely filled with the matrix that its identity with that species is not quite certain. The exterior of the valve is compressed convex, its marginal outline broadly subovate, broader than long and broadest in advance of the midlength. The beak is slender, elongate and acuminate, its apex being acutely pointed and slightly incurved. The maximum length of the valve is a little more than three inches, and its greatest breadth not quite two inches and a half. Its outer service is marked with concentric striæ of growth. Its "deltidium" is much higher or longer than broad, but the surface markings of the whole of its cardinal area are obscured by the tough and tenacious matrix.

A cast of the interior of both valves of a specimen from Elora, kindly lent to the writer, for examination, by Mr. B. E. Walker, of Toronto, appears to be referable to this species.

In the second part of the first volume of the "Report of the Geological Survey of Ohio," pages 184 and 185, Mr. Meek concludes that *T. Ohioensis* is more nearly related to *T. acuminata* than to *T. grandis*, and states that he "should not be surprised if further comparisons should prove the *T. Ohioensis* to be only a more robust, broader variety of *T. acuminata*."

Trimerella Billingsii, Dall.

Trimerella Billingsi, Dall.....1871. Am. Journ. Conch., vol. VIII., pt. 2, p. 82, pl. 11, figs. 1 and 2, but, acc. to Dav. & King, not fig. 3.

" " Davidson & King..1874. Quart. Journ. Geol. Soc. Lond., vol. XXX., p. 150, pl. 16. figs. 8 and 9.

"One cast of a neural valve showing the characters of the area, posterior margin, &c., distinctly, was kindly lent for examination and description by Mr. Billings. I have also seen two other specimens from the same locality." Dall.

"All we have seen of this species is the internal cast, measuring two inches three lines in length by one inch five lines in width, of a single pedicle-valve, found by Mr. Billings in the Guelph limestone at New Hope, West Canada." Davidson and King.

The cast of the interior of the pedicle valve referred to in the foregoing quotations, which was collected by Mr. Billings at Hespeler in 1857, and which is still in the Museum of the Survey, is the only specimen of *T. Billingsii* that the present writer has seen.

Trimerella Dalli, Davidson and King.

Trimerella Dalli, Davidson & King..1874. Quart. Journ. Geol. Soc. Lond., vol. XXX., p. 154, pl. 15, figs. 1-3.
" " Nicholson.....1875. Rep. Pal. Prov. Ont., p. 68.

Hespeler, T. C. Weston, 1867: several casts of the interior of the shell. Elora and Hespeler, Professor H. A. Nicholson.

Monomerella prisca, Billings.

Monomerella prisca, Billings.....1871. Can. Nat., vol. VI., ser. 2, p. 221.
" " Davidson & King..1874. Quart. Journ. Geol. Soc. Lond., vol. XXX., p. 156, pl. 17, figs. 5-8.
" " Nicholson.....1875. Rep. Pal. Prov. Ont., p. 68. fig. 38.
" " Hall.....1892. Pal. N. York, vol. VIII., pt. 1, p. 41, pl. 4C, figs. 6-13.

The types of this species and all the specimens of it referred to by Messrs. Davidson and King in their paper on the Trimerellidæ were collected at Hespeler by Mr. Weston in the spring of 1871. Professor Nicholson (op. cit.) records it as occurring also at Elora. All the specimens of *M. prisca* and *M. orbicularis* that have yet been obtained are mere casts, in dolomite, of the interior of the shell.

Monomerella orbicularis, Billings.

Monomerella orbicularis, Billings.....1871. Can. Nat., vol. VI., ser. 2, p. 221.
" " Davidson & King..1874. Quart. Journ. Geol. Soc. Lond., vol. XXX., p. 158, pl. 17, fig. 10.

Elora, T. C. Weston, 1867; five casts of the interior of the shell: Durham, J. Townsend; a similar specimen.

Monomerella ovata, Whiteaves.

Monomerella ovata, Whiteaves.1884. This vol. pt. 1, p. 5, pls. 2, figs. 1, and 8, figs. 1, 1, *a-c*.
" " Hall.....1892. Pal. N. York, vol. VIII., pt. 1, pl. 4D, figs. 13-15.

Durham, J. Townsend, 1875-82: one perfect specimen, with the valves slightly displaced, and four separate pedicle valves.

Monomerella ovata, var. lata.

Monomerella ovata, var. *lata*, Whiteaves.1884. This vol., pt. 1, p. 6, pls. 2, figs. 2 and 2*a*, and 8, figs. 2 and 2*a*.
" " " " Hall.....1892. Pal. N. York, vol. VIII., pt. 1, pls. 4C, figs. 17-18, and 4D, figs. 11 and 12.

Durham, J. Townsend, 1874-82: two pedicle valves with the test preserved, and a well preserved cast of the interior of the same valve. Specimens which Professors Hall and Clarke believe to belong to this variety have since been found in the Niagara limestone at Hawthorne, Illinois.

Monomerella Durhamensis. (N. Sp.)

Plate 9, fig. 1, and pl. 15, fig. 1.

Shell strongly convex, especially in the umbonal region, elongate subovate in marginal outline, much longer than broad, broadest in advance of the midlength, and narrow and pointed posteriorly: beaks of both valves extremely large and elevated, apparently equal or nearly equal in size, each with a correspondingly high cardinal area or pedicle surface.

Pedicle valve. Cardinal area obliquely flattened, slightly divergent from that of the brachial-valve, subdivided longitudinally into a central and four lateral portions, corresponding to the "deltidium," "deltidial ridges," and "areal borders," of authors, by four slightly divergent linear grooves. "Deltidium" fully twice as high as broad, flat, its surface marked by crowded and nearly transverse raised lines, which curve slightly forward and are crossed and made somewhat tuberculate by a few small and feebly developed longitudinal ridges. "Deltidial ridges" rather broad, nearly half as broad as the deltidium, slightly convex and transversely striated. "Areal borders" narrow. Characters of the interior of this valve unknown.

Brachial valve. Umbonal region enormously thickened, the test of the beak being almost solid, though composed of numerous thin laminæ. Cardinal area flat, not subdivided longitudinally by four grooves, as that of the pedicle valve is, but striated across, and bounded externally on each side by a low narrow ridge with rounded summit, like the "areal border" of a *Trimerella*. "Cardinal facet" apparently rather narrow, though its limits posteriorly are not clearly defined, curved a little forward in the centre and slightly backward on each side. Immediately in front of the cardinal facet, and on each side of its forward curve, there is a shallowly subcrescentic excavation or depression of the hinge plate. Crown of the crescent apparently narrow, its sides and ends not clearly defined. Interior of the valve deeply concave posteriorly, simple and devoid of umbonal chambers. Platform sharply V-shaped; platform vaults apparently shallow; anterior septum short, extending from the apex of the platform to a short distance from the front margin of the valve.

Surface of the exterior of both valves apparently smooth.

The only specimen known to the writer is not sufficiently perfect to admit of exact measurements, but, when unbroken, it was probably about three inches and a half in length, and an inch less in its greatest breadth.

Edge Mills, near Durham, J. Townsend, 1884 : a single specimen with a considerable portion of the test preserved, though the apices of the beaks of both of the valves are broken off. The specimen consists of two pieces, which fit together exactly. One of these pieces, the original of figure 1 on Plate 9, shows the test, though badly exfoliated, of the pedicle valve, the well preserved hinge area of that valve, and an imperfect cast of the interior of the brachial valve. The other piece shows both sides of the test of the umbonal region and part of the beak of the brachial valve, the other portion of that valve, as represented by figure 1 on Plate 15, being drawn from a gutta percha impression of the corresponding cast of the interior of the shell. The test in the umbonal region of the brachial valve is fully half an inch in thickness.

This remarkable shell is referred to the genus *Monomerella*, mainly on the authority of Professor J. M. Clarke, who has carefully examined the specimen described. The species differs from the typical forms of the genus, in the enormous development of the beak and pedicle surface of the brachial valve, and in the apparent presence of shallow platform vaults in that valve, but it could very well be congeneric with such shells as *M. Egani* and *M. Kingii*.

MONOMERELLA. Species uncertain.

Rhynobolus Galtensis, Whiteaves. (Pars.)..1884. This volume, pt. 1, pl. 8, fig. 3*a*, but not fig. 3.

Monomerella, Sp. ? Hall & Clark.....1892. Pal. N. York, vol. VIII., p. 45, pl. 40, figs. 3 and 4.

The specimen from Hespeler represented on Plate 7, figure 3a, of the first part of this volume, as the pedicle valve of *Rhynobolus Galtensis*, was thus identified to a certain extent on the authority of the late Dr. Thomas Davidson, by whom it had been examined and studied. Except in the much greater proportionate breadth of the hinge plate, it is remarkably similar, in shape, size and surface markings, to the brachial valve of that species, but its interior is completely filled with the matrix. More recently, however, Professors Hall and Clark have expressed the opinion that this specimen is probably the brachial valve of a species of Monomerella, and in this opinion the writer is inclined to concur. They state, with much apparent justice, that this specimen does not agree with the pedicle valve of the shell now known as *Rhinobolus Galtensis*, as figured by Davidson and King, but that "it is, on the contrary, of about the same outline as the brachial valve" of that species, with a low incurved umbo and a very broad margin of contact, much like that seen in the species *Monomerella ovata* and *M. Greenii*." The brachial valve of *M. ovata*, however, is much larger, more strongly convex, and its beak much more incurved than

that of the species now under consideration: while the hinge plate of the corresponding valve of *M. Greenii* is much narrower in proportion to its size.

Rhinobolus Galtensis, Billings. (Sp.)

Plate 15, fig. 2.

Obolus Galtensis, Billings.....1862. Geol. Surv. Canada, Pal. Foss., vol. I, p. 168, fig. 152.

Trimerella minor, Dall.....1871. Am. Journ. Conch., vol. VII., p. 83.

Rhynobolus——? (Compare *Obolus Galtensis*, Billings) Hall.....1871. Twenty third Rep. Reg. N.Y. St. Cab. Nat. Hist., p. 247, pl. 13, fig. 10, and expl. of that plate.

Obolellina Galtensis, Billings.....1871. Can. Nat. and Geol., vol. VI., N. S., p. 222.

" " .....1872. Ib., pp. 327-329.

Trimerella ? Galtensis, Davidson & King..1874. Quart. Journ. Geol. Soc. Lond., vol. XXX., p. 151, pls. 18, fig. 13, and 19, figs. 4 and 4 *a*.

Rhynobolus Galtensis, Whiteaves.....1884. This vol., pt. 1, p. 7, pl. 8, fig. 3, and perhaps pl. 2, fig. 1 *a*, but not pl. 8, fig. 3 *a*.

Rhinobolus Galtensis, Hall & Clarke.....1892. Pal. N. York, Vol. VIII., pl. 4B, and explanation of that plate.

The original description of *Obolus Galtensis*, Billings, is as follows: "Ovate, both valves moderately convex; sides gently, and front margin broadly rounded; apical extremity of ventral valve 70°; greatest width a little below the middle. The area of the ventral valve is flat, with a concave groove along the middle; and while in one specimen it lies nearly in the plane of the margin, in another it slopes a little outwards. The largest specimen seen is 25 lines in length and 18 in width. *Locality and Formation.*—Galt. In the Guelph formation; Middle Silurian. *Collectors:* E. Billings, R. Bell." In a paper "On the Genus Obolellina," published in the Canadian Naturalist and Geologist for April, 1872, Mr. Billings adds the following particulars: "The beak of the ventral valve is very large, its length being one-half that of the body of the shell. It is slightly incurved. The area has three furrows, the peduncular and the two lateral grooves. The muscular impressions are rhomboidal rather than ovate, and confined to the central portion of the shell. There are no cavities under the area."

While writing the paper last mentioned Mr. Billings states that "fifteen casts of the interior of *O. Galtensis*" were lying before him, but the specimens in the Museum of the Survey upon which the foregoing descriptions of that species would seem to have been most largely based,

are five in number. Two of these are natural casts of the interior of the brachial valve, both from New Hope, now called Hespeler: the one evidently that referred to as the "largest specimen seen," and the other, (a gutta-percha impression of which is represented on Plate 15,) the original of figure 152, printed inadvertently upside down, on page 168 of the first volume of the "Palæozoic Fossils." One is a cast of the interior of both valves of a small specimen from Galt. This is the original of figures 4 and 4*a* of Plate XIX. of Davidson & King's paper on the Trimerellidæ, in the thirtieth volume of the Quarterly Journal of the Geological Society of London. The remaining two are casts of the interior of the pedicle valve, with the inner surface of the beak and area also fairly well preserved, both from Galt. The smaller of these two is the type of *Trimerella minor*, Dall, and both are almost certainly the specimens upon which Billings, Davidson and King based their descriptions of the beak and area of the ventral or pedicle valve of the species now under consideration.

The genus *Rhinobolus* was based upon a gutta-percha impression of a natural cast of the interior of a ventral or pedicle valve collected by Hall at Galt in 1848. Billings, Davidson and King seem to have been fully satisfied that the type of *Rhinobolus* is a ventral or pedicle valve of *O. Galtensis*, Billings, although Hall and Clarke appear to have entertained some doubts on this point, possibly because they had not seen any authentic examples of the pedicle valve of that species, which was not figured by Billings. However that may be, it seems to the writer that the characters of the two pedicle valves from Galt, upon which Billings evidently based his description of that valve of *O. Galtensis*, are essentially similar to those of the type of *Rhinobolus* as described and figured by Hall.

R. Galtensis was collected at Galt by A. Murray in 1847; at Galt, Guelph and New Hope (now Hespeler) by E. Billings in 1857; at Galt and Guelph by Dr. R. Bell in 1861; at Hespeler by T. C. Weston in 1867 and 1871; and at Durham by J. Townsend in 1880-83. Most of the specimens collected are natural casts of one or both valves, but a few (six) brachial valves with the test preserved were obtained at Durham by Mr. Townsend. On Plate IV. B (fig. 8) of the eighth volume of the Palæontology of the State of New York, Hall figures "the interior of a small brachial valve" of *R. Galtensis*, from Elora. The specimen from Durham, figured on Plate 2, fig. 1*a*, of the first part of this volume, as the pedicle valve of *R. Galtensis*, has the cardinal area completely covered with the matrix and the interior filled with dolomite, so that its identification with that species is by no means certain.

Rhinobolus.

(Species uncertain, but perhaps a var. of *R. Galtensis*.)

Plate 9, figs. 2 and 2 a.

Pedicle valve. Exterior compressed convex, subovate in marginal outline, about one-third longer than broad, broadest a little in advance of the midlength and rather abruptly pointed behind, its surface marked with concentric lines of growth at irregular but somewhat distant intervals. Interior shallowly concave, the concave portion a little longer than broad. Beak elevated, solid, erect: cardinal area or pedicle surface a little broader than high, occupying about one-fourth of the length of the valve, its interior margin convex and slightly produced in the centre and concave on each side. "Deltidium" gently convex, moderately prominent, much higher than broad and striated across: "deltidial ridges" broad, not so much raised as the "deltidium" and almost flat: "areal borders" consisting of a pair of widely divergent narrow and acute angular ridges, which are separated from each of the deltidial ridges by a linear groove. "Umbo-lateral scars" represented by a pair of distant, small and indistinctly defined shallow pits. Crescent much like that of *Trimerella*, but with its sides more nearly marginal. Platform apparently essentially similar to that of *R. Galtensis*, but placed a little farther forward.

Brachial valve. Unknown.

Length, forty-eight millimetres; greatest breadth, thirty-two mm.; maximum thickness of test, eight mm.

Irvine Rocks, Elora, at the "cave" near Modeland's foundry, J. Townsend, 1885: a nearly perfect and well preserved specimen of the pedicle valve, with the test preserved and showing the whole of the characters of both the inside and outside of that valve, though the front margin of the platform is slightly broken.

This shell has a much shorter cardinal area or pedicle surface than that of the pedicle valve of *R. Galtensis*, but it may possibly represent only an extreme variety of that species.

Orthis.

A few casts of the interior of single valves of apparently two species of *Orthis* have been collected at Durham, but they are all much too imperfect and too badly preserved for identification or description.

Strophomena.

Elora, T. C. Weston, 1867: a coarse cast of the interior of the convex valve of a species of this genus, which is also much too imperfect to be identified.

Spirifera plicatella, L.

Anomia plicatella, Linnæus....1767. Systema Naturæ, 12th ed., p. 1154.
plicatella, Davidson..1866. Brit. Silur. Brach., p. 84 (which see for a complete list of synonyms of British and European specimens up to that date) pl. 9, figs. 9-12.

Durham, J. Townsend, 1874-82: one small specimen with both valves preserved, two separate dorsal and two separate ventral valves. Elora, J. Townsend, 1892: one small specimen with both valves preserved. All the specimens that the writer has seen, so far, are either casts of the interior of the shell or else have the outer layer of the test exfoliated and hence do not show the fine radiating raised lines characteristic of the species. The two dorsal valves from Durham have the mesial fold partly divided by a faint longitudinal grove, and there are three low, rounded plications on each side of the fold. The characters of the two ventral valves from Durham are so similar to those of the *Spirifer bicostatus*, the *Orthis bicostatus* of Vanuxem, as described and figured by Professor Hall, that it is just possible that these two valves should be referred to that species rather than to *S. plicatella*. *S. plicatella* and its var. *radiata* had previously been recorded (in the Geology of Canada, 1863) as occurring in the Clinton formation at Flamborough West, near Dundas; in the Niagara limestone at Thorold, Flamborough West and Grimsby; in rocks of about the same age at Port Daniel, in the Baie des Chaleurs; and in division 4 of the Anticosti group at South-west Point and the Jumpers.

Spirifera crispa, Hisinger.

Terebratula crispa, Hisinger (not of Linnæus)..1826. Vet. Akad. Handlingar, pl. 7, fig. 4.
Spirifer crispus, Hall.....1852. Pal. N. York, vol. II., p. 262, pl. 54, figs. 3, *a-k*.
Spirifera crispa, Davidson.....1866. Brit. Silur. Brach., p. 97 (which see for a full list of synonyms, with references, of British and European specimens) 3, *a-k*. pl. 10, figs. 13-15.

Durham, J. Townsend, 1882: a single ventral valve.

According to Professor Hall (op. cit., p. 263), *S. crispa* occurs in the Niagara shales at Lockport, Lewiston and other localities in the state of New York, but Dr. Davidson says that he does "not feel certain" ....." whether the American fossil really belongs to Hisinger's species." In the "Geology of Canada" (1863) *S. crispa* is recorded as having been found in the Niagara limestone at Thorold, Ontario, and (under the name "*S. crispata*," an obvious inadvertence or typographical error) in rocks of the same age, at Port Daniel.

Whitfieldella Hyale, Billings. (Sp.)

Charionella (?) Hyale, Billings..1866. Geol. Surv. Can., Pal. Foss., vol. I., p. 166, figs. 150, *a* and *b*.
Charionella Hyale, Nicholson....1875. Rep. Palæont. Prov. Ont., p. 67.
Whitfieldella Hyale, Hall.....1893. Pal. N. York, vol. VIII., pt. 2, pp. 60 and 79.

Galt, John (not James) Richardson, 1857, and R. Bell, 1861 ; Hespeler and Elora, T. C. Weston, 1867 ; Elora, Nicholson and Hall. Apparently abundant at each of these localities.

Atrypa reticularis, L.

Anomia reticularis, Linnæus.....1767. Syst. Nat., ed. xii., p. 1152.
Atrypa reticularis (L.) Hall.....1852. Pal. N. York, vol. II., p. 72 (which see for a list of synonyms, with references, of this ubiquitous species) pl. 23, figs. 8, *a-e*.
" " " Davidson. ..1866. Brit. Silur. Foss., pp. 129-30 (which see for a still fuller list of synonyms of British and European specimens of this shell) pl. 14, figs. 1 to 22.

Hespeler, T. C. Weston, 1867 : two specimens. This species is apparently rare in the Guelph formation.

Atrypa reticularis, var. aspera.

Terebratulites asper, Schlotheim.....1813. Leonard's Taschenbuch, p. 74, pl. 1, fig. 7.
Atrypa aspera, Dalman.....1827. Vet. Akad. Handl., pl. 4, fig. 3.
Atrypa reticularis, var. *aspera*, Davidson..1864. Brit. Dev. Brach., p. 57 (which see for a list of synonyms of this shell), pl. 10, figs. 5-8.

Hespeler, T. C. Weston, 1867 : one small but very characteristic ventral valve, which is marked by eight nodulose radiating ribs or plications.

Rhynchonella pisa, Hall & Whitfield.

Rhynchonella pisa, Hall & Whitfield..1875. Rep. Geol. Surv. Ohio, vol. II., pt. 2, p. 135, pl. 7, figs. 18-22.

Hespeler and Elora, T. C. Weston, 1867 : a single cast of the interior of the shell from each of these localities. These specimens agree very well with the description and figures of *R. pisa*, but they are too imperfect to be identified with much certainty.

Pentamerus oblongus, J. de C. Sowerby.

Pentamerus lævis, James Sowerby.....1813. Min. Con., vol. I., p. 76, pl. 28.
Pentamerus oblongus, J. de C. Sowerby....1839. Silur. Syst., pl. 19, fig. 10.
Pentamerus lævis, Sowerby.....1839. Ib., pl. 19, fig. 9.

Pentamerus oblongus, Hall.....1843. Geol. Rep. 4th Distr., N. York, p. 7, figs. 1-5.
" " " .....1852. Pal. N. Y., vol. II., p. 79, pl. 25, figs. 1, *a-m*, and pl. 26, figs. 1, *a-d*.
" " Billings.....1863. Geol. Canada, p. 316, fig. 326.
" " Davidson.....1867. Brit. Silur. Brach., p. 151 (which see for a list of synonyms of British and European specimens of this species) pl. 18, figs. 1-12 and pl. 19, figs. 1 and 2.
" " Nicholson.....1875. Rep. Pal. Prov. Ont., p. 61, figs. 31, *a-b*.
" " Hall & Whitfield....1875. Rep. Geol. Surv. Ohio, vol. II., pt. 2, p. 137, pl. 7, fig. 9.
" " Whitfield .....1882. In Geol. Wiscons., vol. IV., p. 288, pl. 17, figs. 4-9.

Durham, J. Townsend, 1878-82: four casts of the interior of the shell.

This well-known species, which is stated by Hall to be abundant in the Clinton group of the state of New York, appears to be comparatively rare in the Clinton and Guelph formations in Canada, but to be one of the commonest fossils of the Niagara formation throughout Ontario, and of the two upper divisions of the Anticosti group of the island of that name. It has long been known to be abundant in the outlier of Niagara limestone at Lake Temiscaming, and, more recently, it has been recorded by Dr. H. M. Ami,* as occurring at the Forks of the Scaumenac River, in the province of Quebec, where it was collected by Dr. R. W. Ells in 1883.

Pentamerus oblongus, var. bisinuatus.

Pentamerus bisinuatus, McChesney.....1861. New Pal. Foss., Extr. No. 2, p. 85.
" " " .....1865. Illustr. N. Sp. Foss., pl. 9, figs. 1, *a-b*.
" " Whitfield .....1882. Geol. Wiscons., vol. IV., p. 290, pl. 17, fig. 3.
Pentamerus oblongus, var. *bisinuatus*, Hall..1893. Pal. N.Y., vol. VIII., pt. 2, fasc. 2, pp. 238 and 239.

Durham, J. Townsend, 1882: a cast of the interior of the dorsal or brachial valve, showing the single septum said to be characteristic of that valve of *P. bisinuatus*. But, according to Hall (op. cit.), the septa of the brachial valve of *P. oblongus* "are usually very short and rest upon the inner surface of the shell. It sometimes happens that these septa unite before reaching the inner surface, and the spondylium thus formed is supported by a very low axial septum. This is the case in the original specimen of *P. bisinuatus*, McChesney, and in the Wisconsin shell referred to that variety by Whitfield."

*In Geological Survey of Canada, Report of Progress for 1882-83-84, p. 26 E.

Pentamerus occidentalis, Hall.

Plate 9, figs. 3 and 3 a.

Pentamerus occidentalis, Hall.....1852. Pal. N. York, vol. II., p. 341, pl. 79, figs. 1, *a-s*, and 2.
" " Billings...1863. Geol. Canada, p. 337, figs. 341, *a*, *b* and *c*.
" " Nicholson.1875. Rep. Pal. Prov. Ont., p. 67, fig. 35.

Galt, A. Murray, 1847, E. Billings, 1857, and T. C. Weston, 1867; Hespeler, T. C. Weston, 1867; Elora, Dr. R. Bell, 1861, and T. C. Weston, 1867; Durham, J. Townsend, 1878-82. Guelph, Professor H. A. Nicholson; who very justly states that it is "one of the most characteristic brachiopods of the Guelph formation." The unusually perfect specimen represented on Plate 9, was collected at Durham by Mr. Townsend. A specimen from Galt, kindly forwarded to the writer by Mr. B. E. Walker, of Toronto, shows that the surface of this species, when well preserved, is marked by low, rounded longitudinal ribs, which are very unequal in breadth, and crossed by numerous, close-set, minute lines of growth, and by rather distant faint transverse constrictions, indicative of periodic arrests of growth.

Pentamerus (Barrandella) ventricosus, Hall.

Pentamerus ventricosus, Hall.....1860. Geo. Surv. Wiscons., Rep. Progr., p. 2, and (1862) Geol. Rep. Wiscons. vol. I., p. 436.
Pentamerus (Pentamerella) ventricosus, Hall.....1868. Twentieth Rep Reg. N.Y. St. Cab. Nat. Hist., p. 374, pl. 13, figs. 18-21.
Pentamerus ventricosus, Nicholson.....1875. Rep. Pal. Prov. Ont., p. 67.
Pentamerus (Pentamerella) ventricosus, Hall & Whitfield...1875. Rep. Geol. Surv. Ohio, vol. II., pt. 2, p. 138, pl. 7, figs. 7 and 8.
Pentamerus ventricosus, Whitfield.....1882. Geol. Wiscons., vol. IV., p. 291, pl. 17, figs. 11-13.
Pentamerus (Barrandella) ventricosus, Hall.....1893. Pal. N. York, vol. VIII., pt. 2, fasc. 2, pp. 242 and 243.

Hespeler and Elora, Professor H. A. Nicholson. The writer has never seen a specimen of this species from the Guelph formation of Ontario, nor indeed from rocks of any age in Canada.

PELECYPODA.

PTERINEA.

Two casts of the interior of single valves of a species of *Pterinea* were collected at Elora by Mr. Townsend in 1882 and 1892. One of these is the cast of a small right valve, not quite seven millimetres in length and with the posterior wing broken off, the other a nearly perfect cast of a left valve. It is scarcely practicable to identify such specimens specifically, but in many respects they agree fairly well with Hall's description and figures of *P. brisa*, which is regarded as a synonym of *P. striæcosta*, McChesney.

AMPHICÆLIA NEGLECTA, McChesney. (Sp.)

Amponychia neglecta, McChesney.....1861. Descr. New. Pal. Foss., Extr. No. 2, p. 88.
Pterinea (Amb.) neglecta, McChesney....1865. Expl. of pl. 9, fig. 2, Illust. New. Pal. Foss.
Amphicælia neglecta, McChesney.....1868. Trans. Ac. Sc. Chicago, vol. I., p. 41, pl. 9, fig. 2.
" " Meek & Worthen....1868. Geol. Ill., vol. III., p. 358, pl. 5, fig. 9.
Leptodomus neglectus, Whitfield.....1882. Geol. Wiscons., vol. IV., p. 292, pl. 18, figs. 3 and 4.

Elora, J. Townsend, 1892: an imperfect cast of the interior of the right valve of a shell which is probably referable to this species.

MEGALOMUS CANADENSIS, Hall.

Megalomus Canadensis, Hall.....1852. Pal. N. York, vol. I., p. 343, pls. 80, figs. 1, *a-c*; 81, figs. 1, *a-f*; and 82, figs. 1, *a-i*.
" " Billings...1863. Geol. Canada, p. 338, fig. 342.
" " Nicholson.1874. Rep. Pal. Prov. Ont., p. 68, figs. 39, *a-c*.

Galt, A. Murray, 1847, E. Billings, 1857, and T. C. Weston, 1867; Guelph, E. Billings, 1857, Dr. R. Bell, 1861, and T. C. Weston, 1867; Hespeler, T. C. Weston, 1867; Elora, Dr. R. Bell, 1861, T. C. Weston, 1867, and D. Boyle, 1873; Durham, J. Townsend, 1878-82; and Belwood, J. Townsend, 1889.

Casts of the interior of this remarkable shell are abundant in almost every exposure of the Guelph formation in the province, but specimens with the test preserved are rare. The species occasionally attains to a comparatively gigantic size. Thus, a cast of the interior of the closed valves found by Mr. Townsend at the junction of the Big and Rocky Saugeen rivers, in the township of Bentinck, is seven inches and two-tenths in length, six inches and three-tenths in height and four inches and nine-

tenths in breadth or thickness. A large left valve, from Durham, with the test preserved, is seven inches and seven-tenths in length and its maximum height is four inches and eight-tenths.

Megalomus compressus, Nicholson and Hinde.

Megalomus compressus, Nicholson and Hinde. 1875. Rep. Pal. Prov. Ont., pp. 68 and 69, figs. 40, *a-b*.
" " Whiteaves.....1884. This volume, pt. 1. pp. 10-12, figs. 1 and 2.

This shell is found, but much less frequently, at the same localities as the preceding species, of which it may be only a variety.

Goniophora crassa, Whiteaves.

Goniophora crassa, Whiteaves. 1884. This volume, pt. 1, p. 9, pl. 9, figs. 3, 3, *a-c*.

Hespeler, T. C. Weston, 1867 : an imperfect cast of the interior of both valves and a similar but nearly perfect cast of a right valve. Durham, J. Townsend, 1874-82 : several specimens, most of which are single valves, with the test preserved.

Conocardium.

Numerous specimens of a small and probably undescribed species of this genus were collected at Durham by Mr. Townsend in 1874-82, but none of them are sufficiently perfect or well preserved to be described with any reasonable degree of accuracy. They are either mere casts of the interior of the closed valves, or fragments of moulds of the exterior of the shell.

Anodontopsis concinna, Whiteaves.

Anodontopsis concinna, Whiteaves. 1884. This volume, pt. 1, p. 12, pl. 2, fig. 4, and pl. 7, figs. 4 and 4 *a*.

Galt, T. C. Weston, 1867 : a cast of the interior of a right valve : Durham, J. Townsend ; a similar cast of both valves.

Ilionia Canadensis, Billings.

Ilionia Canadensis, Billings.....1875. Can. Nat. and Geol., N. Ser., vol. VIII., p. 301.
" " Whiteaves..1884. This volume, pt. 1, p. 13, fig. 3.

Hespeler, T. C. Weston, 1867 ; five badly preserved casts of the interior of as many closed valves : Elora, D. Boyle ; a similar specimen.

Ilionia Galtensis, Whiteaves.

Plate 15, fig. 3.

Ilionia Galtensis, Whiteaves....1884. This volume, pt. 1, p. 15, pl. 3, figs. 1, 1, *a-b*.
" " " S. A. Miller...1889. N. Am. Geol. and Palæont., p. 483, fig. 833.

This species was based upon two very imperfect specimens, the one collected at Galt by Dr. R. Bell, in 1861, and the other at Durham by Mr. Townsend between the years 1878 and 1882. Neither of these specimens gives a correct idea of the marginal outline of the valves or of the nature of the surface ornamentation. Since the first part of this volume was written, Mr. Townsend has obtained five additional and more perfect examples of *I. Galtensis* at Durham, and, quite recently (in 1894), the unusually perfect and well preserved left valve from Elora figured on Plate 15. This specimen, which is drawn from a gutta-percha impression of a natural mould of the exterior of that valve, shows that, when perfect, the valves are nearly as high as long and that the ventral margin is narrowly rounded and somewhat produced at or a little in advance of the mid-length. The beaks are small and subcentral, and the surface markings are seen to consist of very numerous and closely disposed fine concentric striæ, with a few coarser ones at irregular but more distant intervals.

The systematic position of *Ilionia* is quite problematical, as the muscular impressions are not at all well preserved in any of the specimens collected, and its hinge dentition is still unknown. Zittel, in the first part of the second volume of his Handbuch der Palæontologie, published in 1881, places it between the Pholadomyidæ and the Anatinidæ, in a group characterized as "palæozoic genera with a simple pallial line, and of doubtful systematic position." Tryon, in the third volume of his "Structural and Systematic Conchology," published in 1884, places it in the Anatinidæ, and Fischer, in the last "fascicule" of his Manuel de Conchyliologie, published in 1887, includes it in the Lyonsiidæ. On the other hand, the external form of the Elora specimen of *I. Galtensis* figured on Plate 15, is so similar to that of some of the lower Palæozoic species of *Lucina* (inclusive of *Paracyclas*) that it is difficult to see how *Ilionia* is to be distinguished from *Lucina*, and in this connection it is to be observed that the *Tellina prisca* of Hisinger, which E. Billings states is a typical *Ilionia*, is regarded by Bronn and Ferdinand Rœmer* as a *Lucina*.

Ilionia (?) costulata, Whiteaves.

Ilionia (?) costulata, Whiteaves. 1884. This volume, pt. 1, p. 15, pl. 2, fig. 5.

Elora, T. C. Weston, 1867; two specimens: and Durham, J. Townsend, 1879-1883; one specimen. No additional examples of this species have been obtained, since it was first described in 1884.

*In the explanation of Plate 14, figs. 2, *a-b*, of the first vol. of the Lethæa Geognostica.

GASTEROPODA.

SCENELLA CONICA, Whiteaves.

Scenella conica, Whiteaves. 1884. This volume, pt. 1, p. 32, pl. 5, figs. 2 & 2*a*.
" " " S. A. Miller. 1889. N. Am. Geol. and Palæont, p. 392, fig. 648.

Of this species there are about a dozen specimens in the Museum of the Survey, which were collected at Durham by Mr. Townsend between the years 1879 and 1884. Each of these is a nearly perfect cast of the interior of the shell, upon which not a vestige of the muscular impressions can be detected.

The genus *Scenella*, which was constituted by E. Billings in 1872, is not mentioned in Dr. Paul Fischer's manual of recent and fossil shells, by Zittel in his Handbuch der Palæontologie, nor by Nicholson in the latest or any other edition of his Manual of Palæontology. Tryon, in his "Structural and Systematic Conchology," and S. A. Miller (op. cit.) place it in the class Pteropoda, but its conical, limpet-like shell suggests that it may rather be referable to the Patellidæ or Capulidæ. It seems to the writer that *Scenella*, *Palæacmea* (Hall, 1873), and *Hercynella* (Kayser, 1878) are very closely related, if not actually synonymous.

CAPULUS CANADENSIS, Whiteaves.

Plate 11, fig. 1.

Tryblidium Canadense, Whiteaves. 1884. This volume, pt. 1, p. 31, pl. 5, figs. 1 & 1 *a*.

The only known specimen of this species is a cast of the interior of the shell, from Hespeler, which does not show the muscular impressions at all clearly. Still, upon this cast there is an obscure, narrowly elliptical depression on each side of, and at a short distance below, the nearly terminal apex. These depressions seem to be united into one continuous subhemispherical scar, under and immediately behind the presumably posterior apex. This supposed muscular scar is not quite correctly represented in the two figures of *Tryblidium Canadense* on Plate 5, of the first part of this volume, and a new figure of the type specimen is given on Plate 11. If the appearances just described are correctly interpreted, they would seem to indicate that the fossil now under consideration is referable to the Capulidæ of Cuvier rather than to the Patellidæ, though one would expect to find the muscular impressions upon the cast represented by slight elevations rather than depressions. Until more perfect specimens are obtained, therefore, it is thought desirable to refer the present species to *Capulus*, in the sense in which De Koninck uses that generic name, rather than to *Tryblidium*.

BELLEROPHON. Species undeterminable.

Bucania stigmosa (?) Whiteaves..1884. This volume, pt. 1, p. 34, pls. 5, figs. 3 and 3*a*, and 8, fig. 4; but perhaps not *B. stigmosa*, Hall (1852).

The two specimens from Galt that are doubtfully referred to *Bucania stigmosa* on page 34, and figured on Plates 5 and 8 of the first part of this volume are mere casts of the interior of the shell, that are too imperfect to be identified specifically.

TREMATONOTUS ANGUSTATUS, Hall. (Sp.)

Bucania angustata, Hall.....1852. Pal. N. York, Vol. II., p. 349, pl. 84, figs. 7, *a-d*.
Bucania Chicagoensis, McChesney.1860. Decr. N. Sp. Foss. Pal. Rocks W. S., p. 49.
Bellerophon angustata, Billings....1863. Geol. Canada, p. 344, figs. 352, *a-b*.
Tremanotus Alpheus, Hall.....1865. (Jan.) Extr. in adv. of Twentieth Rep. Reg. N. Y. St. Cab. Nat. Hist., p. 347. (teste Hall & Whitfield.)
Bucania Chicagoensis, McChesney 1865. (April.) Plates illustr. N. Sp. Foss. Pal. Rocks W. S., pl. 8, figs. 4, *a-b*.
Tremanotus Alpheus, Hall.....1867. Twentieth Rep. Reg. N. Y. St. Cab. Nat. Hist., pl. 15, figs. 23 and 24.
" " Meek.....1875. Rep. Geol. Surv. Ohio, Vol. II., pt. 2, p. 145, pl. 8, fig. 1.
" " Whiteaves...1884. This volume, pt. 1, p. 34.

Galt, A. Murray, 1847, and E. Billings, 1857; Guelph, E. Billings, 1857; Hespeler, T. C. Weston, 1867 and 1871; Elora, D. Boyle, 1880; and Durham, J. Townsend, 1878-82.

All the specimens from these localities, in the Museum of the Survey, are casts of the interior of the shell. Those of adult shells almost invariably show traces of the "interrupted oblong nodes" on the centre of the periphery, that are said to be characteristic of *T. Alpheus*, and most of them are marked with spiral grooves on the outer volution. These "oblong nodes" on the periphery are said to be absent in *B. angustata*, but the type of that species is stated to be a "rough cast in limestone," which is doubtless too imperfectly preserved to show them. In the writer's judgment, *B. angustata* and *T. Alpheus* are names expressive merely of different states of preservation of the same species.

It is not improbable that *T. angustatus* itself may prove to be identical with the *Bellerophon dilatatus* of Sowerby, which is now known to belong to the genus *Trematonotus*. However this may be, in the Museum of the Survey there is a fine specimen of *T. dilatatus*, identified as such by the late Mr. E. Billings, and showing the widely expanded outer lip of

the adult shell, collected by Dr. R. Bell in 1862 from rocks of about the age of the Niagara limestone, at L'Anse à la Vieille in the Baie des Chaleurs ; and another but less perfect specimen, also identified, though with some doubt, by Mr. Billings as this species, collected by the late Mr. James Richardson in 1856 from "Division 2" of the Anticosti Group, at Cape Sand Bay, Anticosti.

Pleurotomaria.

The Pleurotomariæ that have so far been collected from the dolomites of the Guelph formation in Ontario are so imperfectly preserved that it is not yet practicable to group them according to their natural relations Many of the species are still known only from casts of the interior of the shell, and even in those rare specimens which are partly or wholly testiferous, the minute structures of the slit band are not preserved. Under these circumstances the only course that seems to be feasible is first to group together those species that are now known to have an alate or spinose periphery, and afterwards to consider those apparently devoid of either, in accordance with the dates at which they were described, commencing at the earliest.

A. Periphery alate.

Pleurotomaria Valeria, Billings.

Plate 4, figs. 1 and 1a, and pl. 11, figs. 2 and 3.

Pleurotomaria Valeria, Billings...1865. Geol. Surv. Canada, Pal. Foss., Vol. I., p. 169.
" " Whiteaves.1884. This volume, pt. 1, p. 23, pl. 4, figs. 1, and 1 *a*.
Probably = *Pleurotomaria alata*, Wahlenberg.
Cfr. *Pleurotomaria alata* (Wahl.) as figured by Lindström in 1884 on pl. 10, figs. 18-32 of his Silurian Gasteropoda and Pteropoda of Gotland.

The type of *P. Valeria*, which was figured for the first time in the present volume, is an imperfect cast of the interior of the shell, collected by Mr. E. Billings at Galt in 1857. Between the years 1879 and 1882 a few specimens of this species, with the test partially and imperfectly preserved, were obtained at Durham by Mr. Townsend, and one of these is figured on Plate 4, fig 1 *a*. Two specimens from this locality are natural moulds of the exterior of the apical side of the shell, and gutta-percha impressions of these moulds, such as that represented on Piate 11, fig. 2, show that the comparatively slender tubular portion of the outer volution is encircled externally by a thin and slightly curved alate expansion, that is broader than the tube itself, and shallowly concave. The corresponding alation of the later volutions of the spire is not even indicated in either

of these casts, so that they do not give a very good idea of the original contour of the spire, and the only surface markings that they show, are numerous flexuous growth lines upon the outer volution.

The umbilical side of a shell of this species is well seen in the gutta-percha impression of a natural mould of the exterior of a specimen collected by Mr. Townsend and the writer at Belwood in 1893, and represented by fig. 3 on Plate 11. In this specimen the peripheral alation of the outer volution is remarkably perfect, the outer lip is clearly defined and the incremental striæ are beautifully preserved. These latter are curved concavely backward on the tubular part of the outer volution, and obliquely as well as convexly outward and forward on the peripheral alation.

From the additional information afforded by these specimens it would seem that *P. Valeria* is most probably synonymous with *P. alata*. Still, as the few specimens of *P. Valeria* that have been collected so far, are neither sufficiently perfect nor well preserved to admit of a satisfactory comparison with the published descriptions and figures of *P. alata*, it is thought better to provisionally retain the name already given to the former.

Pleurotomaria velaris. (N. Sp.)

Plate 11, figs. 4 and 4 a.

Shell conical, more than twice as broad as high: its base widely and deeply umbilicated. Volutions perhaps as many as six or seven when perfect, though only the last four are preserved in the single specimen collected, those of the spire obliquely compressed, the alation of each of its three later volutions partially overlapping and appressed to the volution that immediately succeeds it. Outer volution expanded laterally and rather strongly convex next to the alate periphery above: the alation broad and curving concavely outward and downward, as viewed from the apical side: base of the tubular portion gently convex around the umbilicus: aperture transversely subelliptical, a little broader than high.

Surface of the apical side marked by low, rounded, flexuous, transverse plications and striæ of growth, also by numerous small revolving raised lines or minute spiral ridges, that are more distinct upon the peripheral alation of the last volution than upon its tubular portion. Crescents of the slit band unknown. Base marked only by flexuous incremental striæ, that curve concavely and obliquely forward upon the tubular portion of the outer volution, and convexly outward and forward on its alate expansion.

The specimen described is not sufficiently perfect to admit of an accurate statement of its proportionate dimensions, but both the figures are of the natural size.

Irvine rocks, Elora, J. Townsend, 1885: one specimen with the test preserved. The apex is imperfect, but the three latest volutions of the spire, and most or the outer volution, with the characteristic alation of each, are well preserved.

The shell for which the foregoing name is suggested, may prove to be a variety of *P. Valeria* or of *P. alata*, but the surface markings of its apical side seem to be very different to the corresponding markings of either of those species.

Pleurotomaria Halei, Hall. Var.

Plate 10, figs. 2 and 2 a.

Pleurotomaria Halei, Hall...1861. Rep. Sup. Geol. Surv. Wiscons., p. 34.
" " ...1865. Extr. in adv. of Eighteenth Rep. on the N. Y. St. Cab. Nat. Hist., p. 344.
" " ...1867. Twentieth Rep. Reg. N. Y. St. Cab. Nat. Hist., pl. 15, figs. 13 & 14.
Cfr. *Pleurotomaria limata*, Lindström. 1884. Silur. Gastr. and Pterop. Gotland, p. 114, pl. 10, figs. 2-17.

Shell conical or turbinate conical, much broader than high, and deeply though not very widely umbilicated. Volutions probably four or five when perfect, though only the three later ones are preserved in the specimens collected, those of the spire ventricose or expanded, the penultimate volution distinctly angulated anteriorly, in some specimens, such as the one figured, a little below the middle, and in others at or near the base and next to the suture below. Outer volution widely expanded, a little higher than the spire, obliquely convex near the suture and faintly concave next to the alate periphery above; encircled about the midheight with a prominent, but apparently non-spinose, alate keel four millimetres and a half in altitude, which incloses the slit band; rather strongly convex beneath, but depressed and deeply umbilicated in the centre, the umbilicus occupying about one-third of the diameter of the base, though its margin is rounded and indefinite.

The surface markings of the umbilical side are well preserved in most of the specimens collected, and consist of crowded, flexuous, striæ of growth, which curve obliquely and concavely backward from the peripheral alation to the umbilicus, and are crossed by spiral incised lines. The crescents of the slit band are crowded, but they are not sufficiently well preserved to show the details of the irstructure. The surface ornamentation of the apical side is not nearly so well exhibited, but it appears to consist of numerous and closely disposed lines of growth, which are crossed by one or more spiral ridges.

Durham, J. Townsend, 1882-89: nine specimens. As seen from above, these specimens bear a certain general resemblance to *P. Elora*, Billings,

but in the former the alation of the outer volution is central and apparently non-spinose, and the base rather strongly convex exteriorly. In *P. Elora* the alation of the outer volution is basal and distinctly spinose, and the base flattened around the umbilicus.

B. Periphery of the outer volution distinctly spinose.

PLEUROTOMARIA ELORA, Billings.

Plate 11, figs. 5 and 6.

Pleurotomaria Elora, Billings. 1862. Geol. Surv. Canada, Pal. Foss., vol. I., p. 154, fig. 135.
" " " 1863. Geol. Canada, p. 343, fig. 348.

This species was described from a very imperfect cast of the interior of the shell collected by Dr. R. Bell at Elora in 1861. A few additional and much more perfect specimens, some of which have most of the test preserved, have recently been obtained by Mr. Townsend at Durham, Elora and at Aboyne, one mile east of Elora. The testiferous specimens, two of which are figured, show that the angulated periphery of the outer volution, when perfect, is armed with a single row of long and slightly curved, slender and hollow spines, not unlike externally to those of *Guildfordia* or some recent species of *Astralium*. In two remarkable specimens collected by Mr. Townsend at Aboyne in 1892, and presented by him to the Museum of the Survey, these spines, as shown by figure 6 on Plate 11, are more than three-quarters of an inch in length. In another specimen, the original of fig. 5 on the same plate, the spines appear to commence on the outer half of the last volution of the spire, where they form a spiral row of small tubercles immediately above that part of the suture which separates the spire from the outer volution, near the aperture, in consequence of their being almost completely overlapped by the upper portion of the outer volution. The surface of the apical side of the shell is marked by the usual flexuous striæ of growth and that of the spire by a few spiral raised lines, but the markings of the umbilical side are still unknown.

C. Periphery (as far as known) neither alate nor spinose.

PLEUROTOMARIA BISPIRALIS, Hall.

Pleurotomaria bispiralis, Hall. 1852. Pal. N. York. vol. I., p. 349, pl. 84, figs. 2, *a-b*.

Galt, Professor James Hall, 1848: a single mould of the exterior of the shell. An imperfect and very badly preserved cast of the interior of a shell collected at Hespeler by Mr. Weston in 1867 has since been identified with this species by E. Billings. *P. bispiralis* appears to be very rare, as these two specimens are, so far as the writer is aware, the only ones known. It is recognizable by its narrow turbinate-conical form, by its imperforate or nearly imperforate base and by its elevated spire, encircled with two spiral ridges.

Pleurotomaria perlata, Hall.

Pleurotomaria perlata, Hall. 1852. Pal. N. York, vol. I, p. 349, pl. 34, figs. 5, *a*, *b*, *c*.

Pleurotomaria solaroides, Billings (probably by inadvertence). 1863. Geol. Canada, p. 341, fig. 347.

Galt, A. Murray, 1847, and Professor James Hall, 1848; Galt and Hespeler, E. Billings, 1857; Elora, T. C. Weston, 1867; Belwood, J. Townsend and J. F. Whiteaves, 1893. A fine large species of which only casts of the interior of the shell have yet been found. It is, however, distinguishable at a glance from all the other Pleurotomariæ of the Guelph formation, by its compressed lenticular form, acutely angulated periphery and deep but rather narrow umbilicus.

Pleurotomaria Galtensis, Billings.

Plate 11, fig. 7.

Pleurotomaria Galtensis, Billings. 1862. Geol. Surv. Canada, Pal. Foss., vol. I., p. 154, fig. 136.

" " " 1863. Geol. Canada, p. 334, fig. 349.

The types of this species are two imperfect casts of the interior of the shell, collected at Galt by Dr. R. Bell in 1861. The apices of both of these specimens are broken off, and only the three outer volutions are preserved in the more perfect of the two. In September, 1893, Mr. Townsend and the writer obtained at Belwood two casts of the interior of a shell which is evidently referable to *P. Galtensis*, with corresponding moulds of the exterior of each, from which the intermediate test has long ago disappeared. The figure on Plate 11 is a representation of a gutta-percha impression of one of these natural moulds. It shows that the volutions of the spire are angulated and subcarinate at or near their base, that the outer portion of the last volution is angulated a little above the mid-height and encircled by a spiral ridge which is concave on the apical side and convex on the umbilical, also that the very convex umbilical side is imperforate when the test is preserved. On each side of the spiral angulation the whole surface of the shell appears to have been smooth.

Pleurotomaria Deiopeia, Billings.

Plate 12, fig. 1.

Pleurotomaria Deiopeia, Billings. 1862. Geol. Surv. Canada, Pal. Foss., vol. I, p. 155.

This insufficiently defined species, which is now figured for the first time, was based upon a very imperfect cast of the interior of the shell,

with a small piece of the test preserved, collected by Dr. R. Bell at Elora in 1861. No other specimen of it has been seen by the writer. In addition to the original description it may be added that the umbilicus of the type of *P. Deiopeia* is so narrow that it is most probable that the base of the shell is imperforate when the test is preserved.

Pleurotomaria Hercyna, Billings. (Sp.)

Murchisonia Hercyna, Billings. 1862. Geol. Surv. Canada, Pal. Foss., vol. I., p. 158, fig. 141.

Galt, E. Billings, 1857 : two casts of the interior of the shell, one of which has a portion of the test preserved. Elora, T. C. Weston, 1867 : two similarly preserved specimens. According to Professor Lindstr m,* the *Murchisonia Hercyna* of Billings comes near to *Pleurotomaria elliptica*, Hisinger, and may possibly be only a variety of that species, though the Canadian shell is more elongated, and its apical angle is more acute. The characters of *M. Hercyna*, on the whole, seem certainly to accord better with those of *Pleurotomaria* than with those of *Murchisonia*.

"Pleurotomaria? Viola," Billings.

Plate 12, fig. 2.

Pleurotomaria? Viola, Billings. 1865. Geol. Surv. Canada, Pal. Foss., vol. I, p. 169.

Galt, E. Billings, 1857 : a badly preserved cast of the interior of the shell, with nearly the whole of the spire buried in a compact crystalline dolomite, and showing little more than the general shape of the broadly and very deeply umbilicated base. This specimen, which is the type of the species, and which has not been figured before, is the original of the drawing reproduced on Plate 12. Elora, D. Boyle, 1880 : a cast of the interior, with the basal portion only exposed. Belwood, J. Townsend, 1886 : two similar specimens.

This species is so imperfectly characterized that it is very doubtful if it can be retained. No specimen has yet been collected in which even a very small piece of the test is preserved, or any considerable portion of the spire is visible, and the outer volution of the type, as described by Billings, shows only "some appearance of an angulation." It is by no means certain, even, that the species should not be referred to *Straparollus* rather than to *Pleurotomaria*.

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*On the Silurian Gastropoda and Pteropoda of Gotland. Kongl. Svenska Vetenskaps-Akad. Handl., vol. XIX., No. 6, Stockholm, 1884, p. 106.

Pleurotomaria occidens, Hall.

Pleurotomaria occidens, Hall. 1867. Twentieth Rep. Reg. St. N. York, p. 364, pl. 15, figs. 11 and 12.
" " Hall and Whitfield. 1875. Rep. Geol. Surv. Ohio, vol. II., pt. 2, p. 142, pl. 8, fig. 3.

Elora, T. C. Weston, 1867 (one specimen), and J. Townsend, 1892 (one specimen); both with a considerable portion of the test preserved. In his memoir on the Silurian Gastropoda and Pteropoda of Gotland (page 113), Professor Lindström includes *P. occidens* among the synonyms of *P. labrosa*, Hall. This latter species was collected by Sir W. E. Logan, in 1843, from limestones of about the age of the Niagara limestone at Port Daniel, P.Q., and from the supposed Lower Helderberg limestone between Cape Gaspé and Cape Rosier.

Pleurotomaria cyclostoma, Whiteaves.

Pleurotomaria cyclostoma, Whiteaves. 1884. This volume, pt. 1, p. 23, pl. 3, figs. 12 and 12 *a*.

Durham, J. Townsend, 1874-82: two specimens.

Pleurotomaria Durhamensis, Whiteaves.

Pleurotomaria Durhamensis, Whiteaves. 1884. This volume, pt. 1, p. 24, pl. 4, fig. 2.

No other specimen of this species has been obtained, to the writer's knowledge, than the one which was described and figured in the first part of this volume. A salient feature in this specimen is the slender acuminate apex, which is composed of no less than four minute but distinct volutions. It may prove to be only a variety of *P. Galtensis*.

Pleurotomaria Townsendii. (N. Sp.)

Plate 15, fig. 9.

Shell small, turbinate, naticoid, a little higher than broad, spire elevated, but, in its dorsal aspect, distinctly shorter than the last volution: base imperforate. Volutions five in number, increasing rather rapidly in size, those of the spire convex and rounded, the outer one moderately inflated and a little broader than high.

The surface markings are indicated only in the concave mould of the exterior (or convex surface of the test) of the last volution and part of the last but one, of the specimen figured. To the naked eye the surface of

the outer volution appears to be nearly smooth and marked only with a narrow and apparently flat spiral band a little above or on the apical side of the mid-height. Under a lens it seems to be marked with numerous and extremely minute transverse lines of growth, which are crossed by equally minute spiral raised lines, but the specimen is not sufficiently well preserved to show the minute details of the sculpture at all satisfactorily.

Dimensions of the most perfect specimen, the original of fig. 9 : entire height, as measured in the median line of the dorsal surface, fourteen mm. ; greatest breadth, eleven mm. and a half ; height of spire, five mm. and a half.

Durham, J. Towsend, 1878-82 : one natural mould of the exterior of the shell (with part of the test of the spire preserved, though its outer surface is buried in the matrix) and four small casts of the interior of the shell.

This little shell appears to belong to that section of the genus *Pleurotomaria* which Lindström, in the memoir previously referred to, designates as the *Naticoideæ*. According to Lindström, only one species of that section was previously known, viz., the *P. exquisita* of that author himself, from the Silurian rocks of Gotland. The minute surface markings of *P. Townsendii*, so far as they can be ascertained at present, seem to resemble those of *P. exquisita*, but in that species the slit band is placed below or on the umbilical side of the mid-height, the spire is shorter and much more obtuse and the base distinctly umbilicated.

Murchisonia.

It will be convenient to group the species of this genus that are known to occur in the Guelph formation of Ontario, as far as practicable in their natural order, commencing with the short-spired Pleurotomaria-like forms, and ending with the slender species with very numerous volutions. *M. Hercyna*, Billings, is now regarded as a *Pleurotomaria ; M. Boydii*, Hall, appears to the writer to be a *Loxonema ;* and Fisher's genus *Loxoplocus* will be retained for *M. soluta* (Whiteaves) of which *M. tropidophora* (Whiteaves) is now known to be a synonym. Specimens of *M. bivittata* collected at Belwood by Mr. Townsend in 1892, which happen to be broken in such a way as to afford good longitudinal and transverse sections of the empty shell, show that the earlier volutions of the spire are divided into chambers by numerous transverse partitions, also that the columella, which has long been known to be encircled with two spiral folds, is tubular and hollow throughout.

A. Short spired species, approaching to *Pleurotomaria.* Volutions four to seven.

Murchisonia Hespelerensis, Whiteaves.

Murchisonia Hespelerensis, Whiteaves. 1884. This volume, pt. 1, p. 24, pl. 41, fig. 3.

Hespeler, T. C. Weston, 1867, one perfect cast of the interior of the shell; Township of Glenelg, J. Townsend, 1883, a similar specimen. This species should, perhaps, be referred to *Pleurotomaria* rather than to *Murchisonia*.

Murchisonia Mylitta, Billings.

Murchisonia Mylitta, Billings. 1862. Geol. Surv. Canada, Pal. Foss., vol. I, p. 157, fig. 140.

Elora, R. Bell, 1861: a single cast of the interior of the shell with a small portion of the test preserved. The specimen is represented as measuring twenty-four millimetres, or a little less than an inch in height, but the figure of it is slightly restored, the spire of the original being rather badly preserved and its apex broken off. According to Mr. Billings, the shell of this species is short and consists of "four or five ventricose whorls, with a narrow spiral band a little above the middle on the last," and, it may be added, on the last only.

Murchisonia. (Species uncertain.)

Plate 12, fig. 3.

Between the years 1878 and 1882 Mr. Townsend collected, at Durham, five specimens of a rather large short-spired *Murchisonia* which may represent the adult condition of *M. Mylitta*, but which in some respects seems to be intermediate in its characters between that species and *M. Xanthippe*, Billings. The largest of these specimens, which is imperfect at the apical end, is fifty-four millimetres or upwards of two inches in height or length, and three of the smaller ones have most of the test preserved. In these latter the slit band, which is enclosed in a prominent but narrow spiral ridge or keel, encircles the outer volution above the mid-height, especially near the aperture, as represented by the figure on Plate 12, and the volutions of the spire are angulated a little below the mid-height. The whole five give one the impression of a shell like the *Murchisonia bicincta* of Hall, with only one spiral keel developed, and closely resembling that form of *M. bicincta* from Ardre figured by Lindström under the name *Pleurotomaria bicincta* on Plate 8, figure 20, of the "Silurian Gastropoda and Pteropoda of Gotland." In that monograph the "*Trochonema (Eunema) fatua* of Hall, from the Niagara limestone of Wisconsin, is regarded as a synonym of *Pleurotomaria bicincta*.

Murchisonia Xanthippe, Billings.

Murchisonia Xanthippe, Billings. 1862. Geol. Surv. Canada, Pal. Foss., vol. I., p. 155, fig. 137.

Galt, E. Billings, 1857: a single and apparently slightly distorted natural mould of the exterior of the shell.

Murchisonia Vitellia, Billings.

Murchisonia Vitellia, Billings. 1862. Geol. Surv. Canada, Pal. Foss, vol. I., p. 156, fig. 138.
" " Nicholson. 1875. Rep. Pal. Prov., Ont., p. 3, fig. 6.

Galt, E. Billings, 1857: a natural mould of the exterior of the shell. The woodcut of the type of this species is taken from a gutta-percha impression of this mould. Elora, Professor H. A. Nicholson. Durham, J. Townsend, 1883: one fine large specimen with the test preserved. The volutions in *M. Vitellia* are described by Mr. Billings as six in number, "strongly ventricose, obtusely angular, and with a flat spiral band along the middle."

B. Spire elongated, shell slender: *Murchisonia* proper.

BB. Volutions not more than twelve.

Murchisonia Conradi, Hall.

Murchisonia Conradi, Hall. 1867. Twentieth Rep. Reg. N. Y. St. Cab. Nat. Hist., p. 344, pl. 15 (6), fig. 19.
" " Whiteaves. 1884. This volume, p. 27, pl. 4, fig. 6.

The three specimens collected at Elora by Messrs. Weston and Boyle, and referred to on page 27 of this volume as a local variety of *M. Conradi*, are the only ones from the Guelph formation of Ontario that the writer has seen. Professor Hall states that the shell of the typical form of this species consists "of about seven volutions."

Murchisonia Logani, Hall.

Murchisonia Logani, Hall. 1852. Pal. N. York, vol. II., p. 346, pl. 83, figs. 4, *a-b*.

Galt, A. Murray, 1847, and E. Billings, 1857; Elora, R. Bell, 1861, and T. C. Weston, 1867; Hespeler, T. C. Weston, 1867; and Fergus, teste E. Billings, in the "Geology of Canada."

The surface markings of this species are still unknown. all the specimens that have been collected so far being either coarse and imperfect natural moulds of the exterior of the shell, upon which no remains of the

slit band or lines of growth are preserved, with the corresponding cast of the interior in place, or separate casts. All that appears to be known of the shell is, that it is elongate, turreted and composed of about eleven rounded ventricose volutions, that are much broader than high.

Murchisonia macrospira, Hall

Murchisonia macrospira, Hall.....	1852.	Pal. New York, Vol. II., p. 346, pl. 83, fig. 5.
" "	Billings....	1863.	Geol. Canada, p. 339, fig. 334.
" "	Nicholson..	1875.	Rep. Pal. Prov. Ont., p. 70, pl. 3, fig. 9.
" "	Whiteaves .	1884.	This volume, p. 27, pl. 4, fig. 7 and 7*a*.

Galt, A. Murray, 1845, and E. Billings, 1857 ; Elora, D. Boyle, 1880. The species has also been collected at Durham by Mr. Townsend, and at Belwood (in 1893) by Mr. Townsend and the writer. With the exception of the one from Elora represented on Plate 4, fig. 7*a*, of the present volume, all the specimens of this species that the writer has seen are natural moulds of the exterior of the shell. The type of *M. macrospira*, as figured by Professor Hall, is a mould of the exterior of five of the later volutions. A gutta-percha impression of this mould has recently been presented to the Museum of the Survey by Professor R. P. Whitfield. It shows that the volutions are rounded, ventricose and encircled at their mid-height by a low, rounded, spiral ridge which represents the slit band. Other specimens shew that the number of volutions is at least nine.

It is very doubtful whether the distinction between this species and *M. Logani* can be be sustained. The original figures of both give the impression that the volutions of *M. Logani* are a little broader in proportion to their height and perhaps slightly more numerous than those of *M. macrospira*, but these apparent differences do not seem to hold good when a series of specimens is compared. In the diagrammatic figure of *M. macrospira* on page 339 of the "Geology of Canada," the volutions are more like those of *M. Logani* than those of *M. macrospira*. Again, the writer can see no difference, except in size, between the specimen which Professor Nicholson figures on Plate 3, fig. 4, of his second "Report upon the Palæontology of the Province of Ontario" as *M. Logani*, and that which he figures on the same Plate, figure 9, as *M. macrospira*.

Murchisonia Boylei, Nicholson.

Murchisonia Boylei, Nicholson. 1875. Rep. Pal. Prov. Ont., p. 71, pl. 3, fig 1.

Elora, D. Boyle : a natural mould of the exterior of the shell, which is stated by Professor Nicholson to have been presented to the Museum of

Toronto University. The shell, as represented by a gutta-percha impression of this mould, is described as "turreted, with a long conical spire, the apical angle of which is about 18°". Its volutions are said to be "ten or eleven in number, increasing regularly from the apex to the mouth, flat, with a well marked spiral band or angulation situated just above the suture," which causes "the lower part of each whorl to project over the upper portion of the whorl next below." The suture is represented as "canaliculated," the body whorl as little larger than the preceding one, and not ventricose, and the base as "somewhat produced below, apparently with a small umbilicus.

The writer has never seen a specimen of *M. Boylei*, but it appears to be a well characterized and distinct species.

Murchisonia constricta, Whiteaves.

Murchisonia constricta, Whiteaves..1884. This volume, p. 25, pl. 4, fig. 4.

Durham, J. Townsend: a single specimen. Perhaps a variety of the preceding species.

Murchisonia bivittata, Hall.

Plate 12, figs. 5 and 6.

Murchisonia bivittata, Hall.....1852. Pal. N. York, vol. II., p. 345, pl. 83, figs. 1, *a-b*.
" " Nicholson..1875. Rep. Pal. Prov. Ont., p. 70, pl. 3, fig. 7, but not fig. 8.

Galt, A. Murray, 1847, and E. Billings, 1857; Hespeler, T. C. Weston, 1867 and 1871; Elora and Hespeler, Professor H. A. Nicholson; Belwood, J. Townsend, 1892, and J. Townsend and J. F. Whiteaves, 1893.

This is one of the commonest fossils of the Guelph formation at these localities, and one that, as has been pointed out by Professors Hall and Nicholson, is most readily recognized by the "double spiral fold or carina" upon its columella. The condition in which *M. bivittata* is usually obtained, is either that of natural longitudinal sections of the hollow shell, with the columella preserved throughout and the broken edges of the test exposed; or casts of the interior, or specimens with the outer layer of the test exfoliated. When perfect the shell was evidently composed of two layers of about equal thickness, but no considerable portion of the outer surface of the test is preserved in any specimen that the writer has seen.

Specimens of this species recently collected at Belwood by Mr. Townsend and the writer, give the following additional information about the

external shape of its shell and its internal peculiarities. Figure 5 on Plate 12, which represents a gutta-percha impression of a natural mould of the exterior of the shell from Belwood, shows that it is rather slender and composed of about twelve volutions. Those of the spire are compressed convex above and distinctly angulated below the mid-height; the suture is deeply impressed; the outer volution is angulated, apparently with a spiral band, about the mid-height, and rounded and apparently narrowly umbilicated below. Figure 6, on the same plate, represents a longitudinal section of the upper portion of the shell, also from Belwood. It shows that the transverse shelly partitions of the earlier volutions of the spire are concave, numerous, and placed at intervals of from one to two millimetres apart. Other specimens from the same localities show that the columella is hollow throughout, as previously stated on page 78.

M. bivittata seems to be most nearly related to *M. Estella*, Billings, but in the latter species the shell is still more slender and composed of more than fifteen volutions. The diagrammatic representations of *M. bivittata* on page 339 of the "Geology of Canada" is very unsatisfactory and does not give a correct idea of its characters.

BBB. Volutions more than twelve.

MURCHISONIA ESTELLA, Billings.

Murchisonia Estella, Billings..1862. Geol. Surv. Canada, Pal. Foss., vol. I., p. 157, fig. 139.

Galt, E. Billings, 1857, an imperfect mould of the outside of the shell, consisting of fifteen volutions, and Dr. R. Bell, 1861, a similar specimen. According to Mr. Billings "this species is allied to *M. longispira*, Hall," ..... "but is more acutely angular in the whorls."

MURCHISONIA LONGISPIRA, Hall.

Murchisonia longispira, Hall.....1852. Pal. N. York, vol. II., p. 345, pl. 83, figs. 2, *a-b*.
" " Nicholson...1875. Rep. Pal. Prov. Ont., p. 70, pl. 3, figs. 11 and 12.

Galt, A. Murray, 1847, E. Billings, 1857, and Dr. R. Bell, 1861; Elora, T. C. Weston, 1861, and D. Boyle, 1880; Hespeler, T. C. Weston, 1871; Guelph, Professor H. A. Nicholson; Durham, J. Townsend, 1878-82. *M. longispira* is remarkable for its extremely elongated and very slender spire, also for its numerous volutions, which are stated to be "rounded on the surface, and carinated below the centre." Professor Hall says that he has counted twenty-five volutions in a mould of this species

from Galt, that is imperfect at the base. Not more than twenty-one volutions can be counted in the most perfect specimen (from Elora) in the Survey collection, but this specimen is imperfect at both ends.

Murchisonia turritiformis, Hall.

Plate 12, fig. 4.

Murchisonia turritiformis, Hall.....1852. Pal. N. York, vol. II., p. 347, pl. 83, figs. 6, *a-b*.
" " Nicholson....1875. Rep. Pal. Prov. Ont., p. 70, pl. 3, fig. 10.
" " Whiteaves...1884. This volume, pt. 1, p. 26, pl. 4, fig. 5.

Galt, A. Murray, 1847, and E. Billings, 1857; Elora, Dr. R. Bell, 1861 and D. Boyle, 1880; Hespeler, T. C. Weston, 1867 and 1871; Durham, J. Townsend, 1874-82.

The specimen represented on Plate 12, the test of which is beautifully preserved on the seven later volutions, though the earlier ones are broken off, was obtained by Mr. Townsend, in 1885, at the "cave," Irvine rocks, Elora, and presented by him to the Museum of the Survey. In this specimen the volutions of the spire are laterally compressed, but most prominent and obtusely sub-angular a little below the mid-height, where they are encircled by a rather narrow and not much elevated spiral band, which is flattened at the summit and bounded above by a spiral impressed line. The outer volution, which is not much larger than the one which precedes it, and rounded below, is encircled by the spiral slit band a little above the mid-height. On each of the volutions the numerous and close-set striæ of growth curve obliquely backward to the slit band above and forward to the suture, on those of the spire, or to the base of the outer volution, below.

Loxoplocus solutus, Whiteaves.

Plate 12, figs. 7 and 8.

Murchisonia soluta, Whiteaves.....1884. This volume, pt. 1, p. 28, pl. 4, figs. 8 and 8 *a*.
Murchisonia tropidophora, Whiteaves..1884. Ibid, p. 29, pl. 7, figs. 5 and 5 *a*.
Loxoplocus tropidophorus, Fischer.....1885. Man. de Conchyl., etc., p. 847.

The original description of *M. soluta* was based upon a number of casts of the interior of shells collected at Hespeler, Elora and Durham by Messrs. Weston, Boyle and Townsend, which show only one spiral keel on each volution. *M. tropidophora*, on the other hand, was described from an imperfect specimen with nearly the whole of the test preserved, and

shewing the characters of the entire outer volution, which is encircled by three spiral keels. The aperture is circular and the outer lip slightly expanded.

In 1892, however, Mr. Townsend obtained natural moulds of the exterior of two shells (one at Elora and the other at Belwood), which have convinced the writer that the specimens upon which *M. soluta* and *M. tropidophora* were based, are merely different states of preservation of the same species. Fig. 7, on Plate 12, represents a wax impression of the mould from Elora, and fig. 8, on the same plate, a similar impression of the mould from Belwood. These show that, when the test is preserved, the spire is encircled by three spiral keels, two of which are placed comparatively close together, at the upper part of each volution, and the third at the base. On the outer volution of the type of *M. tropidophora* the basal carina ultimately becomes confluent with the upper or posterior margin of the lip, on the columellar side.

Euomphalus inornatus, Whiteaves.

Plate 13, fig. 1.

Trochonema inornatum, Whiteaves. 1884. This volume, pt. I, p. 19, pl. 3, fig. 7.

The specimen from Elora represented on Plate 3 of the first part of the present volume is the only one that the writer has seen, upon which any portion of the test is preserved. The figure of this specimen, however, is not at all satisfactory, and the additional and much more correct illustration upon Plate 13 of the present part of this volume, is drawn from a cast of the interior of the shell, from Durham. In spite of its comparatively elevated spire, and narrow or perhaps closed umbilicus, the general shape and the insinuation of the growth lines on the shoulder of the outer volution, would seem to indicate that this shell is referable to *Euomphalus* rather than to *Trochonema*. It may prove to be merely an abnormal form of the species next to be considered.

Euomphalus Galtensis, Whiteaves.

Euomphalus Galtensis, Whiteaves .....1884. This volume, pt. 1, p. 21, pl. 3, figs. 9 and 9 *a*.

Cfr. *Euomphalus Gotlandicus*, Lindström....1884. Sil. Gastr. and Pter. Gotland, p. 139, pl. 13, figs. 19-31.

Galt, E. Billings, 1857; Hespeler, T. C. Weston, 1867; and Durham, J. Townsend, 1878-82.

This species is very closely related to, if not identical with, the *E. Gotlandicus* of Lindström. Still, if the two should prove to be identical, *E.*

Galtensis is a little the older name, as may be seen from the fact that the first part of this volume is quoted from, more than once, in Professor Lindström's monograph.

Euomphalus circinatus, Whiteaves.

Ecculiomphalus circinatus, Whiteaves. This volume, pt. I, p. 35, pls. 5, figs. 4, 4, *a-c*, and 8, fig. 5.

Galt and Hespeler, T. C. Weston, 1867; Elora, D. Boyle, 1878; Durham, J. Townsend, 1878-84.

Professor Lindström says *that the genus *Ecculiomphalus* was originally based by Portlock upon two shells which are expressly stated to bear "great resemblance to an unrolled *Euomphalus*." Since then *Ecculiomphalus* has been made to include "species of evolute *Euomphali* and likewise evolute *Pleurotomariæ*. It must, consequently, Professor Lindström thinks, "be broken up and its species distributed in these genera." In view of these remarks, *Ecculiomphalus circinatus* appears to the writer to be a sinistrally coiled evolute *Euomphalus*. Further, Professor Lindström has shown† that in *Euomphalus Gotlandicus* the shell may be either involute with the whorls everywhere in contact, or evolute and loosely coiled, also that its volutions are coiled indifferently to the right or to the left. Hence it is not at all improbable that *E. circinatus* may prove to be merely an evolute sinistral variety of *E. Galtensis*, though at present no specimens with characters intermediate between these two forms have been seen by the writer.

Professor James Hall has applied the name *Phanerotinus*, Sowerby, to the uncoiled species of *Euomphalus*, but the type of the genus *Phanerotinus*, the *Euomphalus cristatus* of Phillips, is stated by that palæontologist to be provided with a "large double dentated keel, continued to the inner whorls."

Loxonema Boydii, Hall.

Loxonema Boydii, Hall.....1843. Rep. Fourth Geol. Distr. N. Y., p. 138, fig. 3 (?).
Murchisonia Boydii, Hall.....1852. Pal. N. York, vol. II., p. 346, pl. 83, fig. 3.
" " Billings....1863. Geol. Canada, p. 399, fig. 345.

Galt, A. Murray, 1847, and E. Billings, 1857; Hespeler, T. C. Weston, 1867; and Durham, J. Townsend, 1878-82.

After the brief description of *Murchisonia Boydii* in the second volume of the Palæontology of the State of New York, Professor Hall says: "the

*Silurian Gastropoda and Pteropoda of Gotland, p. 138.
†Ibid., on pl. xiii, figs. 19-31.

few impressions of striæ remaining upon the cast are not sufficient to decide whether the fossil be a *Loxonema* or *Murchisonia;* and since all the Galt specimens, which are of the same age, appear to belong to *Murchisonia*, I have concluded to refer this one to the same genus." All the specimens from Ontario that the writer has seen are mere casts of the shell, upon which no vestiges of the surface markings are preserved. Still in these the general shape of the shell, with its compressed convex but evenly rounded volutions, devoid of the slightest indication of a slit band, appears to the writer to be much more like that of a *Loxonema* than that of a *Murchisonia.* Moreover another species of *Loxonema* is now known to occur in the Guelph formation of the province. The largest specimen of *L. Boydii* known to the writer, when perfect, would probably have been about an inch and three-quarters in height or length. The apical angle of specimens from Ontario is 24°.

The genus *Loxonema* is included by Lindström in the family of Euomphalidæ of De Koninck on account of its insinuated growth lines like those of *Euomphalus*, its solid axis and earliest "whorls filled with an organic deposit of homogeneous calcite," as in that genus. On the other hand, the late Dr. Paul Fischer* regarded these points of resemblance as of little importance, and placed *Loxonema* in the Pyramidellidæ and *Euomphalus* in the Solariidæ.

LOXONEMA MAGNUM, Whitfield. Var.

Plate 13, fig. 2.

Loxonema magnum, Whiteaves. 1884. This volume, pt. 1, p. 17.

Shell rather large, elongated, turreted, slender: apical angle about 16°. Volutions not less than eight and probably as many as ten when perfect, the later ones moderately convex and not much broader than high, the last not much larger than the one which immediately precedes it: suture deeply impressed in the cast. Surface markings unknown.

Galt, Hespeler and Elora: the specimens referred to on page 17 of the first part of this volume as *Loxomena magnum*, Whitfield. They seem, however, never to have attained to so large a size as *L. magnum*, and their volutions are apparently much more convex proportionately than those of that species. The rate of increase of the volutions of the typical *L. magnum* is said to indicate a "length of fully eight inches for the entire shell," but judging by the proportions of specimens from different localities in Ontario, their entire length could scarcely have been much more than five inches. Still, these supposed differences may be more apparent than real, and the writer is by no means convinced that the Ontario specimens are specifically distinct from *L. magnum.*

*Manuel de Conchyliologie, &c., p. 715.

Pycnomphalus solarioides, Hall. (Sp.)

Plate 13, figs. 3, 3 a, 4-8.

Pleurotomaria solarioides, Hall.....1852. Pal. N. Y., vol. II., p. 348, pl. 84, fig. 4 *b*, but not 4 *a*.
" " Nicholson..1875. Rep. Pal. Prov. Ont., p. 72, pl. 3, fig. 15 (?).
Straparollus solarioides, Whitfield....1882. Geol. Wiscons., vol. IV., p. 358.

Galt, A. Murray, 1847, and E. Billings, 1857 ; Hespeler, T. C. Weston, 1867 ; Durham, J. Townsend, 1878-82 ; Elora and Belwood, J. Townsend, 1892. Nicholson (op. cit.) says that *P. solarioides* is "not uncommon in the Guelph formation of Hespeler, Guelph and Elora."

In the writer's judgment, figure 4*a* on plate 84 of the second volume of the Palæontology of New York, which is stated to represent the base of a specimen of *Pleurotomaria solarioides*, represents rather the under side of an imperfect specimen of *P. perlata*. A number of specimens collected by Mr. Townsend at Durham, Elora and Belwood, which correspond perfectly with the other figure (fig. 4*b*) of *P. solarioides* on plate 84 of the volume referred to, have convinced the writer that this species is referable to Lindström's genus *Pycnomphalus*.

Some of these specimens are mere casts of the interior of the shell. In these the volutions are depressed somewhat obliquely above and regularly rounded beneath. The base appears to be widely and deeply umbilicated, and the inner volutions exposed up to the apex, as represented by fig. 5. Other specimens are casts of the interior, with the test preserved in the umbilical cavity and between the volutions. A section through the centre of one of these, transverse to the volutions, as shown in fig. 6, shows that the inner surface of the latter is encircled by a narrow and slightly recurved prominent spiral ridge, which projects to the centre, leaving open only a narrow spiral umbilical perforation. This spiral ridge was first observed by Mr. Lambe in a natural section of a specimen from Belwood. Besides these a few natural moulds of the exterior of the base of the shell, in a dolomitic limestone, have been collected. A gutta-percha impression of one of these moulds from Belwood (fig. 4) shows the characters of the lower half of the aperture, the heavy thickening of the inner or columellar lip, the contour of the exterior of the base, with its narrow umbilical perforation, and some indications of the growth lines around the umbilicus. The largest specimen of this species that the writer has seen (the original of fig. 4, on plate 13,) is fifty-one millimetres, or a little more than two inches in its maximum diameter.

Polytropis, DeKoninck.

In a paper on the development of the gastropoda from the Cambrian to the Trias,* Professor E. Koken remarks that, in his view, the genus *Oriostoma* of Munier Chalmas includes very different things. The typical species of *Oriostoma* (or *Horiostoma*, as the word is amended by Fischer) he thinks belong to the Capulidæ, while the forms from the Upper Silurian described by Lindström (excluding *O. helicinum*, *O. dispar* and *O. nitidissimum*) group themselves around the *Euomphalus rugosus* and *E. discors* of Sowerby, for which DeKoninck, in 1881, proposed the genus *Polytropis*. This latter genus is referred to the Turbinidæ by Lindström on account of the nacreous structure of its test and the peculiarities of its operculum. According to Koken, *Polytropis*, as understood by him, extends very far back in time, as it probably includes the "*Pleurotomaria* (?) *Calphurnia*" of Billings,† from the Quebec group of Newfoundland, which is, he says, nearly related to "*Oriostoma globosum*."

In the "Geology of Canada" (1863, p. 444) *Euomphalus rugosus*, which would now be called *Polytropis discors* var. *rugosus*, is recorded as occurring in the Silurian (Upper Silurian) rocks of Port Daniel, in the Baie des Chaleurs, and the *Pleurotomaria princessa* of Billings,‡ from the Lower Helderberg rocks between Cape Gaspé and Cape Rosier is also a *Polytropis*.

Some of the depressed conical, solid, shelly opercula, with numerous narrow coils, that were formerly referred to *Euomphalus* by English authors, are now known to belong to species of this genus. Such opercula are not uncommon in the Guelph formation at Elora and Durham, and two of these are represented on Plates 3 and 7 of the first part of this volume. Five species of *Polytropis* are now known to occur in this formation in Canada, viz., *P. sulcatus* (= *Cyclonema sulcatum*, Hall); *P. macrolineatus* (= *Euomphalus macrolineatus*, Whitfield); *P. crenulatus* (= *Straparollus crenulatus*, Whiteaves); and two which were previously undescribed.

Polytropis sulcatus, Hall. (Sp.)

Plate 13, figs. 9 and 9 a.

Cyclonema sulcata, Hall.....1852. Pal. N. York, vol. II., p. 347, pl. 34, figs. 1, *a-d*.
" " Billings.....1863. Geol. Canada, p. 343, figs. 350, *a-b*.
Cyclonema sulcatum, Whiteaves...1884. This volume, pt. I., p. 18, pl. 3, fig. 5.

*Separat-Abdr. Neuen Jahrb. fur Min. Geol. and Palæont, 1889, Beilageband VI.
†Geological Survey of Canada, Palæozoic Fossils, vol. I., p. 230, figs. 214, *a-b*.
‡ " " " vol. II., pt. 1, p. 59, fig. 29.

Galt, Professor James Hall, 1848 ; Hespeler, T. C. Weston, 1871 ; Durham, J. Townsend, 1878-82 ; Elora, J. Townsend, 1892 and 1893 ; and Belwood, J. Townsend and J. F. Whiteaves, 1893.

The original types of this species, as figured by Hall, are three in number, viz., (1) an imperfect cast of the interior of the shell, with part of the exfoliated test preserved on the lower half of the outer volution ; (2) "a small individual" about nine millimetres in height ; and (3) "an impression of" the "base of the shell in limestone." These give a very imperfect idea of the shape of the shell, and none whatever of the surface markings of the spire and upper portion of the outer volution. The woodcuts of *C. sulcata* in the "Geology of Canada" are mere reproductions of two of Hall's figures of that species, and the specimen from Durham referred to and illustrated in the first part of this volume, does not add much to our knowledge of its characters.

The specimens recently collected at Elora by Mr. Townsend are two in number. Both of these have nearly the whole of the test preserved, and one of them has also a small portion of its operculum still remaining, almost *in situ*, but turned inside out. So much of this operculum is broken off that it is impossible to say whether it was originally solid or hollow inside, but there is enough left to show that it is calcareous, multispiral and not much elevated exteriorly.

The specimens collected at Belwood by Mr. Townsend and the writer, are sharply defined natural moulds of the exterior of four different shells, and gutta-percha impressions of these moulds, such as the one figured in Plate 13, together with the two testiferous examples from Elora, give the following new information about the species. A specimen of average size is about thirty millimetres in height, and twenty-five in maximum breadth. The volutions are five or six in number, rounded and ventricose, but depressed and flattened above in such a way as to form a shoulder with a narrow band between it and the suture. In the centre of the base of the outer volution there is a narrow but rather deep umbilical depression, but no portion of any of the inner volutions is exposed. The upper portion of each of the last three volutions is marked by a few spiral raised lines, and their central and lower portions are encircled by narrow ridges. Upon the lower half of the last volution of the spire of the specimen figured there are four spiral ridges, and upon the central and basal portions of the outer volution of another specimen, there are as many as ten or eleven spiral ridges, the three around the umbilical depression being more prominent and distant than any of the others. The volutions, also, are everywhere crossed by crowded and oblique minute raised lines.

Polytropis macrolineatus, Whitfield. (Sp.)

Euomphalus macrolineatus, Whitfield....1878. Ann. Rep. Geol. Surv., Wiscons., for 1877, p. 82.
" " " ....1882. Geol. Wiscons., vol. IV., p. 294, pl. 18, figs. 5 and 6.
" " Whiteaves...1884. This volume, pt. 1, p. 20, pl. 3, fig. 6.

Elora, T. C. Weston, 1867 : a specimen with such an unusually high spire as to suggest the idea that the "*Holopea (?) occidentalis*" of Nicholson, which has been found only at Elora, may have been based upon a cast of the interior of a shell of this species. Durham, J. Townsend, 1882 : the original of the figure on Plate 3 of the first part of this volume. These two specimens were identified with *Euomphalus macrolineatus*, in 1884, on the authority of Professor Whitfield, to whom they were submitted for examination. That species was referred to *Polytropis* by Koken in 1889, in a foot-note to page 425 of the paper previously quoted.

Polytropis crenulatus, Whiteaves.

Straparollus crenulatus, Whiteaves..1884. This volume, pt. 1, p. 21, pl. 3, figs. 8, 8, *a-b*.

Durham, J. Townsend, 1878-82 : two specimens. These are remarkably similar to a shell that Hall figures on Plate 25, figs. 11 and 12, of the revised edition of the Twentieth Annual Report of the Regents of the State of New York, under the name "*Pleurotomaria (Trochonema) Hoyi*," but bear very little resemblance to the type of that species, as figured on Plate 15, figure 10, of both editions of that report. Moreover, the periphery of *P. Hoyi* is described as "somewhat flattened, with a depressed band truncating the upper angle," whereas that of the Durham specimens is regularly but rather narrowly rounded.

Polytropis Durhamensis. (N. Sp.)

Plate 14, figs. 1 and 2.

Shell of medium size for the genus, subdiscoidal and more than three times as broad as high, spire depressed and scarcely raised above the highest level of the outer volution : suture deeply channelled : last volution gently convex above and below, subangular and obtusely subcarinate at the periphery ; base rather widely but shallowly umbilicated in the centre, the umbilicus occupying more than one-third of the entire diameter and exposing nearly one-half of each of the inner volutions, though its sides slope gradually inwards and its margin is rounded and

very indefinite. Volutions three in number, or possibly four if the apex were preserved, and encircled by narrow spiral ridges, which are everywhere crossed by numerous and crowded transverse striæ. On the last volution there are five spiral ridges, one at the periphery, two on the apical and two on the basal side, but the two above the periphery are much more prominent and distinct than the two which surround the umbilicus. On the last volution of the spire there are two prominent spiral ridges.

Maximum breadth of the largest specimen collected, thirty-four millimetres: greatest height of the same, ten mm.

Edge Mills, near Durham, J. Townsend, 1879-1885: two specimens with the test preserved, and a remarkably well preserved natural mould in dolomite, of the exterior of the apical side of another specimen.

If the angulation and obtuse carination of the periphery of the only two specimens in which that part of the shell is preserved is not abnormal and due to vertical pressure, it would seem that this species is most nearly related to *Polytropis alatus*, the *Oriostoma alatum* of Lindström, figured on Plate 16, figs. 14-19 of his monograph of the Silurian Gasteropoda and Pteropoda of Gotland. The upper side of the specimen represented by fig. 1 on Plate 13 of the present paper is exactly similar to that of the specimen of *Oriostoma angulatum*, Wahlenberg (Sp.) figured by Lindström on Plate 20, fig. 37, of his monograph, but in Wahlenberg's species the shell is planorbiform, with rounded periphery and an extremely wide and open umbilicus. *Straparollus Niagarensis*, Meek,* which is probably also a *Polytropis*, is described as having a discoidal shell, with rounded volutions and an umbilicus in which "almost the entire diameter of the inner volution is exposed."

Polytropis parvulus. (N. Sp.)

Plate 13, figs. 10 and 10 a.

Shell small, depressed turbinate and a little broader than high: spire not much elevated, not so high as the last volution. Volutions three, or perhaps four when the apex is preserved, rounded and ventricose, but flattened and narrowly shouldered at the suture above: suture angular but apparently not channelled: base of the last volution rather narrowly but deeply umbilicated, though the inner volutions are apparently covered over.

Surface marked by narrow spiral ridges, which appear to be crossed by minute and crowded transverse raised lines. On the last volution there are seven spiral ridges visible (and there may be one or two more in the

*Report of the Geological Survey of Ohio, vol. II., pt. 2, 1875, p. 144, pl. 8, fig. 3.

umbilical cavity, which is almost filled with the matrix), but the ridge at the shoulder above is much more prominent and separated on each side by a wider interval than any of the others, and the four which surround the umbilicus are smaller than the three upper ones and placed very close together.

Dimensions of the only specimen known to the writer: maximum height, about ten millimetres; greatest breadth, thirteen mm.

Durham, J. Townsend, 1884: a single specimen with most of the test preserved.

This little shell resembles *Polytropis Wisbyensis* (the *Oriostoma Wisbyense* of Lindström*) from the Silurian rocks of Gotland, in so many particulars, that it may ultimately prove to be only a geographical variety of that species. As far as can be ascertained at present, the principal difference between these two forms seems to be that on the umbilical side of the Canadian shell there are at least five spiral ridges, which are closely disposed and not very prominent, whereas on that side of the shell in the Gotland species there are only two spiral ridges, which are large and distant.

Codonochilus striatus, Whiteaves.

Codonochilus striatum, Whiteaves..1884. This volume, pt. 1, p. 17, pl. 3, fig. 3.
Codonochilus striatus, Fischer.....1885. Man. de Conchyl., pp. 832-33.

Hespeler, T. C. Weston, 1867, two specimens; Durham, J. Townsend, 1878-85, abundant; Irvine Rocks, Elora, J. Townsend, 1885, three large specimens.

The systematic position of the genus *Codonochilus* is still uncertain, though, as pointed out by Fischer (op. cit.) it is obviously most nearly related to *Scoliostoma*, Braun. Zittel, in the second volume of his "Handbuch der Palæontologie," makes no mention of *Codonochilus*, but places *Scoliostoma* in the family Scalariadæ. Fischer, on the other hand, places *Codonochilus* in the Delphinulidæ, immediately after *Scoliostoma* and its sub-genus *Conchula*, Steininger.

Straparollina Daphne, Billings. (Sp.)

Straparollus Daphne, Billings..1862. Geol. Surv. Canada, Pal. Foss., vol. I., p. 160, fig. 145.

Galt, A. Murray, 1847, and R. Bell, 1861; Elora, D. Boyle, 1880; Durham, J. Townsend, 1878-82.

*Silurian Gasteropoda and Pteropoda of Gotland, Stockholm, 1884, p. 167, pl. 17, figs. 26-28 and 45-46.

Only casts of the interior of this shell have yet been obtained. Judging by these the species is provisionally referred to Billings's genus *Straparollina*, though it may prove to be a *Pycnomphalus*.

Straparollus Hippolyta, Billings.

Straparollus Hippolyta, Billings..1862. Geol. Surv. Canada, Pal. Foss., vol. I., p. 160, fig. 144, *a-b*.

Galt, E. Billings and John Richardson, 1857, and R. Bell, 1861 ; Elora, T. C. Weston, 1867. This species, also, is still only known from casts of the shell, upon which no trace of the surface markings is preserved.

Holopea, Hall.

The genus *Holopea* was referred to the Littorinidæ by Salter in 1859, and by Lindström in 1884, but to the Turbinidæ by Zittel in 1882. Fischer, in his "Manuel de Conchyliologie," remarks that it is composed of incongruous material, and that it has been circumscribed by Salter and Lindström so as to include some small shells apparently near to the Littorinidæ. Four species of gasteropoda from the Guelph formation of Ontario have been referred to *Holopea*, but two of these, viz., *H. Guelphensis* and *H. occidentalis*, are known only as casts of the interior of the shell, so that their generic position is still uncertain.

Holopea Harmonia, Billings.

Holopea Harmonia, Billings..1862. Geol. Surv. Canada, Pal. Foss., vol. I., p. 158, fig. 142.

Galt, John Richardson, 1857 : a single specimen with most of the test preserved on the last volution.

The salient feature in the type and only known specimen of *H. Harmonia*, as described by Billings, is the "wide flat band," which is stated to be "equal to a little more than one-third of the whole height of the whorl," around the middle of the last volution. This "band," however, is merely a very faint lateral compression of the centre of the last volution, but in every other respect the shape of the shell is essentially similar to that of the type of *H. Gracia*.

Holopea Guelphensis, Billings.

Holopea Guelphensis, Billings.....1862. Geol. Surv. Canada, Pal. Foss., vol. I., p. 159, fig. 143.
" " " .....1863. Geol. Canada, p. 343, fig. 351.
" Nicholson....1875. Rep. Pal. Prov. Ont., p. 72, pl. 3, fig. 18.

Galt, A. Murray, 1847; Elora, D. Boyle, 1874; and Durham, J. Townsend, 1878-82: a few casts of the interior of the shell.

This species is very imperfectly characterized, and may be referable to *Polytropis* rather than to *Holopea*.

Holopea Gracia, Billings.

Plate 14, fig. 3.

Holopea Gracia, Billings.....1862. Geol. Surv. Canada, Pal. Foss., vol. I., p. 159.
" " Whiteaves .....1884. This volume, pt. 1, pl. 3, fig. 4.

Galt, E. Billings, 1857: a single cast of the interior of the shell. The base of this specimen was originally covered with the matrix, and in the original description of the species it is stated that the umbilicus and surface markings are unknown. This matrix has since been removed and the base of the cast found to be compressed convex exteriorly, and depressed in the centre, with a very narrow umbilicus partially filled by the inner lip below. Remains of the surface markings show that they consist of lines of growth that curve obliquely and somewhat convexly backward above, and concavely backward below. As stated on page 18 of the first part of the present volume, two specimens, which are probably very large individuals of this species, were collected by Mr. Townsend at Durham, between the years 1874 and 1882.

Holopea (?) occidentalis, Nicholson.

Holopea (?) occidentalis, Nicholson..1875. Rep. Pal. Prov. Ont., p. 85, fig. 00.

Elora, Nicholson. This species is not represented in the Museum of the Survey, and the writer has never seen a specimen of it. As stated on page 91, and, judging by the figure, it may have been based upon a cast of the interior of the shell of a large and high-spired variety of *Polytropis macrolineatis*.

Subulites ventricosus, Hall.

Subulites ventricosa, Hall.....1852. Pal. N. York, vol. II., p. 347, pl. 83, figs. 7, *a-b*.
" " Billings.....1863. Geol. Canada, p. 339, fig. 346.
" " Nicholson...1875. Rep. Pal. Prov. Ont., p. 71, pl. 3, fig. 5.

Galt, A. Murray, 1847, and E. Billings, 1857 ; Elora and Durham, J. Townsend, 1878-82 ; Hespeler, Nicholson.

Subulites compactus, Whiteaves.

Subulites compactus, Whiteaves..1884. This volume, pt. 1, p. 16, pls. 3, fig. 2, and 7, fig. 6.

This species was originally described from a single specimen collected at Durham, and there are now three other typical examples of it in the Museum of the Survey, one from Hespeler, one from Elora and one from Durham. Its principal characteristics are the slender, subfusiform contour of the shell, and the nearly cylindrical shape of the somewhat constricted outer volution, which is usually a little narrower than the one that immediately precedes it. The later volutions of the spire, too, are generally much broader than high.

Subulites compactus? Var.

Plate 14, figs. 4 and 5.

Six specimens of a small *Subulites*, collected by Mr. Townsend at Durham and now in the Survey Museum, differ from the type of *S. compactus* in the following particulars. They are still more slender in shape, not most tumid at the mid-length, and the outer volution of each is scarcely contracted but gently convex, a little more so than the one which precedes it. The last volution of the spire and sometimes the last but one, are usually higher than broad. It is doubtful whether these specimens (two of which are figured) should be regarded as a mere variety of *S. compactus*, or as a distinct species.

Opercula

of unknown genera and species.

A. Paucispiral opercula.

Plate 14, fig. 6.

A few paucispiral opercula, like those of recent species of *Natica* or *Littorina*, were collected by Mr. Townsend at Durham in 1884 and 1885.

These are described in some detail in a paper published in the Canadian Record of Science for December, 1891, and entitled "Notes on the occurrence of Paucispiral Opercula of Gasteropoda in the Guelph formation of Ontario." As there stated, they are "rather thin, nearly flat, but slightly concave externally and as slightly convex internally, broadly subovate, about one-fifth longer than broad, obtusely pointed at the end corresponding to the posterior angle of the mouth of the shell whose aperture they closed, *paucispiral* and composed of from two and a half to three rapidly expanding volutions, the nucleus being eccentric."* "Only the outer or concave surface of each of those opercula is exposed to view, the inner side being buried in the matrix." Figure 6 on Plate 14 represents the exterior of the largest and most perfect specimen known to the writer, of natural size. Its maximum length is twenty millimetres, and its greatest breadth sixteen. It is so highly dolomitized that it is difficult to estimate its exact thickness, but at the distance of a millimetre from the edge, at the somewhat truncated termination of the outer volution, its thickness is between one-half and three-quarters of a millimetre, though it seems to increase rapidly inward.

These opercula would seem to have belonged to shells that are referable either to the Naticidæ or to the Littorinidæ. At present there is no satisfactory evidence that the Naticidæ dated as far back in time as the Palæozoic era, but the Littorinidæ are said to be represented in the Silurian period by numerous species of *Holopea*. It has previously been shown that four nominal species of *Holopea* have been described from the Guelph formation in Canada, but the generic relations of *H. Guelphensis* are still very obscure, and it is most probable that *H. occidentalis* is a *Polytropis*

B. Supposed multispiral opercula.

Plate 15, figs. 4, 5, 5 a and 6.

Several specimens of an organism, which may be the operculum of some gasteropod, were collected at Elora and Durham by Messrs. Boyle and Townsend between the years 1878 and 1892. The most perfect of these organisms, such as the specimen represented by figure 4 on Plate 15, are elongate conical, nearly three times as long as broad and truncated at the larger end. Their internal structure, as shown in natural or artificial longitudinal sections, like that represented three times the natural size and somewhat diagrammatically by figure 6 on the same Plate, is very singular. It consists of an extremely elongated, slender, multispiral calcareous and solid central axis (*a*), which is everywhere surrounded by a second and correspondingly slender, solid and tightly enveloping calca-

*Rather than "subcentral," as stated in the paper referred to.

reous coil composed of from twenty to thirty sinistral volutions, in close contact (*b*), and this in its turn is enveloped in a thin calcareous outer layer or sheath (*c*). The volutions of the outer of these two shelly coils are flattened from back to front and narrow at the edges, so that in specimens such as the originals of figs. 5 and 5 *a*, in which the thin outer coating is not preserved, as is usually the case, it is only the outer edges of the volutions that are visible. At the larger end, the outer layer or sheath, when preserved, seems to project very slightly beyond the outer shelly coil and to form a raised rim around it, but in those specimens in which the outer layer is not preserved, the last volution of the outer coil appears to extend a little beyond the central axis, and to be ultimately truncated rectangularly, thus giving the appearance of a comparatively broad depression in the centre of the larger end, as represented by figure 5 *a*.

CEPHALOPODA.

Orthoceras Selwyni, Billings.

Orthoceras Selwini, Billings. 1862. Geol. Surv. Canada, Pal. Foss., vol. I., p. 161.

Galt, Dr. R. Bell, 1861 ; a very imperfect cast of part of the interior of the septate portion of the shell. The siphuncle is placed at a short distance from the margin and apparently moniliform, like that of *O. angulatum*, Wahlenberg, as figured by Foord, (figs. 7, *a-f*) on page 71 of the first part of his Catalogue of the Fossil Cephalopoda in the British Museum, but the surface markings are unknown. The only other specimen of this imperfectly characterized species that the writer has seen is an equally badly preserved cast of the interior of part of the septate portion of the shell, collected at Elora by Mr. Townsend and kindly presented to the Museum of the Survey by Mr. B. E. Walker, of Toronto.

Orthoceras crebescens, Hall.

Orthoceras crebescens, Hall		1867.	Twentieth Rep. Reg. N. Y. St. Cab. Nat. Hist., p. 354, pl. 19, figs. 1, 2 and 3.
"	"	Hall & Whitfield	1875. Rep. Geol. Surv. Ohio, vol. II., pt. 2, p. 148, pl. 9, fig. 2.
"	"	Whiteaves	1884. This volume, pt. 1, p. 37.

Hespeler, T. C. Weston, 1871, and Elora, Mr. James Gladstone, 1876 : the two specimens referred to on page 37 of the first part of this volume. Both of these are coarse and imperfect casts of the interior of the shell, upon which no traces of the surface markings are preserved.

Orthoceras medullare, Hall.

Orthoceras medullare, Hall.....1860. Rep. Progr. Geol. Surv. Wiscons. for 1859, p. 4.
" " " .....1867. Twenthieth Rep. Reg. N. Y. St. Cab. Nat. Hist., p. 353, pl. 20 (11), figs. 1 and 2.
" " Whiteaves.1884. This volume pt. 1, p. 37.

Elora, David Boyle, 1876: the specimen referred to on page 37 of the first part of this volume.

Orthoceras Scammoni, McChesney.

Orthoceras columnare, Hall.....1860. Rep. Progr. Geol. Surv. Wiscons. for 1859, p. 4. But apparently not *O. columnare*, Marklin, 1857.
" *Scammoni*, McChesney..1861. New Palæoz. Foss., p. 92. (Teste Hall.)
" *Hoyii*, " .. " " " " "
" *lineolatum*, " .. " " " " "
" *irregulare*, " .. " " " " "
" *angulatum*, Hall .....1867. Twentieth Rep. Reg. N. Y. St. Cab. Nat. Hist., p. 353, pl. 19 (10), figs. 10 and 11. But possibly not *O. angulatum*, Wahlenberg, 1827.
" *columnare*, Hall.....1870. Rev. ed. Twentieth Rep. Reg. N. Y. St. Cab. Nat. Hist., p. 411, pl. 19, figs. 4, 6 and 8.
" *angulatum*, Hall.....1870. Ibid., p. 413, pl. 19, figs. 10 and 11, and pl. 24, fig. 1.
" *orus*, Hall.....1877. In first ed. of S. A. Miller's Am. Pal. Foss., p. 245.
Probably also *Orthoceras Cadmus*, Billings, 1866, Cat. Silur. Foss. Anticosti, p. 83; acc. to Hall.

The specimen of *O. Cadmus* from Elora referred to on page 38 of the first part of the present volume, is a fragment of a longitudinally ribbed and fluted *Orthoceras*, not quite an inch and a half in its maximum length. Although identified with *O. Cadmus* by E. Billings himself, it is difficult to see how this fragment can be satisfactorily distinguished from the *O. Darwini*, Billings, of the Guelph formation, as that species is now understood, or from the *O. bellatulum*, Billings, from the Anticosti group of Anticosti.

A much more perfect specimen, which agrees perfectly with Hall's figures of *O. angulatum*, on Plate 19 of both editions of the Twentieth Regent's Report, was collected by Mr. Thomas G. Connon at the Irvine River, Elora, in 1887. This specimen, which has recently been presented to the Museum of the Survey by Mr. Connon, consists of a piece of the septate portion of the shell about five inches in length, and a

portion of the body chamber about an inch and a half long, but there is a piece missing between them, which, from the rate of tapering, is estimated at nearly two inches in length. Allowing two inches for the missing piece, the specimen, which even then is imperfect at both ends, could scarcely have been much less than eight inches and a half long. It has a considerable portion of the test preserved, especially at the smaller end, and the position of the siphuncle is clearly seen in two nearly transverse fractures. The surface markings consist of narrow and continuous longitudinal ridges, separated by rather wide intervals, and by numerous transverse raised lines between the ridges. The siphuncle is very nearly central.

In the Twentieth Regent's Report, Hall says that his *O. angulatum* "is probably the species described by Mr. McChesney, in a paper published in 1861, under the names *O. Scammoni*, *O. Hoyii*, *O. lineolatum*, *O. irregulare*, *O. Woodworthi*. The last one figured is a fragment less than an inch in length. A gutta-percha cast sent by Prof. Winchell under the name *O. Scammoni*, corresponds very well with specimens referred by me to *O. angulatum*. Should the species prove distinct from the European one, we may select a name from among those above cited." In a foot note to page 412 of the revised edition of that Report, he says also, in effect, that *O. angulatum*, Hall, *O. columnare*, Hall, *O. Scammoni*, McChesney, and *O. Cadmus*, Billings, are all probably the same species, and in the explanation of one of the figures of *O. angulatum*, in the same Report, it is stated that the character of its surface "is precisely like that of *O. cancellatum*, Hall, from the Niagara group of New York, and differs in no essential particular from the minute surface markings of *O. columnare*."

At different times no less than ten names have been given to this species, but, of these, *O. Scammoni*, McChesney, is here provisionally retained on the ground that it appears to be the first that is not pre-occupied. Mr. Foord's figures of English and Swedish specimens of *O. angulatum*, Wahlenberg, on page 71 of the first part of his catalogue of the Fossil Cephalopoda of the British Museum, represent shells that are distinctly curved, with sub marginal siphuncles, but his description of *O. canaliculatum*, Sowerby, applies remarkably well to the large Elora specimen here referred to *O. Scammoni*.

Orthoceras Darwini, Billings.

Orthoceras Darwini, Billings.....1862. Geol. Surv. Canada, Pal. Foss., vol. I., p. 161.

Cyrtoceras Myrice, Hall and Whitfield...1875. Geol. Surv. Ohio, vol. II., pt. 2, p. 149, pl. 8, fig. 9.

Orthoceras Darwini, Whiteaves.....1884. This volume, pt. 1, p. 38, pl. 6, figs. 2 and 2 *a*.
Cyrtoceras Myrice, Whiteaves.....1884. Ibid., p. 39, pl. 6, figs. 3 and 3 *a*.
Orthoceras Darwini, Foord.....1888. Cat. Foss. Cephal. Brit. Mus., pt. 1, p. 76, fig. 8.

The type of this species is the abnormally compressed and badly preserved cast of the interior of a shell collected by E. Billings in 1857 at Hespeler (then called New Hope), referred to on page 38 of the first part of the present volume and figured on Plate 6. Two additional specimens, both undistorted and well preserved casts of the interior of the shell, were collected by Mr. Townsend at Durham between the years 1878 and 1882, and one of these is figured on Plate 6 of the first part of the present volume under the name *Cyrtoceras Myrice*. This latter specimen is remarkably similar to Professor Blake's figure (Plate 7, fig. 1) of *O. angulatum* in the first part of his "British Fossil Cephalopoda," which Mr. Foord says represents *O. virgatum*, Sowerby. It seems to the writer that there is very little difference between *O. Darwini*, Billings, *O. bellatulum*, Billings, and *O. virgatum*. Sowerby. In the Museum of the Survey there is a small well preserved fragment of an *Orthoceras*, collected by Dr. R. Bell in 1862 from the Silurian (Upper Silurian) rocks at L'Anse à la Vieille, in the Baie des Chaleurs, which was identified with *O. virgatum*, Sowerby, by E. Billings. The surface ornamentation of this specimen consists of very narrow longitudinal ridges, with extremely fine, numerous and equidistant, transverse raised lines in the rather wide spaces between them, thus producing a cancellated appearance when the specimen is placed in a favourable light.

Orthoceras annulatum, var. Americanum.

Orthoceras annulatum (?), Hall.....1852. Pal. N. York, vol. II., p. 96, pl. 29, fig. 3.
Orthoceras annulatum, Hall.....1852. Ibid., p. 293, pl. 64 and pl. 65, fig. 3.
Orthoceras nodocostatum, McChesney.....1861. New Palæoz. Foss., p. 94, pl. 9, fig. 5.
Orthoceras undulatum, Billings.....1863. Geol. Canada, p. 325.
Orthoceras nodocostatum, McChesney.....1866. Trans. Chicago Ac. Nat. Sc., vol. I., p. 53, pl. 9, fig. 5.
Orthoceras annulatum, Hall.....1867. Twentieth Reg. Rep. N. York St. Cab. Nat. Hist., p. 351, pl. 20, figs. 4-6.
" " " .....1870. Ib., Rev. ed., p. 411, pl. 24, figs. 2-4.
" " Hall and Whitfield.....1875. Geol. Surv. Ohio, vol. II., pt. 2, p. 147, pl. 9, fig. 1.

Orthoceras annulatum, Whitfield.....1882. Geol. Surv. Wiscons., vol. IV., pt. 3, p. 298, pl. 19, fig. 1.
" " Whiteaves.....1884. This volume, pt. 1, p. 38.
Orthoceras annulatum, var. *Americanum*, Foord..1888. Cat. Foss. Cephal. Brit. Mus., pp. 56 and 57.

Hespeler and Elora: the two specimens referred to on page 38 of the first part of this volume.

Mr. Foord (op. cit., p. 57) thinks "that there exist sufficiently well-marked characters in the American form of *O. annulatum* to make it desirable to separate it from the European one," and he accordingly proposes a local designation for the former. "The characters," he says, "by which the variety *Americanum* is distinguished from its European allies reside in the surface ornaments. These consist of transverse elevations, partaking more of the nature of undulations than of ribs, and becoming in some places indistinct or even obliterated. The undulations are generally wider than the spaces separating them, being at a distance of about one-sixth the diameter. The fimbriæ are coarse, as in the variety *crassum*, but with their arches or festoons much wider apart. Three or four only occupy the spaces between the undulations. The longitudinal elevations are sometimes so strong as to cause a nodose appearance; but this is not always the case, as I have a specimen before me in which they are very obscure. The rate of tapering in a somewhat flattened example from Canada, measured along its broader diameter, is 1 in 17."

Gomphoceras septore, Hall.

Gomphoceras septoris, Hall.....1867. Twentieth Rep. Reg. N. Y. St. Cab. Nat. Hist., p. 350, figs. 9 and 10.
Cyrtoceras septoris, Hall and Whitfield..1875. Rep. Geol. Surv. Ohio, vol. II., pt. 2, p. 151.
" " Whiteaves.....1884. This volume, pt. 1, p. 39.

Elora, R. Bell, 1861: the cast of the body chamber referred to on page 39 of the first part of this volume. The six lateral sinuses and azygos dorsal sinus in the aperture of this specimen clearly show that it belongs to that section of the genus *Gomphoceras* which Hyatt has separated under the name *Septameroceras*.* This latter genus is said to be founded upon a species in the Museum of the Geological Survey of Canada, the *Gomphoceras inflatum* of Billings, but *G. inflatum* is a mere manuscript name, which has never been published, attached by Billings to a rough cast of the interior of the body chamber of a shell, with the aperture badly preserved, from the Silurian (Upper Silurian) rocks at L'Anse à la Barbe,

*Genera of Fossil Cephalopods. Proc. Boston Soc. Nat. Hist., April, 1883. vol. XXII., p. 278.

near Port Daniel, in the Baie des Chaleurs. Moreover, it is difficult to see how the specimen thus labelled is to be distinguished from *G. subgracile*, of the same rocks, or from *G. septore*.

Ascoceras Townsendii, Whiteaves.

Ascoceras Townsendi, Whiteaves..1884. This volume, pt. 1, p. 41, pl. 6, figs. 4 and 4 *a*.

The specimen collected by Mr. Townsend at Durham in 1883, and described on page 41 of the first part of this volume, is still the only example of this species that the writer has seen.

Cyrtoceras arcticameratum, Hall.

Cyrtoceras arcticameratum, Hall.....1852. Pal. N. York, vol. II., p. 349, pl. 84, figs. 7, *a-d*.
" " Billings.....1863. Geol. Canada, p. 340.

Galt, A. Murray, 1847, and E. Billings, 1857; Hespeler, E. Billings, 1867. These localities are given on the authority of E. Billings, in the "Geology of Canada," and the names of the collectors and dates at which the specimens were collected, on that of old sheets of printed labels prepared for use in the Museum of the Survey, but the writer has never seen a specimen of this species.

Cyrtoceras Orodes, Billings.

Plate 14, figs. 7, 8 a-b, and 9.

Cyrtoceras Orodes, Billings..1862. Geol. Surv. Canada, Pal. Foss., vol. I., p. 162.

Hespeler (New Hope), E. Billings, 1857: an imperfect cast of the interior of the shell. This specimen, which is the type of the species, but which has not previously been figured, is represented on Plate 14. In the original description of *C. Orodes* no mention is made of the siphuncle, but it is evidently exogastric and situated close to the margin of the venter.

Two specimens, which agree with the type of this species in general form, also, very nearly, as far as known, in the relative position of the siphuncle, were collected by Mr. Townsend at Durham between the years 1878 and 1882. One of these, the original of fig. 8, on Plate 14, is a well preserved but slightly distorted specimen of the septate portion of the shell, about three inches in maximum length, and with the test preserved. The surface is nearly smooth, and marked only with very fine and closely disposed transverse striæ and a few more distant and a little

coarser ones. This specimen was carefully ground down on the ventral side in such a way as to give a longitudinal section through the centre of the siphuncle and to show the edges of 22 septa, as represented in fig. 8*a*. These septa are about one millimetre apart at the smaller end, and four millimetres at the larger. Between the septa the siphuncle is not enlarged. The other specimen from Durham (fig. 9), which is a little over two inches and a half in its maximum length, consists of the greater part of the body chamber and the posterior half of the septate portion of the shell, both almost completely covered with the test. The venter and dorsum are very slightly compressed, and each of the beautifully preserved transverse striæ upon the test forms a very faint hyponomic sinus on the median line of the venter.

In 1890 Mr. Townsend obtained at Elora a large but not very well preserved specimen, nearly four inches and a-half in length, which is also belived to be referable to *C. Orodes*. It is somewhat compressed on the venter and dorsum, and its siphuncle is apparently exogastric and almost marginal. It is very similar, in general outline, to large specimens of *Oncoceras Pettiti*, Billings,* from the Niagara limestone at the North Gore, Grimsby, Ontario, but the siphuncle of the latter is inflated between the septa.

Phragmoceras Hector, Billings.

Phragmoceras Hector, Billings . . 1862. Geol. Surv. Canada, Pal. Foss., vol. I., pt. 1, p. 163, fig. 147.

Hespeler and Galt, E. Billings, 1857 : one cast of the interior of the shell from each of these localities. The specimen figured by Billings is labelled Galt, not New Hope (or Hespeler as it is now called) as stated in the first volume of the "Palæozoic Fossils." and both specimens show the shape of the aperture.

Hyatt, in his "Genera of Fossil Cephalopods,"† maintains that *Phragmoceras* is a mere synonym of *Gomphoceras*, and divides the latter genus into six genera, based exclusively upon the characters of the aperture. Zittel, on the other hand, in the second volume of his "Handbuch der Palæontologie," places *Gomphoceras* in the family Orthoceratidæ and *Phragmoceras* in the Cyrtoceratidæ. Fischer, in his Manuel de Conchyliologie (1883) regards the two genera as distinct and places both in the Nautilidæ. The characters which have so long been used to distinguish *Phragmoceras* from *Gomphoceras* appear to the writer to be still valid and of more structural and systematic importance than the modifications of the aperture upon which Hyatt's six genera are based.

*Catalogue of the Silurian Fossils of the Island of Anticosti, p. 86.

†Proceedings of the Boston Soc. Nat. Hist., April 4, 1883, vol. XXII, p. 277.

PHRAGMCCERAS NESTOR, var. CANADENSE.

Phragmoceras Nestor, var. *Canadense*, Whiteaves..1884. This volume, pt. 1, p. 39, pl. 7, figs. 1, 1*a-b*.

Hespeler, Elora and Durham: the three casts of the interior of the shell described and illustrated in the first part of this volume.

PHRAGMOCERAS PARVUM, Hall and Whitfield.

Phragmoceras parvum, Hall & Whitfield..1875. Rep. Geo. Surv. Ohio, vol. II., pt. 2, p. 151, pl. 8, fig. 10.
" " Whiteaves.....1884. This volume, pt. 1, pt. 41, pl. 7, fig. 2.

Durham (not Hespeler, as inadvertently stated on page 41 of the first part of this volume) J. Townsend, 1881: two imperfect casts of the chamber of habitation.

TROCHOCERAS DESPLAINENSE, McChesney.

Trochoceras Desplainensis, McChesney..1859. Descr. New. Sp. Foss Pal. rocks, &c., p. 68, pl. 8, fig. 1.
Trochoceras Desplainense, Hall.....1867. Twentieth Rep. Reg. N. Y. St. Cab. Nat. Hist., p. 359, pl. 16, figs. 8-10.
" " Whiteaves....1884. This volume, pt. 1, p. 36, pl. 5, fig. 5.

Hespeler, T. C. Weston, 1867: the two specimens referred to on page 36 of the first part of this volume. One of these shows that the position of the siphuncle is central, as represented by Hall in one of his figures of *T. Desplainense*. Elora, J. Townsend, 1885, a well preserved cast of the interior of the septate portion of the shell, a little more than an inch in its maximum diameter. In this specimen the sutures of the septa curve concavely forward and are everywhere crossed by the rather distant transverse ribs, which are directed obliquely backward, as in *T. Æneas*, Hall, which, however, is flattened on the sides. Professor Hyatt, who has seen these three specimens, thinks that they should be referred to his recently constituted genus *Peismoceras*.*

DISCOCERAS GRAFTONENSE, Meek and Worthen. (Sp.)

Lituites Graftonensis, Meek & Worthen..1870. Proc. Ac. Nat. Sc. Philad., vol. XXII., p. 51.
" " " " ..Geol. Surv. Ill., vol. VI., p. 507, pl. 25, fig. 1.
" *multicostatus*, Whitfield.....1882. Geol. Wiscons., vol. IV., p. 303, pl. 20, fig. 7.

*Phylogeny of an Acquired Characteristic, p. 500.

Trochalites multicostatus, Whiteaves.....1884. This volume, pt. 1, p. 36, pl. 6, figs. 1 & 1*a*.

Discoceras Graftonense, Hyatt.....1894. Phylog. of an Acquir. Character., p. 501, pl. 8, figs. 21-23.

Elora, Dr. R. Bell, 1861; Hespeler, T. C. Weston, 1867 and 1871; Durham, J. Townsend, 1878-82: a few specimens from each of these localities. An additional and unusually fine specimen collected by Mr. Townsend at Edge Mills, Durham, in 1885, is nearly two inches and a half in its maximum diameter. It shows that the chamber of habitation occupies fully one-half of the outer volution, that the sutures of the septa are crossed by the ribs in much the same manner as those of the preceding species, and that the spaces between the ribs are filled with crowded lines of growth which are parallel to the ribs.

CRUSTACEA.

OSTRACODA.

LEPERDITIA BALTHICA, var. GUELPHICA.

Leperditia Balthica (Hisinger) var. *Guelphica*, Jones..1891. Contr. Canad. Micro-Pal., pt. 3, p. 80, pl. 13, figs. 12, *a-b*, and 13, *a-c*.

Durham, J. Townsend, 1884; three single valves: Grand River at Aboyne, near Elora, J. Townsend, 1892; a right valve sixteen millimetres long.

LEPERDITIA PHASEOLUS, var. GUELPHICA.

Leperditia phaseolus (Hisinger), var. *Guelphica*, Jones..1891. Contr. Canad. Micro-Pal., pt. 3, p. 86, fig. 5.

Durham, J. Townsend, 1884; one right valve: Grand River at Aboyne, J. Townsend, 1892; a large left valve. All the specimens of this and of the preceding species have been kindly determined by Professor T. Rupert Jones, F.R.S.

TRILOBITA.

CALYMENE BLUMENBACHII, Brongniart.

Calymene Blumenbachii, Brongniart.....1822. Hist. Nat. Crust. Foss., p. 11, pl. 1, figs. 1*a-d*, and of subsequent British and European authors.

Calymene Niagarensis, Hall.....1843. Geol. Rep. 4th Distr. N York, p. 102, and fig. 3 on p. 101.
Calymene Blumenbachii var. *Niagarensis*, Hall..1852. Pal. N. York, vol. II., p. 307, pl. 67, figs. 11 and 12.
Calymene Blumenbachii, Billings.....1863. Geol. Canada, p. 340.
Calymene Niagarensis, Hall.....1867. Twentieth Rep. Reg. N. York St. Cab. Nat. Hist., p. 334.

On one of the tablets in the Museum of the Survey there are three imperfect and badly preserved specimens of a trilobite collected at Galt, two by A. Murray in 1847, and one by E. Billings in 1857, which were labelled with the name of this species by E. Billings, many years ago. These are evidently the specimens of *C. Blumenbachii* referred to on page 340 of the Geology of Canada. Two of them are coarse casts of the interior of the head and thorax, and one a similar cast of the thorax and pygidium.

Mr. Billings was of the opinion that *C. senaria*, Conrad, *C. Niagarensis*, Hall, and *C. platys*, Green, are synonymous with *C. Blumenbachii*, but Salter, in his Monograph of the British Trilobites, retains *C. senaria* as a distinct subspecies, although he places *C. Niagarensis*, Hall, among the synonyms of *C. Blumenbachii*. Exclusive of the trilobites from the Trenton and Hudson River formations which are generally referred to *C. senaria*, there are in the Museum of the Survey, specimens labelled *C. Blumenbachii* by E. Billings, from the Niagara limestone ~~at Limehouse~~, Ontario; from ~~the Anticosti group~~ at six different localities on the island of ~~Anticosti; from~~ the Lower Helderberg rocks at ~~Cap Bon Ami, near Dalhousie, New~~ Brunswick; and from the Silurian (Upper Silurian) rocks at ~~Arisaig, Nova Scotia~~. In the "Geology of Canada" (1863), *C. Blumenbachii* is recorded as occurring also in the Clinton formation at ~~Flamborough West, near~~ Dundas, Ontario; in the Niagara limestone at Thorold and Flamborough West; and in the limestones of the Anticosti Group at the Chatte River in the province of Quebec.

According to Lindström * this species was first described by Brunn in 1781 under the name *Trilobites tuberculatus*, and hence should be called *Calymmene tuberculata* (Brunn), as it is by Friedrich Schmidt † and some other recent writers upon European palæontology.

Ceraurus Niagarensis. Hall.

Ceraurus insignis (Beyrich) Hall..1852. Pal. N. York, vol. II., pp. 300 and 306, pls. 66. fig. 4, and 67, figs. 9 and 10.

*Ofversigt K. Vetenskaps-Ak. Forhandlingar, 1885, p. 63, pl. 16, fig. 9.

†Revision der Ostbaltischen Silurischen Trilobiten, in Mem. l'Ac. Imp. des Sc. de St. Petersbourg, Ser. VII., vol. 42, p. 13, pl. 1, figs. 1-7.

'*Cheirurus insigens* (Beyrich)" Billings..1866. Cat. Silur. Foss. Anticosti, p. 60.
Ceraurus Niagarensis, Hall.....1867. Twentieth Rep. Reg. N. Y. St. Cab. Nat. Hist., p. 376, pl. 21, fig. 10.
" Whiteaves.....1884. This volume, pt. 1, p. 42.
Probably a variety of *Cheirurus insignis*, Beyrich, which, according to Salter, Mon. British Trilobites, p. 63, is a synonym for *C. bimucronatus*, Murchison, sp.

Hespeler, T. C. Weston, 1867: the two specimens of the glabella referred to on page 42 of the first part of this volume. These and a small cephalon from the Anticosti group at the south west point of that island, a large pygidium and imperfect glabella from the Niagara formation at Grimsby, and six small specimens from rocks of about the same age at Port Daniel in the Baie des Chaleurs, were identified many years ago by Mr. E. Billings with *Cheirurus insignis*, Beyrich. A nearly perfect and well preserved cast of the hypostoma of *C. Niagarensis* was recently collected by Mr. Townsend at Elora and is now in the Museum of the Survey.

Illænus Aboynensis. (N. Sp.)

Plate 15, figs. 7 and 8.

Cephalon broadly rounded in front, truncated behind, broader than long, and broadest posteriorly, moderately convex, most prominent a little in advance of its mid-length and somewhat flattened behind. Eyes of medium size, moderately prominent, each situated at a distance of about eight millimetres from the lateral and from the posterior margin; dorsal furrows indistinctly defined both posteriorly and centrally, but each furrow curves concavely forward and outward and terminates in a rather large shallow depression or pit at a short distance from the anterior margin. Facial suture not clearly seen in the only specimen collected: surface markings and characters of the genal angles unknown.

Pygidium not at all three lobed, regularly convex, but flatter and much more narrowly rounded than the cephalon.

The few specimens collected are too imperfect to admit of very exact measurements, but the cephalon and pygidium figured are both of the natural size.

Aboyne, near Elora, J. Townsend, 1892: An imperfect cast of the cephalon and casts of two detached pygidia.

Although based upon rather imperfect material, this trilobite seems to be quite distinct from any of the known species of *Illænus*. Its most salient character would appear to be the large depression at the anterior end of each of the dorsal furrows upon the cephalon.

PROETUS. (Species undeterminable.)

Durham, J. Townsend, 1882 : a single well preserved cast of a pygidium, which the writer has not been able to identify with any known species. This pygidium is nearly semicircular in outline, with a narrow, flat, smooth margin. Its axis is prominent, conical and marked with ten annulations, while the pleural ribs on each side are about nine in number.

EURYPTERIDA.

EURYPTERUS BOYLEI, Whiteaves.

Eurypterus Boylei, Whiteaves. 1884. This volume, pt. 1, p. 42, pl. 7, fig. 3.

Elora, David Boyle, 1881 : the specimen described and figured in the first part of this volume.

PALÆOZOIC FOSSILS.

VOL. III.

3. Systematic list, with references, of the fossils of the Hudson River or Cincinnati formation at Stony Mountain, Manitoba.

By J. F. Whiteaves.

In a letter written by Sir James Hector, dated Fort Carlton, December 14th, 1857, and published in the official report of Captain Palliser's Exploring Expedition,* the following passage occurs :—"At Stony Hill, about fifteen miles north-west from the Upper Fort, there is an isolated bluff of limestone, rising from the plain level to the height of eighty feet. The south and western exposures are abrupt and water worn, it having been at one time an island; and indeed, during the great floods which several times inundated the settlement, it has been one of the few spots upon which the inhabitants can take refuge, reaching it by means of boats. The beds of limestone are horizontal or nearly so, and are slightly different from those at Fort Garry in their mineral aspect, having a more crystalline fracture and the colour being of a reddish hue. No fossils can be discovered in newly fractured portions, but on the weathered surfaces a few obscure remains of fossils are to be seen projecting along with siliceous and gritty particles from a dull floury surface."

On the occasion of a short visit to this locality (now more generally known as Stony Mountain) in 1875, Dr. R. W. Ells noticed that pieces of limestone and shale thrown out while excavating for the foundation of the provincial penitentiary then in course of construction there, were full of fossils in a remarkably fine state of preservation, and made as large a collection of them as the time at his disposal would admit. Lists of most of the species represented in this collection and in one made at the same place by Dr. R. Bell in 1879, were contributed by the writer to the Report of Progress of this Survey for 1878-79 (pp. 49 and 50C), published in 1880, and it was there stated that "a large portion of the mass of Stony Mountain consists of limestones, with clayey partings, which are identical, both in their lithological and palæontological characters, with the well known

* Papers relative to the Explorations by Captain Palliser of that portion of British North America which lies between the north branch of the River Saskatchewan and the frontier of the United States, and between the Red River and the Rocky Mountains. London, 1859, page 21.

rocks of the Hudson River or Cincinnati group of southern Ohio and elsewhere." At the summit of the mountain these limestones pass into rich cream coloured, yellow or greyish white dolomites, but, as the writer had then seen no fossils from the latter, no opinion was expressed as to their age. A collection of the fossils of this locality, made by Mr. T. C. Weston in 1884, consists of about twelve species from these dolomites, which it will be convenient to distinguish as the upper beds, and of an unusually large number of those of the immediately underlying impure limestones or lower beds. This collection and a small series of fossils from the upper beds, obtained by Mr. Tyrrell in 1888, show that the fauna of the upper beds, and hence that of the whole of the rocks at Stony Mountain, are probably referable to the Hudson River or Cincinnati formation, which has not yet been definitely recognized at any other locality in Manitoba.

The Polyzoa and Ostracoda contained in Dr. Ells's and Mr. Weston's collections have been identified or described by Mr. E. O. Ulrich in the second part of the "Contributions to the Micro-Palæontology of the Cambro-Silurian rocks of Canada," published by this Survey in 1889, but no complete list of the fossils from Stony Mountain has yet been prepared. The present paper is an attempt to supply this deficiency, and consists of a systematic list of all the species from that locality which are now represented in the Museum of the Survey. As many of these fossils are common and well known species, it is not thought desirable to give an exhaustive list of synonyms of each, but only such references as are likely to be useful to students of Canadian geology.

ALGÆ.

Bythotrephis (like *B succulens*, Hall).

Cfr. *Buthotrephis succulens*, Hall..1847. Pal. N. York, vol. I., p. 62, pl. 22, figs. 2, *a-b*.

A single specimen, which is too imperfect to be determined satisfactorily but which agrees fairly well with the orginal description of this species, was collected from the summit of the upper beds by Mr. J. B. Tyrrell in 1889.

CŒLENTERATA.

ANTHOZOA.

Streptelasma rusticum, Billings. (Sp.)

Streptelasma corniculum, Edw. & Haime..1851. Mon. Polyp. Foss. Terr. Palæoz., p. 398, pl. 7, figs. 4, 4 *a*, and 4 *b*. But probably not *S. corniculum*, Hall.

Petraia rustica, Billings.....1858. Rep. Progr. Geol. Surv. Canada for 1857, p. 168.

Streptelasma corniculum, Nicholson.....1875. Rep. Pal. Prov. Ont., p. 26.

" " Roninger.....1876. Geol. Surv. Mich., Palæont., Foss. Cor. p. 151 (pars). The specimens from the Hudson River formation only.

Lower beds, Dr. R. W. Ells, 1875, and T. C. Weston, 1884: several specimens of a small coral, which appears to be a broad, short form of this species. Upper beds, T. C. Weston, 1884: apparently not so common.

Streptelasma rusticum, var. trilobatum. (Var. nov.)

Corallum resembling that of the preceding species, but still broader at the summit and longitudinally trilobate, the lobes being broad and rounded, and the furrows between them comparatively narrow and not very deep.

Lower beds, T. C. Weston, 1884: twelve good specimens. Upper beds, T. C. Weston, 1884: one specimen.

Favosites prolificus, Billings.

Favosites prolificus, Billings..1866. Geol. Surv. Canada, Cat. Silur. Foss. Anticosti, p. 6.

Lower beds, Dr. R. W. Ells, 1875, (one large specimen) and T. C. Weston, 1884, (three smaller specimens). Four small specimens which are also probably referable to this species, were collected in the upper beds by Mr. Weston in 1884. The large specimen collected by Dr. Ells is labelled "*Favosites prolificus*" in Mr. Billings's own handwriting. It is fully ten inches in its maximum diameter but nowhere quite three inches in height. Its corallites are polygonal, nearly uniform in size and average about two millimetres in diameter. The tabulæ are very numerous, complete and placed close together. The mural pores, which were first noticed by Mr. Lambe, are very well preserved and situated close to

the angles of the corallites. It is doubtful, however, whether *F. prolificus* should be retained as a distinct species or as a mere local variety of *F. Gothlandicus.*

Protaræa vetusta, Hall.

Porites? vetusta, Hall.....1847. Pal. N. York, vol. I., p. 71, pl. 25, figs. 5, *a-b.*

Protaræa vetusta, Edw. & Haine..1851. Mon. Polyp. Foss. Terr. Palæoz.., p. 208, pl. 14, figs. 6 and 6 *a.*

Lower beds, T. C. Weston, 1874: a rather small but perfect and well preserved specimen.

HYDROMEDUSÆ.

Beatricea undulata, Billings.

Beatricea undulata, Billings..1857. Geol. Surv. Canada, Rep. Progr. 1853-56, p. 344, and (1865) Can. Nat., Sec. Ser., vol. II., p. 405, fig. 1.

Upper beds, T. C. Weston, 1884, three specimens, and A. M. Charles, 1884, one specimen.

Beatricea nodulosa, Billings.

Beatricea nodulosa, Billings.....1857. Geol. Surv. Canada, Rep. Progr. 1853-56, p. 344.

" " Nicholson...1866. Mon. Brit. Stromatop., p. 86, pl. 8, figs. 1-8.

Upper beds, T. C. Weston, 1884: one silicified specimen, which appears to be referable to this species, though its internal structure is almost obliterated.

ECHINODERMATA.

CRINOIDEA.

Glyptocrinus. (Species undeterminable).

Lower beds, T. C. Weston, 1884: a piece of a column only, about four inches and a half in length, which is referred to this genus solely on account of its resemblance to the column of *G. ramulosus*, as figured by E. Billings on plate VII. (figs. 2, *a-f*) of the fourth decade of "Canadian Organic Remains," published by this Survey.

MOLLUSCOIDEA.

POLYZOA.

PROBOSCINA AULOPOROIDES, Nicholson. (Sp.)

Aleeto auloporoides, Nicholson.....1875. Rep. Geol. Surv. Ohio, vol. II., pt. 2, p. 267, pl. 25, figs. 2 and 2, *a-b*.

Proboscina auloporoides, Ulrich.....1889. Geol. Surv. Canada. Contr. Micro-Palæont. Cambro-Silur. rocks, &c., vol. I., pt. 2, p. 28.

Stomatopora auloporides, S. A. Miller.1889. N. Am. Geol. and Palæont., p. 325.

Lower beds, T. C. Weston, 1884: "a small and rather badly preserved fragment."

PROBOSCINA FRONDOSA, Nicholson. (Sp.)

Aleeto frondosa, Nicholson.....1875. Rep. Geol. Surv. Ohio, vol. II., pt. 2, p. 266, pl. 25, figs. 3 and 3, *a-b*.

Proboscina frondosa, Ulrich.....1889. Geol. Surv. Canada, Contr. Micro Palæont. Cambro-Silur. rocks, &c., vol. I., pt. 2, p. 28.

Stomatopora frondosa, S. A. Miller..1889. N. Am. Geol. and Palæont., p. 325.

Lower beds, T. C. Weston, 1884: a single specimen.

MONTICULIPORA PARASITICA, var. PLANA.

Monticulipora parasitica, var. *plana*, Ulrich..1889. Geol. Surv. Canada, Contr. Micro-Palæont. Cambro-Silur. rocks, &c., vol. I., pt. 2, p. 28.

Lower beds, T. C. Weston, 1884: one specimen.

HOMOTRYPELLA GRACILIS, Nicholson. (Sp.)

Chætetes gracilis, Nicholson.....1874. Quart. Journ. Geol. Soc. Lond., vol. XXX., p. 504, pl. 29, figs. 7 and 7 *a*.

" " " .....1875. Rep. Geol. Surv. Ohio, vol. II., pt. 2, p. 198, pl. 21, figs. 8, and 8, *a-b*.

" " " .....1876. Ann. and Mag. Nat. Hist., Ser. 4, vol. 28, p. 90, pl. 5, fig. 13.

Monticulipora (Heterotrypa) gracilis, Nicholson..1881. Struct. and Aff. Genus Monticulipora, &c., p. 125, fig. 20., and pl2, figs. 1 and 1, *a-b*.

Batostomella gracilis, Ulrich.....1889. Geol. Sury. Canada, Contr. Micro-Palæont. Cambro-Silur. rocks, &c., vol. I., pt. 2, p. 35.

Homotrypella gracilis, Ulrich.....1893. Bryozoa Lower Silur. Minn. (in vol. III. Final Rep. Geol. and Nat. Hist. Surv. Minn.), p. 228.

Lower beds, T. C. Weston, 1884: "several fragments."

Bythopora delicatula, Nicholson. (Sp.)

Chætetes delicatulus, Nicholson..1875. Rep. Geol. Surv. Ohio, vol. II., pt. 2, p. 199, pl. 21, figs. 9 and 9, *a*.

" " Whiteaves. 1880. Geo. Surv. Canada, Rep. Progr. 1878-79, p. 49C.

Bythopora (?) delicatula, Ulrich. 1889. Geol. Surv. Canada, Contr. Micro-Palæont. Cambro-Silur. rocks, &c., p. 36.

Lower beds, Dr. R. W. Ells, 1875: one specimen.

Bythopora striata, Ulrich.

Bythopora striata, Ulrich..1889. Geol. Surv. Canada, Contr. Micro-Palæont. Cambro-Silur. rocks, &c., p. 36.

Lower beds, Dr. R. W. Ells, 1875: one specimen.

Petigopora scabiosa, Ulrich.

Petigopora scabiosa, Ulrich..1889. Geol. Surv. Canada, Contr. Micro-Palæont. Cambro-Silur. rocks, &c., p. 34.

Lower beds, Dr. R. W. Ells, 1875, one specimen, and T. C. Weston, 1884, two specimens.

Monotrypella quadrata, Rominger. (Sp.)

Chætetes quadratus, Rominger .....1866. Proc. Philad. Acad. Nat. Sc., p. 116.

Chætetes rhombicus, Nicholson.....1874. Quart. Journ. Geol. Soc. Lond., vol. XXX., p. 507, pl. 29, figs. 11, *a-b*.

" " " .....1875. Rep. Geol. Surv. Ohio, vol. II., pt. 2, p. 201, pl. 21, figs. 12 and 12, *a*.

" " " .....1876. Ann. & Mag. Nat. Hist. Ser. 4, vol. XVIII., p. 86, pl. 5, figs. 1, *a-b*.

Monticulipora rectangularis, Whitfield..1878. Ann. Rep. Geol. Surv. Wiscons. for 1877, p. 70.

" " " .1882. Geol. Wiscon., vol. IV., p. 249, pl. 11, figs. 11 and 12.

Monticulipora (Monotrypa) quadrata, Nicholson..... 1881. Structure and Aff. Genus Monticulipora, &c., p. 179, fig. 36.
Monotrypella quadrata, Ulrich..... 1889. Geol. Surv. Canada, Contr. Micro-Palæont. Cambro-Silur. rocks, &c., vol. I, pt. 2, p. 36.

Lower beds, T. C. Weston, 1884: "several fragments."

Batostoma Manitobense, Ulrich.

Batostoma Manitobense, Ulrich..1889. Geol. Surv. Canada, Contr. Micro-Palæont. Cambro-Silur. rocks, &c., p. 33, pl. 9, figs. 3, 3, *a-c*.

Lower beds, T. C. Weston and A. McCharles, 1884: "several small examples."

Arthroclema angulare, Ulrich.

Arthroclema angulare, Ulrich..1889. Geol. Surv. Canada, Contr. Micro-Palæont. Cambro-Silur. rocks, &c., p. 45.
" " " ..1890. Geol. Surv. Illinois, vol. VIII., p. 641, pl. 29, figs. 6, *a-b*.

Lower beds, Dr. R. W. Ells, 1875, and T. C. Weston, 1884: "several segments."

Helopora Harrisii, James.

Helopora Harrisii, James..1883. The Palæontologist, No. 7, p. 59, pl. 2, figs. 2*a-b*.
" " Ulrich..1889. Geol. Surv. Canada, Contr. Micro-Palæont. Cambro-Silur. rocks, &c., p. 45.

Lower beds, Dr. R. W. Ells, 1875, and T. C. Weston, 1884: "a number of very slender segments."

Sceptropora facula, Ulrich.

Sceptropora facula, Ulrich..1888. Am. Geologist, vol. I., p. 229.
" " " ..1889. Geol. Surv. Canada, Contr. Micro-Palæont. Cambro-Silur. rocks, &c., p. 46, figs. 2, *a-d*.

Lower beds, Dr. R. W. Ells, 1875, and T. C. Weston: "detached egments," abundant.

PTILODICTYA WHITEAVESII, Ulrich.

Ptilodictya Whiteavesi, Ulrich..1889. Geol. Surv. Canada, Contr. Micro-Palæont. Cambro.Silur. rocks, &c., p. 44, pl. VIII., figs. 1, 1, *a-e*.

Lower beds, T. C. Weston and A. McCharles, 1884: one comparatively large and two small specimens.

DICRANOPORA FRAGILIS, Billings. (Sp.)

Ptilodictya fragilis, Billings..1886. Geol. Surv. Canada, Cat. Lower Silur. Foss. Anticosti, p. 9.
Stictopora fragilis, Whitfield..1882. Geol. Wiscons., vol. IV., p. 253, pl. 2, fig. 24.
Dicranopora fragilis, Ulrich..1889. Geol. Surv. Canada, Contr. Micro-Palæont. Cambro-Silur. rocks, &c., p. 40.

Lower beds, T. C. Weston, 1884: "several segments, more less complete."

DICRANOPORA EMACERATA, Nicholson. (Sp.)

Ptilodictya emacerata, Nicholson..1875. Ann. & Mag. Nat. Hist., Ser. 4, vol. XV., p. 179, pl. 14, figs. 5, *a-b*.
" " " ..Report Geol. Surv. Ohio, vol. II., pt. 2, p. 261, pl. 25, figs. 5 and 5, *a-b*.
Dicranopora emacerata, Ulrich. ..1889. Geol. Surv. Canada, Contr. Micro-Palæont. Cambro-Silur. rocks, &c., p. 40.

Lower beds, T. C. Weston, 1884: "a single imperfect segment."

GONIOTRYPA BILATERALIS, Ulrich.

Goniotrypa bilateralis, Ulrich..1889. Geol. Surv. Canada, Contr. Micro-Palæont. Cambro-Silur. rocks, &c., p. 41, figs. 1, 2 and 3, and pl. 9, fig. 1.

Lower beds, Dr. R. W. Ells, 1875, and T. C. Weston, 1884: seven or eight detached segments.

PACHYDICTYA HEXAGONALIS, Ulrich.

Pachydictya hexagonalis, Ulrich..1889. Geol. Surv. Canada, Contr. Micro-Palæont. Cambro-Silur. rocks, &c., p. 42, pl. 9, figs. 2, 2, *a-c*.

Lower beds, T. C. Weston, 1884: one specimen.

BRACHIOPODA.

DINOBOLUS. (Species indeterminable.)

Upper beds, T. C. Weston, 1884: a large but very imperfect single valve, the maximum breadth of which is nearly two inches and a half. Not a vestige of the umbo or beak, but only the anterior and least instructive half of the valve is preserved.

STROPHOMENA INCURVATA (?) Shepard.

Producta incurvata, Shepard....1838. Am. Journ. Sc. and Arts, vol. XXXIV., p. 144, figs. 1 and 2.
Orthis incurvata, Castelneau....1843. Essai sur le Syst. Silur. de l'Ameriq. Septentr., p. 38.
Strophomena convexa, Owen.....1844. Geol. Expl. Iowa, Wiscons. and Ill., p. 70, pl. 17, fig. 2.
Leptæna filitexta, Hall.....1847. Pal. N. York, vol. I., p. 3, pl. 31B, figs. 3 *a-f*.
Strophomena filitexta, Billings..1856. Canad. Nat. and Geologist, vol. I., p. 203, figs. 1 and 2.
" " " ..1863. Geol. Canada, p. 164, fig. 142.
Strophomena incurvata (Shepard), Winchell & Schuchert.....1893. Lower Silur. Brach. Minn., p. 385, pl. 30, figs. 36-40.

Lower beds, T. C. Weston, 1884: a specimen showing only the exterior of the dorsal valve, so that according to Mr. Schuchert, by whom it has been examined, it is doubtful whether it should be referred to this species, or to *S. neglecta*, James.

STROPHOMENA FLUCTUOSA, Billings.

Strophomena fluctuosa, Billings.....1860. Canad. Nat. and Geol., vol. V., p. 57.
" " " .....1862. Geol. Surv. Canada, Pal. Foss., vol. I., p. 123, figs. 102, *a-b*.
" " " .....1863. Geol. Canada, p. 209, fig. 207.
" " Hall.....1892. Pal. N. York, vol. VIII., pt. 1, p. 251, pl. 11A, figs. 4 and 5.
" " Winchell & Schuchert..1893. Lower Silur. Brach. Minn. p. 395, pl. 31, figs. 14-17.

Lower beds, Dr. R. W. Ells, 1875, a dorsal valve, showing the characteristic shape and surface markings; and T. C. Weston, 1884, a dorsal valve with the inner surface exposed and showing all the characters of the interior of that valve.

RAFINESQUINA CERES, Billings. (Sp.)

Strophomena Ceres, Billings..1860. Canad. Nat. and Geol., vol. V., p.54.
" " " ..1862. Geol. Surv. Canada, Pal. Foss., vol. I., p. 119.

Probably a variety of *R. alternata* (Conrad).

Lower beds, T. C. Weston, 1884: two perfect and several imperfect specimens.

LEPTÆNA NITENS, Billings. (Sp.).

Strophomena nitens, Billings..1860. Canad. Nat. and Geol., vol. V., p. 53.
" " " ..1862. Geol. Surv. Canada, Pal. Foss., vol. I., p. 118, figs. 97 and 97 *a*.

Lower beds, Dr. R. W. Ells, 1875, and T. C. Weston, 1884: abundant.

On page 413 of "the Lower Silurian Brachiopoda of Minnesota," * by N. H. Winchell and Charles Schuchert, the following passage occurs. "In Anticosti *Strophomena nutans*, Billings, occurs, which as far as external characters are concerned, appears to be identical with specimens from Wilmington, Illinois, examined by one of the writers. The interiors of these show them to be a species of *Leptæna*, Dalman, and they are apparently closely related to *L. unicostata*." The specimens of *S. nitens* from Anticosti in the Museum of the Survey do not show any of the characters of the interior of either valve, but, in a perfect example of that species from Charleton Point, there is a single rib, larger than any of the others, in the median line of the ventral valve, as in the typical form of *L. unicostata*.

ORTHIS (DINORTHIS) PROAVITA, Winchell and Schuchert.

Orthis subquadrata, Whiteaves (as of Hall)..1880. Geol. Surv. Canada, Rep. Progr. 1878-79, p. 50 C.
Orthis proavita, Winchell & Schuchert.....1892. Amer. Geologist, vol. IX., p. 290.
" " " .....1892. Bull. Minn. Ac. Nat. Sc., vol. III., p. 332, pl. 5, figs. 18-21.
" " " .....1893. Lower Silur. Brach. Minn., p. 431, pl. 32, figs. 51-57.

Lower beds, Dr. R. W. Ells, 1875, Dr. R. Bell, 1879, and T. C. Weston, 1884: abundant, large and well preserved. Upper beds, T. C. Weston, 1884: numerous good casts of the interior of one or both valves. The late Mr. E. Billings, who had seen the specimens collected by Dr. Ells at Stony Mountain, regarded them as a coarsely ribbed variety of *Orthis subquadrata*, Hall.

*Extracted from vol. III., of the Final Report of the Minnesota Geological Survey

Orthis (Dalmanella) testudinaria, Dalman.

Orthis testudinaria, Dalman...1828. Kongl. Svenska Vet.-Acad. Handl. for 1827, p. 115, pl. 2, fig. 4.
" " Conrad...1839. Ann. Rep. N. Y. Geol. Surv., p. 63.
Orthis striatula, Emmons.....1842. Geol. N. York, Rep. Second Distr., p. 394, fig. 3.
Orthis testudinaria (?) Emmons. 1842. Ibidem, p. 404, fig. 4.
Orthis testudinaria, Hall.....1847. Pal. N. York, vol. I., p. 117, pl. 32, fig. 1, and p. 288, pl. 79, fig. 4.
" " Billings...1856. Canad. Nat. and Geol., vol. I., p. 40, fig. 1.
" " " ...1863. Geol. Canada, p. 165, fig. 144.
(And of numerous North American and European palæontologists.)

Lower beds, Dr. R. W. Ells, 1875, Dr. R. Bell, 1879, and T. C. Weston, 1884: abundant. Upper beds, T. C. Weston, 1884: numerous natural casts of the interior of the valves.

Rhynchotrema inæquivalvis, Castelneau. (Sp.)

Spirifer inæquivalvis, Castelneau....1843. Essai sur le Systeme Silur. de l'Ameriq. Septentr., p. 40, pl. 14, fig. 8.
Atrypa increbescens (partim), Hall...1847. Pal. N. York, vol. I., pp. 146, 289, pl. 33, figs. 13, *a-h*.
Rhynchonella increbescens (partim), Billings.....Canad. Nat. and Geol., vol. I., p. 207, figs. 11-14.
Rhynchonella increbescens, Billings...1863. Geol. Canada, p. 18, fig. 153.
Rhynchotrema inequivalvis, Winchell & Schuchert.....1893. Lower Silur. Brachiop. Minn., p. 459, pl. 34, figs. 9-25.

Upper beds, T. C. Weston, 1884: well preserved natural casts of the interior of two perfect shells.

Rhynchotrema capax, Conrad. (Sp.)

Atrypa capax, Conrad.....1842. Journ. Ac. Nat. Sc. Phil., vol. VIII., p. 264, pl. 14, fig. 21.
Atrypa increbescens (partim) Hall.....1847. Pal. N. York, vol. I., p. 146, pl. 33, figs. 13 *i*, and 13, *k-y*.
" " " Billings....1856. Canad. Nat. and Geol., vol. I, p 207, figs. 15-16.
Rhynchonella increbescens (partim) Hall...1862. Geol. Wiscons., vol. I., p. 55, figs. 5-7.
Rhynchonella capax, Billings.....1863. Geol. Canada, p. 211, figs. 213, *a-c*.
Rhynchotrema capax, Winchell and Schuchert.....1893. Lower Silur. Brachiop. Minn., p. 462, (which see for a complete list of synonyms of this species) pl. 34, figs. 30-3

Lower beds, Dr. R. W. Ells, 1875, Dr. R. Bell, 1879, and T. C. W es ton, 1884: large, abundant and well preserved. Upper beds, T. C. Weston, 1884: several fine natural casts of the interior of shells of this species.

RHYNCHONELLA ANTICOSTIENSIS, Billings.

Rhynchonella Anticostiensis, Billings.....1862. Geol. Surv. Canada, Pal. Foss., vol. I., p. 142, figs. 119, *a-c*.
" " " .....1863. Geol. Canada, p. 211, figs. 212, *a-c*.
Rhynchonella (?) Anticostiensis, Winchell & Schuchert.....1893. Lower Silur. Brachiop. Minn., p. 464, figs. 34, *a-c*.

Lower beds, T. C. Weston, 1884: five specimens with the test preserved. Upper beds, T. C. Weston, 1884: three natural casts of the interior of the shell.

MOLLUSCA.

PELECYPODA.

BYSSONYCHIA OBESA, Ulrich.

Byssonychia obesa, Ulrich..1893. Rep. Geol. Surv. Ohio, vol. VII., p. 630, pl. 45, figs. 10-12.

Lower beds, T. C. Weston, 1884: a cast of the interior of the closed valves, which has been identified with this species by Mr. Ulrich.

PLETHOCARDIA. (Sp. nov.?)

"Like *P. suberecta*, Ulrich, but anterior side too imperfect for certainty. On the other hand, the general aspect is decidedly like that of *Whitella megambona*, Whitfield, sp." Ulrich, in letter dated April 4, 1894.

Lower beds, T. C. Weston, 1884: an imperfect cast of the interior of a specimen with the valves closed.

GASTEROPODA.*

PLEUROTOMARIA BICINCTA, Hall. (Sp.)

Murchisonia bicincta, Hall.....1847. Pal. N. York, vol. I., p. 177, pl. 38, figs. 5 *a-h*, but not *M. bicincta*, McCoy, 1844.

*All the species of Gasteropoda in this list are represented in the Survey collection by mere casts of the interior of the shell.

Murchisonia bicincta, Salter .....1859. Geol. Surv. Canada, Canad. Org. Rem., Dec. 1, p. 19, pl. 4, figs. 5, 6 and 7. But not *M. bicincta*, McCoy.

Murchisonia Milleri, Hall.....1877. In first ed. of S. A. Miller's Amer. Palæoz. Foss.. p. 244.

Pleurotomaria bicincta (Hall) Lindström..1884. Silur. Gastrop. and Pterop. Gotland, p. 106, pl. 8, figs. 15-25.

Lower beds, T. C. Weston, 1884: five specimens which appear to be referable either to this species, or possibly to *M. modesta*, Billings, from the Hudson River formation of the Island of Anticosti.

Pleurotomaria. (Species uncertain.)

Lower beds, T. C. Weston, 1884: three badly preserved casts of the interior of shells, either of which may be briefly described as nearly lenticular, three times as broad as high, with a very slightly elevated spire, an acutely angulated periphery, and an umbilicus occupying about one-third of the diameter of the base. Similar specimens, from Division 1 of the Anticosti Group, at Junction Cliff, Anticosti, in the Museum of the Survey, are labelled "*Pleurotomaria acuta*, Sowerby," apparently on the authority of the late Mr. E. Billings. The writer, however, has failed to find any mention of that species in the second edition of Morris's "Catalogue of British Fossils" (1854), in Dr. Bigsby's "Thesaurus Siluricus" (1868), or in the first volume of Etheridge's "Fossils of the British Islands (1888), but the name *P. acuta* was given to an English Carboniferous fossil by Professor John Phillips in 1836, in the second volume of the "Geology of Yorkshire."

Murchisonia bellicincta, Hall.

Murchisonia bellicincta, Hall.....1847. Pal. N. York, vol. I., p. 179, pl. 39, figs. 1, *a-c*.

" " Billings....1863. Geol. Canada, p. 183, fig. 177.

" " Nicholson..1875. Rep. Pal. Prov. Ont., p. 18, and p. 19, fig. 7 *a*.

Lower beds, T. C. Weston, 1884: several very imperfect specimens.

Murchisonia gracilis, Hall.

Murchisonia gracilis, Hall.....1847. Pal. N. York, vol. I., p. 181, pl. 39, figs. 4, *a-c*.

" " Salter.....1859. Geol. Surv. Can., Can. Org. Rem., Dec. 1, p. 22, pl. 5, fig. 1.

" " Billings....1863. Geol. Canada, p. 183, fig. 178.

" " Nicholson..1875. Rep. Pal. Prov. Ont., p. 18, & p. 19, fig. 7*c*.

Lower beds, Dr. R. W. Ells, 1875 (one specimen), and T. C. Weston, 1884 (six specimens).

Bellerophon bilobatus, Sowerby.

Bellerophon bilobatus, Sowerby..1839. In Murchison's Silur. Syst., p. 643, pl. 19, fig. 13.
" " Emmons..1842. Geol. N. York, pt. 2, p. 393, and p. 392, fig. 6.
" " Hall.....1847. Pal. N. York, vol. I.,p.184, pl. 40, figs. 3,*a-d*.
" " Billings...1863. Geol. Canada, p. 184, figs. 180, *a-b*.

Lower beds, T. C. Weston, 1884: four small specimens, two of which are much distorted.

Cyrtolites compressus, Conrad.

Phragmolites compressus, Conrad..1838. Ann. Rep. N. York St., p. 119.
Cyrtolites compressus, Hall.....1847. Pal. N. York, vol. I., p. 188, pl. 40, figs. 2, *a-f*.
" " Whiteaves..1893. Can. Rec. Sc., vol. V., p. 323.

Lower beds, T. C. Weston, 1884: five specimens. This species has been collected also from the (Galena) Trenton limestone at Lower Fort Garry by Dr. R. Bell in 1880, and at East Selkirk by A. MacCharles in 1884.

Cyclora minuta, Hall.

Cyclora minuta, Hall..1845. Am. Journ. Sc. and Arts, vol. XLVIII., p. 294.

Lower beds, T. C. Weston, 1884; one specimen, which has been identified with this species by Mr. E. O. Ulrich.

Trochonema umbilicatum, Hall. (Sp.)

Pleurotomaria umbilicata, Hall.....1847. Pal. N. York, vol. I., pp. 43 and 175, pls. 10, figs. 9, *a-b*, and 38, figs. 1, *a-g*.
Trochonema umbilicata, Salter.....1859. Geol. Surv. Can., Can. Org. Rem., Dec. 1, p. 27, pl. 6, fig. 3.
" " Billings.....1863. Geol. Canada, p. 145, fig. 92.
Trochonema umbilicatum, Whiteaves.....1893. Can. Rec. Sc., vol. V., p. 323.

Lower beds, T. C. Weston, 1884: several specimens. In Manitoba, *T. umbilicatum* has also been collected from the (Galena) Trenton at the Dog's Head, Lake Winnipeg, by T. C. Weston in 1884, and at Snake, Berens and Commissioner's Islands, in that lake, by D. B. Dowling and L. M. Lambe in 1890.

CEPHALOPODA.

ORTHOCERAS SELKIRKENSE, Whiteaves.

Orthoceras Selkirkense, Whiteaves..1892. Trans. Royal Soc. Canada, vol. IX., sect. 4. p. 82, pl. 8, figs. 2, 2, *a-b*.

Lower beds, T. C. Weston, 1884: a crushed and badly preserved specimen which appears to be referable to this species.

ASCOCERAS. (Species undeterminable).

Lower beds, Dr. R. W. Ells, 1875: an imperfect and badly preserved cast of the interior of a shell belonging to this genus.

LITOCERAS INSIGNE, Whiteaves.

Apsidoceras insigne, Whiteaves...1890. Trans. Royal Soc. Canada, vol. VII., sect. 4, p. 82, pl. 17.

Lower beds: the type of the species, a large specimen, which was kindly presented to the Museum of the Survey in 1889 by the Manitoba Historical and Scientific Society. This specimen is probably not an *Apsidoceras*, as it was at one time supposed to be, and is here provisionally referred to *Litoceras* on the ground that it is clearly congeneric with the *Nautilus Hercules* of Billings, which Hyatt has recently referred to that genus, though with a query.*

CRUSTACEA.

OSTRACODA.

LEPERDITIA SUBCYLINDRICA, Ulrich.

Leperditia subcylindrica, Ulrich....1889. Geol. Surv. Canada, Contr. Micro-Pal. Cambro-Silur. rocks, &c., pt. 2, p. 49, pl. 9, figs. 4, *a-b*.

Lower beds, Dr. R. W. Ells, 1875, or T. C. Weston, 1884: one "complete carapace."

*Phylogeny of an Acquired Characteristic, p. 480.

APARCHITES MINUTISSIMUS, Hall. (Sp.)

Leperditia (Isochilina) minutissima, Hall.....1871. Descr. New. Spec. Foss. Hudson R. Gr., &c., p. 7.

" " " " .....1872. 24th Reg. Rep. N.Y. St. Cab. Nat. Hist., p. 231, pl. 8, fig. 13.

" " " Hall & Whitfield..1875. Rep. Geol. Surv. Ohio, vol. II., pt. 2, p. 102, pl. 4, fig. 4.

Aparchites minutissimus, Ulrich.....1889. Geol. Surv. Canada, Contr. Micro-Pal. Cambro-Silur. rocks,&c., pt. 2, p. 49.

Lower beds, Dr. R. W. Ells, 1875: the right valve figured by Mr. Ulrich.

PRIMITIELLA UNICORNIS, Ulrich.

Leperditia unicornis, Ulrich...1879. Journ. Cincinn. Soc. Nat. Hist., vol. II., p. 10, pl. 7, fig. 4.

Aparchites unicornis, Ulrich..1889. Geol. Surv. Canada, Contr. Micro-Pal. Cambro-Silur. rocks, &c., pt. 2, p. 50, pl. 9, fig. 11.

Primitiella unicornis, Ulrich..1894. Lower Silur. Ostrac. Minn., p. 649, pl. 43, figs. 75-77.

Lower beds, the single valve referred to in Mr. Ulrich's Report published by this Survey.

PRIMITIA LATIVIA, Ulrich.

Primitia lativia, Ulrich..1889. Geol. Surv. Canada, Contr. Micro-Pal. Cambro-Silur. rocks, &c., pt. 2, p. 50, pl. 9, figs. 8 and 8 *a*.

Lower beds, R. W. Ells, 1875, and T. C. Weston, 1884; several single valves.

PRIMITIA (?) (? BEYRICHIA) PARALLELA, Ulrich.

Primitia ? (? Beyrichia) parallela, Ulrich..1889. Geol. Surv. Canada, Contr. Micro-Pal. Cambro-Silur. rocks, &c., pt. 2, p. 51, pl. 9, figs. 7 and 7*a*.

Lower beds, T. C. Weston, 1884: two imperfect valves.

Eurychilina Manitobensis, Ulrich.

Eurychilina Manitobensis, Ulrich..1889. Geol. Surv. Canada, Contr. Micro-Pal. Cambro-Silur. rocks, pt. 2, p. 53, pl. 9, figs. 10 and 10 *a*.

Lower beds, Dr. R. W. Ells, 1875, one valve showing the exterior; and T. C. Weston, 1884, one valve showing the interior.

Tetradella quadrilirata, var. simplex.

Beyrichia quadrilirata, Hall & Whitfield..1875. Rep. Geol. Surv. Ohio, vol. II., pt. 2, p. 105, pl. 4, figs. 6 and 7.
Strepula quadrilirata, Ulrich .....1889. Geol. Surv. Canada, Contr. Micro-Pal. Cambro-Silur. rocks, &c., pt. 2, p. 54, pl. 9, fig. 12.
Tetradella quadrilirata, Ulrich.....1890. Journ. Cincinn. Soc. Nat. Hist., vol. XIII., p. 122.
" " " .....1894. Lower Silur. Ostrac. Minn., p. 679, pl. 46, figs. 1-11.

Lower beds, T. C. Weston, 1884: a single valve, the type of the variety *simplex*, Ulrich.

Tetradella lunatifera, Ulrich.

Strepula lunatifera, Ulrich.....1889. Geol. Surv. Canada, Contr. Micro-Pal. Cambro-Silur. rocks, &c., pt. 2, p. 56, pl. 9, figs. 14 *a-b*.
Tetradella lunatifera, Ulrich...1890. Journ. Cincinn. Soc. Nat. Hist., vol. XIII., p. 112.
" " " ...1894. Lower Silur. Ostrac. Minn., p. 680, figs. 51 *a-b*, and pl. 46, figs. 12-14.

Lower beds, Dr. R. W. Ells, 1875: a single valve.

On page 48 of the second part of the "Contributions to the Micro-Palæontology of the Cambro-Silurian rocks of Canada, published by this Survey in 1889, a specimen from the lower beds, collected by Mr. Weston in 1884, is referred by Mr. Ulrich to *Bythocypris cylindrica* (Hall), but, on page 688 of his memoir on the Lower Silurian Ostracoda of Minnesota, published in 1894, Mr. Ulrich states that he is "now fully convinced" that this identification is incorrect.

TRILOBITA.

Calymene callicephala, Green.

Calymene callicephala, Green.....1832. Monogr. Trilobites N. America, p. 30, cast 2.
Calymene senaria, Meek.....1873. Geol. Surv. Ohio, Palæont., vol. I., p. 173, pl. 14, figs. 14, *a-f*.
Calymmene callicephala, Clarke..1894. Lower Silur. Trilobites Minn., p. 699.

Lower beds, T. C. Weston, 1884 : the cephalon, minus the free cheeks, of a very small specimen, which is referred to this species with some doubt. It is most probably identical with the species so common in the Hudson River or Cincinnati formation of Ohio, for which, according to Dr. Clarke, the name *C. callicephala* must be retained, but it may possibly be referable to the *C. senaria*, Conrad, of the Trenton limestone. Its anterior margin seems to be regularly rounded, rather than shovel shaped.

Cheirurus Icarus, Billings.

Cheirurus Icarus, Billings.....1859. Canad. Nat. and Geol., vol. V., p. 67.
" " " .....1863. Geology of Canada, p. 219, fig. 231.
Ceraurus Icarus, Meek.....1873. Geol. Surv. Ohio, Palæont., vol. I., p. 162, pl. 14, figs. 11, *a-c*.
Cheirurus Icarus, (Billings), Whiteaves..1880. Geol. Surv. Canada, Rep. Progr. for 1878-79, p. 50 C.

Lower beds, Dr. R. Bell, 1879, one pygidium, and T. C. Weston, 1884, two pygidia.

Encrinurus raricostatus, Walcott.

Encrinurus raricostatus, Walcott.....1877. Adv. sheets Thirty-first Reg. Rep. N.Y. St. Cab. Nat. Hist., p. 16.
" " " .....1879. Thirty-first Reg. Rep. N.Y. St. Cab. Nat. Hist., p. 69.
" " Safford & Vogdes....1887. Proc. Acad. Nat. Sc. Philad., p. 167, fig. 2.

Lower beds, T. C. Weston, 1884 : one pygidium, and portions of two glabellæ that may be referable to this species, which was based upon a pygidium only.

PLATE IX.

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

MONOMERELLA DURHAMENSIS (page 57).

Figure 1. The larger portion of the specimen described, showing the cardinal area of the pedicle valve and the cast of the interior of the brachial valve. The other part of this specimen is represented on Plate XV., fig. 1.

RHINOBOLUS GALTENSIS (?) Billings. Var. (page 61).

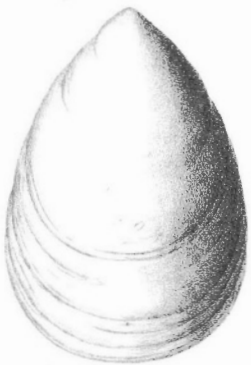
Figure 2. Exterior of the pedicle valve of the only specimen known to the writer

" 2*a*. Interior of the same.

PENTAMERUS OCCIDENTALIS, Hall (page 65).

Figure 3. Dorsal view of an unusually perfect specimen of this species.

" 3*a*. Lateral view of the same.



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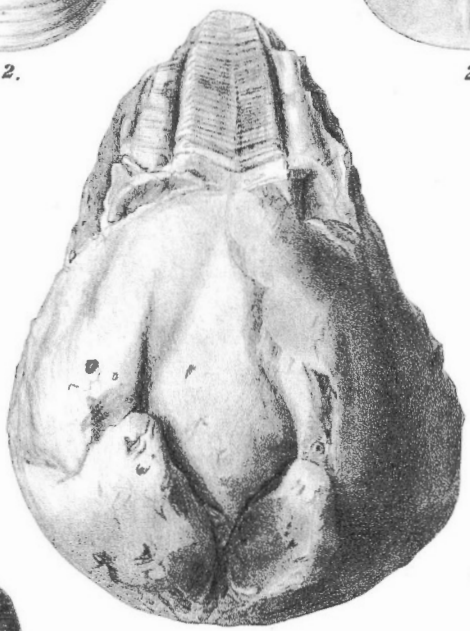
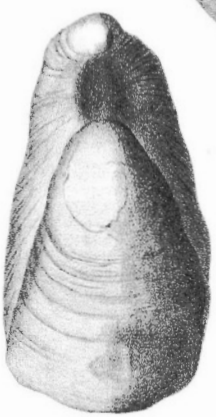


1.



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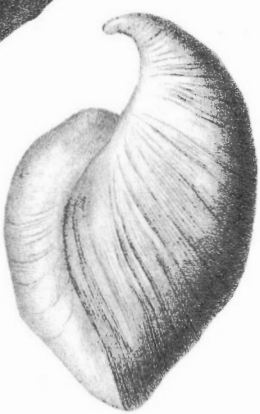


3a.

PLATE X.

TRIMERELLA OHIOENSIS, Meek (page 54).

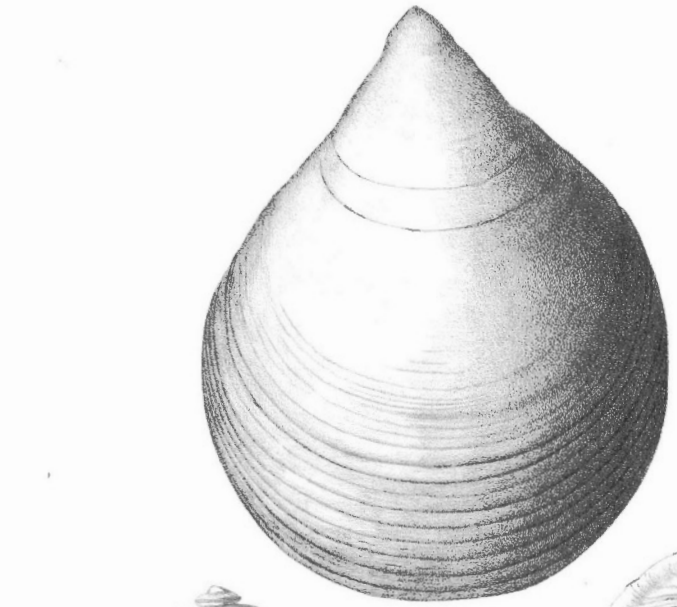
Figure 1. Exterior of an unusually perfect and well preserved pedicle valve, from Durham, supposed to be referable to this species.

" 1*a*. Interior of the same.

PLEUROTOMARIA HALEI, Hall. Var. (page 73).

Figure 2. Lateral view of a specimen from Durham, showing the height of the spire, and position and comparative prominence of the alate slit band.

" 2*a*. Umbilical side of the same.



1.

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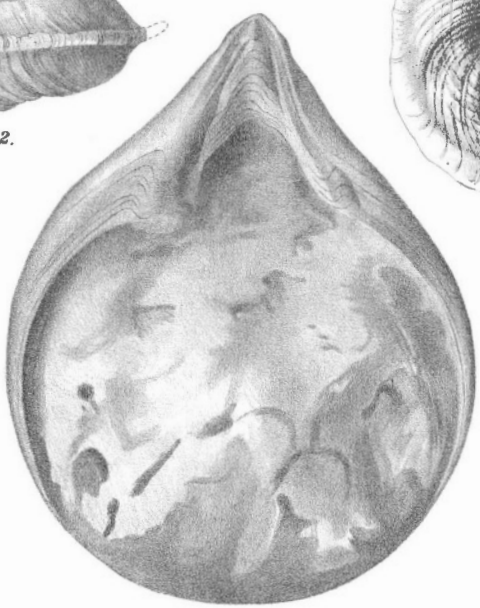
2 a.



1 a.

PLATE XI.

Capulus Canadensis (page 69).

Figure 1. Cast of the interior of the shell of the only specimen known to the writer, as seen from above.

Pleurotomaria Valeria, Billings (page 71).

Figure 2. View of a gutta percha impression of a natural mould of the apical side of a specimen from Durham.

" 3. View of a similar impression of the umbilical side of a specimen from Belwood.

Pleurotomaria velaris (page 72).

Figure 4. Lateral view of the type and only known specimen of this species.

" 4*a*. Umbilical side of the same.

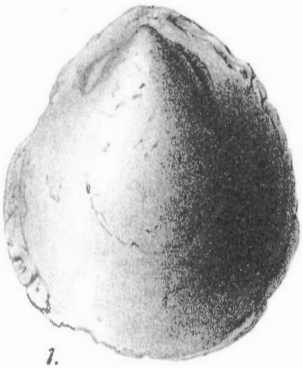
Pleurotomaria Elora, Billings (page 74).

Figure 5. Gutta percha impression of a natural mould of the apical side of a specimen from Durham, showing portions of some of the peripheral spines.

" 6. Umbilical side of a specimen from Aboyne, showing six long peripheral spines and part of another.

Pleurotomaria Galtensis, Billings (page 75).

Figure 7. Lateral view of a gutta percha impression of a natural mould of a specimen of this species, from Belwood.



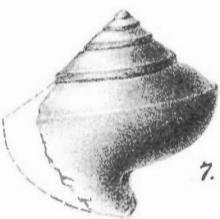
1.

2.

4a.

3.

4.



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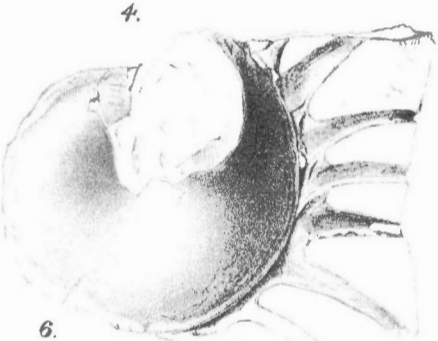

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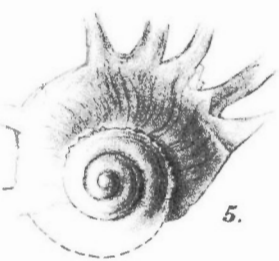


5.

PLATE XII.

PLEUROTOMARIA DEIOPEIA, Billings (page 75).

Figure 1. Side view of the type of this species, from Elora.

" 1*a*. Portion of the exterior of the test, three times the natural size, to show the surface markings.

PLEUROTOMARIA VIOLA, Billings (page 76).

Figure 2. Umbilical side of the type of this species, from Galt.

MURCHISONIA. Species uncertain. (page 79).

Figure 3. One of the specimens from Durham referred to in the text.

MURCHISONIA TURRITIFORMIS, Hall (page 84).

Figure 4. Side view of an unusually well preserved specimen of this species, from Elora.

MURCHISONIA BIVITTATA, Hall (page 82).

Figure 5. Gutta percha impression of a natural mould of the exterior of a shell of this species, from Belwood.

" 6. Natural and longitudinal section of the upper part of a shell of this species, from Belwood, showing the transverse, concave, calcareous partitions of the earlier volutions of the spire.

LOXOPLOCUS SOLUTUS (page 84).

Figure 7. Side view of an impression in wax from a natural mould of the exterior of a shell of this species, from Elora.

" 8. Wax impression of a similar mould of a specimen from Belwood.

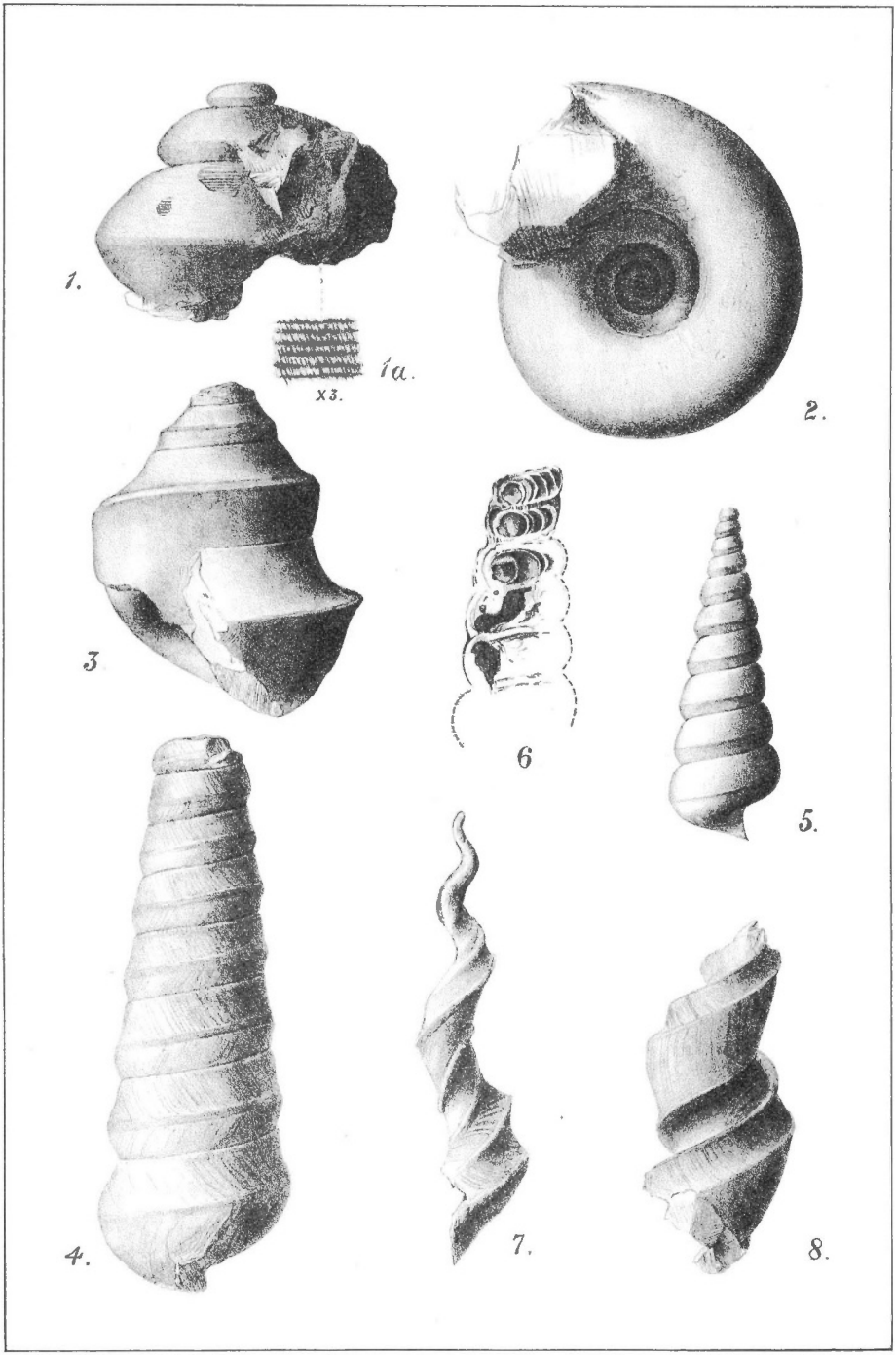

1.
1a.
x3.
2.
3
6
5.
4.
7.
8.

PLATE XIII

EUOMPHALUS INORNATUS (page 85).

Figure 1. Cast of the interior of a shell of this species, from Durham.

LOXONEMA MAGNUM, Whitfield. Var. (page 87).

Figure 2. Side view of a specimen from Elora.

PYCNOMPHALUS SOLARIOIDES, Hall. Sp. (page 88).

Figure 3. Apical side of a cast of the interior of a shell of this species, from Durham.

" 3*a*. Lateral view of the same.

" 4. Wax impression of a natural mould of the exterior of the umbilical side of a shell of this species, from Belwood, shewing the thickening of the lip on the columellar side of the almost closed umbilicus.

" 5. Umbilical side of a cast of the interior of a specimen from Belwood, shewing that the umbilicus is deep and rather wide, when no vestige of the test or of the spiral ridge around the umbilicus is preserved.

" 6. Vertical section of a specimen from Durham, shewing the test of the inner side of the volutions, and the very prominent spiral ridge around the umbilicus.

" 7. Umbilical side of a cast of the interior of the shell from Durham, with the umbilicus almost filled by the base of the spiral ridge and a cast of the remainder of the ridge.

" 8. Umbilical side of a similarly preserved but smaller specimen from Durham.

POLYTROPIS SULCATUS, Hall. Sp. (page 89).

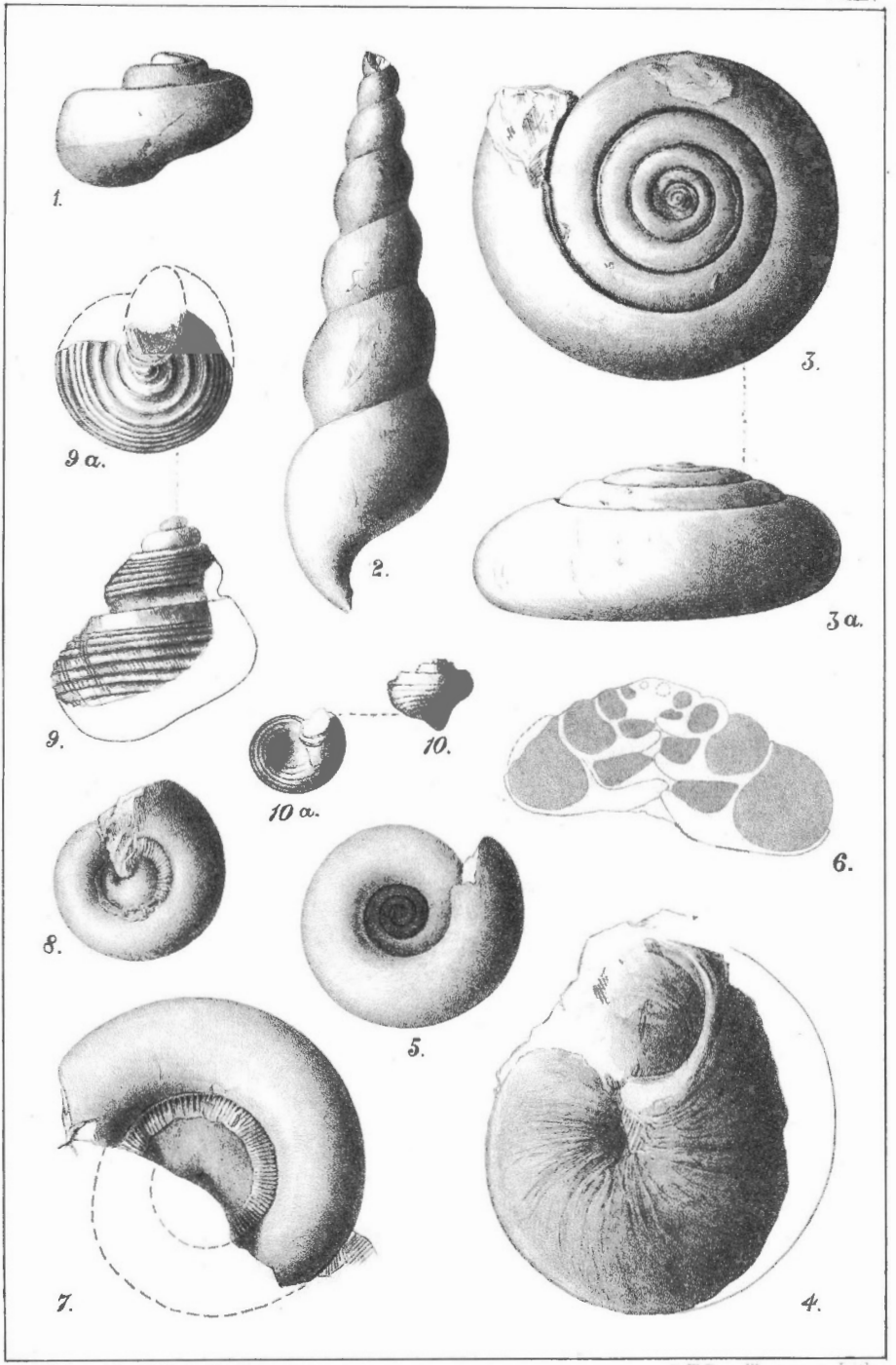
Figure 9. Gutta-percha impression of a natural mould of the exterior of a shell of this species, from Belwood.

" 9*a*. Umbilical side of the same.

POLYTROPIS PARVULUS (page 92).

Figure 10. The type and only known specimen of this species, from Durham.

" 10*a*. Umbilical side of the same.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3a.
9a.
9.
10.
10a.
6.
8.
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7.
4.

PLATE XIV.

POLYTROPIS DURHAMENSIS (page 91).

Figure 1. Gutta percha impression of a natural mould of the exterior of the apical side of a shell of this species, from Durham.

" 2. Umbilical side of a specimen with the test preserved, from Durham.

HOLOPEA GRACIA, Billings, (page 95).

Figure 3. Umbilical side of the original type of this species, from Galt.

SUBULITES COMPACTUS? Var. (page 96).

Figure 4. A small specimen from Durham, twice the natural size.

" 5. Another specimen from the same locality.

PAUCISPIRAL OPERCULUM (page 96).

Figure 6. Exterior of the largest and most perfect specimen known to the writer.

CYRTOCERAS ORODES, Billings, (page 103).

Figure 7. Ventral view of the original type of this species, from Hespeler. The dotted lines indicate the position of the siphuncle.

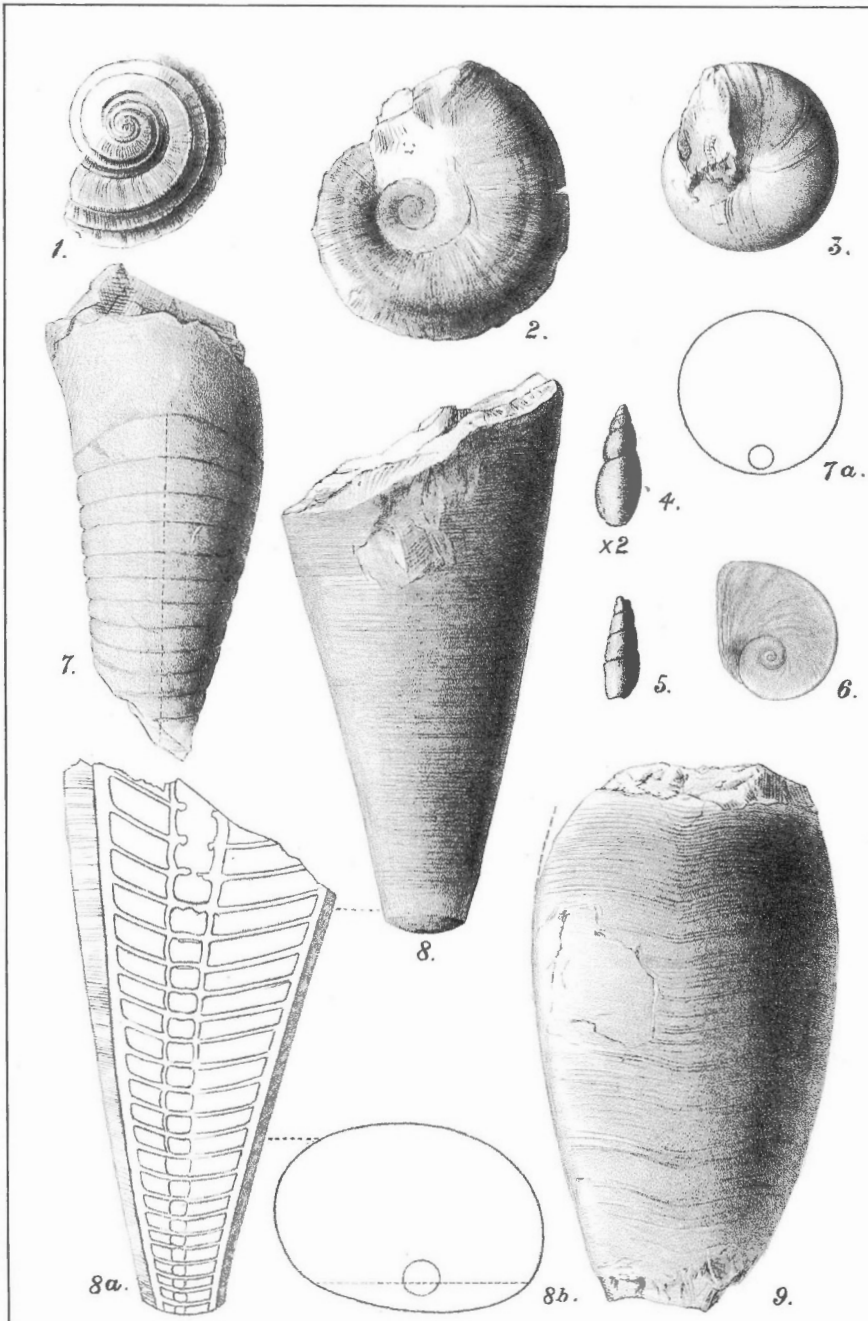
" 7*a*. Outline of a transverse section of the same, showing the position of the siphuncle.

" 8. Dorsal view of a specimen from Durham, supposed to be referable to this species, with the test preserved, to shew the surface markings.

" 8*a*. Ventral view of the same, ground down to show the septa and siphuncle.

" 8*b*. Outline of transverse section of the same, at the larger end.

" 9. Ventral view of another specimen from Durham, also supposed to be referable to this species, with the test preserved, and showing the faint hyponomic sinuses of the incremental striæ of the test.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7a.
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x2
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8a.
8b.
9.

PLATE XV.

Monomerella Durhamensis (page 57).

Figure 1. Interior of the brachial valve, drawn partly from the actual test preserved on the smaller portion of the specimen represented on Plate IX, fig. 1, and partly from a gutta percha mould of the cast of the interior of that valve.

Rhinobolus Galtensis, Billings. Sp. (page 59).

Figure 2. Interior of the brachial valve, from a gutta percha mould of the cast of the interior of that valve, from Galt, represented upside down by figure 152, on page 168, of the first volume of the "Palæozoic Fossils."

Ilionia Galtensis (page 68).

Figure 3. An unusually perfect and well preserved left valve of this species, drawn from a gutta percha impression of a natural mould of the exterior of that valve, from Elora.

Supposed Multispiral Opercula (page 97).

Figure 4. Side view of one of these supposed opercula, from Elora, with the thin calcareous outer layer or sheath preserved.

" 5. Similar view of a large specimen, from Elora, with the outer layer not preserved.

" 5*a*. View of the larger end of the same.

" 6. Longitudinal section of one of these opercula, three times the natural size, and slightly restored: *a*, the narrow, solid, multispiral, central axis; *b*, a second slender, solid and tightly enveloping calcareous coil; and *c*, the thin outer layer or sheath.

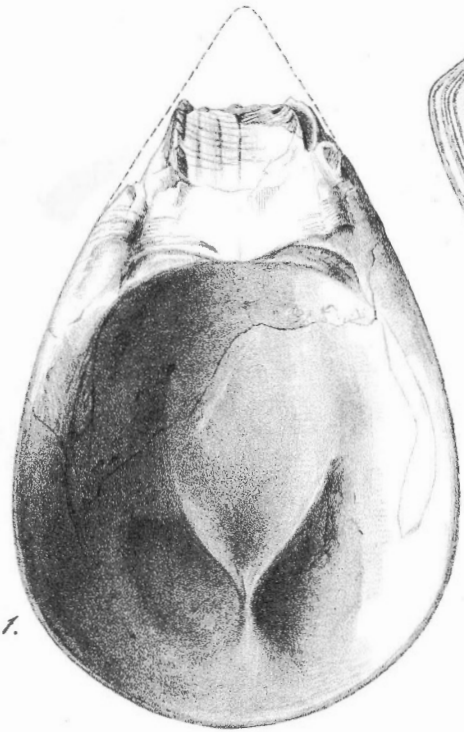
Illænus Aboynensis (page 108).

Figure 7. Imperfect cephalon of this species, from Aboyne, near Elora.

" 8. Pygidium of the same.

Pleurotomaria Townsendii (page 77).

Figure 9. Side view of the most perfect specimen known to the writer, drawn from a wax impression of a natural mould of the exterior of a specimen from Durham, the slit band from the mould itself.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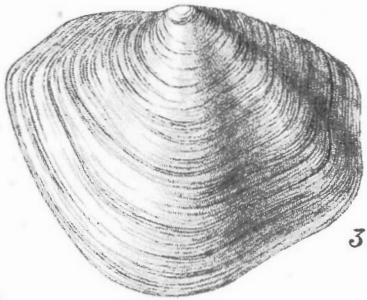
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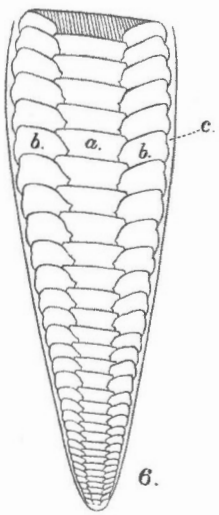

6.
×3.

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