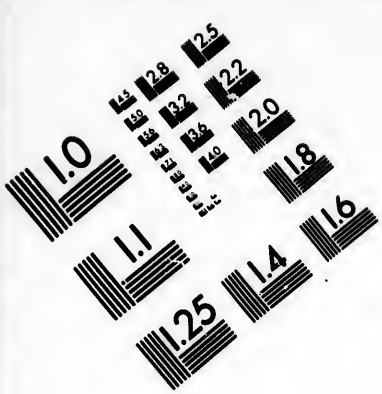

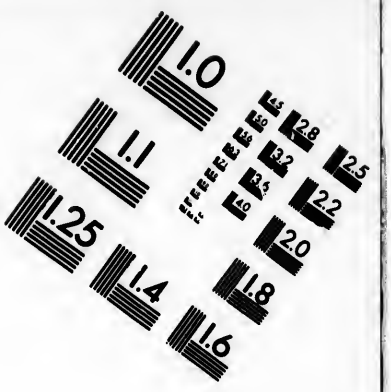

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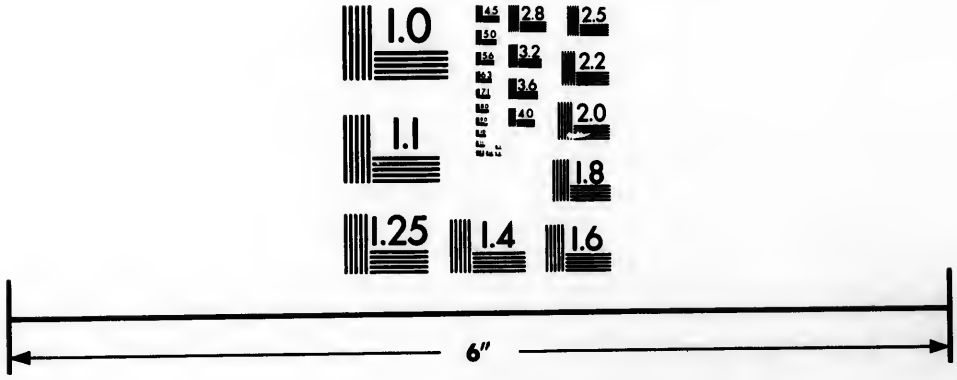

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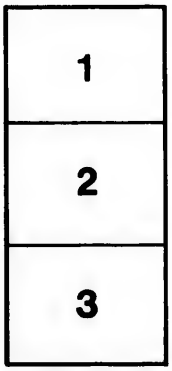

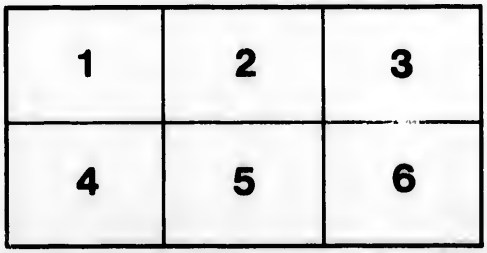

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CONTRIBUTIONS

TO

CANADIAN PALÆONTOLOGY.

VOLUME I.

BY

J. F. WHITEAVES, F.G.S., F.R.S.C., &c.,

PALÆONTOLOGIST AND ZOOLOGIST TO THE SURVEY.

PART II.

2. *On some fossils from the Hamilton Formation of Ontario, with a list of the species at present known from that formation and province.*
3. *The fossils of the Triassic Rocks of British Columbia.*
4. *On some Cretaceous fossils from British Columbia, the North West Territory and Manitoba.*

PRINTED FOR THE GOVERNMENT OF CANADA

WILLIAM FOSTER BROWN & CO., PUBLISHERS,
MONTREAL.
1889.

The Second Part of the "Contributions to Canadian Palæontology" consists of three separate papers, on more or less widely different subjects.

No. 2 is "on some fossils of the Hamilton Group of Ontario, with a list of the species at present known from that formation and province;" No. 3 is an enumeration or description, as the case may be, of the fossils of the Triassic Rocks of British Columbia; while No. 4 is "on some Cretaceous fossils from British Columbia, the North-West Territory and Manitoba."

Advances copies of the letter press of pages 91–122 were issued in September, 1887, pages 123–150 were issued in December, 1888, pages 181–184 in June, 1889, while the remainder, or pages 185–196, will bear date herewith.

The Part complete, as now presented, consists of 107 pages of text, illustrated by fifteen full page plates, lithographed by Messrs. Mortimer & Co., of Ottawa, from original drawings made by Mr. L. M. Lambe, the artist to the Survey.

ALFRED R. C. SELWYN.

Geological and Natural History Survey Office,
Ottawa, Aug. 1, 1889.

CONTRIBUTIONS TO CANADIAN PALÆONTOLOGY.

VOLUME I.

BY J. F. WHITEAVES.

2. *On some fossils from the Hamilton Formation of Ontario, with a list of the species at present known from that formation and province.*

The calcareous shales and limestones of the Hamilton Formation of the Middle Devonian System in western Ontario have long possessed a special interest to palæontologists, on account of the variety and excellent state of preservation of the fossils which they contain.

A succinct account of the first recognition of the exact geological horizon of this group of rocks is given by Mr. Alexander Murray on pages 129-182 of the "Report of Progress of the Geological Survey of Canada for 1853-54-55-56," published in 1857, and their distribution in Ontario is described more in detail in the fifteenth chapter of the "Geology of Canada" (1863) and in Professor Chapman's "Outlines of the Geology of Canada" published in 1876.

According to the writer last mentioned, "the formation in this district is estimated at about 250 feet in thickness. It extends across the counties of Norfolk, Elgin, Kent, Middlesex and Lambton, and also the south part of Huron, but is much obscured throughout this area by overlying clays, sands and other drift and superficial deposits. The best exposures occur in the township of Bosanquet, in the north-west corner of Lambton." To this it may be added that extensive and richly fossiliferous outcrops occur on both banks of the Sable River, in the adjacent township of West Williams, county of Middlesex, near Bartlett's Mills, that Wisder and Thedford are both in the township of Bosanquet, and that the name of the station on the Grand Trunk Railway which was formerly called Widder has been changed to Thedford, the two villages of that name being only one mile and a half apart.

Most of the fossils that have been recorded from these rocks in Ontario are enumerated or described in two papers by the late Mr. E. Billings, and in two reports by Professor H. Alleyne Nicholson.

In Mr. Billings paper "On the Fossil Corals of the Devonian rocks of Canada West," published in the Canadian Journal for March 1859, two species, viz.: *Heliophyllum Halli* of Edwards and Haime and *H. tenui-*

septatum, Billings, are enumerated as occurring in the Hamilton Formation, the latter being then described for the first time. To these should probably be added the *Cystiphyllum Americanum* of Edwards and Haime, which is one of the commonest fossils of this formation, although by some inadvertence Mr. Billings omitted to state from what particular horizon the specimens he referred to were obtained.

In another paper by Mr. Billings, 'On the Devonian Fossils of Canada West," published in the Canadian Journal for May 1860, nine species of corals, six of which had not previously been described, and fifteen of brachiopoda, two which were here named and characterized for the first time, are enumerated as having been collected in the Hamilton Formation.

Professor H. A. Nicholson's "Report upon the Palæontology of the Province of Ontario," published at Toronto in 1874, which is exclusively devoted to the organic remains of the Devonian rocks, contains the most exhaustive and indeed the only list that had appeared up to that date of the fossils of the Corniferous and Hamilton Formations of that province. The number of species from the latter formation enumerated in this list is fifty-six, many of which were described for the first time in this report, but seventeen out of the fifty-six are identical with forms that had previously been recorded by Mr. Billings as occurring in the same formation.

In his Report upon the Palæontology of the Province of Ontario, published at Toronto in 1875, Professor Nicholson adds fifteen species to the fauna of the Hamilton Formation of that province, two out of the seventeen there mentioned as belonging to it having been previously recognized or described by Mr. Billings.

Due allowance being made for names that are mentioned by both of these palæontologists, the total number of species recorded in these four publications from the formation and province in question is eighty-one, and since 1875 about twenty additional species have been described or identified by E. Billings, Drs. Nicholson, Carl Rominger and G. J. Hinde, Prof. H. Montgomery and Messrs. Etheridge and Carpenter, thus bringing the general total, to the close of 1886, up to a little over one hundred.

In addition to these the Museum of the Geological Survey of Canada contains nearly forty species of fossils, most of which have not previously been recognized as occurring in the Hamilton Formation of Ontario, or at least not in any Canadian publication. With the exception of *Spirifera subdecussata* and *Dalmanites Helena*, they are all from the townships of Bosanquet or West Williams, and a few of them appear to be undescribed. Some of these fossils were collected by Mr. James Richardson in 1859 and by Mr. Johnson Pettit in 1868, but by

far the greater number were obtained by the Rev. Hector Currie (formerly of Widder and now resident at Thedford) and by the Rev. J. M. Goodwillie, two zealous and successful collectors of the fossils of these townships since 1876, who generously presented a number of their choicest specimens to the Museum of the Canadian Survey in 1882.

The object of the present paper is to place upon record the names of these and other fossils new to the published lists, with descriptions and figures of such as appear to be undescribed, and finally to give as complete a list as possible of all the species known up to the present date from the formation in Ontario.

In the preparation of this paper the writer desires to acknowledge his obligations to Mr. Charles Wachsmuth for the identification of three species of crinoids, as well as for valuable critical suggestions in reference to the crinoids and blastoids generally; to Professor James Hall for the loan of two of the types each of his *Pentremites leda and P. Whitei*; and to Professor R. P. Whitfield for the loan of one of the types of *Nucleocrinus lucina*, Hall, now in the American Museum of Natural History in New York city, and for the comparison of Canadian specimens supposed to be referable to *Nucleocrinus elegans*, Conrad, and *Productella truncata*, Hall, with the types of those species in the same institution.

CŒLENTERATA.

ANTHOZOA.

(Tetracoralla, Haeckel: Rugosa, Edwards and Haime.)

ACERVULARIA PROFUNDA, Hall.

Acervularia profunda, Hall. 1758. Rep. Geol. Surv. St. Iowa, vol. I., pt. 2, p. 477, pl. 1, figs. 7 a, b, c.

Township of Bosanquet, Mr. J. Pettit, 1868: one fine specimen.

Dr. Rominger, in his "Fossil Corals of Michigan," (p. 106) expresses the opinion that *A. profunda* is only a variety of *A. Davidsoni*, Edwards and Haime, and that *Acervularia* itself is synonymous with *Cyathophyllum*.

ECHINODERMATA.

CRINOIDEA.

TAXOCRINUS LOBATUS, Hall, var.

Plate 12, fig. 1.

Forbesiocrinus lobatus, Hall. 1862. Fifteenth Rep. N. York St. Cab. Nat. Hist., p. 124.
Taxocrinus lobatus, Wachsmuth and Springer. 1879. Rev. Paleocrinoidea, pt. 1, p. 49.
" " Miller. 1883. Cat. Am. Pal. Foss., Second Ed., p. 288.

Plates of the "dorsal cup" and arms of apparently the same shape, number, and disposition as those of the type of *T. lobatus*, but the bifurcating plates or third radials of the Canadian variety are destitute of nodes, and the entire surface appears to be smooth rather than "finely granulose." This latter circumstance, however, may be due to a slight weathering of the specimens.

Near Thedford, Rev. Hector Currie, two specimens: one collected in 1882 and the other in 1883.

These two fossils are regarded with some doubt as a local variety of *Taxocrinus lobatus*, principally upon the authority of Mr. Charles Wachsmuth who has examined and reports as follows upon them in a letter to the writer: "I have compared the two specimens with *Forbesiocrinus lobatus* and *F. nuntius*, Hall, which are both *Taxocrinus*. They differ from both of these species in having neither nodes nor spines upon their bifurcating plates. The nodes, however, might be undeveloped, as is the case sometimes in *Taxocrinus Thiemei*, and this is the more probable as the specimens agree in other respects with Hall's description of *Forbesiocrinus nuntius*. It is very curious that Hall, in his description of *Forbesiocrinus nuntius*, speaks of the very remarkable resemblance of this species to *F. Thiemei* and that in Vol. 2 of the Ohio Report, Pl. 12, fig. 2, a specimen which is almost identical with *Taxocrinus Thiemei* is called *Forbesiocrinus lobatus*, var. *tardus* and not *F. nuntius*, var. *tardus*, as it ought to be. I have compared your specimens also with *Taxocrinus Ithacensis*, Williams, with which they agree more closely than his figures on Plate 1 would suggest. I have good india rubber casts of his type specimens, and find in none of them the second primary radials so widely separated as in his figure. He describes all plates in a radial direction from the first primary radial up as brachials and arm plates, i. e. as free plates; while in fact

his species, like all others of the genus, has not only three or more primary but also several secondary radials, connected laterally by interradials, though these latter, which were moveable in the animal, are rarely preserved in the fossil. *Taxocrinus Ithacensis* differs from your specimens in having less bifurcations and in possessing almost straight and not strongly waving sutures."

Homocrinus crassus. (N. Sp.)

Plate 12, fig. 2.

Calyx, or rather "dorsal cup," somewhat bell-shaped, rather broad and slightly inflated near the base and concavely as well as very shallowly constricted a little below the middle. Height of the dorsal cup, from the lower margin of the underbasals to the summit of the first radials, very little greater than its maximum breadth. Underbasals pentagonal, about one half the size of the basals, and broader than high: basals moderately large, about equal in size to the anterior radials, the three anterior ones hexagonal, the two posterior ones heptagonal and truncated above: inferior anal plate equal in size to the underbasals, square and resting obliquely between two basals, the right radial and the superior anal plate. Primary radials pentagonal, nearly flat below, slightly raised in the middle above, and truncated abruptly and somewhat obliquely, in such a manner as to form a shallowly excavated articulating area whose contour is almost circular, but a little broader than high, and which is furnished with a small, ovate, marginal foramen, whose acutely pointed apex opens directly into an obtusely angular notch in the centre of the upper margin of the plate. Right posterior radial a little smaller than the rest. Superior anal plate pentagonal, equal in size to the right posterior radial, but devoid of course of a distinct lateral articulating area. Substance of the plates thick: outer surface apparently smooth.

Near Thedford, Rev. Hector Currie, 1882: a single specimen of the dorsal cup, entirely free from the matrix.

This species may be easily distinguished from the *H. scoparius* of Hall, from the Lower Helderberg of the State of New York, and from the *H. proboscidialis* of Hall, from the Oriskany Sandstone of the same State, by its much larger size, by its broader, shorter and more bell-shaped dorsal cup, and by the much greater thickness of the plates of which this part of the calyx is composed.

ARTHROACANTHA PUNCTOBRACHIATA, Williams.

Plate 13, figs. 1, and 1a.

Arthroacantha punctobrachiata, H. S. Williams. 1883. Trans. Am. Phil. Soc., April, pp. 83 & 86.
Hystricrinus Carpenteri, Hinde. 1885. Annals and Mag. Nat. Hist., Ser. 5, vol. XV., p. 157.

Township of Bosanquet, Mr. J. Pettit, 1868: Bartlett's Mills, near Arkona, Rev. Hector Currie and Rev. J. M. Goodwillie, 1882, and H. M. Ami, 1883.

In the Museum of the Survey there are five good specimens of this species and there are two also in the Redpath Museum at Montreal. These latter were collected by the Rev. Hector Currie, and were kindly loaned to the present writer for examination and study, by Sir William Dawson. Of these seven specimens five have the whole of the calyx, with portions of the arms, beautifully preserved, but the summit of each is completely filled by a shell of *Platyceras dumosum*, Conrad, var. *rarispinum*, Hall. The perforated tubercles to which the moveable spines were attached, are well shewn in each specimen and it is not unusual to find the spines lying alongside of the tubercles.

In 1883 Prof. H. S. Williams published a description of a new genus of crinoids for which he proposed the name *Arthroacantha*. This genus was shewn to be most nearly related to *Hexacrinus*, Austin, but to differ therefrom in "possessing a well defined third primary radial similar in size to the second, and from which the free arms abruptly diverge," and from it and "from all other hitherto undescribed crinoids, in the possession of slender, acicular spines which were free from the plates and were evidently articulated by some means upon elevated pitted tubercles on the surface of the calyx, vault and free arms." The type of this genus was stated to be the *A. Ithacensis* (Williams) "from the base of the Chemung Group at Ithaca, N. Y.," and this species was described in minute detail, with full measurements of all the parts known, and illustrated with an octavo plate of eight figures.

On page 83 of the paper in which the genus *Arthroacantha* was described by Profesor Williams the following remarks occur. "In studying this genus, I have examined several specimens which agree with the typical form in the general character of the plates and the arms in one case, and possess the pitted tubercles on the surface. The most important among these is the original specimen of a figure issued by the New York State Museum with the name *Platycrinus ? punctobrachiatus*. The original is in the Museum of Cornell University. The

name was proposed by Prof. Hall, but, as he informs me, the species was never described. This, with several other undescribed species, was photographed and the plate was privately distributed about 1872, with name attached, but with no descriptions. The arms, the shape of calyx, and the plates that were preserved, correspond in general with *A. Ithacensis*, but the tubercles on the calyx plates are finer, more numerous, and the pitting very indistinct, and the basal plates are relatively larger than in the typical specimens of that species. Hence we are led to believe that the Hamilton species is distinct from the Chemung specimens, and even if it were properly described and published, it is probably safe to regard it as a distinct species. Although the specimen shows no traces of the free spines, the nature of the tubercles leave little doubt of a generic identity with *Arthroacantha Ithacensis*, and the Hamilton form may be called *Arthroacantha punctobrachiata*. In the Museum of Cornell University are two specimens, each a portion of the basal disc, which appear to be identical with *A. punctobrachiata*. One is marked *Moscow shale*, locality not designated; the other is marked *Hamilton Period, Delphi, N.Y.* and is on a soft dark shale with specimens of *Pholidops*."

On page 86 of the same paper, in reference to *A. Ithacensis*, we read as follows: "This species differs from the *Arth. punctobrachiata* of the Hamilton group in the more distinct and less numerous tubercles on the surface of the calyx plates: the smaller size of the tubercles leads to the inference that the spines were smaller in the Hamilton form; the calyx plates were apparently thicker in the Chemung species, and the second and third radial of the specimen *Arth. punctobrachiata* are higher than those of *Arth. Ithacensis*."

The following year, on receipt of a copy of Professor Williams' paper, the present writer came to the conclusion that the specimens now under consideration were referable to *A. punctobrachiata*, Williams, first, because they are from the Hamilton Formation,—secondly, because they agree perfectly with Professor Williams' diagnosis of the characters of the genus,—and thirdly, because they differ from the *A. Ithacensis*, of the Chemung group, as figured by Williams, in having more numerous and less distinct tubercles on the surface of the calyx plates, with shorter and smaller spines articulated to these tubercles. A similar conclusion had previously been arrived at, on perfectly independent grounds, by Mr. Charles Wachmuth, to whom two of the Canadian specimens had been submitted.

In 1885 Dr. George Jennings Hinde published a paper entitled "Description of a New Species of Crinoids, with Articulating Spines," and to this species he gave the name *Hystricrinus Carpenteri*. The specimens upon which the paper was based were stated to be from the

Middle Devonian of Arkona, Ontario, and the locality, as well as the description and figures, leave little room for doubt that Dr. Hinde's specimens are both specifically and generically identical with those whose nomenclature is now being discussed. In this and in a subsequent paper Dr. Hinde claims that Professor Williams' genus *Arthroacantha* cannot be retained, because "the name *Arthracanthus* was employed by Schmarda in 1854 for a genus of Rotatoria," and that the species *Arthroacantha punctóbrachiata* must also be rejected, because it was never properly described.

But to the first of these objections it may be answered that, although from a purist's standpoint, the *o* in *Arthroacantha* may be superfluous, yet the difference in the terminations of the two words in question is quite sufficient to admit of the use of both. Generic terms which differ only in this respect, such as, for example, *Picus*, a woodpecker, and *Pica*, a magpie—*Cyprinus*, a carp, and *Cyprina*, a mollusk—and many such instances could be cited, are in universal use among biologists at the present day, with no inconvenience resulting therefrom. In reply to Dr. Hinde's second contention, viz., that the *A. punctobrachiata* has never been properly described, the whole of the original description of that species has already been quoted, so that the reader, on this point, can form his own opinion. In the writer's judgment, however, the distinctive characters given by Prof. Williams, though largely negative and unaccompanied with any figures, are yet sufficiently explicit to allow of the recognition of the species, and if this be the case, the laws of nomenclature would seem to require that his name should be adopted.

Dolatocrinus liratus, Hall.

Cacabocrinus liratus, Hall. 1862. Fifteenth Rep. N. York St. Cab. Nat. Hist., p. 139.
Dolatocrinus liratus, S. A. Miller. 1877. Cat. Am. Pal. Foss. p. 77.
" " Wachsmuth and Springer. 1881. Rev. Paheocrinoidea, pt. 2, p. 126.

Bartlett's Mills, near Arkona, Rev. J. M. Goodwillie, 1882: one good specimen, which appears to belong to this species, although, as pointed out by Mr. Wachsmuth, it has only 1 x 2 secondary radials (brachials, Hall) while the type of *D. liratus* is said to have 2 x 2. The generic and specific characters of this specimen and of the beautiful example of *Ollacrinus spinigerus* collected by the Rev. Hector Currie, were first recognized by Mr. H. M. Ami.

Dolatocrinus lamellosus, Hall.

Cacabocrinus lamellosus, Hall. 1862. Fifteenth Rep. N. York St. Cab. Nat. Hist., p. 141.
Dolatocrinus lamellosus, S. A. Miller. 1877. Cat. Am. Pal. Foss., p. 77.
" " Wachsmuth and Springer. 1881. Rev. Palæocrinoidea, pt. 2, p. 126.

Near Thedford, Rev. Hector Currie, 1882, *teste* Wachsmuth: one nearly perfect and tolerably well preserved but somewhat crushed example of the calyx.

Dolatocrinus Canadensis. (N. Sp.)

Plate 12, figs. 3, 3 a, 3 b, and 3 c.

Calyx rather small, sub-hemispherical, much broader than high: "dorsal cup" broadly and shallowly basin-shaped but deeply concave in the centre exteriorly: dome moderately elevated, rather distinctly pentalobate as viewed from above, the radial areas being slightly raised and the interradial as slightly depressed.

United basals small and forming a funnel-shaped concavity for the reception of the column.

First primary radials hexagonal, broader than high and broadest above the middle,—almost completely sunk in the basal concavity. Second primary radials quadrangular, much broader than high, rather smaller than the first and unlike them forming part of the lateral wall of the calyx. Third primary radials pentagonal, much broader than high and a little broader than the second. On the upper sloping sides of each third primary radial, there is a similarly shaped but much smaller pair of secondary radials, or radials of the second order. On its two upper sides each secondary radial to the right bears a pair of still smaller tertiary radials while each one on the left bears a single tertiary radial on its inner and upper side. These three tertiary radials are quadrangular or subquadrangular in outline, but their upper margins are obliquely bevelled off and deeply emarginate in the centre, in such a way as to form articulating bases, or portions of bases, of attachment for the arms. In every ray, therefore, there were originally three arms, two on the right side and one on the left, though the arms themselves do not happen to be preserved in the only specimen known to the writer.

Interradials two: the first rather larger than the first primary radials,

subovoid and truncated above, or obscurely nine-sided with the upper side much the broadest, resting against the sides of the second and third primary radials, and about equal in height to both of the latter. Second interradials much smaller than the first, about twice as broad as high, hexagonal (or possibly quadrangular) in outline. Above each of the second interradials there are three plates, the central one pentagonal and broader than high, with a minute and apparently hexagonal plate, which is higher than broad, on each side of it. These three plates are in each case placed between the arm bases of two contiguous rays.

Dome plates polygonal, varying in shape and size according to their relative position, some of those in the interradial areas being slightly larger than any of those in the radial. Anal aperture nearly but not quite central.

The sculpture of the outer surface of the plates of the dorsal cup consists of numerous raised ridges which radiate from a large and prominent tubercle in the centre of each plate. In the radial series the first, second and third primary radials are connected by a continuous ridge, which is broader and more prominent than any of the other radiating ridges in these plates, and this bifurcates, in the centre of each third primary radial, into two branches which diverge outwards and upwards through the secondary radials as far as the commencement of the arm bases below. In the interradial series, a ridge which is also broader and more prominent than the other radiating ridges, commences in the middle of the lower margin of each of the first primary interradials and extends upwards as far as the central tubercle. From this point it bifurcates widely outward and upward until the extremity of each of its branches reaches nearly as far as and almost coalesces with that of the corresponding branch in the nearest secondary radial.

The outer surface of the dome plates is very minutely granulose and ornamented, with but few exceptions, by minute, low, isolated and rounded tubercles, of which there are from one to six in each plate.

Maximum height of the only specimen known, about thirteen and a half millimetres; greatest breadth of the same, nineteen mm. and a half.

Near Thedford, Rev. J. M. Goodwillie, 1882: a single specimen.

This species appears to be most nearly related to *Dolatocrinus triadactylus* of Barris, from the Hamilton Formation of Alpena, Michigan.* Mr. Wachsmuth, who has kindly compared the type of *D. Canadensis* with authentic examples of *D. triadactylus*, in a letter to the

* Described and figured in the "Proceedings of the Davenport Academy of Natural Sciences" for 1883.

writer states that the latter "has the same general form and the same arm formula, but the basals are less deep and have around the column, at a level with the lower plane of the calyx, a prominent rim, and its ornamentation consists of numerous ridges arranged in triangles *without* tubercles, and these outer ones enclose two smaller triangles."

Columns of Dolatocrinus.

Plate 12, figs 4, 4a.

Portions of the column of one or more species of *Dolatocrinus* were collected by Mr. J. Pettit, in 1868, in the shales of the Hamilton Group of the township of Bosanquet.

These consist of groups of from two to ten or more joints, which are circular in outline and depressed at the sutures, which are sometimes minutely crenulated. In the centre of each of these groups, and superimposed upon two or three joints, there is a prominent but still rather narrow ring, which at equal distances apart bears three laminar expansions, which are flattened at a right angle to the joints on which they are placed, but in a direction parallel to the axis of the column. These laminar expansions are triangular in outline, in the only specimen in which their margin is unbroken, their bases are as broad as the cluster of joints of the column of which they form a part is high, and they project from it to a distance of as far as six millimetres. The central canal is very large and circular in outline.

Megistocrinus rugosus, Lyon and Casseday.

Megistocrinus rugosus, Lyon and Casseday. 1859. Am. Journ. of Sc. and Arts, Vol. xxviii, p. 243.

Near Thedford, Rev. J. M. Goodwillie, 1882: one specimen, which has been identified with this species by Mr. Charles Wachsmuth.

Megistocrinus, Sp. Indt.

Plate 13, figs. 2, 2a, 2b.

A specimen which Mr. Wachsmuth thinks is probably the central dome plate of a large *Megistocrinus*, was collected by the Rev. Hector

Currie, near Thedford, in 1882. At the same locality and date two other and similar specimens were obtained by Mr. Currie, but the original of figures of 2, 2a and 2b on Plate 13 is the only one that the writer has seen.

Its dimensions are: height, fourteen millimetres; maximum breadth, sixteen mm.; breadth at base, eight.

As viewed in one direction its outline is somewhat hatchet-shaped with a truncated base, while, as viewed in the opposite direction, its outline is wedge-shaped with the sides slightly convex. The centre of the base is rather deeply excavated and surrounded by a single row of concave and somewhat oblique facets. From one point of view the plate broadens rapidly from the base upwards about as far as the middle, and its upper margin is semicircular, while, from another (at nearly a right angle to the first) it narrows rapidly from below upwards and outwards into a thin and sharp edge.

To the naked eye the surface of the plate seems smooth, but when examined under a lens the base is seen to be minutely granulose and the sides and edge minutely corrugated in a longitudinal direction, though one of the flattened sides seems to be much less distinctly corrugated than the other.

Spine of dome of Crinoid. (Genus and species unknown.)

Plate 13, figs. 3, 3a.

The curious flask-shaped body represented on Plate 13, which is evidently a spine from the dome of some unknown crinoid, was also collected by the Rev. Hector Currie, at Thedford, in 1882, and presented by him to the Museum of the Survey.

Its apex is unfortunately broken off, but the part which is preserved is fourteen millimetres in length or height. The centre of the base is rather deeply excavated and surrounded by a single row or ring of eight oblique facets, some of which are faintly concave. Immediately above the base the spine is swollen into a rather narrow bulb-like expansion, whose maximum breadth is five millimetres, and above this it narrows gradually, the breadth at the broken summit being about two mm.

When viewed under a lens the facets which surround the central excavation of the base are seen to be minutely granulose, and the bulbous part of the spine is ornamented with irregular and longitudinally disposed, but somewhat twisted, thin and flat lamellar ridges, which are more or less broken up into low spines whose apices are directed

upwards. Above the bulb the surface is minutely and longitudinally corrugated, but near the apex it becomes nearly smooth.

A certain general resemblance which this spine bears to the spines on the dome of *Dorycrinus cornigerus* and *D. Gouldii*, especially in the structure of the base, suggests the idea that it may have formed part of the dome of a crinoid belonging to the family *Actinocrinidæ*.

Ollacrinus spinigerus, Hall.

Plate 13, figs. 4, 4a and 4b.

Tremotocrinus spinigerus, Hall. 1862. Fifteenth Rep. N. York St. Cab. Nat. Hist., p. 128.

Goniasteroidocrinus spinigerus, Meek & Worthen. 1866. Geol. Surv. Illinois, vol. 2, p. 222.

Goniasteroidocrinus spinigerus, S. A Miller. 1877. Cat. Am. Pal. Foss., p. 80.

Ollacrinus spinigerus, Wachsmuth & Springer. Rev. Palæocrinoidea, pt. 2, p. 219.

Near Thedford, collected by the Rev. Hector Currie in 1883: one perfect and exquisitely preserved specimen of the calyx, with the dome plates *in situ*, which he has kindly presented to the museum of the Survey.

"This beautiful specimen shews splendidly the interradial depressions described on page 218, part 2, of the Revision of the Palæocrinoidea. It also shows well the ambulacral or arm openings, and the extended arm-like water tubes, which are represented exceptionally in this species, from their base up, by two independent appendages; while in all other known species of this genus the tubes in this as in the other interradii, respectively, are suturally connected for some distance, being only divided at their outer ends." Wachsmuth.

Messrs. Meek and Worthen with some doubt and Mr. S. A. Miller positively state that this species should be placed in Lyon & Casseday's genus *Goniasteroidocrinus*, rather than in *Ollacrinus*, Cumberland. Zittel, however, in his "Handbuch der Paleontologie," as well as Wachsmuth & Springer, in the memoir cited above, take the opposite view of the case.

Ancyrocrinus bulbosus, Hall.

Plate 13, fig. 5.

Ancyrocrinus bulbosus, Hall. 1862. Fifteenth Rep. N. York State Cab. Nat. Hist., p. 118, pl. 1, figs. 25 and 26.

A perfect but worn specimen of the root and part of the column of a crinoid which is clearly referable to the genus *Ancyrocrinus* and appa-

rently to the species named above, has long been in the Museum of the Survey, labelled as having been collected in the township of Bosanquet.

It is thirty-three millimetres in height from base to summit, thirteen mm. in breadth, as measured from the apices of two lateral processes, and four across the summit. The base is shortly and broadly conical or bluntly pointed as viewed laterally, and distinctly quadrangular, with the sides faintly concave, as viewed endways. In the centre of the base there is a minute circular depression or pit, around which at a distance of about two mm. there is a circular impressed line. The four lateral ascending spinose processes upon which the genus was based, are represented by four low conical protuberances, which are slightly flattened laterally and truncated at their apices in a direction nearly parallel to the main axis of the column. At the summit of each of these truncated protuberances there is a longitudinally oval depression, in the centre of which there seems to be a minute and narrowly linear perforation. Immediately above these processes the ascending column is eight mm. broad and about seven-eighths of an inch long, and from this point it narrows gradually upwards to the summit, which, as already stated, is four mm. in diameter. Throughout its entire length the column appears to be circular, but the specimen is very much worn, and its central canal as seen from above, is distinctly four lobed.

BLASTOIDEA.

PENTREMITIDEA FILOSA. (N. Sp.?)

Plate 14, figs. 1, 1 a, 1 b.

Perhaps the same as *Pentremites Whitei*, Hall, a description of which may be found on page 150 of the Fifteenth Rep. N. York St. Cab. Nat. Hist.

Of medium size, height about one-fourth greater than the maximum breadth, which latter ranges from a little below the middle of the specimen to the base of the radial sinuses: lateral outline subovate but conical at the base and truncated at the summit: transverse section, in the thickest part, pentagonal in outline with nearly straight sides, which latter, however, are very faintly depressed in the centre, and as faintly convex laterally.

Ab-oral side inversely and doubly pyramidal, three-sided at and near the base of the body, but gradually becoming five-sided and pentalobate above; its lower portion rather narrowly conical as viewed sideways, its upper moiety broadening more rapidly upward and

outward. Oral side not quite three times as high as the ab-oral, of nearly equal thickness for about one-third of its height, then narrowing gradually and convexly upwards from about the middle of the calyx to the summit: peristome narrow and concavely excavated.

Basals reaching rather more than half-way to the bases of the radial sinuses, and together forming a rather shallow cup, which is three-sided below, five-sided above and angularly five-lobed at its upper margin, and whose breadth above is nearly twice its height. Basal plates three, two pentagonal and one quadrangular.

The "bodies" or undivided portions of the radials broaden outwards more rapidly than the basals do, and from this circumstance it follows that an obtuse angle is formed at the junction of the basals with the radials, especially in a line with the ambulacra.

Radials occupying about eleven-thirteenths of the entire height of the calyx, lanceolate in outline, with a truncated base, and rather more than twice as high as broad. The apices of each of the two adjacent radials are united so as to form an acute point, which projects a little above the oro-anal surface. Radial sinuses very deeply cleft, and occupying about nine-tenths of the total height of each radial. The sides bordering the sinuses are elevated and formed into sharp edges, which stand out at right angles above the ambulacra in such a way as to form prominent radial lips, which are somewhat effuse and most raised around the bases of the ambulacra.

Ambulacra linear, rather narrow, increasing in breadth regularly but very slowly upwards, so that they are nearly twice as broad at their summits as at their bases, which latter are narrowly rounded. The food groove in the centre of each ambulacrum deepens towards the summit, and is almost obsolete at and near the base, while the outer sides of the ambulacra are depressed in such a way as to form a deep groove on each side next to the radial lips. The whole surface of each ambulacrum, although convex towards the centre, is not prominent, but on the contrary sunk a little below the general level of that of the radials.

The interradial on the anal side is comparatively large, and plainly visible in a side view, especially when examined with a lens: its outline is rhomboidal, but its apex is narrowly and rather deeply emarginate. The other interradials are extremely small, and not visible at all in a side view, as they are sunk in the oro-anal excavation, and form a narrow rim around the spiracles.

The posterior spiracle is confluent with the anal aperture. The other spiracles (four in number) are rather large, between crescentic and reniform in outline, rounded on their inner margins, and placed close to the central opening. They are situated within the inter-

radials, and occupy nearly their whole area, leaving only a very narrow rim exposed. They are equal in size, similar in shape, and partly divided in the centre by an incomplete septum. Central opening pentagonal or obscurely five-lobed, but shallowly and concavely emarginate on the anal side.

Summit plates, hydrospires, pinnules and column unknown.

The surface ornamentation consists of exceedingly fine concentric lines, which follow the general contour of each plate. These lines are always too minute to be seen without the aid of a lens, but are much coarser and more sharply defined in some specimens than in others.

Dimensions of one of the most perfect specimens collected: Height, thirteen millimetres; maximum breadth, nine and a half mm.; height of radial, eleven; breadth of radial, five; depth of sinus of radial, nine and a half.

Near Thedford, Rev. Hector Currie, 1876-82: nine specimens, most of which are perfect, undistorted and remarkably well-preserved.

A provisional name has been given to the specimens described above, because it is almost impossible to decide whether they are or are not identical with the *Pentremites Whitei* of Hall, owing to the very peculiar state of preservation of the latter.

Professor Hall's types of *P. Whitei* (two of which he has kindly lent to the present writer, for comparison) are all stated to be "crushed" so that "their true form cannot be known." One of the specimens forwarded by Professor Hall has the pinnules preserved on all sides, so that the whole of the interradials and summit characters, as well as the upper halves of the radials, are completely hidden from view. In the other, most of the pinnules are preserved, especially on one side. This latter is the only specimen which shews any of the interradials, and in it the writer has failed to find more than one, which appears to be the interradial on the anal side. Moreover, the characters of this supposed solitary interradial on the anal side in one, and those of the lower and exposed half of the body in both of the typical examples of *P. Whitei* that the writer has been able to examine, appear to be essentially similar in all respects to those of the corresponding parts in the Canadian specimens.

But, on the other hand, Professor Hall distinctly states that the interradials of *P. Whitei* are "comparatively large and lozenge shaped," and if this is true of any of its interradials other than the one on the anal side, then *P. Whitei* must be both generically and specifically distinct from the specimens collected by the Rev. H. Currie. Again, in the original description of *P. Whitei*, the pseudambulacral fields (ambulacra) are said to "extend a little more than half the length of the body," and the pseudambulacral areas (or radial sinuses) to occupy

about two-thirds the length of the radials, from which it would seem that the radials in Professor Hall's species are not nearly so deeply cleft as they are in the Canadian specimens.

By whatever name they may eventually be known, the Thedford specimens now under consideration differ from the genus *Pentremites*, as recently restricted by Etheridge & Carpenter in their "Catalogue of the Blastoidea in the British Museum," in the fact that only the interradial on the anal side is visible in a side view. In this particular, as well as in the fact that the posterior spiracles are confluent with the anus, they resemble *Troostocrinus* as defined in the monograph just cited, but their base is *not* long and tapering, and upon the whole they seem to agree best with the characters of *Pentremitidea* as expressed in the same volume.

NUCLEOCRINUS ELEGANS, Conrad.

Plate 14, fig. 2. (Summit plates only.)

Nucleocrinus elegans, Conrad. 1842. Journ. Ac. Nat. Sc. Phil., vol. VIII., p. 289, pl. 15, fig. 17.
" " Hall (as of Conrad). 1862. Fifteenth Rep. N. York St. Cab. Nat. Hist., p. 147, pl. 1, figs. 14 and 15.
Nucleocrinus lucina? Hall. Montgomery. 1881. Can. Nat. and Geol. (N. S.) vol. X., p. 80, with three woodcuts.
Nucleocrinus Canadensis, Montgomery. Ib., p. 83.
Elxacrinus lucina, Hall, var. *Canadensis*, Mongomery. Etheridge and Carpenter. 1886. Cat. Blast. Brit. Mus., p. 36, pl. 18, fig. 19.

Near Thedford, Rev. Hector Currie, 1877-82: five specimens.

These differ slightly from typical specimens from the State of New York, in being not quite so globose in their contour. Judging from diagrams forwarded by Mr. Wachsmuth there would appear to be some minor differences in the shape and number of the summit plates in examples from the two localities, but as the sutures between these plates are nearly always difficult to define, these supposed differences may be more apparent than real. In each of the Canadian specimens the summit plates are preserved, and these, as represented in the figure on plate 14, appear to be seven in number, viz., one rather large and somewhat excentric central or sub-central plate, which is partly surrounded by four large and two small proximals. In the New York specimens, the lower portion of the central or sub-central plate is divided transversely by a suture in such a manner as to separate from it an eighth and distinct anal plate, which is pentagonal in outline, and of which suture or plate no trace has yet been detected in the Canadian

specimens. In other species of the genus, however, Mr. Wachsmuth states that some of the sutures of the summit plates are as frequently anchylosed as not, and it may be that this is the case with the suture in question in the few Canadian examples of *N. elegans* that have yet been collected. Further, the outer margin in each of the four large proximals in the New York specimens of *N. elegans* is represented by Professor Hall, as well as by Mr. Wachsmuth, as convex in the middle and concave only at the sides, whereas the outer margin in each of the larger proximals of the Canadian specimens is uniformly though rather shallowly concave. Still, these differences, whether real or apparent, can scarcely be regarded as of specific importance, and Professor R. P. Whitfield, who has kindly compared some of the specimens collected by the Rev. H. Currie with Conrad's type of *N. elegans* now in the American Museum of Natural History in New York city, entertains no doubt as to their identity with that species.

Some of the specimens collected by Mr. Currie are more elongated than others, and it was at one time supposed that the most elongated forms might possibly be referable to *N. lucina*, Hall, but in that species, as shown in an authentic specimen forwarded by Professor Whitfield and as stated by Prof. Hall, the sides are deeply and angularly concave whereas those of *N. elegans* are nearly flat.

Granatocrinus Leda, Hall (Sp.)

Plate 14, figs. 3, 3 a, 3 b, 3 c, 3d and 3f.

Pentremites leda, Hall. 1862. Fifteenth Rep. N. York St. Cab. Nat. Hist., p. 149, pl. 1, fig. 11.

Pentremitidea leda, Hall? sp., Etheridge and Carpenter. 1886. Cat. Blast. in Brit. Mus., pp. 12, 17, 104, pl. 5, figs. 12, 13 and 14.

Near Thedford, Rev. Hector Currie, 1878: three perfect and beautiful specimens, two of which are entirely free from distortion.

All three have been directly compared with two of the types of *Pentremites Leda* kindly forwarded by Professor Hall, which latter, however, are crushed nearly flat laterally and do not shew any of the spiracles. The only appreciable difference that the writer has been able to detect between the Canadian and the New York State specimens, is that in the former the whole surface of each of the interradials, all of which are visible in a side view, is distinctly but irregularly corrugated when examined with a lens, while in the latter most of the surface is covered by fine lines which follow the contour of each plate, and by only a few and less distinct corrugations which are often

altogether absent. This difference, even if constant, which it does not appear to be, is probably not even of varietal importance.

The species is placed in the genus *Granatocrinus*, rather than in *Pentremitidea* as suggested by Etheridge and Carpenter, mainly on the authority of Mr. Wachsmuth, who informs the writer that it "is intermediate between *Granatocrinus* and *Pentremitidea*, but nearer the former. It has five circular spiracles, that of the posterior side confluent with the anal aperture; all five deltoid pieces are plainly seen in a side view, and the ambulacra extend to almost the full length of the calyx; the basals slightly projecting."

Professor Whitfield thinks that the *Pentremites Maia* of Hall is only a variety of the present species.

Codaster Canadensis, Billings.

Plate 14, Figs. 4 and 4 a.

Codaster Canadensis, Billings, 1869. Am. Journ. Sc. and Arts, Series 2, vol. XLVIII., p. 79.
" " " 1870. Ann. Mag. Nat. Hist., Series 4, vol. V., pp. 262, 263.
" " " 1874. Geol. Surv. Can., Pal. Foss., vol. II., pp. 100, 101.
Codaster Hindei, Etheridge and Carpenter. 1882. Ann. and Mag. Nat. Hist., Series 5, vol. IX., p. 235.

The types of *C. Canadensis* appear to have been collected by Mr. Johnson Pottit in 1868 in the township of Bosanquet, and from the same township, three-quarters of a mile from Thedford, the Rev. Hector Currie has since obtained twelve other specimens, two of unusually large size, in 1882-84, three of which he has kindly forwarded to the writer for examination and study.

Although the name suggested by Mr. Billings is here provisionally retained, partly because it is the oldest and partly because it was published in one of the Survey reports, it is quite possible that it may have to be abandoned in favour of the later name given to it by Messrs. Etheridge and Carpenter, on the ground that the former was not accompanied by a recognizable definition of its specific characters.

On page 92 of a paper entitled "On the Devonian Fossils of Canada West," published in the "Canadian Journal" (of Toronto) for May, 1860, in reference to the genus *Cyrtodonta*, Mr. Billings himself writes: "I have been the first to describe correctly and illustrate this genus under a name that is in no respect inappropriate, and I have a right to retain that name against those which are objectionable *or not founded on*

an intelligible generic description." The clause italicized (the italics are the present writer's) if applicable to a genus ought to be equally so to a species, and if this be the case, the few remarks published about some of the minute structural peculiarities of *C. Canadénis* can scarcely be regarded as an intelligible specific description.

But, in spite of Mr. Billings' contention, the majority of American palæontologists seem to have rejected his genus *Cyrtodonta* and to have adopted the earlier name *Cypricardites*, Conrad, notwithstanding the extremely vague and unsatisfactory definition of the characters of the latter, and every naturalist knows that many of the species proposed by such writers as Linnæus and Lamarck in Europe, and Rafinesque and Conrad in America, are universally accepted to-day although no one pretends that they could be identified from the original description. It is also only proper to add that although the shales of the Hamilton Group of Ontario have been diligently examined by many collectors for the last twenty years, it has yet to be shewn that they have yielded more than one species of *Codaster*, and further, that the types of *C. Canadensis* have for many years been preserved in the Museum of the Survey which is and always has been freely accessible to all.

Eleutherocrinus Cassedayi, Shumard and Yandell.

Plate 14, figs. 5, 5a and 5b.

Eleutherocrinus Cassedayi, Shumard and Yandell. 1856. Proc. Ac. Nat. Sc. Phil., vol. VIII., p. 73, plate 2.

Near Thedford, Rev. J. M. Goodwillie, 1882: two good and exceptionally well preserved specimens, one of which (the original of the figures on Plate 14) he has generously presented to the Museum of the Survey.

In reference to this latter, which he has minutely examined, Mr. Wachsmuth writes: "Your specimen is most beautifully preserved, especially the ambulacra which are excellently shown, the food grooves can be followed up to the sockets of the pinnules. I think the anus has never been described in this genus, it having been taken for a mere break in the plate. Your specimen shows that it is located at the right upper edge of the azygos radial, which is somewhat excavated and constitutes the outer wall of the triangular aperture."

MOLLUSCOIDEA.

BRACHIOPODA.

LINGULA LIGEA, Hall.

Lingula ligea, Hall.	1860.	Thirteenth Rep. N. York St. Cab. Nat. Hist., p. 76.
" " "	1867.	Pal. St. N. York, vol. IV., part 1, p. 7, pl. 1, figs. 2a, and 2b.

Near Thedford, Rev. Hector Currie, 1882: one specimen.

LINGULA THEDFORDENSIS. (N. Sp.)

Plate 15, fig. 1.

Shell strongly compressed, thickest in the umbonal region: lateral outline rather broadly subelliptical; length about one-third greater than the maximum breadth. Lateral margins nearly straight and but slightly convex in their central portions, but narrowing gently in a convex curve at and towards each extremity; anterior margin regularly rounded; cardinal slopes slightly convex, diverging forward and outward from the beaks at an angle of about one hundred and twelve degrees, and not at all angular or even subangular at their junction with the lateral margins; beaks small and not very prominent.

Surface polished and glossy, but marked with fine, concentric, raised lines of growth, which are crossed by numerous, closely arranged and almost equally minute radiating raised lines, which extend from the beaks to the anterior margin and are most prominent on and near the latter.

Dimensions of the specimen figured: maximum length, fifteen millimetres and a half; greatest breadth, eleven mm.; maximum thickness, two and a half. In another specimen the dimensions are: length, twenty-one mm.; breadth (approximately) fourteen and a half; thickness, three.

Near Thedford, Rev. Hector Currie, 1882: two specimens, the smaller and more perfect of which is figured. In the other the beak is somewhat more prominent and pointed.

This species seems to be somewhat nearly related to the *Lingula maida* of Hall, *but differs therefrom in its broader and more regularly elliptical outline, as viewed laterally, as well as in the greater convexity of its cardinal slopes, which diverge at a much more obtuse angle. It

*Pal. State New York, vol. IV., pt. I, p. 9, pl. 2, fig. 13.

approaches also in shape to the oval variety of *L. punctata* represented by figure 6 f of plate 1 of the first part of the fourth volume of the "Palæontology of the State of New York," but is broader in proportion to its length and its surface is not punctate.

PRODUCTELLA (STROPHALOSIA?) TRUNCATA, Hall.

Plate 16, figs. 1 and 2.

Productus truncatus, Hall. 1857. Tenth Rep. N. York St. Cab. Nat. Hist., p. 171.
Strophomena pustulosa, Hall. 1843. Geol. Rep. 4th Distr. N. York, p. 189, fig. 4, "but not *Productus pustulosus*, Phillips.
Productella truncata, Hall. 1867. Pal. State N. York, vol. IV., pt. 1, p. 160, pl. 23, figs. 12-24.
Productus (*Productella*) *truncatus*, (Hall) Walcott. 1884. Pal. Eureka Dist., p. 131, pl. 14, fig. 2.

Bartlett's Mills, near Arkona, and near Thedford in the township of Bosanquet, Revs. Hector Currie and J. M. Goodwillie, 1882: a few specimens which are referred to this species solely on the authority of Prof. R. P. Whitfield.

As compared with Professor Hall's description and figures of *P. truncata*, however, these specimens seem to differ materially in their far less convex ventral valves, (which resemble *Leptæna* or *Chonetes* in this respect rather than *Productus* or *Productella*, whose umbones are not at all prominent, and neither broadly nor distinctly truncated. It is difficult to see how the specimens from Arkona and Thedford are to be distinguished from some forms of the *Strophalosia productoides* of Murchison, especially from such as are represented on plate 19, figures 15, 16 and 19 of Dr. Davidson's monograph of the British Devonian Brachiopoda.

In 1882 several good examples of *S. productoides* were collected by Dr. R. Bell from rocks apparently of about the age of the Hamilton Formation on the Athabasca River in the first ten miles below the Clearwater, the most perfect of which is represented, for comparison, on Plate XV. This beautiful fossil was compared by Dr. Davidson with authentic English and European examples of *S. productoides* and pronounced somewhat confidently to be identical therewith (as the writer had previously supposed was the case) in the spring of 1883. In the specimens from Arkona and Thedford the umbones are not so prominent and the so-called pseudo-deltidium not so distinctly marked as in those from the Athabasca, but these apparent differences seem largely attributable to the much greater size of the latter and Davidson's figures show that specimens from various localities in England vary quite as much in both of these characters.

It is true that in two of the specimens from Arkona, though apparently not in all, the beak of the ventral valve is very faintly truncated, but DeVerneuil represents the beak of the corresponding valve of the shell which he calls *Productus membranaceus* and which Davidson places in the synonymy of *S. productoides*, as distinctly truncated. Prof. Hall states that "on the authority of M. de Verneuil, the *Strophomena pustulosa* has been referred to the *Productus* (*Strophalosia*) *Murchisonianus* of De Koniek," or, in other words, that De Verneuil thinks *P. truncata*, Hall, is synonymous with the shell which Davidson calls *S. productoides*, and to the writer it seems that de Verneuil's figures of *Productus membranaceus* would do very well for *P. truncata*. On the other hand, Mr. C. D. Walcott considers that the two shells, i. e., *P. truncata* and *S. productoides*, "present but very few characters in common."

CHONETES CARINATA, Conrad.

Strophomena carinata, Conrad. 1842. Journ. Ac. Nat. Sc. Phil., vol. VIII., p. 257.
" *syrtalis*, Conrad. " Ib., p. 254, pl. 14. fig. 1.
Chonetes coronata, Hall. 1867. Pal. State N. York, vol. IV., pt. 1, p. 133, pl. 21, figs. 9–12, incl.
Chonetes carinata, S. A. Miller (as of Conrad). 1877. Am. Pal. Foss., p. 108.
Chonetes coronata, Whitfield. 1882. Geol. Wiscons., vol. IV., p. 327, pl. 25, fig. 16.

Bartlett's Mills, near Arkona, Rev. J. M. Goodwillie, 1882: one perfect and well preserved specimen showing the exterior of both valves.

Professors James Hall and R. P. Whitfield both think that the specific name of this shell should be written *coronata* rather than *carinata*. The former doubtless would be the more appropriate of the two.

STREPTORHYNCHUS PERVERSUM, Hall.

Orthis perversa, Hall. 1857. Tenth Rep. N. York St. Cab. Nat. Hist., p. 97.
Orthisina alternata, Hall. 1860. Thirteenth Rep. N. Y. St. Cab. Nat. Hist.
Streptorhynchus perversa. Hall. 1867. Pal. State N. York, vol. IV., pt. 1, p. 72, pl. 9, figs. 13–17 and fig. 26.

Lot 24, Concession 3, Township of Bosanquet, J. Richardson, 1859: one small but perfect specimen which was identified with this species or variety many years ago by Mr. E. Billings.

Professor Hall regards *S. perversum* as only a varietal form of *S. Chemungense*, Conrad.

STROPHODONTA PLICATA, Hall.

Strophodonta plicata, Hall. 1860. Thirteenth Rep. N. York St. Cab. Nat. Hist., p. 90.
" " " 1867. Pal. State N. York, vol. IV., pt. 1, p. 144, pl. 63, figs. 30-32.

Near Thedford, Rev. J. M. Goodwillie, 1882: one rather small but very characteristic specimen.

SPIRIFERA SUBDECUSSATA. (N. Sp.)

Pl. 15, figs. 3 and 3 a.

Shell somewhat compressed, the maximum thickness through the closed valves being a little less than one-half the greatest length of the ventral valve: lateral outline transversely rhomboidal or obscurely pentagonal, but with the front margin nearly semicircular: breadth a little greater than the length: greatest breadth at the hinge line, whose extremities are angular.

Ventral valve considerably elevated at the umbo: cardinal margins diverging at an angle of about 132°: mesial sinus broad and shallow, especially at and near the anterior margin: area large, ascending and obliquely flattened, rather more than one-fourth as high as broad and transversely striated, pseudo-deltidium also large, its breadth at the base nearly equalling its height.

Dorsal valve very moderately convex, with a broad, low, rounded mesial fold, which is most strongly defined on and at the anterior margin.

Surface ornamented by about fifteen low, rounded ribs on each side of the mesial fold and sinus. The central portion of each valve is quite devoid of ribs, but the whole surface is faintly and concentrically striated, and the ribs on the lateral areas are marked with exceedingly minute and closely arranged radiating lines.

Dimensions of the only specimen collected: maximum length, thirty-eight millimetres; greatest breadth, forty-five mm.; approximate thickness through the closed valves, eighteen; height of hinge area in the ventral valve, twelve; breadth of pseudo-deltidium of the same, at its base, eleven.

Banks of the Thames River, Moraviantown, Rev. J. M. Goodwillie, 1882: one imperfect and not very well preserved specimen.

The shape and coarser markings of this shell are extremely like those of the *S. aspera* of Hall,* from "calcareous shales of the age of

* Geol. Iowa, vol. I., part 2, (1858) p. 508, pl. 4, figs. 7 a, b, c, d.

the Hamilton Group" in Iowa and Illinois. In Professor Hall's species, however, the entire surface of the valves is represented as granulose, whereas in the *S. subdecussata*, in addition to the concentric lines of growth which are common to all brachiopodous shells, the ribs on the lateral areas are marked by exceedingly fine and crowded radiating lines, which are scarcely visible to the naked eye, and no traces of granulations can be detected, or have yet been detected, on any portion of its surface.

NUCLEOSPIRA CONCINNA, Hall.

Atrypa concinna, Hall. 1843. Geol. Rep. Fourth Distr. N. York, p. 200, fig. 3.
Nucleospira concinna, Hall. 1859. Twelfth Rep. N. York St. Cab. Nat. Hist., pp. 25 and 26.
" " " 1857. Pal. State N. York, vol. IV., pt. 1, 279, pl. 45, figs. 33-57.

Near Thedford, Rev. J. M. Goodwillie, 1882: nine good specimens.

MERISTELLA UNISULCATA, Conrad.

Atrypa unisulcata, Conrad. 1841. Ann. Rep. Pal. N. York, p. 56.
Rhynchonella unisulcata, Hall. 1857. Tenth Rep. N. York St. Cab. Nat. Hist., p. 125.
Athyris (?) unisulcata, Billings (as of Conrad). 1860. Canadian Journal, pl. 32, figs. 39–42.
Meristella unisulcata, Hall. 1867. Pal. State N. York, vol. IV., pt. 1, p. 309, pl. 50, figs. 18, 35.

Township of Bosanquet, Mr. J. Pettit, 1868: two ventral valves; and near Thedford, Rev. J. M. Goodwillie, 1882: one specimen with both valves preserved. The species has previously been recorded from the Corniferous Limestone of Ontario, but the specimens indicated above are the only ones that the writer has seen from the Hamilton Group of that province.

MERISTELLA HASKINSI, Hall.

Meristella Haskinsi, Hall. 1860. Thirteenth Rep. N. York St. Cab. Nat. Hist., p. 84.
" " " 1867. Pal. State N. York, vol. VI., pt. 1, p. 306, pl. 49, figs. 23, 35.

Near Thedford, Rev. J. M. Goodwillie, 1882: one specimen which is nearly perfect, but which has most of the outer and part of the inner layer of the test exfoliated.

RETIZA (TREMATOSPIRA) NOBILIS, Hall.

Rhynchospira nobilis, Hall. 1860. Thirteenth Rep. N. York St. Cab. Nat. Hist. p. 83.
Trematospira? nobilis, Hall. 1867. Pal. State N. York, vol. IV., pt. 1, p. 412, pl. 63, figs. 33-36.

Near Thedford, J. Richardson, 1859, and Rev. H. Currie, 1882: apparently not uncommon. The specimens from this locality, though nearly always much distorted, are often perfect and well preserved.

In his "Handbuch der Palæontologie," (vol. I., p .686) Zittel admits both *Rhynchospira* and *Trematospira* of Hall as sub-genera of *Retzia*, King, though Billings, in 1870, maintained that they are merely synonyms of that genus.

MOLLUSCA.

LAMELLIBRANCHIATA.

PTERINEA FLABELLUM, Conrad.

Avicula flabella, Conrad. 1842. Journ. Ac. Nat. Sc. Phil., vol. VIII., p. 238, pl. 12, fig. 8.
Pterinea flabellum, Conrad. S. A. Miller. 1877. Am. Pal. Foss., p. 201.
" " " Hall. 1883. Pal. State N. York, vol. V., pt. 1. (advance copies) pl. 14 and pl. 15, fig. 1.

Township of Bosanquet, Mr. J. Pettit, 1868: five well preserved specimens.

GRAMMYSIA ARCUATA? Conrad, Var.

Grammysia (*Leptodomus?*) *arcuata*, Hall (as of Conrad). 1883. Pal. State N. York, vol. V., pt. 1 (advance copies), p. 15, pl. 61, figs. 1-9.

Township of Bosanquet, Mr. J. Pettit, 1868: an imperfect cast of the interior of the right valve of a shell which may represent a local variety of this species. An equally imperfect cast of a smaller but in other respects similar specimen, was collected by the Rev. Hector Currie near Thedford, in 1882.

GASTEROPODA.

TURBO SHUMARDI, De Verneuil.

Plate 16, fig. 3.

Turbo Shumardi, De Verneuil. 1846. Bull. de la Soc. Géol. de France.
" " " " Hall. 1879. Pal. State N. York, vol. V., pt. 2, p. 135, pl. 29, figs. 1-4.

Township of Bosanquet, Mr. J. Pettit, 1868: one large and character-

istic cast and a smaller one, both of which show, more or less distinctly, either the blunt angulation of the periphery of the body whorl or the distant nodes on the shoulder above it.

The reference of this shell to the Linnæan genus *Turbo* does not seem to the writer to be entirely satisfactory, and it is not easy to define in what particular it differs from *Platyostoma*.

Platyceras carinatum, Hall.

Platyceras carinatum, Hall. 1862. Fifteenth Rep. N. York St. Cab. Nat. Hist., p. 33.
" " " 1876. Illustr. Dev. Foss., pl. 2, figs. 12–29 and (1879) Pal. State N. York, vol. V., pt. 2, p. 5, pl. 2, figs. 12–29.

Township of Bosanquet, Mr. J. Pettit, 1885: five specimens.

Platyceras quinquesinuatum, Ulrich.

Plate 15, figs. 5 and 6, and plate 16, fig. 5.

Platyceras quinquesinuatum, Ulrich. 1886. Contr. to Americ. Palæont., Cincinnati, vol. I., p. 29, pl. 3, figs. 4, 4a, and 4b.

Near Thedford, Rev. J. M. Goodwillie, 1882: three fine specimens.

This species, which is very nearly related to some forms of the *P. symmetricum* of Hall from the Hamilton Formation of the State of New York, was described from specimens collected from the "Middle Devonian" of the Falls of the Ohio.

Platyceras (Orthonychia) conicum, Hall.

Plate 16, fig. 4.

Platyceras conicum, Hall. 1862. Fifteenth Rep. N. York St. Cab. Nat. Hist., p. 31.
Platyceras (*Orthonychia*) *conicum*, Hall. 1876. Illustr. Dev. Foss., pl. 1, figs. 13–23, and pl. 2, figs. 30 and 31. Also, Pal. State N. York, vol. V., pt. 2, (1879) p. 3, pl. 1, figs. 13–23, and pl. 2, figs. 30 and 31.

One fine specimen of this species was collected in the township of Bosanquet by Mr. J. Pettit in 1868, another near Thedford in the same township by the Rev. Hector Currie, and a third, also near Thedford, by the Rev. J. M. Goodwillie, in 1882, all of which are now in the Museum of the Survey. The species was first recorded as occurring near Widder by Professor Hall in 1876.

PLATYOSTOMA LINEATUM, Conrad.

Platyostoma lineatum, Conrad. 1842. Journ. Ac. Nat. Sc. Phil., vol. VIII., pt. 2, p. 276, pl. 17, fig. 7.
" " Hall. 1876. Illustr. Dev. Foss., pl. 9, figs. 1-21, and Pal. State N. York, (1879) vol. V., pt. 2, p. 21, pl. 10, figs. 1-21.

Township of Bosanquet, Mr. J. Pettit, 1868, and near Thedford, Rev. J. M. Goodwillie, 1882: several well preserved and nearly perfect specimens. The species is not uncommon in the Corniferous Limestone of Ontario.

In his Catalogue of "American Palæozoic Fossils," Mr. S. A. Miller has changed the name of Conrad's genus *Platyostoma* to *Platystoma*, but Zittel, in his "Handbuch der Palæontologie," retains both names on the ground that the latter had previously been proposed by Hornes for a totally distinct genus or rather subgenus of gasteropoda, from the Triassic rocks of Europe.

PLATYOSTOMA PLICATUM. (N. Sp.)

Plate 16, fig. 6.

Shell turbinate, about as broad as high, whorls certainly three (and perhaps four when perfect, the nuclear portion being broken off in the only specimen collected) increasing rapidly in size, the later ones ventricose, flattened above and step-shaped but with a rounded shoulder; suture distinct and nearly rectangular; spire moderately elevated but much shorter than the height of the aperture; body whorl strongly inflated, its base apparently imperforate or nearly so; aperture subcircular.

The only part of the test that happens to be preserved is a rather large piece of the upper part of the body whorl immediately at and behind the outer lip. In this region there are indications of faint spiral grooves with low rounded spiral ridges between them, and these are crossed by prominent, distant and very distinct transverse plications.

Maximum height of the only specimen collected, allowing for the nucleus, two inches and a quarter; maximum breadth, also two inches and a quarter; height of spire, near the aperture, not quite one inch.

Township of Bosanquet, Mr. J. Pettit, 1868: a nearly perfect cast of the interior of the shell, with a portion of the test preserved near the aperture.

In general shape this shell is extremely similar to some specimens of the *Platyostoma affine* of Billings (Geol. Surv. Can., Pal. Foss., vol.

II., p. 60, pl. 5, fig. 2), and more especially to the original of the woodcut (fig. 30) on page 60 of that volume. *P. affine*, however, is stated to have been collected from rocks which are "nearly of the age of the Oriskany Sandstone," and its sculpture is said to consist of "fine transverse strie.....with a few obscure undulations."

CRUSTACEA.

TRILOBITÆ.

DALMANITES HELENA, Hall.

Dalmania Helena, Hall. 1862. Fifteenth Rep. N. York St. Cab. Nat. Hist., p. 89.
Dalmanites Helena, Hall. 1876. Illustr. Dev. Foss., pl. 13, figs. 11 and 12.

Township of Plympton, A. Murray, 1848: two fine specimens of the pygidium. It is somewhat doubtful, however, from what formation and locality these specimens were really collected. The printed label on the tablet upon which they were placed by Mr. E. Billings many years ago, states that they were collected by Mr. Murray from the Hamilton Formation of the Township of Plympton, but to one of them is affixed a label in Mr. Billings hand writing, marked "Nanticoke, Walpole," so that one of them, if not both, may have come from the Corniferous Limestone. Professor Hall's specimens of *D. Helena* are said to have been obtained from the Upper Helderberg Group (the equivalent of the Corniferous Limestone) of the State of Ohio and New York.

FISHES.

MACROPETALICHTHYS SULLIVANTI, Newberry.

Agassichthys Sullivanti, Newberry. 1857. Bull. Nat. Inst., p. 3.
Macropetalichthys Sullivanti, Newberry. 1862. Am. Journ. Sc. and Arts, Series 2, vol. XXIV., p. 75.
" " " 1873. Rep. Geol. Surv. Ohio, Vol. I., pt. 2, p. 294, pl. 24, and pl. 25, figs. 1 and 1a.

Numerous fragments of the cranial plates of this species, ornamented on their exterior by the characteristic stellate tubercles, were collected by the Rev. Hector Currie near Thedford in 1882, and by the Rev. J. M. Goodwillie in the same year on the banks of the Sable River near Bartlett's Mills. Similar fragments are not infrequent in the Corniferous Limestone of Western Ontario, and a few were found by Dr. R. Bell in 1875, on the Mattagami, a branch of the Moose River, in the Hudson's Bay Territory, in rocks apparently of similar age.

LIST OF FOSSILS FROM THE HAMILTON FORMATION OF ONTARIO.

In this list the crinoids are arranged in conformity with Wachsmuth and Springer's "Revision of the Palæocrinoidea," and the blastoids with Etheridge and Carpenter's "Catalogue of the Blastoidea in the Geological Department of the British Museum," but in all the other groups the classification adopted by Zittel in his "Handbuch der Palæontologie" (Munich and Leipsig, 1876-85) has been followed.

CŒLENTERATA.

SPONGIÆ.

Receptaculites Neptuni, Defrance. . . . "Near Widder, Ont.," Hinde.

ANTHOZOA.

ALCYONARIA.

Aulopora Canadensis, Nicholson.
" cornuta, Billings.*
" filiformis, Billings.
Syringopora intermedia, Nicholson.
" nobilis, Billings. . . "Hamilton Group of Canada," Rominger.

ZOANTHARIA.

(A. *Tetracoralla*, Hæckel : = *Rugosa*, Edwards and Haime.)

Microcyclus discus, Meek and Worthen.
Zaphrentis cornicula, Lesueur. . . . . "Arkona," Nicholson.
Heterophrentis prolifica, Billings.
Cyathophyllum Zenkeri, Billings. . . . . "Arkona," Nicholson.
Heliophyllum exiguum, Billings.†
" Halli, Edwards and Haime.
" tenuiseptatum, Billings.

* Dr. Rominger thinks this the young of *Rominger ia umbellifera*, which is the *Aulopora umbellifera* of Billings.

† Dr. Rominger places this species in the genus *Zaphrentis*, but in the types the septa are certainly marked on their flat sides with numerous "obscure arched striæ" as Billings asserts.

Crepidophyllum Archiaci. (=Diphyphyllum Archiaci, Billings.)
" subcæspitosum. (=Diphyphyllum subcæpitosum, Nichl.)
Eridophyllum strictum, Edwards and Haime.
Acervularia profunda, Hall.
Cystiphyllum Americanum, Edwards and Haime.
" conifolle, Hall. . . . "Township of Bosanquet," Hall.
" superbum, Nicholson.
" vesiculosum, Goldfuss.

(B. *Hexacoralla*, Hæckel:=*Tabulata*, Edwards and Haime.)

Favosites Canadensis. (=Fistulipora Canadensis, Billings.)
" clausa, Rominger. . . . . "Arkona," Nicholson.
" Gothlandica, Lamarck, and var. Billingsi, Rominger.
" hemisphærica, Yandell and Shumard.
" placenta, Rominger.*
" tuberosa, Rominger. . . . . "Arkona," Nicholson.
" turbinata, Billings.
Alveolites Goldfussi, Billings.
" Rœmeri, Billings.
Striatopora Linnæana, Billings.
Pachypora cervicornis, de Blainville.
" Fischeri. (=Alveolites Fischeri, Billings.)
" frondosa, Nicholson.†
" polymorpha, Goldfuss.
Trachypora elegantula, Billings.
" ornata. (=Dendropora ornata, Rominger, teste Nicholson.)

HYDROMEDUSÆ.

HYDROIDA.

Stromatoporella granulata, Nicholson.
" nulliporoides, Nicholson.

ECHINODERMATA.

CRINOIDEA.

Taxocrinus lobatus, Hall.
Homocrinus crassus, Whiteaves.

* According to Nicholson this is a variety of *Favosites Canadensis*, the *Fistulipora Canadensis* of Billings.
† Nicholson regards *Cladopora Canadensis*, Rominger, as synonymous with this species.

Arthroacantha punctobrachiata, Williams.
Dolatocrinus liratus, Hall.
" lamellosus, Hall.
" Canadensis, Whiteaves.
Megistocrinus rugosus, Lyon and Casseday.
Ollacrinus spinigerus, Hall.
Ancyrocrinus bulbosus, Hall.

BLASTOIDEA.

Pentremitidea filosa, Whiteaves.
Nucleocrinus elegans, Conrad.
Granatocrinus Leda.(=Pentremites leda, Hall.)
Codaster Canadensis, Billings.
Eleutherocrinus Cassedayi, Shumard and Yandell.

VERMES.

Spirorbis angulatus, Hall.
" Arkonensis, Nicholson.
" omphalodes, Goldfuss.
" spinuliferus, Nicholson.
Ortonia intermedia, Nicholson.
Eunicites alveolatus, Hinde.
" nanus, Hinde.
" palmatus, Hinde.
" tumidus, Hinde.
Ænonites compactus, Hinde. . . "Rivière au Sable," Hinde.
Arabellites politus, Hinde.
" similis, var. arcuatus, Hinde.
Nereidavus solitarius, Hinde.

MOLLUSCOIDEA.

POLYZOA.

Ceramopora Huronensis, Nicholson.
Botryllopora socialis, Nicholson.
Fenestella Davidsoni, Nicholson.
" filiformis, Nicholson.
" tenuiceps, Nicholson.

Polypora tuberculata, Nicholson.
Phyllopora prisca. (=Retepora prisca, Goldfuss, teste Nicholson.)
Ptilodictya cosciniformis, Nicholson.
" Meeki, Nicholson.
Tæniopora exigua, Nicholson.
" penniformis, Nicholson.
Ceriopora Hamiltonensis, Nicholson.
" Huronensis, Nicholson.
Fistulipora incrassata, Nicholson.
" minutissima. (=Callopora minutissima, Nicholson.)
" utriculus, Rominger . . . . "Widder, C. W," Rominger.
Monotrypa quadrangularis, Nicholson.
Amplexopora Barrandei, Nicholson.
" moniliformis, Nicholson.
Ascodictyon fusiforme, Nich. and Eth., jun. . . . "Widder," Nicholson.
" stellatum, Nich. and Eth., jun. . . . " "

BRACHIOPODA.

Lingula ligea, Hall.
" Thedfordensis, Whiteaves.
Discina Doria, Hall.
Crania crenistriata, Hall.
" Hamiltoniæ, Hall.
Productella (Strophalosia?) truncata, Hall.
Chonetes carinata (or coronata) Conrad.
" lepida, Hall.
" scitula, Hall.
Orthis Vanuxemi, Hall.
Streptorhynchus perversum, Hall.
Strophodonta ampla, Hall.
" concava, Hall.
" demissa, Conrad.
" inæquistriata, Conrad.
" nacrea, Hall. (=S. lepida, Hall.)
" perplana, Conrad.
" plicata, Hall.
Strophomena (Leptagonia) rhomboidalis, Wilckins.
Spirifera granulifera, Hall.
" mucronata, Conrad.
" Parryana, Hall.
" sculptilis, Hall.
" subdecussata, Whiteaves.

Spirifera (Amboccelia) umbonata, Conrad.
Spirifera (Martinia) fimbriata, Conrad.
" " Maia. (=Athyris Maia, Billings.)
Cyrtina Hamiltonensis, Hall.
Spirigera spiriferoides, Eaton.
Meristella nasuta. (=Atrypa nasuta, Conrad, and Athyris Clara, Billings.)
" Haskinsii, Hall.
" unisulcata, Conrad.
" scitula, Hall.
" rostrata, Hall.
Retzia Chloe. (=Athyris Chloe, Billings.)
Retzia (Trematospira) nobilis, Hall.
Atrypa reticularis, Linnæus.
Rhynchonella Tethys, Billings.
Rhynchonella (Leiorhynchus) Laura, Billings. (=L. multicosta, Hall.)
Rhynchonella (Leiorhynchus) Huronensis, Nicholson.
Rhynchonella (Stenoschisma) Billingsi, Hall. (=R. Thalia, Billings.)

MOLLUSCA.

LAMELLIBRANCHIATA.

Pterinea flabellum, Conrad.
Grammysia arcuata? Conrad, var.

GASTEROPODA.

Turbo Shumardi, de Verneuil.
Platyceras carinatum, Hall.
" dumosum, Conrad and var. rarispinum, Hall.
" erectum? Hall.
" quinquesinuatum, Ulrich.
" (Orthonychia) conicum, Hall.
Platyostoma lineatum, Conrad.
" plicatum, Whiteaves.

PTEROPODA.

Tentaculites attenuatus, Hall.

CEPHALOPODA.

Orthoceras Anax, Billings.
" exile, Hall.
Goniatites uniangularis, Conrad.

ARTHROPODA.

CRUSTACEA.

OSTRACODA.

Cythere? (Beyrichia) punctulifera, Hall.

TRILOBITA.

Phacops rana, Green.
Dalmanites Boothii, Green.
" Helena, Hall.

FISHES.

Macropetalichthys Sullivanti, Newberry.

(Accidently omitted from the list of Hydroida.)

Stylodictyon retiforme, Nicholson and Murie. Riviére-aux-Sables, Hinde.

GEOLOGICAL AND NATURAL HISTORY SURVEY OF CANADA.

CONTRIBUTIONS TO CANADIAN PALÆONTOLOGY.

VOLUME I.

BY J. F. WHITEAVES.

3. *On some Fossils from the Triassic Rocks of British Columbia.*

In 1875, numerous well-preserved specimens of a fossil shell which was identified by the writer with the *Monotis subcircularis* of Gabb, a characteristic species of the Upper Trias of California, were collected by Dr. Selwyn on the Peace River, in latitude 56° 10′ and longitude 122° 10′.

In 1877, specimens of the same species were obtained by Mr. J. Hunter on the Upper Pine River, in latitude 55° 30′ and longitude 122°; while an obscure fossil, which was doubtfully referred also to *Monotis subcircularis*, was collected by Dr. G. M. Dawson on the Whipsaw Creek, at the head-waters of the Similkameen River. During the same year, limestones supposed to be of Triassic origin, on account of the occurrence in them of a *Terebratula* like *T. Humboldtensis*, Gabb, and of a few scattered joints of a species of *Pentacrinites* similar to those of the Nevada Trias which Professors Hall and Whitfield doubtfully referred to the *P. asteriscus* of Meek, were observed by Dr. Dawson at McDonald's River on Nicola Lake. These limestones form part of a group of rocks mostly of volcanic origin, for which the name of the "Nicola Series" was suggested.

In 1878, rocks holding fossils which are believed to be Triassic, were discovered by Dr. Dawson at several localities in the central and southern portions of the Queen Charlotte Islands, viz., at Crescent Inlet on Moresby Island, on the south shores of Skidegate and Houston Stewart Channels, on the north coast of Kun-ga Island, and at Section Cove at the north end of Burnaby Island; also on the north-west coast of Vancouver Island, at Browning Creek in Forward Inlet, Quatsino Sound, and in Forward Inlet near Observatory Rock. In the same year Mr. J. W. McKay gave to Dr. Dawson some pieces of shale from Glenora on the Stikine River, which hold imperfect valves of a species of *Halobia*. These specimens are of interest as coming from the most northerly locality in the province, and indeed on the continent of North America, from which Triassic fossils have yet been obtained.

While engaged in a special geological exploration of the northern

part of Vancouver Island and adjacent coasts, in 1885, fossils apparently of Triassic age were collected by Dr. Dawson at Robson Island, and on the east side of Winter Harbour in Forward Inlet, at Alexander Harbour on Galiano Island, in a bay five miles and a half west of Cape Commerell, and on Hernando Island in the Strait of Georgia. Finally, a series of fossils, which are probably also of Triassic age and which are remarkably well-preserved, was obtained by Mr. R. G. McConnell, in 1887, on the Liard River, about twenty-five and thirty miles below Devil's Portage, or, approximately in latitude 59° 16′, and longitude 125° 35′.

The stratigraphical relations of the rocks from which the fossils here reported on were obtained, will be found described in the Reports of the Survey for each of the years in which the fossils were collected.

All the specimens collected at these localities are in the Museum of the Survey, and the collection of the Triassic fossils of British Columbia now contained therein consists of three species of brachiopoda, five of lamellibranchiata, one of gasteropoda and eight of cephalopoda, besides the undeterminable fragments of *Pentacrinites* already referred to. Of these, only four (viz., *Terebratula Humboldtensis*, *Monotis subcircularis*, *Halobia Lommeli* and *Arcestes Gabbi*,) can be identified with previously described species, the rest being apparently new to science.

The present paper will consist of a systematic list of the whole of the species at present in the Museum of the Survey from the formation and province indicated in its title, with descriptions and figures of those that are believed to be new. For critical and valuable suggestions in regard to some of the latter, and for the description of a supposed new genus of cephalopoda, the writer is indebted to Professor Alpheus Hyatt.

BRACHIOPODA.

SPIRIFERINA BOREALIS. (N. Sp.)

Plate 17, fig. 1.

Shell transversely subelliptical, broadly rounded in front and obtusely subangular in the middle behind, a little broader than long, and broadest at the midlength: cardinal angles rounded: surface of the valves marked with angular and rather coarse radiating plications.

Ventral valve moderately convex, most prominent on each of the outer boundaries of the angular and well-defined mesial sinus, which is

narrow on and near the beaks but which widens rapidly towards the front margin, its maximum width being not much less than one-half the greatest breadth of the whole valve. Umbo broad, curved and slightly depressed, but projecting considerably above the general level of the hinge line: beak incurved and slightly decurved: area concavely arcuate, broadly triangular in outline and nearly three times as broad as high: pseudo-deltidium rather narrowly triangular and apparently a little higher than broad. Surface marked with five well-defined, angular, radiating plications on each side of the mesial sinus and with one in the sinus.

Dorsal valve also moderately convex, its mesial fold elevated and somewhat narrower than, but in other respects corresponding to, the sinus in the opposite valve. Umbo narrower and very much less elevated than that of the ventral valve, its beak lightly incurved. Surface marked with two well-defined and angular radiating plications on the mesial fold, and with four similar ones on each side. In addition to the radiating folds, the surface of each valve is marked with numerous and for the most part rather closely disposed lines of growth.

Characters of the interior of the valves unknown.

Dimensions of the only specimen collected: maximum length, twenty-nine millimetres; greatest breadth, thirty-three mm. and a half; maximum thickness through the closed valves, twenty-one mm.; greatest breadth of the mesial sinus of the ventral valve, fourteen mm.

Liard River, about twenty-five miles below Devil's Portage, R. G. McConnell, August, 1887: one perfect but somewhat distorted and abnormally developed specimen.

On the right-hand side the two radiating plications next to the outer boundary of the mesial sinus in the ventral valve and the one next to the fold in the dorsal, bifurcate distinctly at about their midlength, whereas on the left-hand side all the plications are clearly simple and undivided throughout their entire length.

Terebratula Humboldtensis, Gabb.

Terebratula Humboldtensis, Gabb. 1864. Geol. Surv. Cal., Palæont., vol. I., p. 34, pl. 6, figs. 35 and 35 a, b.

" " Hall and Whitfield (as of Gabb). 1877. U.S. Geol. Expl. Fortieth Parallel, vol. IV., p. 282, pl. 6, figs. 22-24.

McDonald's River, on Nicola Lake, Dr. G. M. Dawson, 1887, as already recorded on page 171 B of the "Report of Progress of the Geological Survey of Canada for 1877-78."

Terebratula Liardensis. (N. Sp.)

Plate 17, figs. 2, 2 a, 2 b and 2 c.

Shell rather below the medium size, varying in outline from somewhat narrowly ovate to almost circular, but always a little longer than broad, moderately convex, the thickness through the closed valves varying from a little less to slightly more than one-half the maximum length, the broad specimens being proportionately flatter than the narrow ones.

Ventral valve longer and more convex than the dorsal, its umbo somewhat elevated but obtuse and distinctly recurved at its apex, which latter is obliquely truncated in such a way that the produced inner margin of the foramen overhangs and partially overlaps the small and sunken deltidium. Foramen complete but apparently lightly channelled and rather spout-like in front, nearly circular in outline but a little longer than wide. Front margin with two low, narrow, rounded folds, which are separated by a shallow and equally narrow mesial sinus, and which gradually become obsolete and disappear before reaching the midlength. On the outer side of each of these folds there is a correspondingly shallow but somewhat broader depression.

Dorsal valve very gently convex, its umbonal region obliquely depressed and its beak small and scarcely projecting above the highest level of the hinge margin. Front margin with one central fold and two lateral folds, which are low, rounded and separated by two shallow depressions which do not extend quite as far back as those on the ventral valve do. When examined with a lens, a faintly impressed line, which probably indicates the existence of a raised mesial septum within, may be seen to extend longitudinally from the umbo nearly half way to the front margin, along the centre of the exterior of the valve.

Surface nearly smooth and marked only with a few rather distant lines of growth. Characters of the interior of the valve unknown.

Dimensions of one of the largest specimens of the narrow variety: maximum length, nineteen millimetres; greatest breadth, fourteen mm.; maximum thickness, ten mm. In the largest specimen collected of the broad variety, the corresponding measurements are: length, nineteen millimetres; breadth, seventeen mm.; thickness, nine mm.

Liard River, about twenty-five miles below Devil's Portage, also about thirty miles below the same portage, R. G. McConnell, 1887. At the locality first mentioned, a small piece of limestone was obtained, containing five specimens of this species *in situ;* while at the second

seven well-preserved casts of the interior of both valves, with a little of the inner layer of the test remaining, were collected. Three of the latter are evidently casts of adult shells in which the double fold on the front margin is fully developed, while the remaining four are as obviously immature.

This species seems to differ from *T. Humboldtensis* in its distinctly biplicated front margin, which is not at all truncated. Accurate drawings of two of the best specimens collected by Mr. McConnell have been kindly compared by Dr. C. A. White with Professors Hall and Whitfield's types of *T. Humboldtensis* and with Gabb's figures of his type specimens. The double fold at the front in the present species is regarded by Dr. White as a probably good distinguishing character, and he thinks that the drawings sent indicate a proportionately shorter and more robust shell than *T. Humboldtensis*. He adds, also, that the specimens of Hall and Whitfield and the figures of Gabb show that in *T. Humboldtensis* "there is a very shallow median sulcus, or a mere median flattening of the dorsal valve at the front, with which that part of the ventral valve coincides. This gives the seeming truncation of the front to which they refer."

The indications of a rather long mesial septum in the dorsal valve of *T. Liardensis* are suggestive of the idea that when the characters of the interior of both valves are better known, the shell may have to be referred to the genus *Waldheimia*.

MOLLUSCA.

LAMELLIBRANCHIATA.

Monotis subcircularis, Gabb.

Plate 17, figs. 3 and 3 a.

Monotis subcircularis, Gabb. 1864. Palæont. Californ., vol. I., p. 31, pl. 6, figs. 29, 29 a.

Pseudomonotis subcircularis, Mojsisovics. 1886. Arktische Triasfaunen, p. 123.

Perhaps=*Pseudomonotis ochotica*, Keyserling. (Sp.)

Cfr. *Avicula ochotica*, Keyserling, 1848, in v. Middendorf's "Reise in den äussersten Norden u Osten Siberiens," St. Petersburg, band 1, theil 1, p. 257, taf. 6, fig. 15-17.

Pseudomonotis ochotica (Keyserling). Mojsisovics. Op. cit., p. 116, taf. 17, fig. 1-15, and taf. 18, fig. 15-17.

A few miles above Fossil Point on the Peace River, in lat. 56° 10′ and

long. 122° 10′, A. R. C. Selwyn, 1875. Fossil Ridge, Upper Pine River, in lat. 55° 30′ and long. 122°, J. Hunter, 1877. Whipsaw Creek, head-waters of the Similkameen, Dr. G. M. Dawson, 1877: a few obscure specimens, which are referred to this species with some doubt. South side of Skidegate Channel, Q.C.I., a mile and a half west of Log Point; G. M. Dawson, 1878.

The specimens, though characteristic and easily recognisable, are for the most part imperfect, except those from the locality first mentioned. Among these latter there are several nearly perfect and well-preserved right valves, two of which are represented on Plate 17, as only the left valve of *M. subcircularis* has been figured by Mr. Gabb.

The specimens from British Columbia are as often obliquely subovate and longitudinally elongated as subcircular in outline, but the "rounded upper end of the anterior margin," which Mr. Gabb states is the "most obvious difference between his species and *M. salinaria*," appears to be a constant character of the former.

In his memoir on the Arctic Trias Fauna, Mojsisovics expresses the opinion that *M. subcircularis* belongs to the genus *Pseudomonotis* of Beyrich, and that it is probably identical with *P. ochotica*. The specimens of *M. subcircularis* collected by Dr. Selwyn on the Peace River certainly bear a very close resemblance, both in general form and in sculpture, to some of Mojsisovics' figures of *P. ochotica*, but in these figures both valves and more especially the right valves are represented as provided with a minute and spine-like anterior auricle, the existence of which is not satisfactorily shown in any of the Canadian specimens.

Monotis ovalis. (N. Sp.)

Plate 17, fig. 4.

Left valve (the only one known) compressed, but moderately tumid in the umbonal region. General outline rather broadly subelliptical but slightly inequilateral: height about one-fourth greater than the length: cardinal margin very short.

Anterior side a little shorter than the posterior, its margin much less convex and nearly straight and vertical or slightly sinuous above the middle: posterior margin regularly and broadly rounded: pallial border also regularly but narrowly rounded. Superior border sloping obliquely, convexly and rapidly downward behind the beak, higher and nearly straight for a short distance immediately in front thereof: anterior cardinal angle less broadly rounded off than the posterior:

beak small, depressed, incurved and subcentral, but placed a little in advance of the middle.

Surface marked by flat, radiating ribs, which broaden outwards rather rapidly in the central portion of the valve. At and near their outer termination, the central ribs are distinctly broader than the spaces between them. The whole of the ribs are invariably simple and entire, but occasionally, though very rarely, a single and very narrow rib is intercalated between two of the broader costæ. Characters of the interior of the valves unknown.

Dimensions of the only specimen collected: maximum length, sixteen millimetres; greatest height of the same, twenty-one mm.

Liard River, about twenty-five miles below Devil's Portage, R. G. McConnell, 1887: a perfect and well-preserved left valve.

This species seems to be well characterized by its broadly elliptical form and flattened radiating ribs. It is apparently most nearly related to the *Monotis boreas* of Oberg,* from the Trias of Spitzbergen (which Mojsisovics says is a *Pseudomonotis*) and to the *Pseudomonotis scutiformis* of Toller†, from the Trias of Eastern Siberia, but both of these species are nearly circular in marginal outline and ornamented with a sculpture quite different from that of *M. ovalis*.

Halobia (Daonella) Lommeli, Wissman.

Halobia Lommeli, Wissman.—1841. Beitr. Petref., IV. Heft 22, tab. 6, fig. 11.
" " Horness.—1855. Denk. Kais. Akad. Wissensch. IX, 52, taf. 2, fig. 17.
Avicula pectiniformis, Catullo.—1847. Prodr. Pal. Alpi. Ven., 73, pl. 1, figs. 1, 2. 3.
Posidonomya Lommeli, d'Orbigny.—1840. Prodr. du Paleont. Stratigr. Univ. I., 201.
? *Halobia dubia*, Gabb.—1864. Palæont. Californ., vol. I, p. 30, pl. 5, figs. 28 a, b.
Daonella dubia, Mojsisovics.—1874. Ueber der Triasch. Pelecyp. Gatt. Daonella und Halobia, p. 22.
Halobia (*Daonella*) *Lommeli*, Meek.—1877. U.S. Geol. Expl. 40th Par., vol. IV, p. 100, pl. 10, fig. 5.

South side of Houston Stewart Channel, Q.C.I., nearly opposite Rose Harbour, G. M. Dawson, 1878; and Liard River about twenty-five miles below Devil's Portage, R. G. McConnell, 1887: a few detached but almost invariably imperfect valves of a *Halobia* (or *Daonella*) with subcentral beaks and broad, flat, radiating ribs. These agree very well

* Om Trias-Försteningar från Spetsbergen. Kongl. Svensk. Vetensk.-Akad. Handl., Bandet 14, No. 14, p. 17, Taf. 5, figs. 5 a, b.
† Arktische Triasfaunen. Mem. de l'Acad. Imper. des Sciences de St. Pétersbourg, VII Series, Tome XXXIII, p. 125, pl. 19, figs. 2 a, b.

with the description and figure of the Nevada shell which Meek has identified with the *H. Lommelli* of European authors.

Small slabs of limestone, covered with numerous valves of a *Halobia* which may possibly represent an extreme local variety of this species, were collected by Dr. Dawson in 1878 at Section Cove, north end of Barnaby Island, Q.C.I., and in 1885 in a bay five miles west of Cape Commerell, at the north end of Vancouver Island. The specimens from these two last mentioned localities differ from those from Houston Stewart Channel in having much finer radiating ribs, which, however, are flattened and broader than the fine linear grooves between them,—and in the circumstance that the beaks are usually, though not always, placed much farther forward. As already remarked (on page 127), similar specimens were collected by Mr. J. W. McKay at Glenora on the Stikine River.

Halobia occidentalis. (N. Sp.)

Plate 17, figs. 5 and 6.

Left valve (the only one that has been recognized with any certainty) rather strongly convex, especially in the umbonal region: slightly inequilateral and a little higher than long: marginal outline subovate, somewhat pointed below, broadest a little above the middle, but truncated distinctly and transversely at the hinge line above. Posterior margin broadly rounded: anterior side a little shorter than the posterior, the upper half of its margin nearly straight, vertical, and at length forming a nearly rectangular junction with the cardinal border above: pallial border narrowly rounded or obtusely pointed a little in advance of the midlength. Cardinal border straight, very little shorter than the maximum length of the valve: posterior cardinal angle rounded off, the anterior subangular: beak moderately prominent, appressed and placed a little in front of the middle.

Surface marked by numerous thread-like, radiating raised lines, which are narrower and often very much narrower than the spaces between them, especially on the lower half of the posterior side of the shell. Characters of the interior of both valves unknown.

Dimensions of the type specimen: maximum length, twenty-two millimetres; greatest height, twenty-five mm.

Liard River, about twenty-five miles below Devil's Portage, R. G. McConnell, 1887: one perfect and well-preserved cast of the interior of a left valve.

At the same locality and date two other specimens were collected,

both of which are probably referable to the present species. The first of these (fig. 6) is a small piece of rock, upon one of whose surfaces a well-preserved cast of the interior of the basal portion of a left valve and a similar cast of a right valve, with the anterior margin broken off, are exposed to view. In this specimen the right valve is conspicuously flatter than the left, and the height of both is obviously greater than their maximum length. The second, which is most likely only a transversely elongated form of the species, is a nearly perfect but not very well-preserved cast of the interior of the left valve. This differs from the type specimen in being much more distinctly inequilateral, in being a little longer than high, in its more broadly rounded pallial border, and in the circumstance that its anterior cardinal angle is more rounded. Should the whole of these specimens prove to belong to the same species, the original diagnosis of the characters of the latter will, of course, have to be considerably modified, but in the meantime it is thought most prudent to select the most perfect example collected as the type, and to describe it first without reference to any of the others.

TRIGONODUS (?) PRODUCTUS. (N. Sp.)

Plate 17, figs. 7, 7a and 7 b.

Shell small and slightly compressed at the sides, the maximum thickness through the closed valves being a little less than their greatest height, very inequilateral, longer than high and narrowly subovate in marginal outline, valves closed all round, not gaping at either extremity. Anterior side short and regularly rounded at its margin: posterior side much longer and narrowing gradually to a point which is more or less obtuse in different specimens, some of which are more elongated and more narrowly pointed behind than others: ventral margin gently convex, most prominent in or a little in advance of the middle, rounding upwards rather abruptly in front and somewhat straighter behind: superior border sloping gradually downward behind the beaks and very rapidly so in front of them: umbones broad and projecting very little, if at all, above the highest level of the cardinal border: beaks small, depressed, curved inward, downward and forward, and placed near the anterior end: escutcheon or ligamental area (?) lanceolate and tolerably well-defined: lunule none.

Surface marked by numerous concentric and impressed lines of growth, most of which are not visible without the use of a lens. Test apparently thin. Characters of the interior of both valves unknown.

Dimensions of one of the specimens figured (a right valve): maxi-

mum length, eight millimetres; greatest height, five mm.; of the other (a left valve)—length, seven millimetres; height, five mm.

Liard River, about thirty miles below Devil's Portage, R. G. McConnell, 1887: five detached left valves, one right valve and a small but nearly perfect cast of the interior of both valves.

This little shell is only provisionally and very doubtfully referred to the genus *Trigonodus* of Sandberger, on account of a certain general resemblance which it bears, both in shape and surface markings, to the *T. Sandbergeri* of Alberti, from the Trias of Würtemburg.

In the entire absence of any knowledge of the hinge dentition, muscular impressions or pallial line of the specimens collected by Mr. McConnell, it is not only doubtful to what genus or family but even to what order they should be referred. On first studying them, the writer was struck with their similarity in external characters to the *Nucula elongata* of Oberg, from the Trias of Spitzbergen, and Professor Hyatt, who has since examined two of the most perfect ones, thinks that they bear a similar resemblance to two or three species of *Nucula* from the European Trias, described by Klipstein, Münster and Wissman. But, so far as the writer has been able to observe, there are no indications or traces of the peculiar, comb-like, interlocking teeth of *Nucula* in any of the specimens from the Liard River, and there are some reasons for supposing that in the latter the ligament was external. If the present species should prove to be a *Nucula* rather than a *Trigonodus*, then, in accordance with the known relations of the animal to its shell in living representatives of the former genus, the shorter side of the two would be the *posterior*, and vice versâ, and the beaks would point backwards.

GASTEROPODA.

Margarita triassica. (N. Sp.)

Plate 17, figs. 8 and 8 a.

Shell small, globosely turbinate and about as broad as high: whorls four, increasing rapidly in size, the latter ones ventricose but flattened next to the suture above: spire apparently a little shorter than the outer whorl, which latter is depressed in the centre below and rather narrowly umbilicated, the umbilicus being somewhat deep, with a broadly rounded margin and about one-third the diameter of the base: suture distinct and nearly rectangular: aperture nearly circular but

apparently somewhat pointed above and a little sinuous on the columellar side: outer lip thin and simple.

As viewed in its dorsal aspect the last whorl of the spire is seen to be encircled by three rather distant raised lines or minute spiral ridges, one of which is placed on the shoulder above, one in the middle and one close to the suture below. The outer whorl bears four rather distant spiral, raised lines on its upper half, and below these there are a number of others which are finer and much more closely disposed. When examined with a lens, the whole of this spiral sculpture is seen to be crossed and overlaid by densely crowded and exceedingly minute raised striæ. Test extremely thin.

As the apex is broken off in each of the few specimens collected, it is not practicable to give the exact proportionate dimensions of any.

Liard River, about thirty miles below Devil's Portage, R. G. McConnell, 1887: four casts of the interior of the shell, in two of which portions of the test are well preserved.

It is possible that this shell may not be a true *Margarita*, but it seems to be more closely allied to the *M. spiralis* of Münster, from the Trias of St. Cassian, as figured by Zittel, than to any other genus known to the writer. Professor Hyatt, who has examined two of the best specimens collected by Mr. McConnell, thinks that they resemble the *Turbo Johannis Austriæ* of Klipstein (figured in Stoppani's "les Pétrifications d'Esino," pl. 14, fig. 16), but that "they are not quite so elevated, their whorls are flatter above and their spiral ridges better marked." It is, however, quite evident that they cannot be referred to the genus *Turbo* as now restricted, and it is most likely that their affinities are rather with the Trochidæ than the Turbinidæ.

CEPHALOPODA.

Nautilus Liardensis. (N. Sp.)

Plate 18, figs. 1 and 1 a.

Shell broad, subglobose, but deeply though rather narrowly umbilicated: maximum breadth of the aperture about equal to the entire length, as measured from the centre of the outer lip to a corresponding point on the periphery of the opposite side. Volutions very closely embracing, the inner ones almost completely covered, the outer one increasing rapidly in size, but expanding much more rapidly in a lateral than in a dorso-ventral direction: periphery somewhat

flattened, but probably abnormally so: sides and umbilical margin both rounded, the latter not at all angular: aperture a little more than twice as broad as high, transversely subreniform, or transversely and broadly elliptical but shallowly emarginate in the centre of the base by the encroachment of the preceding volution.

Septa somewhat closely approximated, their average distance apart on the periphery, where their margins are nearly straight, being about six millimetres. Position of the siphuncle unknown.

Surface apparently almost smooth, and marked only by transverse striæ of growth.

Dimensions of the only specimen collected: maximum length, fifty-seven millimetres; maximum breadth at the aperture, where the shell is broadest, fifty-eight mm.; height of aperture in the centre, twenty-seven mm.

Liard River, about twenty-five miles below Devil's Portage, R. G. McConnell, 1887: a slightly distorted cast of the interior of the shell, with small portions of the test preserved, but with the greater portion of the chamber of habitation broken off. The number of septa whose margins are visible in this specimen is twenty-one, and the portion of the body chamber that remains is about three-quarters of an inch in length.

This shell appears to bear such a close resemblance to the *Nautilus Sibyllæ* of Mojsisovics,* from the Trias of Spitzbergen, in almost every respect, that it may possibly prove to be only a local variety of that species. Still, in the figures of *N. Sibyllæ* the umbilical margin is represented as rather distinctly angular, whereas that of *N. Liardensis* is very regularly rounded.

Popanoceras McConnelli. (N. Sp.)

Plate 18, figs. 2, 2 a, b, and 3, 3 a.

Typical Form. (Figs. 2 and 2 a, b.) Shell globosely sublenticular, but always a little depressed in the umbilical region: greatest thickness or breadth varying in different specimens from a little more to a little less than half of the maximum diameter: umbilicus well defined and rather deep, with steep sides, but very narrow and rather less than one-eighth of the maximum diameter, in adult specimens. At a very early stage of growth, however, the umbilicus is much wider proportionately. Thus,

* Arktische Triasfaunen (Mem. l'Ac. Imp. des Sciences de St. Pétersbourg, Ser. VII, Vol. 33, No. 6), p. 100, pl. 16, fig. 2.

in a specimen whose maximum diameter is fourteen millimetres, the umbilicus is about six mm. in width and the inner volutions are partly exposed. In adult specimens the outer volution is so closely embracing that the whole of the inner whorls are covered. Sides of the outer volution narrowing rapidly and convexly from the umbilical margin to the periphery, which latter is somewhat obtusely but very distinctly angulated. Aperture very narrow in a dorso-ventral direction, angular above, widening rapidly and convexly to the base, which is deeply and broadly emarginated by the encroachment of the preceding volution. If measured in the centre, where the emargination is deepest, the height of the aperture is not more than one-half of its maximum length, but if measured outside of the emargination its height is a little greater than its breadth

Surface nearly smooth, marked only by rather distant but somewhat irregularly disposed and very indistinct spiral striations, which are crossed by almost equally indistinct and very slightly elevated transverse plications. The faint revolving striæ are most strongly marked on the outer half of the sides and become obsolete near the umbilical margin, while the low, transverse plications or wrinkles are usually, though not always, nearly straight and widen outwards towards the periphery, over which they do not pass.

Sutural line consisting of six simple saddles on each side of the siphonal saddle, and of six simple lobes on each side of the siphonal lobe. The apex of the very small siphonal saddle has a minute notch in the centre, but all the other saddles are quite entire at their margins. The siphonal saddle is less than half the height of the first and second lateral saddles, which are larger than the rest and about equal in size to each other and to the corresponding lobes, while the third, fourth, fifth and sixth lateral saddles are all very small and much shorter than the first or second. All the lobes are minutely incised at their margins. The siphonal lobe, which is rather deeply emarginated in the centre by the small siphonal saddle, is broader but not quite so high as the first lateral lobe, which latter is a little higher than the second. The third, fourth, fifth and sixth lateral lobes are all very small and much shorter than the second.

The septa are closely approximated, and as the sutural lines of only two or three contiguous septa are visible in specimens in which a not inconsiderable portion of the outer lip is broken off, it seems clear that when perfect the chamber of habitation must have been large and that it must have occupied fully the whole of the outer volution.

Dimensions of the largest undistorted specimen collected: maximum diameter, fifty-one millimetres; greatest breadth or thickness, twenty-seven mm. and a half; width of umbilicus, six mm. In a

larger but slightly distorted specimen, the maximum diameter is not quite seventy mm.

Variety lenticulare. (Figs. 3 and 3 a.) Shell sublenticular, but always a little depressed in the umbilical region: greatest breadth or thickness equal to one-third of the maximum diameter: umbilicus very narrow and indistinctly defined, in some specimens almost closed: periphery acutely angulated: aperture much narrower laterally than in the typical form.

Surface nearly smooth, marked only with fine radiating striæ, which are doubly flexuous on each of the sides and produced into a series of obtuse, beak-like projections which arch forwards on the periphery.

Sutural line apparently similar to that of the typical form.

Dimensions of the largest specimen of this variety known to the writer: maximum diameter, sixty millimetres; greatest breadth of the same, twenty mm.

It is only proper to add that the typical and convex form and the flattened variety *lenticulare* are connected by numerous intermediate gradations both in form and sculpture.

Liard River, about twenty-five miles below Devil's Portage, also about thirty miles below the same portage, R. G. McConnell, 1887. At the first mentioned locality five specimens were collected, of various sizes, most of which belong to the typical and convex form of the species. At the second locality indicated, seventeen specimens were collected of all sizes, varying from eight to about sixty millimetres in their greatest diameter. Eight of these have a maximum diameter of more than an inch and a half, and of these four belong to the typical form and four to the variety *lenticulare*.

The genus *Popanoceras* was first proposed and its characters defined by Professor Hyatt, in 1884, in the twenty-second volume of the Proceedings of the Boston Natural History Society, on page 337. The types of the genus are there stated to be the *Goniatites Kingianus*, *G. Koninckianus* and *G. Soboleskyanus* of Murchison, De Verneuil and Keyserling, from the Dyas (or Permian formation) of Russia. In 1886, on pages 67-72 and plates 14 and 15 of his "Arktische Triasfaunen," Mojsisovics described and figured four named* and two unnamed additional species from the Upper Trias of Spitzbergen. The present species, which the writer has much pleasure in associating with the name of its discoverer, may be readily distinguished from the whole of these previously characterized forms by its much larger size and more especially by its more or less convexly sublenticular form and very distinctly angulated periphery.

* *P. Hyatti, P. Torelli, P. Malmgreni* and *P. Verneuili.*

ARCESTES GABBI, Meek.

Ammonites Ausseanus, Gabb.—1864. Palæont. Californ., vol. I., p. 25, pl. 3, figs. 11 and 17 (not of Hauer, teste Meek).

Arcestes Gabbi, Meek.—1877. U.S. Geol. Expl. 40th Parallel, vol. IV, pt. I, p. 121, pl. 10, figs. 6, 6 a and 6 b.

Bay five miles and a half west of Cape Commerell, north end of Vancouver Island, G. M. Dawson, 1885: one tolerably perfect specimen and a few fragments of others.

A nearly perfect but considerably crushed and distorted specimen of an *Arcestes*, collected by Dr. Dawson in 1878 at Houston Stewart Channel, in the Queen Charlotte Islands, has been referred to this species by the writer, in the Report of Progress of the Geological Survey of Canada for 1878-79, but its specific relations are somewhat doubtful.

ACROCHORDICERAS (?) CARLOTTENSE. (N. Sp.)

Plate 19, fig. 1.

The foregoing name is suggested provisionally for a remarkably sculptured shell, of which two rather large fragments, which Professor Hyatt thinks are "probably specimens of *Acrochordiceras*," were collected by Dr. Dawson in 1878 at Houston Stewart Channel, Q.C.I.

The larger of these two fragments is a piece of the outer volution about twenty-seven millimetres high in its dorso-ventral diameter, about thirty-five mm. in length from the posterior to the anterior termination and twelve mm. in thickness near the periphery.

The outer volution seems to have been strongly compressed at the sides, the umbilicus appears to have been narrow and in both specimens the periphery or abdominal region is distinctly flattened. At and near the posterior termination of each of these fragments, the ribs or pilæ are frequently bifurcating and in one instance bidichotomous, but in their anterior halves the ribs are broken up into numerous, short and simple, transversely elongated tubercles.

These specimens, Professor Hyatt writes, "are interesting in so far as they exhibit a style of sculpturing which is different from that of any Triassic form I have ever seen either upon a specimen or figured. They both at an earlier stage evidently had divided pilæ, but these at the stage of growth represented in both these fragments have begun to be resolved into numerous, short and elongated, interrupted folds. The style of this makes the larger of the two fragments a close copy

of some Scaphites of the Cretaceous. Even the large and extremely aged specimens of *Acrochordiceras* figured by Mojsisovics retain the entire trachyceran pilæ, and in part the tubercles or at least indications of them. It is very evident that in this species a marked change takes place either upon the transient living chambers of the adults or upon the latter part of the last whorls in extreme age. It is evident, also, that the changes proceeded from the umbilical shoulders outward, and that the continuous pilæ probably entirely disappeared within a short space. I did not succeed in cleaning the abdomen satisfactorily and therefore cannot say positively that the pilæ or ribs cross it as in *Acrochordiceras*. The species is certainly new, so far as I can judge."

Trachyceras Canadense. (N. Sp.)

Plate 18, figs. 4 and 4 a.

Shell compressed at the sides and a little the thickest around the umbilical margin: periphery or abdominal region broad and flattened, but rounded at its junction with the sides and encircled in the centre by a deep, narrow groove or abdominal channel. Volutions rather strongly involute, the umbilicus occupying about one-fourth of the entire diameter: maximum breadth of the outer whorl a little less than its dorso-ventral diameter as measured from the umbilical margin to the outer boundary of the abdominal channel: umbilical margin distinct and subangular: inner wall of the umbilicus steep.

Surface of the outer volution marked by transverse ribs which are ornamented by rows of closely arranged tubercles. On the inner half of each side the ribs are nearly straight or but slightly flexuous, but on the outer half they curve concavely forwards in such a way as to form a series of obtusely pointed or narrowly rounded linguiform processes on the periphery, in the centre of which, however, they are invariably cut through by the narrow abdominal channel. Many of the ribs bifurcate from a tubercle placed on the umbilical margin, and these bifurcating ribs, which extend outward to the abdominal channel, usually alternate with one or two simple ribs of similar length. On the outer half of each side, one or both of the branches of these bifurcating ribs occasionally divides again, and in other cases a short rib, which itself bifurcates near or upon the abdominal region, is intercalated between the two branches. In one instance, also, a short, bifurcating rib alternates with a similar but much longer one. On each side of the peripheral or abdominal groove the longer ribs, whether simple or bifurcating, bear transversely elongated tubercles,

one of which is placed on the umbilical margin, six next to it, one at the junction of the side with the periphery, and one, which appears to be divided into two points, next to the abdominal groove.

The sutural line consists of three lateral saddles on each side of the siphonal saddle, and of two principal lateral lobes, besides a third and minute lobe, which is partly sunk in the umbilical cavity, on each side of the siphonal lobe. The margins of all the saddles are rounded and entire, but those of the lobes appear to be minutely incised. The siphonal saddle is much smaller than any of the rest; the first and second lateral saddles are nearly equal in size and a little larger than the third. The siphonal lobe, whose summit is shallowly emarginate in the centre by the small siphonal saddle, is a little larger than the first lateral lobe, and it again is slightly larger than the second lateral.

Dimensions of the only specimen collected: greatest diameter, fifty millimetres; maximum breadth or thickness, twenty mm.; greatest breadth of umbilicus, thirteen mm.

Liard River, about twenty-five miles below Devil's Portage, R. G. McConnell, 1887: one tolerably well preserved and nearly perfect cast of the interior of the shell.

According to Professor Hyatt, this specimen belongs to the group of the *Trachycerata margaritosa* of Mojsisovics. "It is closely allied to *Trachyceras Aon*, Mojs. (Ceph. der Med. Triaspr., p. 133, pl. 21, figs. 1–38), but differs therefrom in the number of rows of closely arranged tubercles, in its broad abdomen and the division of the spines of the abdomen into two points. It is like *P. ladinum*, Mojs. (Ib., pl. 14, fig. 2), but has more rows of tubercles, and these smaller; also like *T. Judicaricum*, Mojs. (Ib., pl. 14, fig. 3), but is more involute. It is also like *T. longobardicum* (Ib, pl. 19, fig. 4), but is different in the sutures and has smaller ribs and tubercles."

In the writer's judgment the specimen now under consideration appears to be still more closely related to the Nevada fossil which has been referred to *T. Judicaricum* in the fourth volume of the United States Geological Exploration of the Fortieth Parallel, on the authority of Professor Hyatt, who, however, now doubts the correctness of this identification, as will be seen from the following extract from a letter of his to the present writer, dated March 20th, 1888:—"At the time that I wrote the note for Meek in Geol. Expl. 40th Parallel, vol. iv, p. 118, I was disposed to give greater latitude to specific characters than I am now. I should not, I think, now consider the shell there described as *T. Judicaricum*. If Meek's figures are at all correct, the nodes and pilæ (ribs) are distinct, as are also the involution and channel. Your specimen, if I remember rightly, differed from Meek's in having very much finer pilæ (ribs), many rows of closely set tubercles,

and the tubercles on the abdomen had two points so closely set as to look like parts of one big tubercle, or as if they had originated from some such division of a large tubercle."

Arniotites, Hyatt. (Gen. nov.)

(=Balatonites arietiformes. Mojsisovics.)

Shell discoidal, whorls moderately numerous, strongly compressed at the sides, everywhere in close contact, but very slightly embracing, so that the umbilicus is wide and open and almost the whole of the inner volutions is exposed to view: periphery simply carinated, "keel single, smooth, with slight linear channels on either side, or none, according to the species:" surface of the outer whorls simply costate. "The pilæ (ribs) arise from folds and are smooth, perfectly developed, straight on the sides, bending forward at the geniculæ, which are sometimes noticeably prominent. The sutural line has not been seen, but, judging by analogy, the lobes were probably dentate and the saddles smooth."

In reference to this genus Prof. Hyatt writes as follows: "The careful examination of the specimens collected by Dr. Dawson convinced me of what I had long suspected, that the genus *Balatonites* of Mojsisovics contains three distinct genera. This eminent authority had, in fact, himself clearly seen and distinguished three groups, but did not consider them to be of generic rank. The shells of Balatonites arietiformes, Mojsis. (Ceph. der Mediterr. Triaspr.) have complete pilæ without tubercules, and entire keels in the young, and the latter are only very slightly, if at all, ridged in adults. I propose for this group the name of *Arniotites*, in allusion to the close resemblance of the shells to the *Arnioceras* of the Lias, a fact first noticed by Mojsisovics.

The type of Mojsisovic's genus is *Balatonites Balatonicus* (V. 1, kürse Uebers d. Amm.—Gattun. d. Mediterr. u. juvav. Trias; Verh. d. k. k. Reichsan., 1870, No. 7, p. 139). This belongs to the second group, the Balatonites gemmati. These shells have heavily tuberculated pilæ, a line of tubercles replaces the keel and they resemble *Trachyceras* in general aspect. The sutures are similar to those of *Arniotites*, the lobes being dentated and the saddles smooth.

Mojsisovics' third group, the Balatonites acuti, is the most distinct of the three. The shells have sutures with smooth lobes and saddles, true keels are not present, but the abdomens are exceedingly acute in some species. In the few species known, the whorls are much compressed and the mode of growth discoidal—the whole presenting a

very unusual combination of characteristics. I propose for this group the name *Dorikranites* (from Δορικράνος, spear-headed), the type being *Dorikranites Bogdoanus* (=Balatonites Bogdoanus, Mojsis., Ceph. der Triaspr., p. 87, pl. 80, figs. 1-4), and the following were described by Mojsisovics under the name of *Balatonites, Dorikranites rossicum* and *D. acutum.*

The young of *Arniotites* has a thin keel, and this, together with the form of the whorls and pilæ, shows that the more discoidal and stouter shells of *Celtites* are larval or radical forms as compared with *Arniotites*, and are probably the near allies of this series. In *Arniotites* the earliest whorls are often smooth, compressed, and are probably rounded as well as keel-less on the abdomen.* The shell during this stage must have closely resembled the adult of *Dinarites Mohamedanus*, Mojsisovics (Mediterr. Triaspr., p. 7, pl. 40), and more remotely *Ceratites Sturi* (ibid, p. 44, pl. 39), both of those being forms belonging to the direct line or stock of Ammonoid radicals which terminated in the Lias with *Psiloceras planorbe.* Among Balatonitidæ, *Arniotites*, with its smooth young, evidently bore precisely similar relations to those stock radicals of the Trias that *Arnioceras*, among the Arietidæ, bore to the stock radical, *Psiloceras*, in the Lias. *Arniotites Vancouverensis*, Whiteaves, does not approximate closely to any species described by Mojsisovics. The pilæ are straighter, the forward bend is hardly perceptible, the whorls are narrower, and the young smooth for a more prolonged period of the growth. These characters have all been exaggerated by compression, but this cannot account for the whole of the observable differences. This species is, of course, the type of the genus, and the small specimen from Crescent Inlet shews the characters best. The following species are described and figured by Mojsisovics in his great work (Ceph. der Mediterr. Triaspr.) under the name *Balatonites; Arn[illegible]ites euryomphalus, A. arietiformis, A. prezzanus, A. stradanus* and *A. [illegible]ini.*

* "It is quite common for species of Ammonoids to be rounded and keel-less on the abdomen, during the smooth stage, until the shell is of considerable size, and they are invariably so during the earlier part of the smooth stage. The slight crenulations of the keel, described by Mojsisovics in Balatonites arietiformes, are probably not constant in all the species and I have not considered them as of generic importance."

ARNIOTITES VANCOUVERENSIS.

Plate 19, fig. 2.

Celtites (?) Vancouverensis, Whiteaves.—1887. Dawson, Rep. Geol. Exam. N. pt. Vanc. Isld. and adj. coasts, in Ann. Rep. Geol. Surv. Can. for 1886, p. 110 B.

Shell small, discoidal, whorls about four in number, compressed and very gently convex at the sides, slender, increasing slowly in size and very slightly embracing, so that the whole of the sides of the inner ones is exposed to view: umbilicus wide and shallow: outer volution distinctly keeled at the periphery, the keel apparently single, entire and with a faint linear channel on each side. Surface of the first and second volution, and the inner half of the third volution apparently smooth, that of the outer half of the third and of the whole of the fourth distinctly ribbed; the ribs being simple, transverse, generally straight, broadening outward and interrupted on the keeled periphery of the outer volution.

Sutural line unknown.

In a supplement to Dr. Dawson's report, which was written more than a year before the present paper was printed, the name *Celtites*(?) *Vancouverensis* was suggested provisionally for a number of specimens collected from the Triassic rocks at three localities in the Queen Charlotte Islands, at five on or near the north or north-west coast of Vancouver Island, and at Hernandez Island, in the Strait of Georgia. With the exception of a few crushed fragments, the specimens from each of these localities are mere natural moulds or impressions in shale of the exterior of one side (or of a portion of one side) only of each shell, in which not a vestige of any part of the sutural line could be detected.

Since the original diagnosis of *C. Vancouverensis* was written, some of the most perfect specimens from most of these localities have been examined by Professor Hyatt, who is inclined to think that nearly all of them are not referable to *Celtites*, but to a new genus which is here described under the name *Arniotites*, that they may possibly be separable into two or perhaps three species, and that it is not quite certain even that they all belong to the same genus. He suggests, also, that the small specimen represented on plate 19, figure 2, be regarded as the type of the genus *Arniotites* and of the species *A. Vancouverensis*, and it is in accordance with this suggestion that the description of both has been prepared for the present paper. Professor Hyatt thinks that the most salient characters of the species as now restricted are "the smooth character of the young shell as shown in the umbilicus, the

simple keel bordered on each side by a faint linear channel, and the abruptly terminating ribs on the outer volutions."

The type of *Arniotites Vancouverensis* as here defined was collected by Dr. Dawson in 1878, at Crescent Inlet, Moresby Island, Q. C. I., and six imperfect specimens, which are believed by the present writer to be referable to the same species, were obtained by Dr. Dawson in the same year at Forward Inlet, on the north-west coast of Vancouver Island, near Observatory Rock.

Arniotites. (Species uncertain.)

Plate 19, fig. 3.

Celtites (?) *Vancouverensis*, Whiteaves. (Pars.) 1887. Op. cit., p. 110 B.

Six natural moulds of the exterior of one side of each shell of a species of *Arniotites* and two small and crushed fragments of casts of the interior of the test were collected by Dr. Dawson in 1885, at Robson Island, in Forward Inlet. These were supposed by the present writer to represent merely an advanced stage of growth of the preceding species. Professor Hyatt, however, who has examined the most perfect specimen from this locality, the one figured on plate 19, is of the opinion that its "whorls are proportionately broader, in an abdomino-dorsal direction, than those of *A. Vancouverensis*, that the pilæ of the former are more numerous and not so coarse and fold-like, and that they begin to be developed earlier, the young being smooth for a much shorter time than those of *A. Vancouverensis*." To the writer the pilæ of the typical *A. Vancouverensis* seem finer and closer together than those of the specimens from Robson Island.

Arniotites or Celtites. (Species uncertain.)

Plate 19, fig. 4.

The large specimen from Forward Inlet, figured on plate 19, Professor Hyatt thinks may be "either an *Arniotites* or a *Celtites*." The numerous, narrow-sided, compressed whorls, entire keel, crowded pilæ (ribs) and discoidal form are very similar, possibly identical, with those of *Celtites Epolenensis*, Mojsisovics, figured from smaller specimens in Mediter. Triaspr., pl. 29, 38. The last part of the last whorl in the specimen collected by Dr. Dawson is curiously distorted by

pressure, and the side assumes an aspect like *Arniotites*, not possessed by the earlier stages, which are not distorted. As noted by Mojsisovics, *Arniotites* and *Celtites* are undoubtedly very closely allied in some of their species, but the typical forms seem to be generically separable."

Badiotites Carlottensis. (N. Sp.)

Plate 19, fig. 5.

Shell small, strongly compressed at the side, periphery sharp but not distinctly keeled; whorls increasing rapidly in breadth in the dorso-ventral direction. Surface of the outer volution marked by crowded, regularly disposed and nearly equidistant, minute and falcate rib-like folds, which curve concavely forwards on each of the sides and which are apparently not interrupted on the periphery. Sutural line unknown.

South side of Houston Stewart Channel, Queen Charlotte Islands, nearly opposite Rose Harbour, G. M. Dawson, 1878: one small and very much distorted specimen, the maximum diameter of which is twelve millimetres or about half an inch.

The type and only specimen collected is so much distorted by obliquely lateral pressure that its outer volution looks much more strongly embracing than it probably was in its normal condition, and its umbilicus is made to assume an abnormally narrow appearance.

For the elucidation of the generic relations of this shell the writer is indebted to Professor Hyatt, who writes as follows in regard to it: "It is much larger than the only other known species of this genus, the *Badiotites Eryx* of Mojsisovics (Ceph. der Mediterr. Triaspr, p. 91). After considerable trouble and some rather hazardous work, I succeeded in splitting off a part of the otherwise indeterminable shell, cleaned a part of the whorl, and traced the well-known pilæ of *Badiotites* running continuously across the abdomen of the much compressed and acute whorl. The extreme flatness, of course, may be in a measure accounted for by pressure, but the agreement in aspect of the whorls and the continuity of the pilæ leave hardly any room for doubting that it is a form of *Badiotites*. It is much larger than *B. Eryx*, and probably new."

AULACOCERAS CARLOTTENSE, Whiteaves.

Plate 19, fig. 6.

Aulacoceras Carlottense, Whiteaves.—1887. Dawson, Rep. Geol. Exam. N. part Vanc. I., &c.; in Ann. Rep. Geol. Surv. Can. for 1886, p. 109 B.

Guard elongated, in the more perfect though smaller of the only two specimens collected, which may therefore be regarded as the type of the species, narrowly conical and increasing very slowly in thickness from the acutely pointed posterior end, whose apex is slightly excentric; in the larger but less perfect example comparatively thick, somewhat fusiform and bluntly pointed posteriorly, with the apex distinctly excentric. Alveolus and phragmocone unknown. Outer surface marked by close-set, rounded, longitudinal ribs, which are separated from each other by narrow but deep linear furrows.

In 1878 six badly preserved specimens of the guards of one or more species of Belemnites were collected by Dr. G. M. Dawson at Houston Stewart Channel, in the Queen Charlotte Islands. Of these, the two described above are both longitudinally ribbed on the outside and apparently belong to the genus *Aulacoceras* of Hauer. The smaller of the two is a natural longitudinal section of the guard, about two inches in length and not quite half an inch broad at the thickest end, while the larger, which is only a badly preserved natural mould or impression of one side of a large specimen of the guard with part of the test preserved at the posterior end, but which shows clearly one of the lateral grooves as well as several of the longitudinal ribs that are said to be characteristic of the genus, is nearly five inches in length and fully an inch and a half broad in the thickest part. Of the other four specimens two are mere fragments which cannot be determined either generically or specifically, one being a very slender guard about two inches and a half long and not quite a quarter of an inch broad at the thicker end, whose surface markings are not preserved, while the other is a piece of the posterior or pointed end of the guard of a small individual, about an inch and a quarter long and a quarter of an inch broad at the thicker end, whose surface appears to be perfectly smooth.

GEOLOGICAL AND NATURAL HISTORY SURVEY OF CANADA

CONTRIBUTIONS TO CANADIAN PALÆONTOLOGY.

VOLUME I.

By J. F. Whiteaves.

4. *On some Cretaceous Fossils from British Columbia, the North West Territory and Manitoba.*

(A.) FROM THE EARLIER CRETACEOUS OF BRITISH COLUMBIA.

MOLLUSCA.

Lamellibranchiata.

Aucella Mosquensis, var. concentrica.

Inoceramus concentricus, Fisch. 1837. Oryctogr. de Moscou, p. 17, pl. 20, figs. 1–3.
Aucella concentrica, v. Keyserling. 1846. Petchorareise, p. 100, pl. 16, fig. 16.
Inoceramus Piochii, Gabb. 1864. Pal. Calif., vol. I, p. 187, pl. 25, fig. 173, (exclus. fig. 174).
Aucella concentrica, Eichwald (as of Fischer). 1865. Lethæa Rossica, vol. II, pt. 1, p. 521, pl. 22, figs. 3 a, b.
Aucella Piochii, Gabb. 1869. Pal. Calif., vol. II, p. 194, pl. 131, figs. 92, a–c.
Aucella concentrica, Eichwald (as of Fischer). 1871. Geogn. Palæont. Bemerk. über die Halbins. Mangisch. und die Aleutischen Inseln, p. 186, pl. 17, figs. 1 and 2.
Aucella concentrica, White (as of Fischer). 1884. Bull. U. S. Geol Surv., No. 4, p. 13, pl. 6, figs. 2–12.

Tatlayoco Lake, B.C., G. M. Dawson, 1875. Banks of the Upper Skagit River, B.C., G. M Dawson, 1877, and Browning Creek, Forward Inlet, Quatsino Sound, north west coast of Vancouver Island, G. M. D., 1878.

Long Island, Harrison Lake, B.C., also west shore and peninsula on the south-east shore of the same lake, and Chilliwack River, near Tamiahai Creek, B.C., A. Bowman, 1882.

Browning Creek, Forward Inlet and west side of Winter Harbour in Forward Inlet, also Raft Cove on the west coast of Vancouver Island, north of Quatsino Sound, V.I., G. M. Dawson, 1885.

West of Fraser River, B.C., a little to the north of sources of Bridge

River, B.C., from a mountain six or seven thousand feet high above sea level, Mr. Soues (per Mr. T. Elwyn), 1886. South Fork of Quesnel River, near the foot of Quesnel Lake, A. Bowman, 1886.

Porcupine River, N.W.T., in latitude 67° 8′ N. and longitude 137° 47′ W.; also Yukon River, Alaska, eight miles below the Antoine River, in latitude 65° 15′ N. and longitude 141° 40′ W.; R. G. McConnell, 1888. Extremely abundant at most of these localities.

The specimens from each of these localities are undoubtedly conspecific with the *Aucella Piochii* of Gabb from the Shasta Group of California, and with the fossils from the Cretaceous rocks of Alaska which Dr. C. A. White regards as a variety of the *A. concentrica* of Fischer. In the Lethæa Rossica, however, Eichwald has expressed the opinion that *A. concentrica* is not specifically distinct from the *A. Mosquensis* of von Buch, and the writer has long been convinced that *A. Piochii* also is only an inconstant varietal form of A. *Mosquensis*. The names *A. concentrica* and *A. Piochii* have been given with the view of distinguishing comparatively broad specimens whose valves are almost equally convex, from the typical *A. Mosquensis*, which is narrowly elongated and whose right valve is flatter than the left, but a study of some three or four hundred Aucellæ from various localities in British Columbia has led to the conclusion that the most dissimilar examples are connected by every kind of intermediate gradation. A careful comparison of Dr. White's illustrations of the Alaskan fosssils which he refers to *A. concentrica* with Eichwald's figures of specimens of *A. Mosquensis* from Alaska and the Aleutian Islands, will be sufficient to shew how difficult if not impracticable it is to discriminate between these nominal species.

By some writers the Aucella-bearing deposits of Russia have been regarded as of Jurassic age, and by others as of Cretaceous. D'Orbigny refers them to his "étage Oxfordien," Trautschold and Rudolph Ludwig to the Tithonic system of Oppel, and Eichwald to the Upper Neocomian. Ever since 1875, the year in which Aucellæ were first discovered in British Columbia, the present writer has been convinced that the rocks in which they are the prevalent fossil, in that province as well as in California, are of Cretaceous age. In the Transactions of the Royal Society of Canada for 1882, the opinion was expressed that these rocks are probably of the horizon of the Upper Neocomian. At the time that this paper was written, not more than eight species in a sufficiently perfect state for identification or description had been found associated with the Aucellæ in British Columbia, and of these, only two (viz., *Ancyloceras Remondi* and *Syncylonema Meekiana*), besides the *Aucella*, were recognized as occurring also in the "Lower Shales and Sandstones, or Subdivision C" of the Cretaceous rocks of the

Queen Charlotte Islands.* The more recent collections made by Dr. Dawson from the Aucella-bearing rocks of British Columbia, and reported on in the present paper, shew that ten fairly recognizable species are associated with the Aucellæ in that province, and that of these, two, (viz., *Astarte Carlottensis* and *Yoldia arata*), besides the two already mentioned, or, counting the *Aucella*, five out of the entire eleven are common to these deposits and to Subdivision C of the Cretaceous rocks of the Queen Charlotte Islands. Moreover, the fragment of an Ammonitoid shell to which the name *Olcostephanus Quatsinoensis* was given, in the paper to which reference has been made, proves to be a portion of a small Scaphite, closely allied to the *S. æqualis* of Sowerby, from the English Upper Greensand, and the *Pholadomya Vancouverensis* described and figured in the same paper is possibly only a form of the *Pleuromya Carlottensis* from the Queen Charlotte Islands, in a peculiar and unusual state of preservation. The present writer has long entertained the opinion that the "Lower Shales" (C) of the Queen Charlotte Islands Cretaceous are the homotaxial but by no means necessarily the contemporaneous equivalents of the Gault of England and Europe, and it now seems most probable that the rocks in British Columbia in which Aucellæ are the prevalent fossils, are of the same age as the deposits first mentioned rather than a little older.

When the acute inflection of the anterior margin of the right valve immediately under the beak, is not apparent, as is often the case, it is very easy to mistake an *Aucella* for a small species of *Inoceramus*, and if, as Eichwald suggests and as the figures and descriptions would seem to imply, the *Inoceramus Coquandianus* of d'Orbigny, which is described and figured in the "Paléontologie Française" and the "Paléontologie Suisse," be identical with one of the varietal forms of *Aucella Mosquensis*, then in Europe also Aucellæ would rank among the characteristic fossils of the Gault.

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* In this connection it may be well to quote the scheme of classification of the Cretaceous rocks of these islands which was published by Dr. Dawson in 1880 and based upon stratigraphical and lithological grounds, though, as has been elsewhere stated, it does not seem practicable to separate subdivisions C, D, and E on purely palæontological considerations.

Subdivisions of the Cretaceous Formation in the Queen Charlotte Islands, in descending order.

A.	Upper Shales and Sandstones	1,500 feet.
B.	Coarse Conglomerates	2,000 "
C.	Lower Shales and Sandstones, with coal	5,900 "
D.	Agglomerates	3,500 "
E.	Lower Sandstones	1,000(?)"
	Total	13,000 "

A and B being regarded as Later and C D and E as Earlier Cretaceous.

YOLDIA ARATA, Whiteaves.

Yoldia arata, Whiteaves. 1884. Geol. and Nat. Hist. Surv. Can., Mesoz. Foss., vol. I., p. 233, pl. 31, figs. 4 and 4*a*.

East side of Winter Harbor, Forward Inlet, G. M. Dawson, 1885: a few casts of the interior of the shell of a small *Yoldia*, which are somewhat doubtfully referred to this species.

ASTARTE CARLOTTENSIS. (N. Sp.)

Astarte Packardi, Whiteaves (as of White). 1884. Geol. and Nat. Hist. Surv. Can., Mesoz. Foss., vol. I., p. 229, pl. 30, figs. 6, 6a and 6b; but possibly not *A. Packardi*, White, 1880, U. S. Geol. Surv., Contr. to Palæont., Nos. 2–8, p. 149, pl. 37, figs. 6a and b.

Shell moderately convex, somewhat compressed at the sides, very inequilateral: marginal outline varying in different individuals from subcircular to transversely subovate: length and height equal in the subcircular specimens, whereas in the transversely subovate examples the length exceeds the height by rather more than one fourth: hinge margin descending abruptly and concavely in front and convexly and much more slowly behind: umbonal region somewhat tumid, beaks not very prominent, directed forwards and placed about half way between the centre and the anterior margin.

Surface marked by numerous and regularly disposed, narrow and acute concentric ribs or plications, and by minute striæ of growth.

The hinge dentition consists of two transverse cardinal teeth in each valve but there are no lateral teeth. In the right valve both teeth are most prominent in the middle, but the posterior cardinal tooth is triangular in outline and larger than the anterior. The inner margin of the valves below and at the sides is simple in some specimens and distinctly crenulated in others.

In a large specimen with nearly circular outline the maximum length and height are both thirty millimetres; in a transversely elongated specimen, the length is twenty-six mm., and the height twenty.

East side of Alliford Bay, Moresby Island, Q.C.I.; four large and beautifully preserved specimens with the test preserved, and a few fragments: south side of Alliford Bay; abundant in the condition of small but perfect casts: east end of Maud Island, in Skidegate Channel, Q.C.I., five small samples with the test preserved: all collected by G. M. Dawson in 1878.

The three or four imperfect and badly preserved casts from the felsites of the Iltasyouco River, B.C., which were provisionally identified with the *A. ventricosa* of Meek on page 155 of the Report of Pro-

gress of the Geological Survey of Canada for 1876-77, most probably belong to the present species.

Some imperfect valves of an *Astarte* collected by Dr. Dawson in 1885, on the east side of Winter Harbour, Forward Inlet, Vancouver Island, can also be scarcely distinguished from *A. Carlottensis*.

This species belongs to a typical and persistent section of the genus *Astarte*, which has ranged from the Liassic period up to the present time with very little variation in form or surface markings, and which is consequently very difficult to separate into well defined species. It agrees so well with the description and figures of *A. Packardi*, White, that it was at one time somewhat confidently identified with that species, but as Dr. White, who has examined some of the most perfect specimens from the Queen Charlotte Islands, thinks that it is most probably distinct therefrom, it seems necessary to distinguish it by a new specific name.

Opis Vancouverensis, Whiteaves.

Opis Vancouverensis, Whiteaves. 1879. Geol. and Nat. Hist. Surv. Can., Mesoz. Foss., vol. I., p. 158, pl. 18, figs. 4 and 4*a*.

West end of Lasqueti Island (in the Strait of Georgia) near False Bay: a cast of the interior of the right valve of a shell which almost certainly belongs to this genus and most probably to this species.

Pleuromya lævigata, Whiteaves.

Pleuromya lævigata, Whiteaves. 1884. Geol. and Nat. Hist. Surv. Can., Mesoz. Foss., vol. I., p. 224, pl. 30, figs. 1, 1*a*, 1*b*, 1*c*.

Nookneamish River, north-west end of Vancouver Island, G. M. Dawson, 1885: six badly preserved, but nearly perfect, and eight imperfect casts of the interior of the shell. These specimens are very variable in shape, no two being alike.

CEPHALOPODA.

Placenticeras occidentale, Whiteaves.

Plate 21, fig. 1.

Placenticeras occidentale, Whiteaves. 1887. Geol. and Nat. Hist. Surv. Can., Ann. Rep., N.S., vol. II, for 1886, page 113 B.

Shell strongly compressed at the sides, periphery rather sharply angulated but not distinctly keeled; outer whorl very closely embracing, umbilicus rather narrow, a little less than one fourth of the greatest

diameter, aperture narrowly sagittate, its base deeply emarginate by the encroachment of the preceding volution.

Surface of the sides of the outer whorl marked by broad and rather distant, radiating, bifurcating and doubly flexuous raised plications, which commence at the umbilical margin, curve at first gently forward, then as gently backward, and are finally bent very abruptly forward next to the periphery, upon which they form narrow, elongated and acute tongue-like processes. In addition to these plications the surface is marked by fine, simple and comparatively close set, radiating, raised lines, which are also doubly flexuous on each side. These raised lines are most strongly marked on the outer half of the sides, and are as well defined on the summits of the plications as in the smaller spaces between them. Septation unknown.

K-uk River, coast of British Columbia, G. M. Dawson, 1885: one tolerably well preserved but somewhat imperfect cast of the interior of the shell, whose greatest diameter is a little less than five inches.

This species seems to be most nearly related to the *Ammonites bicurvatus* of Michelin, from the Gault of France, as figured by d'Orbigny on Plate 64, figs. 3 and 4 (but not figs. 1 and 2 of the same plate, which, according to Pictet, represent *A. Cleon*, d'Orb.) of the Atlas to the first volume of the Paléontologie Française, Terrains Crétacés. It seems, however, to differ from *A. bicurvatus*, which Zittel places in Meek's genus *Placenticeras*, not only in its much greater size, but also in the presence of numerous, closely arranged and doubly flexuous raised lines, in addition to the doubly flexuous radiating plications or rib-like folds which are common to both.

Placenticeras Perezianum.

Ammonites Perezianus, Whiteaves. 1876. Geol. Surv. Can., Mesoz. Foss., vol. I., p. 19, pl. II., figs. 1 and 1 a.
Haploceras Perezianum, Whiteaves. 1884. Ib., p. 201.

Liard River, below Old Fort Halkett, in latitude 59° 26′ and longitude 124° 48′ W., R. G. McConnell, 1887: two specimens, which though a little larger, seem to be precisely similar in all other respects to the type of *A. Perezianus* from the Queen Charlotte Islands. In one of the specimens from the Liard River nearly the whole of the sutural line is well preserved, but the exact shape of the siphonal saddle cannot be ascertained, though it was evidently very small. The first, second, third and fourth lateral saddles, which diminish gradually in size towards the umbilicus, are variously but unequally branched and incised, and are succeeded in the umbilical region by four or five small unbranched saddles with incised margins. The siphonal lobe is moderately large and is divided at the summit into two equal parts by

the small siphonal saddle. The first lateral lobe is much larger than any of the rest and is rather deeply and unequally divided a little on one side of the centre by a small offset of the first lateral saddle. All the lobes are incised at their margins, but the siphonal and first lateral lobes are the only ones that are branched.

In 1876, the writer, who had not then seen a copy of Dr. Neumayr's paper on the Ammonites of the Chalk Formation,* expressed the opinion that the type of the present species belongs to the group of the Clypeiformes and that it might prove to be an *Oppelia* allied to the *O. Waageni* of Zittel.

A subsequent study of other specimens from the Queen Charlotte Islands, in 1884, induced the writer to refer the species to *Haploceras*, on account of its supposed affinities with the *Ammonites Cleon* of d'Orbigny and *A. bicurvatus* of Michelin, both of which were placed by Dr. Neumayr in that genus. But, in his Manuel de Conchyliologie, published at intervals between 1880 and 1887, Dr. Paul Fischer states that the genus *Haploceras*, which he regards as a synonym of *Lissoceras*, Bayle, corresponds to the group Ligati, and places the whole of the Clypeiformes in Meek's genus *Sphenodiscus*.

In the second volume of the "Handbuch der Palæontologie" (1881-85), Zittel re-defines and slightly extends the characters of Meek's genus *Placenticeras* so as to make it embrace the whole of the Clypeiformes and among the representative species cites the *Ammonites bicurvatus* of the "Terrains Cretacés," which, Pictet says, includes *A. Cleon*. He (Zittel) restricts the use of the generic term *Haploceras* so as to make it include a few Jurassic and two Neocomian species, and constitutes a new genus, which he calls *Desmoceras*, for the reception of the Ligati.

The present species, no doubt, bears a very close resemblance to *Desmoceras Beudanti* in the general shape of its shell, and in its sutural line, but differs therefrom in the total absence of the distant, periodic arrests of growth which are generally held to be characteristic of the Ligati. Hence it would seem that the former species can no longer be satisfactorily referred to *Haploceras*, or even to *Desmoceras*, but that it belongs to an aberrant section of the Clypeiformes, in which the periphery or abdominal region is more or less narrowly rounded rather than thin and sharp.

By Dr. Fischer the Clypeiformes, as a whole, are included in *Sphenodiscus* and by Zittel in *Placenticeras*. But, if the specimens of the present species collected by Messrs. Richardson and McConnell

*Uber Kreideammonitiden. Aus dem LXXI Bande der Sitzb. der K. Akad. der Wissensch., I Abth. Mai-Heft, Jahrg. 1875.

be carefully compared with Meek's original diagnosis of these two genera, it will be found that they differ materially from *Sphenodiscus* in having their outer lateral lobes and saddles distinctly branched, as well as in the much greater obtuseness of their periphery, and from *Placenticeras* proper, in the circumstance that their narrowly rounded periphery is neither truncated nor "provided with a row of compressed alternating nodes around each margin." Still, under all the circumstances of the case, the course that seems open to the fewest objections is to follow Zittel and to refer the species, for the present at least, to *Placenticeras*.

Placenticeras (Perezianum? var.) Liardense.

Plate 20, figs. 1 and 2.

Liard River, near Old Fort Halkett, R. G. McConnell, 1887: four other specimens of an Ammonite, which may possibly represent a local variety of *P. Perezianum*. They were found in flattened lenticular masses which have been split open in such a way as to expose one side only of each shell, and two out of the four are mere fragments. The characters of the periphery cannot be ascertained in either, the sides are crushed nearly flat and the sutural line is not visible, but the surface markings and the size and shape of the umbilicus are clearly shown in all.

So far as it can be made out, the general contour of each of these four specimens appears to have been essentially the same as that of the type of the species, but their sculpture is of a much more decided character, and consists of well defined, slightly flexuous, rounded and transverse, rib-like folds, which widen rapidly outward towards the periphery and are entirely devoid of tubercles. At an early stage of growth these folds are simple, and alternately long and short, but in the larger specimens, most of the longer folds bifurcate near the middle of the sides, and a shorter fold, which becomes obsolete before reaching the umbilical margin, is usually intercalated between each pair of the longer ones.

Scaphites Quatsinoensis.

Plate 21, fig. 2.

Olcostephanus Quatsinoensis, Whiteaves. 1882. Trans. Roy. Soc. Can., vol. I., Section IV., p. 82, woodcut fig. 1.

Scaphites Quatsinoensis, Whiteaves. 1887. Geol. and Nat. Hist. Surv. Can., Ann. Rep., N. S., vol. II., p. 114 B.

East side of Winter Harbour, Forward Inlet, Quatsino Sound, Van-

couver Island, G. M. Dawson, 1885 : two well preserved and nearly perfect but not quite adult specimens and a few fragments.

These show clearly that the species is not an *Olcostephanus* of the type of *O. bidichotomus*, as was at first supposed, but a finely-ribbed small Scaphite, very nearly related to the *Scaphites æqualis* of Sowerby. Its ribs too are not invariably bidichotomous, for in some of the specimens collected in 1885 they trifurcate, while in others, in closely contiguous portions of the same specimen, they are bidichotomous, trifurcate, or simple with shorter ones intercalated between, though they are apparently never tuberculated nor nodose.

The type of *O. Quatsinoensis* is a well preserved but very imperfect and immature specimen collected by Dr. Dawson in 1878 at Browning Creek, Forward Inlet, where it is associated with an abundance of *Aucella Mosquensis*, var. *concentrica*.

B. FROM THE NORTH WEST TERRITORY.

(1.) From Rink Rapids, on the Lewes River, a tributary of the Yukon, in latitude 60° 20′ and longitude 136° 30′; collected by Dr. G. M. Dawson in 1887.

BRACHIOPODA.

Discina pileolus. (N. Sp.)

Plate 21, figs. 3 and 3 a.

Upper or dorsal valve (the only one known) depressed conical, its greatest height being a little less than one half of its maximum breadth : apex erect and placed a little behind the mid-length : base broadly elliptical or elliptic ovate in outline, and about one fourth longer than broad.

Surface shining, polished and marked with crowded and minute but somewhat irregularly disposed concentric raised lines.

Length of the most perfect specimen collected, twelve millimetres ; breadth of the same, a little more than nine mm. and a half : approximate height, four mm.

Two dorsal valves, one of which is nearly perfect and remarkably well preserved.

LAMELLIBRANCHIATA.

CYPRINA YUKONENSIS. (N. Sp.)

Plate 21, fig. 4.

Shell rather small, compressed convex, inequilateral: marginal outline varying from subcircular or ovately subcircular to subovate, the height in the majority of specimens being very nearly as great as the length. Anterior side short and rounded: posterior side longer and somewhat obliquely subtruncated at its extremity: ventral margin longitudinally semiovate, rounding upward rapidly in front and straighter behind: superior border sloping downward very gently behind the beaks and descending abruptly and concavely in front of them: beaks broad, prominent, appressed, placed in advance of the mid-length, and curved obliquely forward: posterior umbonal slopes sometimes distinctly angulated, but, as this character is seen in only one specimen, it may be the result of distortion.

Surface marked by concentric lines of growth. Hinge dentition and muscular impressions unknown, though the pallial line appears to have been entire.

Dimensions of one of the most perfect specimens collected: maximum length, thirteen millimetres; greatest height, twelve mm.

One somewhat crushed left valve, with the whole of the test preserved, two perfect and well preserved casts of the interior of the same valve and three similar casts of the right valve.

This species is rather variable in shape, and seems to be most nearly allied to the *Cyprina Marcousana* of de Loriol, from the Middle Neocomian of Switzerland.

CEPHALOPODA.

SCHLOENBACHIA BOREALIS. (N. Sp ?)

Plate 21, fig. 5.

Perhaps a variety of *Schloenbachia propinqua*.

Cfr. *Schloenbachia propinqua*, Whiteaves. 1884. Geol. and Nat. Hist. Surv. Can., Mesoz. Foss., vol. I., p. 247, pl. 33, figs. 2, 2a, 2b, 2c.

Shell compressed at the sides, its periphery encircled by a flattened, thin and very prominent simple keel, which attains to a height of

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* See Pictet and Campiche's Paléont. Suisse., Foss. du Terr. Cret. des Envir. de Ste. Croix, Ser. 3, p. 214, pl. 113, figs. 3 and 4.

three millimetres near the aperture: umbilicus wide and shallow. Volutions about five in number, increasing rather rapidly in size, but more rapidly in a dorso-ventral than in a lateral direction, not very closely embracing, nearly the whole of the sides of the inner ones being exposed: umbilicus, as measured from suture to suture, occupying about one-third of the entire diameter, and nearly equal in width to the height of the aperture just outside of its emargination. Aperture narrowly subelliptical, higher than broad, pointed above and very shallowly emarginated below by the slight encroachment of the preceding volution.

On the outer volution, each of the sides is ornamented by doubly flexuous, transverse and rib-like raised plications, which are interrupted by or do not pass over the prominent keel on the periphery, and which are entirely devoid of tubercles. Most of these plications extend completely across the sides, and some of them bifurcate or even trifurcate at about their mid-length, but near the keel a short fold is occasionally intercalated between two of the longer plications.

The characters of the sutural line are not satisfactorily exhibited in any of the specimens collected. In a small cast of the interior of the shell, whose longest diameter is about three-quarters of an inch, three lobes and as many saddles can, it is true, be counted on one side of the siphonal saddle, but the whole of the exposed surface of this cast is so much worn that nearly all the finer incisions and ramifications of the sutures are obliterated.

Dimensions of the largest and most perfect specimen obtained; greatest diameter sixty-two millimetres: width of umbilicus, as measured from suture to suture, twenty-three mm.: height of aperture, inclusive of keel, twenty-two mm.

In addition to the specimen whose dimensions have just been given, six much smaller examples, and several impressions or fragments of others, were collected.

This shell is certainly very closely related to the *Schloenbachia propinqua*, from the "Lower Sandstones or Division E" of the Cretaceous rocks of the Queen Charlotte Islands, and may prove to be only a local variety of that species. Judging by the rather scanty material at present available for comparison, the present form appears to differ from the typical *S. propinqua* in having more slender whorls (in a dorso-ventral direction) and a consequently wider umbilicus,—in its more distinctly doubly flexuous folds, and in the greater prominence of its abdominal keel. *S. borealis* seems also to be very nearly allied to the *Schloenbachia cultrata* (the *Ammonites cultratus* of d'Orbigny) of the French Neocomian, and to differ therefrom in almost exactly the same way as it does from *S. propinqua*.

The *Aptychus* or portion of an *Aptychus* represented on Plate 21, (fig. 6) was found in the same beds as the *S. borealis*, and may have belonged to that species. It is longitudinally semiovate in outline, and its outer surface is marked only with rather closely disposed concentric raised lines.

CRUSTACEA.

PHYLLOPODA.

ESTHERIA BELLULA. (N. Sp.)

(Plate 21, figs. 7 and 7a.)

Carapace valves compressed at the sides, but regularly though moderately convex (so that a transverse section of both when closed would be ovately and narrowly lenticular in outline), inequilateral, a little longer than high and varying in outline in different specimens from obliquely subovate to longitudinally semiovate. Anterior end always shorter and generally narrower than the posterior.

The most perfect specimen collected, which is figured on Plate 21, fig. 7, and which may be regarded as the type of the species, is obliquely subovate in marginal outline. Its anterior and posterior ends are both rounded, as are also both of its cardinal angles, and its dorsal margin is comparatively short, though more than half the entire length. In one of the longitudinally semiovate examples (fig. 7 A) the anterior end is angular at its junction with the dorsal margin above, and much narrower than the posterior end, which latter is rounded both above and below; while in another, the marginal outline is not far from semicircular, the dorsal border or hinge line extends nearly the whole length of the valves, and is angular at both ends. Umbones small, depressed, contiguous and placed near the anterior end, but not quite terminal.

Surface marked by from thirteen to eighteen closely and rather regularly disposed concentric ridges, which are rounded and not very prominent, although distinctly defined.

Dimensions of one of the most perfect specimens collected: maximum length, seven millimetres: greatest height, five.

One perfect and well preserved cast of the interior of a pair of valves which had become widely spread out, a few similar but not quite so well preserved casts of detached valves, and a single cast of the exterior of a left valve.

As no portion of the thin test is preserved on any of these specimens, it is of course by no means certain that they are really the valves of phyllopod crustaceans. Still, in spite of the circumstance that the other organisms with which they are associated seem to indicate purely marine rather than fresh water or brackish conditions, these little fossils appear to the writer to bear a much closer resemblance to some of the species described and figured by Professor T. Rupert Jones in his "Monograph on the Fossil Estheriæ," published by the Palæontographical Society, than they do to any lamellibranchiate bivalve.

The few fossils collected by Dr. Dawson at this particular locality on the Lowes River are, perhaps, not altogether sufficient to indicate the exact position which the rocks from which they were collected occupy in the Cretaceous System. The genera *Discina* and *Estheria* have such an extensive range in time that they afford no definite information on this point. The most characteristic fossil, apparently, which has yet been found in these rocks, is the *Schloenbachia* which has just been described under the name *S. borealis*. This species appears to be very nearly related to the *S. propinqua* of the lowest division yet recognized of the Cretaceous rocks in the Queen Charlotte Islands. As will be seen farther on, it occurs also in the Rocky Mountains near Devil's Lake, in deposits which hold several other species of fossils which were first described from specimens collected in the Lower Shales and Sandstones, or Subdivision C of the Queen Charlotte Island Cretaceous. So far as it goes, therefore, the palæontological evidence would seem to show that these rocks on the Lowes River represent as low a horizon in the Cretaceous system as has yet been definitely recognized in Canada.

(2.) From the Rocky Mountains three miles north of the east end of Devil's Lake; collected by R. G. McConnell in 1887.

Probably from the same geological horizon as the Lower Shales and Sandstones of the Queen Charlotte Island Cretaceous.

BRACHIOPODA.

Terebratula robusta. (N. Sp.)

Plate 22, figs. 1, 1 a, 1 b and 2.

Shell large, rather strongly convex, the maximum thickness through the closed valves being very little less than their greatest breadth marginal outline ovately subelliptical, the length being nearly one third greater than the breadth, and the greatest breadth a little in

advance of the midlength; front margin subtruncated in the centre; posterior extremity bluntly pointed.

Ventral valve rather more convex than the dorsal; the umbo of the former moderately prominent, its beak incurved and slightly decurved as well as somewhat obliquely truncated; deltidium very small as the central portion of the anterior margin of the truncated beak of the ventral valve almost touches the beak of the dorsal; foramen rather large and apparently complete. In an end view the front margin of the ventral valve is seen to be sinuated, the sinus being very shallow and indistinctly defined, but moderately broad and nearly straight in the centre. At a short distance from the front margin the mesial fold and sinus become obsolete.

Dorsal valve smaller as well as less convex than the ventral, its beak small and depressed, and its front margin provided with a shallow mesial fold which fits into the corresponding sinus of the opposite valve.

The foregoing description is applicable only to the adult shell. In immature specimens the marginal outline is very nearly circular, the length and breadth are almost equal, and the shallow fold and sinus of the front margin of the valves are not developed.

The surface markings are very imperfectly preserved, but the exterior appears to have been nearly smooth, and marked only by concentric lines of growth and by minute and crowded radiating striæ.

The markings on the interior of the valves are also very imperfectly preserved. In a cast of a dorsal valve there is a longitudinal median groove less than half the entire length, which probably represents the septum. In the same cast the posterior adductor appears to have been long, narrow, pointed at both ends, and more convex on its inner margin than externally, while the anterior adductor, though also long, narrow and pointed posteriorly, is narrowly rounded and somewhat dilated in front.

Dimensions of an average adult specimen: maximum length, seventy-one millimetres; greatest breadth, forty-eight mm. and a half; thickness through the closed valves, forty-two mm.

Seventeen more or less perfect casts of the interior of the closed valves were collected, some of which have portions of the test adherent thereto.

Two specimens of a *Terebratula* collected by Mr. James Richardson in 1872 from the "Lower Shales and Sandstones" of Skidegate Inlet in the Queen Charlotte Islands, appear to be immature individuals of this species.

OSTREA SKIDEGATENSIS, Whiteaves.

Ostrea Skidegatensis, Whiteaves. 1884. Geol. and Nat. Hist. Surv. Can., Mes. Foss., vol. 1 p. 243, fig. 12.

Two casts of the interior of the shell of an *Ostrea* which is probably referable to this species.

EXOGYRA. Species undeterminable.

Four casts of what appear to be the convex valves of a small mytiloid or subtriangular and somewhat arcuate *Exogyra*, which the writer has not been able to identify with any known species but which are not in a satisfactory condition for description or illustration.

LIMA PEROBLIQUA. (N. Sp.)

Plate 22, figs. 3 and 3 a.

Shell of medium size, strongly compressed, very inequilateral and broader than long; marginal outline obliquely semioval. Anterior side or buccal region nearly straight, but very slightly concave in the middle, its margins being deeply but narrowly inflected; posterior side or anal region broadly rounded, but truncated or subtruncated in the cardinal region; pallial border narrowly rounded. Beaks moderately prominent, anterior, terminal, the posterior umbonal slope forming nearly a right angle with the anterior. Ears and cardinal area unknown. The only portion of the test that happens to be preserved in either of the two specimens collected, is a small piece round the anal margin of the less perfect of the two. On this part of the shell the surface ornamentation appears to consist of very fine and delicate radiating striæ or impressed lines, which are much narrower than the flattened spaces between them, and of concentric lines of growth.

Dimensions of the most perfect specimen collected: greatest length, forty-one millimetres; maximum breadth of the same, fifty-seven mm. A not very well preserved but nearly perfect cast of the interior of a left valve and a portion of another.

Although its surface markings are very imperfectly exhibited, the lateral outline of this shell seems to be very different to that of any other species of *Lima* that has so far been described and figured as occurring in the Cretaceous rocks of North America.

Pteria (Oxytoma) Corneuiliana, d'Orbigny.

Plate 23, figs. 1, 1 a and 1 b.

Avicula Corneuiliana, d'Orbigny, 1845. Pal. Franc., Terr. Cret, tome III, p. 471, pl. 389, figs. 3 and 4.
" " Pictet and Campiche. 1868–71. Paléont. Suisse., Descr. des foss. du Terr. Cret. des Env. de Ste. Croix, tome III, p. 66, pl. 152, figs. 1–4.

A few detached and more or less imperfect valves of a shell which cannot at present be satisfactorily distinguished from the above named European species. The following is a description of the specimens collected by Mr. McConnell, as they appear to the writer.

Shell rather large, very inequilateral: left valve compressed but somewhat tumid in the umbonal region, at least in some specimens; right valve nearly flat; marginal outline of the valves, apart from the two wings, obliquely and broadly semiovate, the maximum length very slightly exceeding the greatest height. Anterior side very short and broadly rounded; posterior side produced and much longer, as well as more narrowly rounded at its termination, than the anterior; pallial border convex; hinge line apparently straight both behind and in front of the beaks; anterior wing small and triangular; posterior wing apparently short and extending to less than half the distance from the beak to the farthest termination of the valve behind (at least in the most perfect left valve collected) but much longer proportionately in the most perfect right valve, its posterior margin concavely excavated; beaks small, scarcely projecting above the highest level of the hinge line, and placed considerably in advance of the midlength.

The surface markings of the largest and most perfect of the left valves collected consist of seventeen narrow but prominent, distant and simple radiating ribs, and these are separated from each other by broad flattened spaces which bear still narrower and much less prominent radiating raised lines. The principal ribs seem to have projected beyond the outer margin of the valve as short free spines, and between each pair, on and around the said margin, from five to six radiating raised lines can be counted.

The right valve is marked only by numerous fine radiating ribs, which are much smaller than the large ones in the opposite valve, as well as nearly equal in size and placed comparatively close together.

Hinge dentition and muscular impressions of both valves unknown.

Maximum length of the largest specimen collected (a left valve) sixty-eight millimetres; greatest height of the same sixty-one mm.

Two well preserved moulds of the exterior of the left valve, one nearly perfect and both shewing the surface markings well; three casts of the interior of the same valve, and three imperfect right valves.

It is not improbable that specimens of an *Oxytoma* from Subdivisions C. and E. of the Cretaceous rocks of the Queen Charlotte Islands, which the writer referred to the *O. mucronata* of Meek and Hayden (on pages 238 and 251 of the first volume of Canadian "Mesozoic Fossils") may prove to be immature individuals of the present species.

Inoceramus.

Three casts of the interior of detached valves of shells which obviously belong to this genus, but which are far too imperfect and too badly preserved to be determined specifically. They seem, however, to represent two species, both of which are referable to the section or subgenus *Catillus* of Brongniart, in which the hinge line is elongated in a direction parallel with the longer axis of the shell.

Trigonoarca tumida, Whiteaves.

Trigonoarca tumida, Whiteaves. 1884. Geol. and Nat. Hist. Surv. Can., Mesoz. Foss., vol. I., p. 235, pl. 31, fig. 6.

One imperfect and and badly preserved cast of the interior of both valves, and three similar casts of detached left valves, which resemble the type of this species very closely in external form, but which are in too bad condition to be identified with much certainty.

Trigonia Dawsoni, Whiteaves.

Trigonia Dawsoni, Whiteaves. 1878. Geol. Surv. Can., Rep. Prog. 1876-77, p. 154. 1884. Geol. and Nat. Hist. Surv. Can., Mesoz. Foss., vol. I., p. 231, pl. 31, figs. 1 and 1a.

A few specimens, which are evidently conspecific with the original types of *T. Dawsoni* from the Iltasyouco River and Sigutlat Lake.

In 1884 the writer expressed the opinion that the shells for which this name had been suggested were probably identical with the *Trigonia intermedia* of Fahrenkohl, from the Neocomian of Russia. About a year after this statement was made, however, three unusually large, perfect and well preserved specimens of *T. Dawsoni* from Skidegate Inlet, in the Queen Charlotte Islands, were presented to the Museum

June, 1889.

of the Survey by Mr. James Deans, of Victoria, V. I. A comparison of these specimens with Eichwald's description and figures of *T. intermedia* has not tended to confirm the impression that *T. Dawsoni* is synonymous with that species, but has led to the conclusion that there are apparently several points of difference between them, which may be thus briefly summarized.

1. *T. Dawsoni* seems to have attained to fully twice the size of *T. intermedia*. According to Eichwald the latter measures one inch and a half in length, from the anterior to the posterior side, and one inch in height, measured from the middle of the inferior margin to that of the dorsal border, whereas the corresponding dimensions in the largest of the three specimens of *T. Dawsoni* from Skidegate Channel are, length three inches and an eighth, height two inches.

2. The curved ribs of *T. intermedia* are said to be ornamented with very small *spinous* nodes, but in *T. Dawsoni* the nodes on the ribs can scarcely be called very small, and they are generally obtusely rounded, though often intersected or partly intersected by the concentric grooves which alternate with the rather crowded raised lines of growth.

3. There appears to be a slight but constant difference between the sculpture of the broad posterior area of *T. Dawsoni* and that of *T. intermedia*. In the last named species this area is described as over-run (parcourue) with oblique, almost vertical, close striæ, divided into two parts by a horizontal groove. In the figures of *T. intermedia* these vertical striæ are represented as straight, parallel, regular, continuous and devoid of tubercles, and the only tubercles on the posterior area appear to be those on the elevated ridge which separates it from the main body of the shell. But, in *T. Dawsoni* the vertical raised lines on the posterior area are often irregularly disposed, interrupted, more or less angularly bent as well as somewhat tuberculated, and there are indications of a row of transversely elongated tubercles on each side of the central groove, and of a similar but less distinct row on the subangular ridge which separates this area from the escutcheon proper.

In view of these apparent differences between the two forms, it is probably advisable to retain the name originally given to the types from British Columbia, for the specimens from that province and for those now under consideration from the Rocky Mountains.

Astarte Carlottensis, Whiteaves.

(For the synonymy of this species and reference to the publication in which it was figured, see page 154 of this Report.)

One fairly characteristic specimen of a left valve.

Protocardium Hillanum, (?) Var.

Cardium Hillanum, Sowerby. 1813. Min. Conch., vol. i., p. 41, pl. 14, fig. 1.
" " d'Orbigny (as of Sby.) Pal. Franc., Terr. Cret., vol. iii., p. 27, pl. 243.
Protocardium Hillanum, Stoliczka. 1871. Palæont. Indica. Cret. Faun. S. India, vol. iii, p. 219, pl. 12, figs. 8-10 and pl. 13, figs. 1-3.
" " Whiteaves.—1884. Geol. and Nat. Hist. Surv. Can., Mesoz. Foss., vol. 1, p. 228, pl. 30, fig. 5.

Three casts of the interior of single valves and a similar cast of a pair of partially displaced valves of a rather large species of *Protocardium*, which seems to differ from *P. Hillanum* only in being rather more produced behind and consequently a little longer than high. The maximum length of the largest specimen collected at this locality is thirty-nine millimetres and its greatest height, inclusive of the beaks, thirty-four mm., or as measured in the centre, just behind the beaks, thirty mm. The impressions left by the radiating ribs on the posterior area are plainly visible on these casts, but no traces of any concentric markings can be detected on the remainder of their surface. In d'Orbigny's figures of a cast of a French specimen of *C. Hillanum* the maximum length and height are represented as exactly equal, but the small specimens from the Queen Charlotte Islands which the present writer has identified with that species, like those from the Rocky Mountains now under consideration, are a little longer than high.

Cyprina occidentalis, Whiteaves.

Cyprina occidentalis, Whiteaves.—1884. Geol. and Nat. His. Surv. Can., Mesoz. Foss., vol. 1, p. 227, woodcut, fig. 10.

One small but nearly perfect cast of the interior of both valves and a less perfect but in other respects similar cast of a left valve, both of which can be somewhat confidently identified with this species, which is nearly related to the *C. Dallii* of White,* from the Cretaceous rocks of Alaska.

* Bull. U. S. Geol. Surv., Washington, 1884, p. 14, pl. vi., fig. 1.

Pleuromya Carlottensis, Whiteaves.

Pleuromya Carlottensis, Whiteaves. 1876. Geol. and Nat. His. Can., Mesoz. Foss. vol. I, p. 57, pl. 9, fig. 8.
Pleuromya subcompressa, var. Carlottensis, Whiteaves. 1884. Ib., p. 223, pl. 29, figs. 7 and 7a.

One imperfect but fairly characteristic specimen. It is quite possible that the shells for which this name was proposed, are only a local variety of the *Pleuromya papyracea* of Gabb,* from the Shasta Group of California, and that the *Pholadomya Vancouverensis*† which was described and figured by the present writer from a single specimen collected by Dr. G. M. Dawson in 1877 from the north-east slope of Jackass Mountain, in the valley of the Lower Fraser River, is, as already stated on page 153, either another variety of the same species, or the same shell in an unusual and very peculiar state of preservation.

CEPHALOPODA.

Schloenbachia borealis, Whiteaves.

(This species has already been described on page 160 of this Report and is figured on Plate 21.)

Two specimens, which do not seem to differ in any essential particular from the type of *S. borealis* from the Lewes River. One is a badly preserved cast of the interior of a shell, and the other a well preserved mould of the exterior of another,‡ both of which measure about three inches and a half in their greatest diameter.

A third specimen, which is probably only a variety of the same species, was also collected by Mr. McConnell at this locality. It resembles the type of *S. borealis*, both in external form and in the prominence of its simple abdominal keel, but has much coarser ribs, many of which bifurcate half way across the sides.

The occurrence of the same species of Ammonite at localities so wide apart as the Rink Rapids of the Lewes River and the Rocky Mountains near Devils Lake, is not without significance from a purely geological point of view.

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* Geol. Surv. Calif., Palæont. vol. II, (1869) p. 178, pl. 29, fig. 66.
† Trans. Royal Soc. Can., 1882, vol. I, Sec. IV, p. 83, woodcut, fig. 2.
‡ A very similar specimen to this was collected by Mr. McConnell in the same year at a locality about five miles from that indicated in the last heading, viz., in the Rocky Mountains, three miles north of Devil's Lake and three miles north of the Cascade Trough.

SCHLOENBACHIA GRACILIS. (N. Sp.)

Plate 23, figs. 2 and 2a.

Shell shallowly but widely umbilicated, the inner whorls occupying a little more than one half of the entire diameter; periphery encircled apparently with a central and very slightly raised, simple abdominal keel. Volutions about five, narrow, increasing slowly in size and but slightly embracing. Outer volution somewhat rectangular, its sides being compressed and its abdominal region slightly flattened on both sides next to the keel, though rounded off exteriorly. Aperture subelliptical but somewhat rectangular, higher than wide and very slightly emarginate by the encroachment of the preceding volution.

Surface marked by distant, slightly curved, prominent and simple radiating ribs or rib-like folds. On the outer volution these ribs, which curve somewhat obliquely forward in a shallowly concave curve, become obsolete in the abdominal region and disappear before reaching the keel. They are much narrower than the broad, shallow depressions between them, and are most prominent a little more than half way across the sides, where each rib rises gradually into a low, pointed tubercle. Sutural line unknown.

Approximate dimensions of the most perfect specimen collected: greatest diameter, one hundred and ten millimetres; width of umbilicus, from suture to suture, fifty-eight mm.; height of the aperture (at the broken anterior extremity, thirty mm.; width of the same, if measured on the summits of two opposite ribs, twenty-two mm., or, if in the interstices between them, eighteen mm.

Two imperfect and not very well preserved specimens, both of which are mere casts of the interior of the shell.

Associated with these, two other fragments of a *Schloenbachia* were collected by Mr. McConnell, in one of which the abdominal region is encircled by three prominent angular ridges, of which the central one is much the highest, just as in the *Ammonites Tehamaensis* of Gabb,* which would now be called a *Schloenbachia*. In several other respects, however, these fragments differ materially from the types of *S. gracilis* and from *S. Tehamaensis*. Their volutions are much more closely embracing, their outer volution is much broader in a dorso-ventral direction, and their umbilicus is much narrower in proportion to the size of the shell. The ribs on their outer volution, too, are very faint and indistinct, and in none can any trace of a tubercle be detached either near their centre or at their outer termination.

* Geol. Surv. Calif., Palæont. Vol. II [1869] p. 132.

BELEMNITES. (Species undeterminable.)

Two portions of the phragmocone and five fragments of the guard, the latter all broken at both ends, of a species of Belemnite which it is, of course, quite impossible to identify from such imperfect specimens. One of the fragments of the guard has a deep median groove, which is not the case with any of the others.

(3.) FROM THE PEACE RIVER, A FEW MILES BELOW FORT VERMILION; COLLECTED BY MR. W. OGILVIE, D.L.S., IN 1885.

CEPHALOPODA.

PLACENTICERAS GLABRUM. (N. Sp.)

Plate 24, figs. 1, 1 a and 1 b.

Shell rather strongly compressed at the sides, its maximum breadth being a little more than one fourth of the greatest diameter, most prominent and broadest at the umbilical margin and narrowing very slowly from thence to the periphery, which latter is narrowly but regularly rounded. Umbilicus rather deep and occupying about one-fifth of the entire diameter, though its outer margin is rounded and indistinctly defined. Volutions deeply embracing, fully three fourths or more of the inner ones being covered: suture distinct. Aperture obtusely and narrowly subsagittate, its outline, outside of the deep basal emargination, being narrowly elliptic ovate. Length of body chamber unknown.

Surface apparently smooth, though not a vestige of the outer layer of the test is preserved.

The sutural line, which is minutely and angularly incised throughout its entire length, is composed of two large outer lateral saddles and five much smaller inner ones, as well as one large outer lateral lobe and four much smaller inner ones (or seven of the latter, if three very small ones on the lower part of the umbilical wall be counted) on each side of the siphonal saddle and lobe. The small siphonal saddle is angularly notched on each side of the centre and divided into three erect spurs, the middle one of which is the shortest and the least incised at its margin. The first lateral saddle is much broader than high, it is also broader than the second, but not quite so high. The upper portion of the first lateral saddle is deeply divided near the middle into

two nearly equal parts, each of which is subdivided into three spreading branchlets with bifurcate or trifurcate apices. Between the first and second lateral saddles there are two rather small auxiliary saddles, the outermost of which is the larger and the more subdivided of the two. The second lateral saddle is deeply divided near the centre into two unequal parts, the outer one of which bears four short incised branchlets and the inner five. The third lateral saddle is so deeply divided in the middle as to form two almost independent saddles. Of these, the outer one, which is the larger of the two, bears three branchlets at its summit, and the inner one two. The fourth lateral saddle is somewhat similar to the third, but a little smaller. The fifth, sixth and seventh, which are still smaller and decrease gradually in size toward the suture, are rather emarginate than branched at their summits.

The siphonal lobe is about equal in height to the first lateral lobe. On each side the former bears two spreading lateral branches, which trifurcate at their summits, besides a short, erect, incised spur next to the siphuncle above, and a similar but spreading spur or offset at the base. Between the siphonal and first lateral lobes, as also between the first and second, second and third, and third and fourth lateral lobes, there are three small auxiliary lobes, of which the central one is always the largest. The first lateral lobe is broad in its basal and undivided portion, which bears a lateral incised spur or offset on each side. Its upper moiety is deeply divided into two branches of unequal size, viz., into an outer and smaller one which bifurcates above and an inner or larger one which trifurcates above, while both widen outward and ultimately throw off a number of minute and more or less deeply incised lateral branchlets or spurs. The second lateral lobe is shorter and much narrower than the first. Though its apex is minutely bifid, the lobe itself is not deeply divided above, but it bears on each side three irregularly incised spurs or offsets, which also widen a little outward. The third lateral lobe is much shorter than the second, and its upper portion is divided into two branches which trifurcate on their outer sides. The fourth is smaller, but in other respects similar to the third, and the rest of the lobes, which are not branched but incised at their margins, are very small, and decrease gradually and regularly in size to the suture.

Dimensions of the only specimen collected: greatest diameter, ninety six millimetres; maximum breadth, twenty-six mm.; greatest width of the umbilicus, nineteen mm.

One remarkably well preserved and nearly perfect cast of the interior of the septate portion of the shell, which shews the finest details of the lobes and saddles over nearly the whole of its surface, ex-

cept where they are covered by small portions of the inner layer of the test.

This species appears to belong to the same group of Ammonites as the *A. *Cleon* and *A. nisus*† of d'Orbigny and the *Placenticeras Porezianum* of the Queen Charlotte Islands, and the remarks on pages 157 and 158 of this report, on the generic position of the shell last named, are equally applicable to *P. glabrum*.

(4.) From the Fort Pierre Group of the Later Cretaceous Rocks of the Saskatchewan and its Tributaries; collected by J. B. Tyrrell in 1885 and 1886.‡

LAMELLIBRANCHIATA.

Pteria linguiformis, var. subgibbosa, Meek.

Avicula subgibbosa, Meek and Hayden. 1860. Proc. Ac. Nat. Sc. Phil., p. 180.
Pteria subgibbosa, Meek. 1864. Smithson. Check-List N. Am. Cret. Foss.
Pteria linguiformis, var. *subgibbosa*, Meek. 1876. Rep. U. S. Geol. Surv. Terr., vol. IX., p. 33, pl. 28, fig. 12.

Battle River, Township 45, Range 4, west of the 4th Principal Meridian, 1885.

Inoceramus Sagensis, var. Nebrascensis, Owen.

Inoceramus Sagensis, Owen. 1852. Geol. Rep. Wisc., Iowa & Minn., p. 582, pl. 7, fig. 3.
Inoceramus Nebrascensis, Owen. 1852. Ib., p. 582, pl. 8, fig. 1.
Inoceramus Sagensis, var. *Nebrascensis*, Meek. 1876. Rep. U. S. Geol. Surv. Terr., vol. IX., p. 52, pl. 13, figs. 2 a, b.
Inoceramus Sagensis, Whitfield. Pal. Black Hills Dakota, p. 393, pl. 7, fig. 12, and pl. 8, fig. 2.

Mouth of Vermilion River, Township 54, Range 3, west of the 4th Principal Meridian; North Saskatchewan River, Township 54, Range 2, west of the 4th Principal Meridian; Neso Creek, Section 24, Township 44, Range 2, west of the 4th Principal Meridian, 1886: one specimen from each of these localities.

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* For the synonymy of this species see Pictet and Campiche, Pal. Suisse, t 1, p. 169.
† Pal. Franc., Terr. Cret., t. 1, p 184, pl. 55, figs. 7-9.
‡ Pages 174 to 184 are reprinted, with some additions, from an Appendix to Mr. Tyrrell's Report in the Annual Report of the Survey for 1886, Vol. 2, New Series, pp. 153-163 E.

Inoceramus Vanuxemi, Meek and Hayden.

Inoceramus Vanuxemi, Meek and Hayden. 1860. Proc. Ac. Nat. Sc. Phil., p. 180.
Inoceramus Mortoni, Meek and Hayden. 1860. Ib., p. 428.
Inoceramus proximus, Meek. 1876. Rep. U. S. Geol. Surv. Terr., vol. IX., p. 53, pl. 12, fig. 7; and var. *subcircularis*, Meek, ib., p. 55, pl. 12, fig. 2.
Inoceramus Vanuxemi, Whitfield. Pal. Black Hills Dakota, p. 396, pl. 7, figs. 8, 9, and pl. 8, figs. 4, 5.

Mouth of Vermilion River, Township 54, Range 3, west of the 4th Principal Meridian, 1886, five specimens; and North Saskatchewan River, Township 54, Range 2, west of the same meridian, 1886, two specimens.

Gervillia recta, var. borealis, Whiteaves.

Gervillia recta, var. *borealis*, Whiteaves. 1885. Contr. to Canad. Palæont., vol. I., p. 35, pl. 4, figs. 2, 2 a and 2 b.

Sounding Creek, Township 30, Range 8, west of the 4th Principal Meridian, 1886: a few characteristic fragments.

Tancredia Americana, Meek and Hayden.

Hettangia Americana, Meek and Hayden. 1856. Proc. Ac. Nat. Sc. Phil., vol. VIII., p. 274; and 1860, Ib., vol. XII., p. 185.
Tancredia Americana, Meek. 1876. Rep. U. S. Geol. Surv. Terr., vol. IX., p. 142, pl. 38, figs. 1, a–h.

Same locality and date as the preceding species: two very imperfect and badly preserved specimens.

Cyprina ovata, Meek and Hayden.

Cyprina ovata, Meek and Hayden. 1857. Proc. Ac. Nat. Sc. Phil., vol. IX., p. 144.
" " Meek. 1876. Rep. U. S. Geol. Surv. Terr., vol. IX., p. 146, pl. 29, figs. 7 a, b, c, and pl. 30, fig. 11.

Battle River, Township 40, Range 13, west of the 4th Principal Meridian, and Township 40, Range 15, west of the same meridian, 1885: a single and barely recognizable specimen from each of these localities.

CYPRINA SUBTRAPEZIFORMIS, Whiteaves.

Plate 24, figs. 2, 2a and 2b.

Cyprina subtrapeziformis, Whiteaves. 1887. Geol. and Nat. Hist. Surv. Can., Ann. Rep. N. Series, vol. II, p. 155 E.

Shell small, inequilateral, transversely subtrapezoidal: valves moderately convex, most prominent on the posterior umbonal slopes, which are subangular: height (in the centre) one third greater than the maximum breadth: length a little more than one fourth greater than the height. Anterior side short and evenly rounded: posterior side about three times as long as the anterior, its extremity obliquely truncated above and somewhat bluntly pointed below: superior border descending rather abruptly in an obliquely convex curve in front of the beaks, and nearly straight and parallel with the ventral margin behind them: umbones swollen laterally, but scarcely prominent: beaks small, appressed and slightly depressed, placed about half-way between the centre and the anterior margin: lunule none: posterior area subangularly inflected, but very indistinctly defined: ventral margin nearly straight for the greater part of its length, but rounding up abruptly at the anterior end and forming an obtusely subangular junction with the posterior margin behind.

Surface marked with rather coarse concentric lines of growth: test somewhat thin. Anterior muscular impression subovate: posterior muscular impression rather larger and more nearly circular: pallial line simple and entire: hinge dentition unknown.

Dimensions of the most perfect specimen collected: maximum length, twenty-three millimetres and a half; greatest height, fifteen mm; approximate thickness through the closed valves, ten mm.

Battle River, Township 46, Range 4, west of the 4th Principal Meridian, 1885: apparently abundant. About thirty specimens were collected at this locality, but of these, only one is quite perfect, with the whole of the test preserved, while the rest are for the most part little more than mere casts of the interior of the closed valves, with portions of the exfoliated test adherent thereto.

The hinge dentition being unknown, it is uncertain to what genus this shell should be referred. It may prove to be a *Cypricardia* or a *Veniella* rather than a *Cyprina*.

PROTOCARDIA SUBQUADRATA, Evans and Shumard.

Cardium subquadratum, Evans and Shumard. 1857. Trans. Ac. Nat. Sc. St. Louis, vol. I., p. 39.

Protocardia (Leptocardia) subquadrata, Meek. 1876. Rep. U. S. Geol. Surv. Terr., vol. IX., p. 175, pl. 29, figs. 8 a, b, c, d, e.

Protocardia subquadrata, Whiteaves, as of Shumard. 1885. Contr. to Canad. Palæont[illegible] I., p. 41, pl. 5, figs. 4 and 4 a.

Sounding Creek, Tow[illegible] Range 8 west of the 4th Principal Meridian, 1886: a few [illegible]ed and characteristic specimens.

PROTOCARDIA BOREALIS, Whiteaves.

Protocardia borealis, Whiteaves. 1885. Contr. to Canad. Palæont., vol. I., p. 41, pl. 6, figs. 1, 1 a, 2, 2 a, and 3.

"The Nose," Township 27, Range 8, west of the 4th Principal Meridian, 1885: two specimens.

LINEARIA FORMOSA? Meek and Hayden.

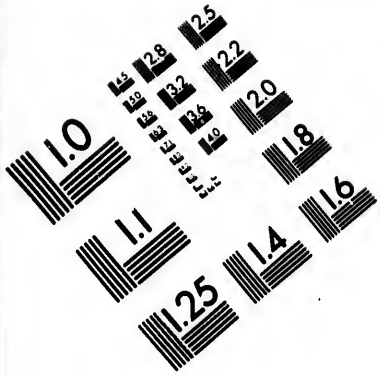
Plate 24, fig. 3.

Tellina formosa, Meek and Hayden. 1860. Proc. Ac. Nat. Sc. Phil., vol. XII., p. 179.

Abra (?) formosa, Meek. 1864. Smithson. Check-List N. Am. Cret. Fossils, p. 14.

Linearia (?) formosa, Meek. 1876. Rep. U. S. Geol. Surv. Terr., vol. IX., p. 199, pl. 30, fig. 2.

Sounding Creek, Township 30, Range 8, west of the 4th Principal Meridian, 1886: a perfect right valve of a small Tellinid which corresponds remarkably well with Meek's figure of the above-named species. In the specimen collected by Mr. Tyrrell, however, only the outer surface is exposed to view, the whole of the interior being buried in the matrix. No traces of any radiating striæ can be discovered on its test, with a lens, although the markings on its outer surface are beautifully preserved, and its test does not appear to have been "*very* thin."



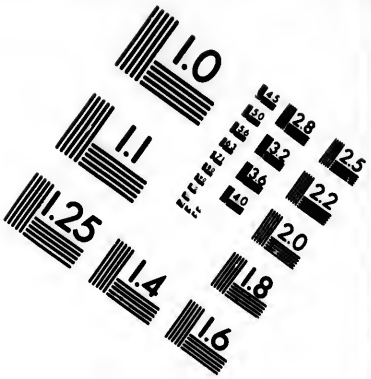
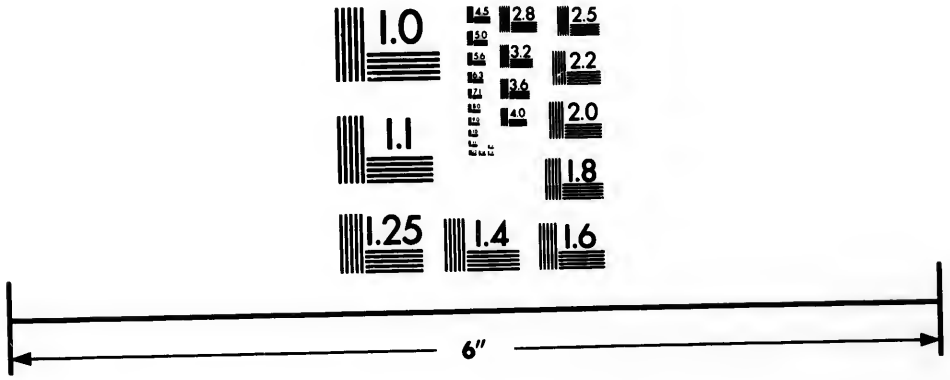


IMAGE EVALUATION TEST TARGET (MT-3)



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PHOLADOMYA SUBVENTRICOSA, Meek and Hayden.

Pholadomya subventricosa, Meek and Hayden. 1857. Proc. Ac. Nat. Sc. Phil., vol. IX., p. 142.
Pholadomya subventricosa, Meek. 1876. Rep. U. S. Geol. Surv. Terr., vol. IX., p. 217, pl. 39, figs. 8, a, b.

North Saskatchewan River, at Fort Pitt, and in Township 54, Range 2, west of the 4th Principal Meridian, 1886: one nearly perfect specimen with both valves preserved, from each of these localities. A portion of a mould of a shell which may have belonged to this species, was collected on the banks of the same river near the mouth of Moose Hill Creek.

Dr. Hector records finding a *Pholadomya* which he refers to *P. occidentalis* of Morton, but which is probably referable to this species, at Fort Pitt, on the North Saskatchewan, and at the elbow of the South Saskatchewan, in 1857 or 1858.

LIOPISTHA UNDATA, Meek and Hayden.

Pholadomya undata, Meek and Hayden. 1856. Proc. Ac. Nat. Sc. Phil., vol. VIII., p. 81.
Pholadomya (*Cymella*) *undata*, Meek. 1864. Smithson. Check-List N. Am. Cret. Inv. Foss., pp. 14 and 34.
Liopistha (*Cymella*) *undata*, Meek. 1876. Rep. U. S. Geol. Surv. Terr., vol. IX., p. 236, pl. 39, figs. 1, a, b.

Nose Creek, Township 37, Range 9, west of the 4th Principal Meridian, 1885: one characteristic specimen.

SOLECURTUS (TAGELUS) OCCIDENTALIS, Whiteaves.

Plate 24, fig. 4.

Solecurtus (*Tagelus*) *occidentalis*, Whiteaves. 1887. Geol. and Nat. Hist. Surv. Can., Ann. Rep., N. Ser., vol. II., p. 157 E.

Shell transversely elongated, a little more than twice as long as high, very nearly equilateral, strongly compressed at the sides, most prominent on the umbonal slopes, and faintly depressed in the middle below. Anterior and posterior ends both rounded at their margins, but rather more broadly so below than above, while the (presumed)

posterior extremity is a very little the narrower of the two. Superior border nearly straight for some distance in front of and behind the beaks, which are inconspicuous, central, appressed and depressed; ventral margin nearly straight or very faintly concave in the centre.

Surface apparently marked only with concentric lines of growth. Hinge dentition, muscular impressions and pallial line unknown.

Approximate dimensions of the only specimen collected: maximum height, twenty-three millimetres; greatest length, sixty-seven mm.; thickness through the closed valves, about fourteen mm.

Battle River, Township 40, Range 13, west of the 4th Principal Meridian, 1885: an imperfect and badly preserved left (?) valve.

MARTESIA TUMIDIFRONS, Whiteaves.

Plate 25, figs. 1, 1a and 2.

Martesia tumidifrons, Whiteaves. 1887. Op. cit., p. 157 E.

Shell rather large for the genus, very inequilateral, valves subglobose or semiglobose and abruptly swollen in front, produced and rather rapidly attenuated behind; outline, as viewed from above, somewhat pyriform. Greatest height, as measured in the centre, behind the beaks, about equal to the maximum thickness through the closed valves; greatest height, as compared with the maximum length, about as three to five.

Lateral outline transversely subovate; anterior side very short, its outer margin broadly rounded but somewhat truncated inwardly below the middle; posterior side much more elongated, narrowing gradually at its upper margin and much more rapidly from below upward, its narrow and conspicuously gaping extremity being apparently somewhat obliquely truncated, though the margins of the cast of the united valves of the only specimen collected are both a little broken at this point. Superior border rounding abruptly downward in front, and nearly straight, but descending very gently behind: ventral margin broadly rounded, most prominent a little behind the middle: umbones swollen and prominent: beaks large, incurved and depressed, with a slight forward inclination and placed very near the anterior end: escutcheon broadly lanceolate and tolerably well defined.

On the umbonal region of the left valve only, a small portion of the test is preserved, and the outer surface of this is marked with concentric and rather irregularly disposed, ridge-like folds, which are often separated from each other by somewhat broader and rather deep con-

centric furrows. In addition to these, in each valve an elevated but narrow linear ridge runs obliquely backward from the posterior side of the beaks to a little behind the centre of the ventral margin.

Posterior muscular impression narrowly subelliptical, placed very high up, almost within the escutcheon, and a little behind the mid-length; anterior muscular impression, pallial line and accessory valves unknown. The pedal opening in front seems to have been large and broadly rhomboidal in outline.

The measurements of the only specimen collected are approximately as follows: maximum length, about fifty-one millimetres; greatest height, as measured in the centre, immediately behind the umbones, and maximum thickness through the closed valves, both thirty-one mm.

North Saskatchewan River, Township 54, Range 2, west of the 4th Principal Meridian, 1886: one nearly perfect and well preserved cast of the interior of the closed valves, with a small portion of the test adhering to the left valve. An apparently well characterized and very distinct species.

Since the above description was written, another specimen of this species, the exact locality of which is unfortunately unknown, has been presented to the Museum of the Survey by the Historical and Scientific Society of Manitoba.

In this specimen, which is represented on Plate 25, fig. 2, and which retains a considerable portion of the test, especially on the right valve, the concentric markings would perhaps be better described as raised lines of growth, which are very faint and almost obsolete posteriorly but prominent and well defined anteriorly, rather than as "ridge-like folds." On the tumid anterior portion of each valve these concentric lines of growth are crossed by faint radiating ribs which give to the former a somewhat tuberculated appearance. In this specimen, too, the slightly elevated median ridge which runs obliquely backward from the beak, is longitudinally and very narrowly grooved, at any rate on the right valve.

GASTEROPODA.

HYDATINA PARVULA, Whiteaves.

Plate 24, figs. 5 and 5a.

Hydatina parvula, Whiteaves. 1887. Op. cit., p. 158 E.

Shell small, the outer whorl enveloping all the preceding volutions, strongly inflated and very ventricose, so much so that its maximum breadth is very little less than the entire height or length,—subtruncated posteriorly, broadest above or behind the middle, narrowing rapidly

below or in front, and distinctly angular at the base or anterior extremity. Spire narrow, depressed and sunk deeply below the highest level or rounded posterior shoulder of the outer whorl.

Outer lip thin and simple: characters of the aperture and surface markings unknown.

Maximum height or length of the only specimen collected, ten millimetres and a-half; greatest breadth of the same, nine mm.

Sounding Creek, Township 30, Range 8, west of the 4th Principal Meridian, 1886: one perfect cast of the interior of the shell, with a considerable portion of the inner layer of the test preserved, though the aperture is entirely filled up with the matrix.

This interesting little shell may belong to Conrad's genus *Bullopsis*, rather than to *Hydatina*. It seems to differ from *B. cretacea* of that author in being more expanded posteriorly and more angular in front.

LUNATIA CONCINNA, Hall and Meek. (Sp.)

Natica concinna, Hall and Meek. 1854. Mem. Am. Ac. Arts. and Sc., vol. V., p. 384, pl. 3, figs. 2 a, b, c, d.

Natica Moreauensis, Meek and Hayden. 1856. Proc. Ac. Nat. Sc. Phil., vol. VIII, pp. 64 and 282.

Natica (*Lunatia*) *Moreauensis*, Meek and Hayden. 1860. Ib., vol. XII., p. 422.

Lunatia concinna, Meek. 1876. Rep. U. S. Geol. Surv. Terr., vol. IX., p. 314, pl. 32, figs. 11 a, b, c.

Battle River, Township 46, Range 3, west of the 4th Principal Meridian, 1885: four imperfect and badly preserved specimens. Sounding Creek, Township 30, Range 8, west of the same meridian, 1886: one specimen.

CEPHALOPODA.

BACULITES OVATUS, Say.

Baculites ovatus, Say. 1821. Am. Journ. Sc. and Arts, vol. II., p. 41.—Morton, 1829. Journ. Ac. Nat. Sc. Phil., vol. VI., p. 196, pl. 5, figs. 5 and 6; and 1830, Am. Journ. Sc. and Arts, vol. XVIII., p. 249, pl. 1, figs. 6, 7 and 8; also 1834, Synops. Org. Rem. Cret. Group U. S., p. 42, pl. 5, figs. 5 and 6.—Hall and Meek. 1854. Mem. Am. Ac. Arts and Sc., vol. V., (N.S.) p. 399, pl. 5, figs. 1, a, b, and pl. 6, figs. 1–7.—Meek. 1876. Rep. U. S. Geol. Surv. Terr., vol. IX., p. 394, pl. 20, figs. 2, a, b, d, and 1, a, b.

Ghost River, Township 25, Range 6, west the of 5th Principal Meridian, 1885. North Saskatchewan River, near mouth of Moose Hill Creek; also on the same river, in Township 54, Range 2, and in

township 56, range 5, in each case west of the 4th Principal Meridian. Mouth of Vermilion River, in Township 54, Range 3, west of the same Meridian, 1886.

A few specimens from each of these localities, some of which seem to belong to the typical form of the species, while others are apparently intermediate in their characters between *B. ovatus* and *B. compressus*.

BACULITES GRANDIS, Hall and Meek.

Baculites grandis, Hall and Meek. 1854. Mem. Am. Ac. Arts and Sc., Boston, vol. V., (N. S.) p. 402., pl. 7, figs. 1 and 2, pl. 8. figs. 1 and 2, and pl. 6, fig. 10. Also, Meek, 1876, Rep. U. S. Geol. Surv. Terr., vol. IX., p. 398, fig. 53, and pl. 33, figs. 1, a, b, c.

Sounding Creek, Township 30, Range 8, west of the 4th Principal Meridian, 1886: two large but fairly characteristic fragments.

BACULITES COMPRESSUS, Say.

Baculites compressus, Say. 1821. Am. Journ. Sc. and Arts, vol. II., p. 41.—Morton. 1834. Synops. Org. Rem. Cret. Group U. S., p. 43, pl. 9, fig. 1; and Journ. Ac. Nat. Sc. Phil., vol. VIII., p, 211.—Hall and Meek. 1854. Mem. Am. Acad. Arts and Sc., Boston, vol. V. (N.S.), p. 400, pl. 5, fig. 2, and pl. 6, figs. 8 and 9.—Meek. 1876. Rep. U. S. Geol. Surv. Terr., vol. IX., p. 400, figs. 55 and 56, and pl. 20, figs. 3, a, b, c.

"The Nose," Township 37, Range 8, west of the 4th Principal Meridian, and Nose Creek, Township 37, Range 9, west of the same Meridian, 1885.

North Saskatchewan, near mouth of Moose Hill Creek, apparently grading into *B. ovatus*; same river, in Township 56, Range 5, west of the 4th Principal Meridian; mouth of Vermilion River, in Township 53, Range 3, west of the 4th Principal Meridian: several distorted fragments apparently also passing into *B. ovatus*; North Saskatchewan River, Township 54, Range 2, west of the 4th Meridian, 1886.

SCAPHITES NODOSUS, Owen.

Scaphites (*Ammonites*) *nodosus*, Owen. 1852. Geol. Rep. Surv. Wisc., Iowa and Minn., p. 580, pl. 8, fig. 4.

North Saskatchewan River, near the mouth of Moose Hill Creek, 1886: a fragment of a mould of the exterior of the shell, which shews the characteristic sculpture of the species, but not enough of the general shape to enable one to say to which of the varieties described and figured by Meek (in the ninth volume of the Rep. U. S. Geol. Surv. Terr.) it should be referred.

PLACENTICERAS PLACENTA, Dekay. (Sp.)

Ammonites placenta, Dekay. 1828. Ann. N. York Lyc. Nat. Hist., vol. II, p. 278, pl. 5, fig. 2 (3 by mistake).—Morton. 1829. Journ. Ac. Nat. Sc. Phil., vol. VI, p. 195; and Am. Journ. Sc. and Arts, vol. XVIII, pl. 2, figs. 1, 2 and 3; also 1834, Synops. Org. Rem. Cret. Form. U. S., p. 36, pl. 2, figs. 1 and 2.

Placenticeras placenta, Meek. 1876. Rep. U. S. Geol. Surv. Terr., vol. IX, p. 465, pl. 24, figs. 2, a, b.

Battle River, Township 40, Range 13, west of the 4th Principal Meridian, 1885: a small fragment.

Sounding Creek, Township 30, Range 8, west of the same meridian, 1886; a single but nearly perfect specimen which measures nearly nine inches in its greatest diameter.

CRUSTACEA.

PALÆASTACUS (?) ORNATUS, Whiteaves.

Plate 25, fig. 3.

Palæastacus (?) ornatus, Whiteaves. 1887. Geol. and Nat. Hist. Surv. Can., Ann. Rep., N. Ser., vol. II., p. 161 E.

The foregoing was suggested as a provisional name for a rather remarkable specimen of a long tailed decapod, which evidently belongs to the family *Astacomorpha* of Zittel. Of the Cretaceous representatives of this family, it seems to come nearest to such genera as *Palæastacus* and *Hoploparia*, though it differs from each in some important particulars. In many respects it appears to the writer to be still more nearly related to the recent and fresh-water genera *Astacus* and *Cambarus*, but there is good reason for supposing that it will eventually prove to be the representative of a new generic type, which at present there is not sufficient material to define satisfactorily.

Nearly the whole of the under surface of the cephalothorax of the specimen is buried in the matrix, the front margin of the carapace is very imperfect, the tail fin as well as the under part of the five abdominal segments are broken off, and only small portions of the pinching claws and of the other ambulatory legs are preserved or exposed.

The carapace is moderately convex or slightly depressed, and not quite twice as long as broad. It is divided into two nearly equal parts by a single, well marked and deeply impressed neck furrow, which is arched forward in a shallowly concave curve. Behind this furrow the lateral margins of the carapace are slightly expanded, the test in the branchial region is moderately inflated, and the posterior margin

is shallowly concave in the middle. A short distance in advance of the neck furrow, on the outer and lower portion of the carapace, on each side, there is a very short and transverse groove or narrow constriction, which may possibly be confluent with the neck furrow on the strongly decurved lateral margins of this part of the carapace. The exact outline of the anterior margin of the carapace cannot be ascertained, and the tip of the rostrum is broken off. The basal portion which remains is about seven or eight millimetres long. At the base it measures five mm. in breadth, and at the broken anterior extremity its breadth is two mm. Its outer margins are defined by two linear and acute, tuberculated and raised longitudinal ridges, between which the surface is smooth and concavely excavated.

The whole of the outer surface of the carapace is ornamented by rather distant, isolated tubercles. In its posterior moiety these tubercles are somewhat irregularly disposed, though there is a low, very narrow, and rather inconspicuous keel on the median line, on either side of which the cardiac region is comparatively smooth. On the anterior portion of the carapace the tubercles are grouped somewhat obscurely in two or three longitudinal rows on both sides of the narrow median keel, which is continued with greater or less distinctness up to the commencement of the rostrum.

The anterior pinching claws appear to have been unusually short and robust, while their surface is distinctly tuberculated. The portions of the posterior ambulatory legs that happen to be preserved, on the other hand, are very slender, and their surface is minutely granulated. The abdominal segments are badly preserved, but their outer surface seems to have been smooth, though a narrow median keel can be traced throughout the greater part of their dorsal surface.

Sounding Creek, Township 30, Range 8, west of the 4th Principal Meridian, 1886.

At the same locality and date, five detached pinching claws of an apparently second species of decapod were collected in as many concretionary nodules. These claws resemble those of *P. ornatus* in the comparative shortness and robustness of their terminal segments, but the outer surface of the latter is finely granulated rather than coarsely tuberculated.

FISHES.

A well preserved tooth of a Selachian was collected on the Battle River, in Township 46, Range 3, west of the 4th Principal Meridian, in 1885; and a pectoral fin, apparently of a large Selachian, at Sounding Creek, Township 30, Range 8, west of the 4th Principal Meridian, in 1886.

C. FROM MANITOBA*.

From the Niobrara-Benton Formation of the Later Cretaceous in the Duck and Riding Mountain District.

VERMES.

Serpula semicoalita. (N. Sp.)

Plate 26, fig 1.

Tubes subcylindrical, a little broader than high, attached by their bases to some foreign object, increasing very gradually in size, irregularly curved but apparently never spirally coiled, and growing for the most part in very closely aggregated groups. The tubes often cross each other, and in those places where they either run parallel to or are in contact with each other in the same plane, two, three, four, or more, are not unfrequently united or anchylosed together. Upper surface nearly smooth, marked only by a few irregularly disposed and transverse lines of growth.

Length unknown; average transverse diameter, three millimetres.

Vermilion River, Township 25, Range 20 W.†: two specimens. Swan River, Township 35, Range 29 W.: one specimen. All three from the Niobrara group, or upper part of the series.

MOLLUSCOIDEA.

BRACHIOPODA.

Lingula subspatulata (?) Hall & Meek.

Lingula subspatulata, Hall & Meek. 1856. Mem. Am. Ac. Arts & Sciences, Cambridge, vol. V., p. 380, pl. 1, figs. 2 a, b.

Rolling River, Township 35, Range 26 W., J. B. Tyrrell, 1887: one imperfect valve and a fragment of another, on a small piece of sandstone from the base of the Fort Benton group, or lowest beds of the series.

The more perfect of these two specimens is in almost exactly the same condition as the type of *L. subspatulata*, the shell in both being

* Mr. Tyrrell, who is at present engaged in making a geological examination of this region, states that although the rocks there seen are precisely similar to those described by Messrs. Meek and Hayden in Nebraska as Nos. 3 and 2 of their typical section, they are so intimately associated together that it is practically impossible to draw any line of demarcation between them.

† All the localities in this district, from which the fossils mentioned were collected, are west of the 1st Principal Meridian.

"preserved only on the margins" and the beak either obliterated or covered by the matrix. In both the lateral margins are nearly straight and parallel and the front border is subtruncate, so that although the type of Hall and Meek's species is said to be from the Fort Pierre group (near Red Cedar Island, on the Upper Missouri River,) and the specimens obtained by Mr. Tyrrell are from a distinctly lower horizon in the Cretaceous, no essential differences can at present be detected between them.

MOLLUSCA.

LAMELLIBRANCHIATA.

OSTREA CONGESTA, Conrad.

Ostrea congesta, Conrad. 1843. Nicollet's Rep. Expl. in the N.W., p. 167.—Hall & Meek (1854) Mem. Am. Acad. Arts & Sc., Boston, vol. VIII. (N. S.), p. 405.—Meek & Hayden (Nov., 1856) Proc. Ac. Nat. Sc. Phil., p. 286.—Hall (1856). Pacific R.R. Repts., vol. III., p. 100, pl. 1, fig. 11.—Meek (1876). Rep. U. S. Geol. Surv. Terr., vol. IX. p. 13, pl. 9, figs. 1 a, f.

Swan River, J. W. Spencer, 1874.

Ochre River, Township 23, Range 17 W., and Township 22 in the same Range; Vermilion River, Township 24, Range 17 W., and Township 25 in the same Range; Rolling River, two miles above the old C.P.R. crossing, and Swan River, Township 35, Range 29 W.; J. B. Tyrrell, 1887.

Thunder Hill, Township 35, Range 30 W.; D. B. Dowling, 1887.

Assiniboine River, Section 36, Township 8, Range 11 W.; Warren Upham, 1887.

From each of these localities a few specimens, which are apparently referable to this widely distributed species, were collected from the Niobrara group, or upper part of the series. Most of these specimens are less than an inch in their greatest diameter, though they occasionally attain to a length of an inch and a half or an inch and three-quarters. In each of those from Thunder Hill the lower valve is attached to a fragment of a large *Inoceramus*, and the only example in which the shells are clustered is from the Rolling River. All the rest appear to be both single and unattached to any foreign body, though fully one half of the specimens are upper valves. The writer has not yet seen, either from Manitoba or from any other part of Canada, any specimens of *O. congesta* which correspond with that form of the species described and figured by Meek in which the margins of the lower valves are "abruptly deflected upward at right angles to the flat,

attached base and produced in this direction often for as much as an inch or more," so that, in certain conditions of preservation these valves look "like short cylindrical tubes with one end abruptly truncated and closed by the flat surface of attachment."

ANOMIA OBLIQUA, Meek & Hayden.

Anomia obliqua, Meek & Hayden. 1860. Proc. Ac. Nat. Sc., Phil., p. 181; also Meek, 1876, in U. S. Geol. Surv. Terr., vol. IX., p. 22, pl. 9, fig. 2.

Vermilion River, Township 24, Range 20 W., and Ochre River, Township 22, Range 17 W., J. B. Tyrrell, 1887: two rather small upper valves from each of these localities. All from the Niobrara group, or upper portion of the series.

INOCERAMUS PROBLEMATICUS, Schlotheim.

Ostracites labiatus, Schlotheim. 1813. Brown's Jahrb., vol. VII., p. 93.

Mytilites problematicus, Schlotheim. 1820. Petrefactenk, vol. I., p. 302.

Mytiloides labiatus, Brongn. 1822. Cuv., Oss. Foss., pl. 3, fig. 4, in Geol. des env. de Paris.

Inoceramus mytiloides, Mant. 1822. Geol. of Sussex, p. 215, pl. 27, fig. 2, and pl. 28, fig. 2.

" " Sowerby. 1823. Min. Conch., vol. V., p. 62, pl. 442.

" " Goldfuss. 1835. Petref. Germ., vol II., p. 188, pl. 113, fig. 4.

Inoceramus problematicus, d'Orbigny. 1843. Pal. Franc., Terr. Cret., vol. III., p. 510, pl. 406.

Inoceramus labiatus, Stoliczka. 1871. Palæont. Ind., vol. III., Cret. Pelecyp. S. Ind., p. 408, pl. 29, fig. 1.

Inoceramus problematicus, Meek. 1876. Rep. U. S. Geol. Surv. Terr., vol. IX., p. 62, pl. 9, figs. 3, a, b.

Swan River and Thunder Hill, J. W. Spencer, 1874: a few specimens from each of these localities.

Vermilion River, Riding Mountain, Section 7, Township 24, Range 20 W., T. A. Burrows, 1886: a perfect cast of the interior of a left valve.

Ochre River, Township 22, Range 17 W., eleven specimens; Edwards Creek, Township 23, Range 19 W., two specimens; Vermilion River, Township 25, Range 20 W., nine specimens; Wilson River, Township 25, Range 21 W., two specimens; Valley River, Township 25, Range 21 W., one specimen, and Range 22 W., in the same Township, one specimen; Rolling River, two miles above the old C. P. R. crossing, one specimen; J. B. Tyrrell, 1887.

Thunder Hill, Township 35, Range 30 W., three specimens, D. B. Dowling, 1887. All from the Niobrara group, or upper part of the series.

The specimens collected at these localities are usually little more than imperfect casts of the interior of detached valves, but they represent the typical form of the species rather than the variety *aviculoides* of Meek and Hayden.

On account of its real or supposed earlier date, a question which the present writer has no means of investigating, the name *I. labiatus* is preferred to *I. problema ..cus* by Stoliczka and some other German palæontologists.

Modiola tenuisculpta. (N. Sp.?)

Plate 26, figs. 2 and 2a.

Shell elongated, compressed, the length being more than twice the height, and the greatest thickness through the closed valves about one-third less than their maximum height; umbonal slopes rounded, nearly obsolete, and not at all angulated. Superior border moderately elevated and somewhat angular a little behind the middle; hinge line straight, occupying rather more than one-half of the entire length, and forming a very obtusely subangular junction with the obliquely convex downward slope of the anal margin; postero-basal extremity rather narrowly rounded; basal margin shallowly concave; anterior extremity forming a subangular, but somewhat rounded, narrow lobe which projects a short distance beyond the beaks, the latter being small, depressed and appressed, with a forward inclination.

Surface marked by fine and very numerous radiating ribs, which bifurcate at irregular intervals, and which are crossed by extremely minute concentric striæ, as well as by a few distant and impressed periodic arrests of growth. The radiating ribs are coarser above the nearly obsolete umbonal slopes than they are below them, and the concentric striæ which cross them are too small to be visible without the use of a lens.

Characters of the interior of the valves unknown.

Dimensions of the most perfect specimen collected: maximum length, fifty-three millimetres; greatest height, twenty-two mm.; breadth or thickness, fourteen.

Swan River, Township 37, Range 26 W., J. B. Tyrrell, 1887: a somewhat imperfect cast of the interior of the closed valves, with a small portion of the test preserved, and a well preserved portion of the mould of a detached valve. Rolling River, Township 35, Range

26 W., J. B. Tyrrell, 1887: an imperfect right valve. All from the Fort Benton group, or lower part of the series.

The specimens described above seem to be very nearly related to the *Volsella** (*Brachydontes*) *multilinigera*† of Meek, from "Cretaceous sandstones at Coalville, Utah," but they appear to differ therefrom in their much more broadly rounded umbonal slopes, and in the greater prolongation of their anterior extremity beyond the beaks.

CEPHALOPODA.

BELEMNITELLA MANITOBENSIS. (N. Sp.)

Plate 26, figs. 3, 3a and 3b.

Guard of medium size, elongated and projecting beyond the apex of the phragmocone to a distance of about four inches, acutely pointed posteriorly and subcylindrical anteriorly; apex eccentric; outline of a transverse section at the thicker end broadly ovate or ovately subcircular. Vascular impressions consisting of two distinctly defined, longitudinal and nearly straight, impressed lines, one of which is placed on each side of the narrowest part of the guard, and presumably, therefore, on its dorsal surface. These dorsal impressions commence at a short distance from the apex and extend to the broken anterior termination of each specimen. The central portion of the presumed ventral surface is marked also by a somewhat similar, but not quite so clearly defined, median impressed line, and by a few extremely faint and irregular impressed striæ, which run nearly parallel with it, but which radiate slightly outwards towards the apex. Apart from these longitudinal markings, the general surface is perfectly smooth. Alveolar cavity and phragmocone unknown.

East bank of the Assiniboine River, a short distance below the mouth of the Little Souris River, D. Armit, 1876: one specimen. Ochre River, Riding Mountains, D. Armit, 1884: one specimen.

Vermilion River, Township 24, Range 20 W.; one specimen: South Duck River, Township 34, Range 23 W.; one fragment: Swan River, Township 35, Range 29 W.; one fragment: J. B. Tyrrell, 1887.

Assiniboine River, Section 36, Township 8, Range 11 W., Warren Upham, 1887: one specimen. All from the Niobrara group, or upper part of the series.

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* Mr. Meek has claimed that the name *Volsella*, Scopoli, should be used for this genus rather than *Modiola*, Lamarck, but in this view he is not followed by authors of the most modern manuals of palæontology or conchology.

† U. S. Geol. Surv. Terr., Contr. to Palæont., by Dr. C. A. White, 1880, Nos. 2-8, p. 18, pl. 11, fig. 3 a.

The few specimens which have been collected at these localities are here referred to the genus *Belemnitella* rather than to *Belemnites* proper, on account of their surface being marked with distinct vascular impressions. They all consist of the posterior, fibrous portion of the guard, broken off at greater or less distances behind the apex of the phragmocone. As not a vestige of the alveolar border is preserved, it is quite uncertain whether the anterior margin of the latter had a straight fissure on its ventral side or not.

The species seems to be readily distinguishable from the most nearly related North American species, the *Belemnitella bulbosa* of Meek and Hayden from the Fox Hills group of Dakota, by its much greater size, less slender proportions and by the different outline of its transverse section at the larger end.

Although in Meek's extended definition of the generic characters of *Belemnitella*,* the surface of the guard is said, perhaps inadvertently, to be marked "on the *ventral* side by distinct vascular markings," yet in d'Orbigny's original description of that genus the two lateral vascular impressions are stated to be *dorsal*.

ARTHROPODA.

CRUSTACEA.

CIRRIPEDIA.

Loricula Canadensis. (N. Sp.)

Plate 26, figs. 4 and 4a.

The foregoing name is proposed for the unusually perfect specimen of a species of *Loricula* figured on Plate 26, which was collected by Mr. J. B. Tyrrell, in 1887, at South Duck River, in Township 34, Range 23 W., from the Fort Benton group, or lower portion of the series.

Of the nine plates of which the capitulum was originally composed no fewer than seven, viz., the carina, three of the four lateral plates, (*i.e.*, two on the under surface and one on the upper),one tergal plate, and two of the scuta (the one on the under side nearly covered by that on the upper) are preserved, more or less entire, in this specimen. Most of one side of the scaly peduncle, also, is preserved, though the whole of the exterior row of narrow plates immediately under the carina is absent, and the posterior or pointed end of the peduncle is imperfect, most of the scales in that region being considerably displaced.

The present species resembles the type of the genus, the *L. pulchella* of Sowerby, very closely in the number, shape and relative arrange-

* Rep. U. S. Geol. Surv. Terr., vol. IX., p. 502.

ment of the capitular plates and scales on the peduncle, as well as in the surface markings of the former, but it seems to differ materially from *L. pulchella* in its much smaller size and more narrowly subfusiform lateral outline, while the scales of its peduncle appear to be more obliquely disposed and not at all curved. In the figure of *L. pulchella* in Darwin's Monograph on the British Fossil Cirripedes (published by the Palæontographical Society), which is stated to be of natural size, the maximum height of the entire organism is twenty-six millimetres and a half, and its greatest breadth sixteen mm. and a half. The greatest breadth of the specimen collected by Mr. Tyrrell is seven millimetres, and although its exact height cannot be accurately ascertained, it may be approximately estimated at fourteen, or perhaps, fifteen mm.

Judging by woodcut 721 a. on page 536 of the second volume of Zittels' "Handbuch der Palæontologie," the present species would seem to be more nearly related to the *L. lævissima* of Zittel, from the upper chalk of Westphalia, than to *L. pulchella*.

A few isolated capitular plates of *L. Canadensis* were also collected by Mr. Tyrrell in 1887, at the Vermilion River, in Township 24, Range 20 W., from the Fort Benton group, or lower part of the series.

FISHES.

SELACHII.

PTYCHODUS PARVULUS. (N. Sp.)

Plate 26, figs. 5, 5a and 5b.

Tooth (in the only specimen known to the writer) very small for the genus: the crown conical, with obliquely compressed sides, its maximum height being about equal to its breadth at the base, though, as its apex is somewhat worn down from use, its original height may have slightly exceeded its breadth. Outline of the base of the crown, as viewed from above, somewhat quadrangular and much longer than broad, but its posterior end is deeply excavated in the centre and produced on both sides into a small and short process, which expands slightly outward and is truncated and minutely grooved at its termination. Lateral outline of the base of the crown, shallowly concave: characters of the root unknown.

At the anterior end of the crown there is a triangular smooth space, but the rest of its surface is marked by corrugations or ridges, which appear to have crossed the summit and posterior end continuously. At the posterior end the continuity of three of the corrugations or ridges,

from the base of one side to that of the other, is still clearly visible, and there is a certain amount of regularity in their disposition. In the central portion the wearing down of the summit has destroyed their continuity, and on the sides the corrugations are so much abraded as to be nearly obsolete. Near the anterior end the corrugations on the sides are more irregular in their shape and disposition than at any other part of the surface, and those which correspond to each other, on the two opposite sides, are seldom, if ever, exactly alike. Thus, on the right hand side of the crown, one of the corrugations close to the front branches three or four times below the middle, and its longest branch bends inward at nearly a right angle to the main stem and to the rest of the corrugations, but this is not the case with the corresponding one on the opposite side, and in no part of the surface do the corrugations cross each other sufficiently often to form a complete, or even partially complete, network. Under a lens also, the external orifices of the dentinal tubuli are plainly visible through the polished transparent enamel, and where the latter is worn away, as on the summit and at the anterior end, the orifices themselves are exposed and appear as close-set punctures of irregular shape.

Dimensions of the only specimen collected: maximum length of the crown, nine millimetres and three-quarters; actual height of the crown, as measured in the centre, six mm.; breadth of the crown at its base, also as measured in the centre, six mm.

Swan River, below Thunder Hill, J. W. Spencer, 1874: one specimen, which consists of the whole of the crown and a small portion of the roots of one of the palatal teeth. From the Niobrara group, or upper part of the series.

In its general shape, especially as seen from above, and in the peculiar ornamentation of its crown, this tooth appears to differ from those of any of the previously characterized species of *Ptychodus* from the Cretaceous rocks of North America, but, until a larger series of specimens shall have been obtained, its specific relations must remain doubtful.

Lamna Manitobensis. (N. Sp.)

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

Perhaps a variety of *Lama macrorhiza*, Cope.

Cfr. *Lamna macrorhiza*, Cope. 1875. Vert. Cret. Form. West (Rep. U.S. Geol Surv. Terr., vol. II), p. 297, pl. 42, figs. 9, 10.

" " A. S. Woodward. 1889. Cat. Foss. Fishes Brit. Mus., p. 399.

Teeth rather small; crown or enamelled portion of each tooth consisting of a central and nearly equilateral principal cusp or cone, with

one well developed denticle on each side of its base: root deeply but narrowly and not at all angularly forked, the two radicles being nearly parallel and but slightly divergent, with their ends narrowly rounded. Central cusp of the crown slightly recurved, conical and rather slender, its height, as measured on the longer and flatter of the two sides, being more than twice its breadth at the base, which latter, as viewed edgeways, is oblique, the plane face descending far below the convex. Outer coronal face nearly flat, but marked with a shallow longitudinal depression or faint groove on each side, next to the lateral margins, the intervening central space being nearly flat or very slightly convex,—but its basal portion is ornamented also with a few acute and longitudinal plications of unequal size and length, the two nearest to the centre being longer and larger than any of the others. Inner coronal face convex, especially below, the greater part of its surface marked by numerous (about sixteen) irregular and longitudinal, but not quite straight, acute ridges or plications, some of which are comparatively short and do not extend the whole length of the cusp, while those that do usually bifurcate or trifurcate at the base. When examined with a lens, however, this plicated area is seen to be bordered with a narrow, smooth space, on both sides and next to the lateral margins. Cutting edge thin and sharp, with a minute tubercle at the base, on each side.

The lateral denticles are triangular, with their apices slightly divergent and pointing upward and outward: their height and breadth are about equal. On their outer side they are nearly flat and on their inner convex, while the ornamentation on both sides of the surface is essentially similar to that of the central cusp of the crown, though the plications on their inner or convex side, while equally well marked, are of course not nearly so numerous. The root also is nearly flat on its outer side, but on its inner face it is everywhere more or less convex, and immediately under the base of the central cusp it swells up into an elevated protuberance with a rounded summit.

The foregoing description is based upon two nearly perfect detached teeth collected by Mr. Tyrrell, in 1887, at Rolling River, two miles above Heart Hill, from the Niobrara group or upper portion of the series. The dimensions of one of these specimens, which is figured on Plate 26, are as follows: entire height, from the base of one of the radicles to the summit of the central cusp, eighteen millimetres; breadth of the tooth, near the base of the root and below the two denticles, nine mm. and a half; height of central cusp, ten mm. and a half on the outer or flattened side and seven mm. and a half on the inner; breadth of the same at the base, four mm. and a half.

A few dental crowns of similar teeth were collected by Mr. Tyrrell in the same year at the Rolling River, in Township 36, Range 26 W.,

but only one of these has the lateral denticles preserved. In this latter specimen, whose inner or convex surface is buried in the matrix, the central cusp is exceptionately long and slender, and the plications at the base of its outer surface are unusually short, small and nearly uniform in size.

The detached teeth for which the present provisional name is proposed, seem to differ from those of the *L. macrorhiza*, from the "Niobrara epoch" of Kansas, in their proportionately broader and shorter dental crowns, in their very slightly divergent and nearly horseshoe-shaped roots, and more particularly in the distinctly though minutely plicated surface of their inner coronal faces.

TELEOSTEI.

Enchodus Shumardi, Leidy.

Plate 26, figs. 7, 7a, 7b and 7c.

Enchodus Shumardi, Leidy. 1873. Contr. Extinct Vert. Faun. W. Terr. (U.S. Geol. Surv. Terr., vol. 1) p. 289, pl. 17, fig. 20.

A small slab of shale whose fossiliferous surface is strewn with displaced portions of the jaws, with the teeth *in situ*, and detached teeth of a small species of *Enchodus*, was collected by Mr. Tyrrell in 1887, on the Rolling River, two miles below the old C. P. R. crossing, from the Niobrara group or upper part of the series. These remains are probably referable to the *E. Shumardi* of Leidy, a species which was based upon a dentary bone with teeth, found by Dr. Benjamin F. Shumard in ash-coloured shales of the Cretaceous series of Nebraska, though, judging by the description, and more especially by the figures, in the fifth volume and atlas to the fifth volume of the "Poissons Fossiles," it is difficult to see by what characters they can be distinguished from the *E. halocyon* of Agassiz.

The specimen collected by Mr. Tyrrell, like the fragment described by Dr. Leidy, shows that in this species the lower jaw was armed with nearly straight and erect, but very slightly incurved, slender teeth, placed at rather distant intervals, and that these teeth are of unequal size, the one nearest the anterior end of each ramus being much longer than any of the rest. Impressions of the greater part of each of the dentary bones, with the teeth in place, are preserved, and the surface ornamentation of part of the lower jaw is very well exhibited. The most perfect of the dentary bones indicated in the specimen figured (fig. 7) is forty millimetres long and thirteen mm. broad or deep at its broken

posterior extremity, and its upper margin is armed with six teeth, the largest of which is nine millimetres high and three mm. broad at the base. The external surface of the dentary portion of the lower jaw (fig. 7a) is finely ribbed in a longitudinal direction, and the summit of each rib bears a single row of minute and closely arranged tubercles. One little bone, (fig. 7c) which is very similar in its shape and in the general style of its dentition to the palatine bone of *E. halocyon* as described and figured by Agassiz, but which is most probably one of the maxillaries, has its under margin fringed with a single row of very minute teeth, though these latter are of very nearly equal size, and not of distinctly different sizes as they are represented as being in the palatine bone of *E. halocyon*. A long and slender tooth, (fig. 7b) whose longitudinally striated exposed portion is fourteen millimetres long and only two mm. broad at the base, to the basal portion of which a small fragment of bone is still adherent, is evidently one of the elongated fangs at the anterior extremity of the premaxillary.

In 1875, the genus *Enchodus* was included by Professor Cope in a new family of physostomous fishes, for which the name Stratodontidæ* was proposed, an arrangement which has since been adopted by Zittel in the third volume of his "Handbuch der Palæontologie."

CLADOCYCLUS OCCIDENTALIS, Leidy.

Plate 26, figs. 8 and 9.

Cladocyclus occidentalis, Leidy. 1873. Contr. Extinct Vert. Fauna West. Terr. (Rep. U. S. Geol. Surv. Terr., vol. I.) p. 288, pl. 17, figs. 21, 22, and pl. 30, fig. 5.

Ochre River, Township 23, Range 17 W., eight specimens; Edwards Creek, Township 23, Range 19 W., one specimen; Vermilion River, Township 25, Range 20 W., one specimen; Rolling River, two miles above the old C. P. R. crossing, four specimens; and Favell River, Township 35, Range 26 W., one specimen: J. B. Tyrrell, 1887.

Thunder Hill, Township 35, Range 30 W., one specimen: D. B. Dowling, 1887. All from the Niobrara group, or upper portion of the series.

The name *C. occidentalis* was proposed by Dr. Leidy for a number of large, detached cycloid scales "found by Dr. John E. Evans and subsequently by Prof. Hayden and Mr. Meek in ash-colored shales of the cretaceous series of Nebraska." "Mostly," Dr. Leidy says, "they are

* Vert. Cret. Form. West. (Rep. U. S. Geol. Surv. Terr., vol. II.) p. 218.

oval, with the length but little more than half the depth, while others are circular, and these may really pertain to a different species, if not genus, from the former." In one of these scales, the depth of which "is estimated to have been nearly 2½ inches, and its length nearly 1½ inches," the inner portion is described as exhibiting "numerous radiating ridges, while the outer portion, separated from the former by a narrow, smooth tract, presents a minutely tubercular or granular aspect."

The specimens collected by Messrs. Tyrrell and Dowling from the northern continuation into Manitoba of the Cretaceous rocks of Dakota, at the localities indicated, are all large detached scales, which are very similar in size and shape to those described by Dr. Leidy, and which do not appear to differ from them except in some minute details of their surface ornamentation. Like those from Nebraska, too, they may represent more than one species, and, perhaps, even more than one genus.

Of the two specimens figured, one (fig. 8), which measures forty-seven millimetres (or nearly two inches) in depth and twenty-four mm. (or about one inch) in length. is somewhat pointed above and below, while its lateral margin is broadly rounded anteriorly and nearly straight posteriorly. In the other, (fig. 9), which is twenty-nine millimetres in depth and twenty-nine mm. and a half in length, the marginal outline is more nearly circular. When examined with a lens, the radiating markings on the surface of each are seen to consist of fine grooves, which are more or less interrupted or broken up into rows of punctures, and not of continuous raised ridges as in the types of *C. occidentalis*. The smooth central area is well marked in both and in all the specimens collected, and the granulations on the exposed surface of each scale appear under the lens as longitudinal but slightly divergent and densely crowded rows of minute punctures with raised margins, the punctures in each row being connected by a still more minute ridge.

ERRATA.

Page 116. Immediately under the words "GRAMMYSIA ARCUATA? Conrad, Var.", add Plate 15, fig. 4.

Page 133. Line 21 from the bottom, for "Wissman" read Wissmann.

Page 138. Line 7 from the bottom, for "species" read specimens.

Page 165. Between the running heading at the top and the first line below it, insert the word LAMELLIBRANCHIATA.

Page 169. Line 2 from top, for "PROTOCARDIUM HILLANUM" read "PROTOCARDIA HILLANA, for although Woodward, Stoliczka and Tryon write the name of Beyrich's genus PROTOCARDIUM, yet Meek, Paul Fischer and Zittel claim that the original spelling of the word is PROTOCARDIA.

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PLATE XII.

Unless otherwise stated, the figures in this and the following plates are of natural size.

Taxocrinus lobatus, var. (page 94).

Figure 1. Side view of the dorsal cup of a specimen from Thedford.

Homocrinus crassus (page 95).

Figure 2. Side view of the dorsal cup of the only specimen collected.

Dolatocrinus Canadensis (page 99).

Figure 3. Basal view of the dorsal cup of the type of this species. Twice the natural size.

Figure 3*a*. Summit view of the same specimen, shewing the dome plates. Twice the natural size.

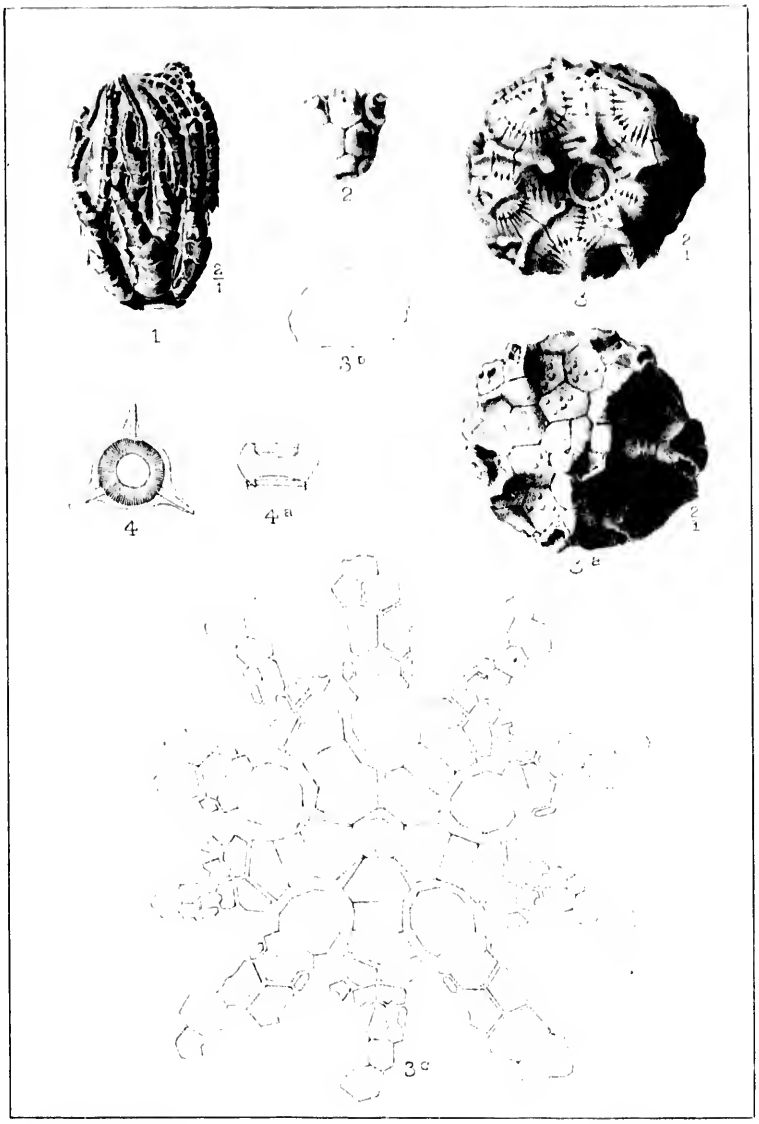
Figure 3*b*. Outline of the same, as viewed laterally.

Figure 3*c*. Diagram of plates of the dorsal cup of this species.

Columns of Dolatocrinus (page 101).

Figure 4. Portion of a column of a species of this genus, as seen from above.

Figure 4*a*. Lateral view of another portion of a similar column.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4a
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3c

PLATE XIII.

ARTHROACANTHA PUNCTOBRACHIATA (page 96).

Figure 1. Side view of a specimen of the dorsal cup of this species, from Bartlett's Mills.

Figure 1*a*. Similar view of another specimen from the same locality, in which the summit is completely filled by a *Platyceras*.

MEGISTOCRINUS, SP. INDT. (page 101).

Figure 2. Side view of the central dome plate.

Figure 2*a*. End " " " " "

Figure 2*b*. Basal " " " " "

SPINE OF DOME OF CRINOID (page 102).

Figure 3. Side view of the spine.

Figure 3*a*. Basal view of the same.

OLLACRINUS SPINIGERUS (page 103).

Figure 4. Side view of an unusually perfect specimen from Thedford.

Figure 4*a*. The same, as seen from above, shewing the dome plates.

Figure 4*b*. The same, as seen from below.

All enlarged four times.

ANCYROCRINUS BULBOSUS (page 103).

Figure 5. Side view of a worn specimen of the root and part of the column of this species.

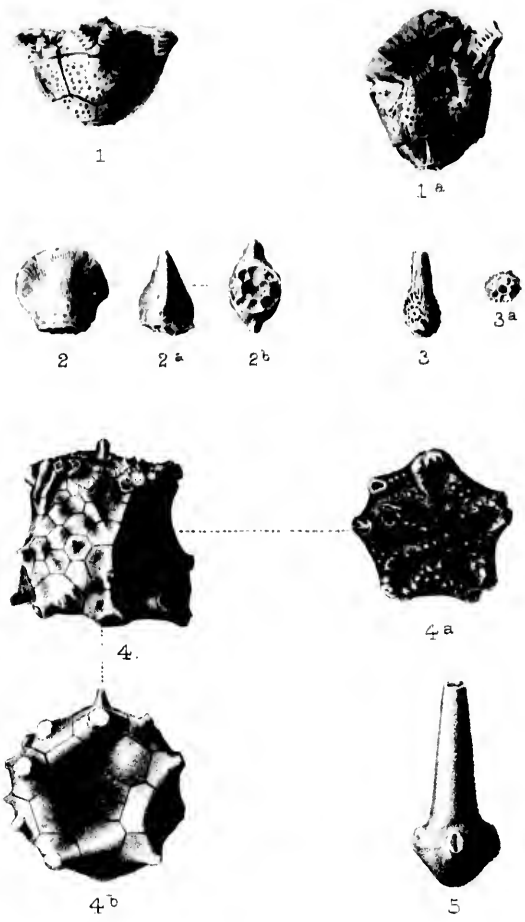
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PLATE XIV.

Pentremitidea filosa (page 104).

Figure 1. Side view of the most perfect specimen collected. Twice the natural size.

Figure 1*a*. Outline of the same specimen, as seen from above. Twice the natural size.

Figure 1*b*. Outline of a portion of the summit of the same. Four times the natural size.

Nucleocrinus elegans (page 107).

Figure 2. Outline of the summit plates of a Canadian specimen. Much enlarged.

Granatocrinus Leda (page 108).

Figure 3. Side view of a specimen from Thedford.

Figure 3*a*. The same specimen as seen from above.

Figure 3*b*. One of the radial plates of the same. Twice the natural size.

Figure 3*c*. A portion of the surface of the radial plate figured, still further enlarged, to show the minute details of the sculpture.

Figure 3*d*. One of the deltoid plates of the same specimen. Three times the natural size.

Figure 3*f*. Diagram of the calyx plates of a Canadian specimen of this species.

Codaster Canadensis (page 109).

Figure 4. Lateral view of a specimen from Thedford.

Figure 4*a*. The same, as seen from above.

Both twice the natural size.

Eleutherocrinus Cassedayi (page 110).

Figure 5. Radial view of the most perfect specimen yet collected in Canada.

Figure 5*b*. View of the opposite side of the same, shewing the large and unforked azygos lateral, with the paired basals below it, in the centre, and a partly modified radial on each side.

Figure 5*a*. Summit view of the same, shewing the four regular ambulacra, and the modified azygos one, &c.

All twice the natural size.

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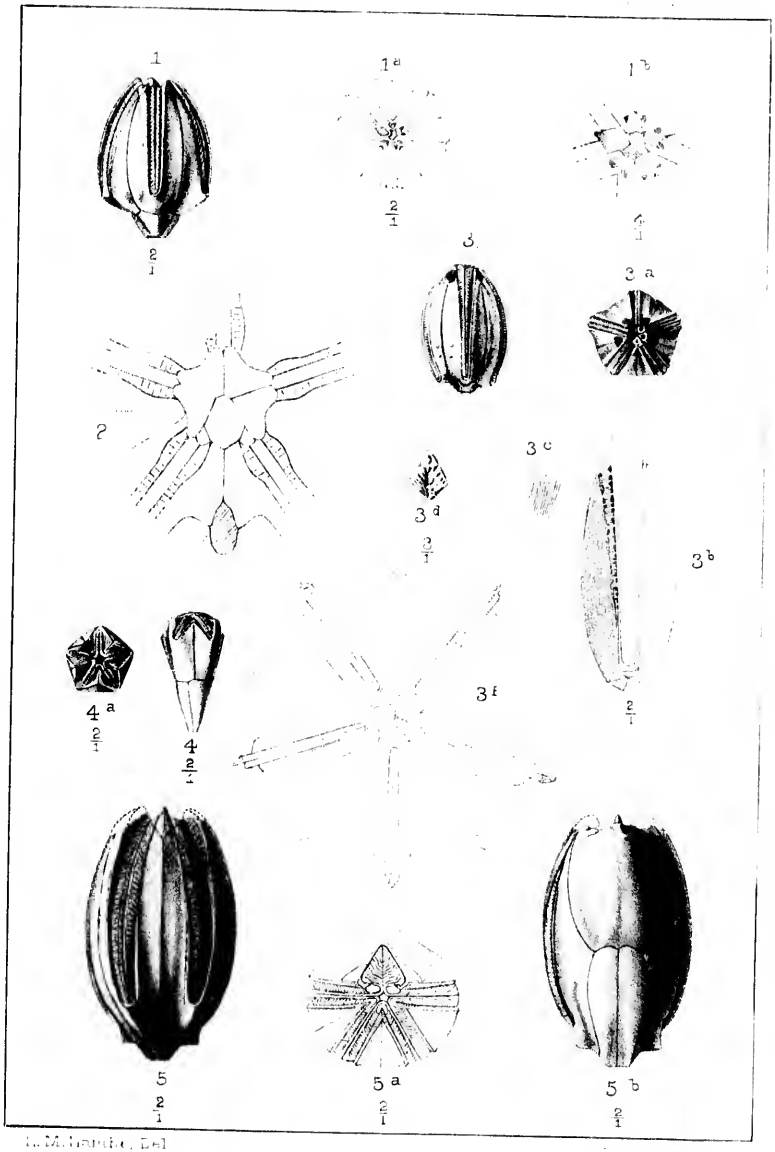

J. M. Gamble, Del.

PLATE XV.

Lingula Thedfordensis (page 111).

Figure 1. Side view of the type of this species. Twice the natural size.

Strophalosia productoides (page 112).

[Referred to in the text in connection with *Productella* (*Strophalosia*) *truncata*, Hall.]

Figure 2. View of a specimen of this species from the Athabasca River, shewing the exterior of the ventral valve.

Figure 2*a*. Opposite side of the same specimen, shewing the exterior of the dorsal valve and the hinge areas of both.

Both three times the natural size.

Spirifera subdecussata (page 114).

Figure 3. View of the type of this species, shewing the dorsal valve and the hinge area of the ventral. Natural size.

Figure 3*a*. A portion of the surface of the same, enlarged, to shew the finer details of the sculpture.

Grammysia arcuata? Var. (page 116).

Figure 4. View of the cast of the interior of the left valve, referred to in the text as having been collected by Mr. J. Pettit.

Platyceras quinquesinuatum (page 117).

Figure 5. Side view of a specimen of this species from Thedford.
Similar view of another specimen from the same locality.

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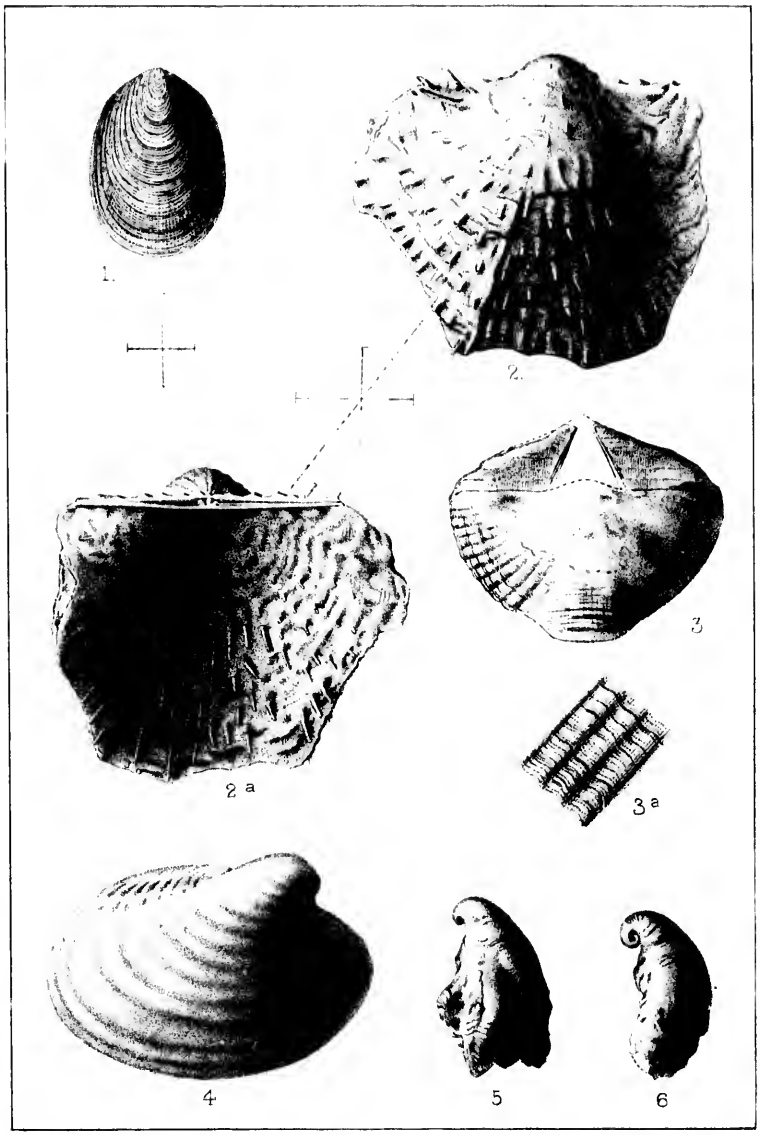


J. McLeish, del.

A. Sharples, lith.

PLATE XVI.

PRODUCTELLA (STROPHALOSIA?) TRUNCATA (page 112).

Figure 1. Specimen of this species, showing the exterior of the ventral valve.
Figure 2. Similar view of another specimen.
Both figures are twice the natural size. The outlines on the side of each figure are intended to shew the contour of the closed valves and the exact dimensions of each specimen.

TURBO SHUMARDI (page 116).

Figure 3. Dorsal view of a specimen of this species, from the Township of Bosanquet.

PLATYCERAS (ORTHONYCHIA) CONICUM (page 117).

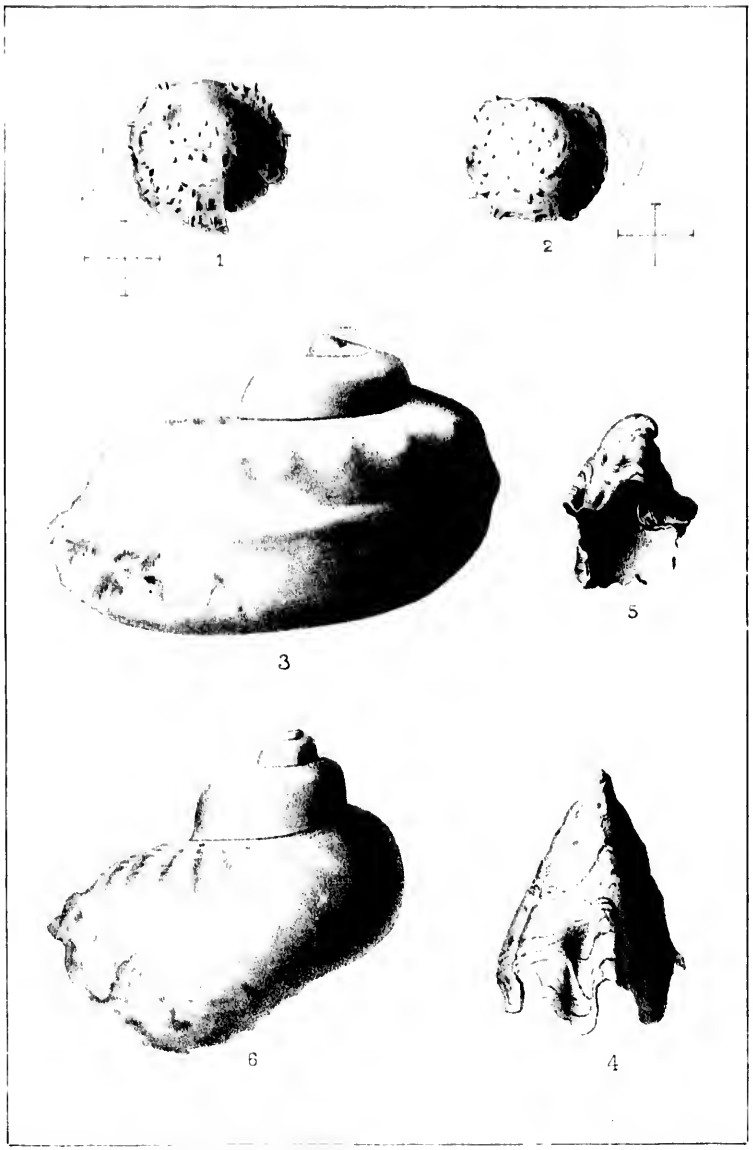
Figure 4. Lateral view of a specimen of this species, from Thedford.

PLATYCERAS QUINQUESINUATUM (page 117).

Figure 5. Apertural view of a specimen from Thetford.

PLATYOSTOMA PLICATUM (page 118).

Figure 6. Dorsal view of the type of this species.



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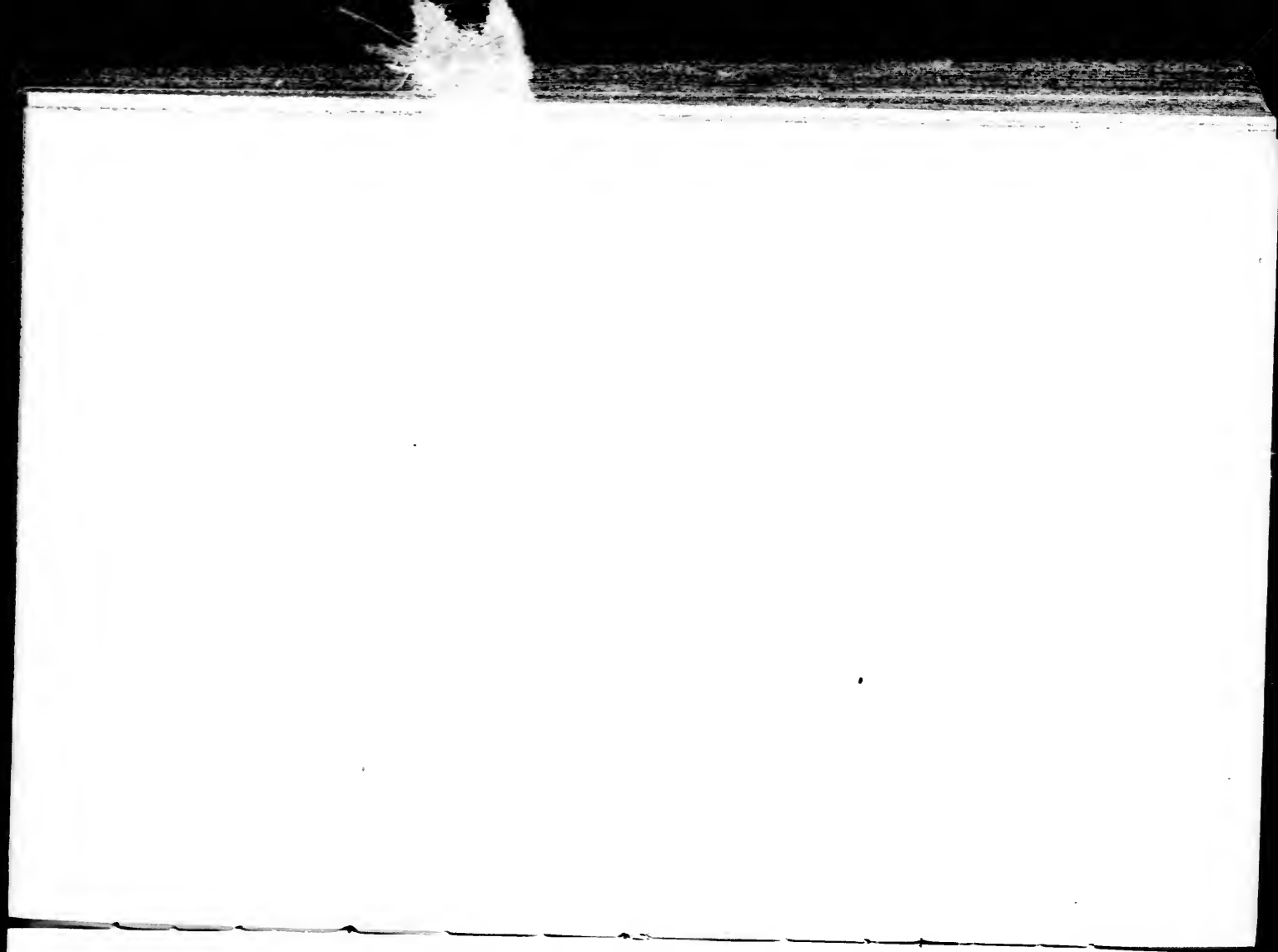

PLATE XVII.

SPIRIFERINA BOREALIS (page 128).

Figure 1. Dorsal view of the type of the species.

TEREBRATULA LIARDENSIS (page 130.)

Figure 2. Dorsal view of one of the most perfect specimens of the narrowly ovate and most usual form of this species.
Figure 2*a*. Profile view of the same specimen, in outline only.
Figure 2*b*. Front view of the same, also in outline only.
Figure 2*c*. Dorsal view of a broad and nearly circular form of the species.

MONOTIS SUBCIRCULARIS (page 131).

Figure 3. Right valve of an obliquely subovate specimen of this species, from Fossil Point on the Peace River.
Figure 3*a*. Right valve of another specimen, of more nearly circular outline, from the same locality.

MONOTIS OVALIS (page 132).

Figure 4. Left valve of the type of this species.

HALOBIA OCCIDENTALIS (page 134).

Figure 5. Left valve of the type specimen.
Figure 6. Small piece of rock, partly covered by the basal portion of a left valve and a nearly entire right valve of a shell which is somewhat doubtfully referred to this species.

TRIGONODUS (?) PRODUCTUS (page 135).

Figure 7. Right valve of a specimen of this species
Figure 7*a*. Left valve of another specimen, from the same locality.
Figure 7*b*. Dorsal view of the closed valves of a third specimen, in outline only.

All the figures twice the natural size.

MARGARITA TRIASSICA (page 136).

Figure 8. Dorsal view of one of the most perfect specimens collected.
Figure 8*a*. Basal view of the same.

Both figures three times the natural size.

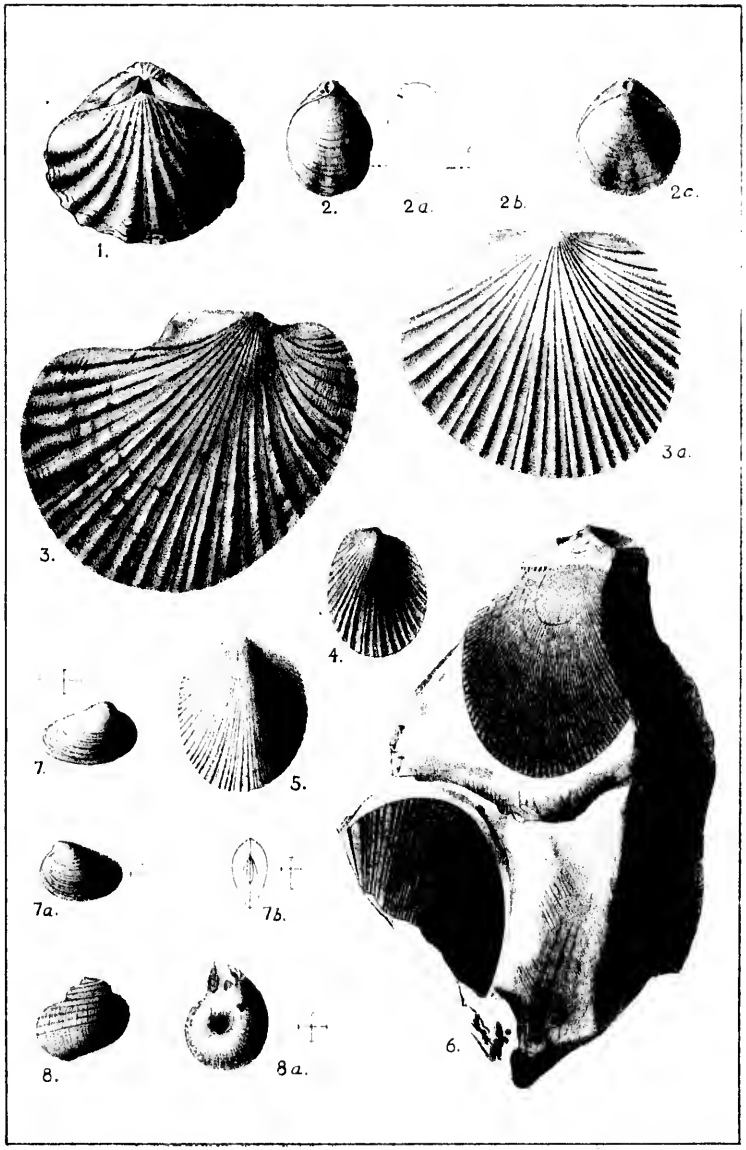
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PLATE XVIII.

NAUTILUS LIARDENSIS (page 137).

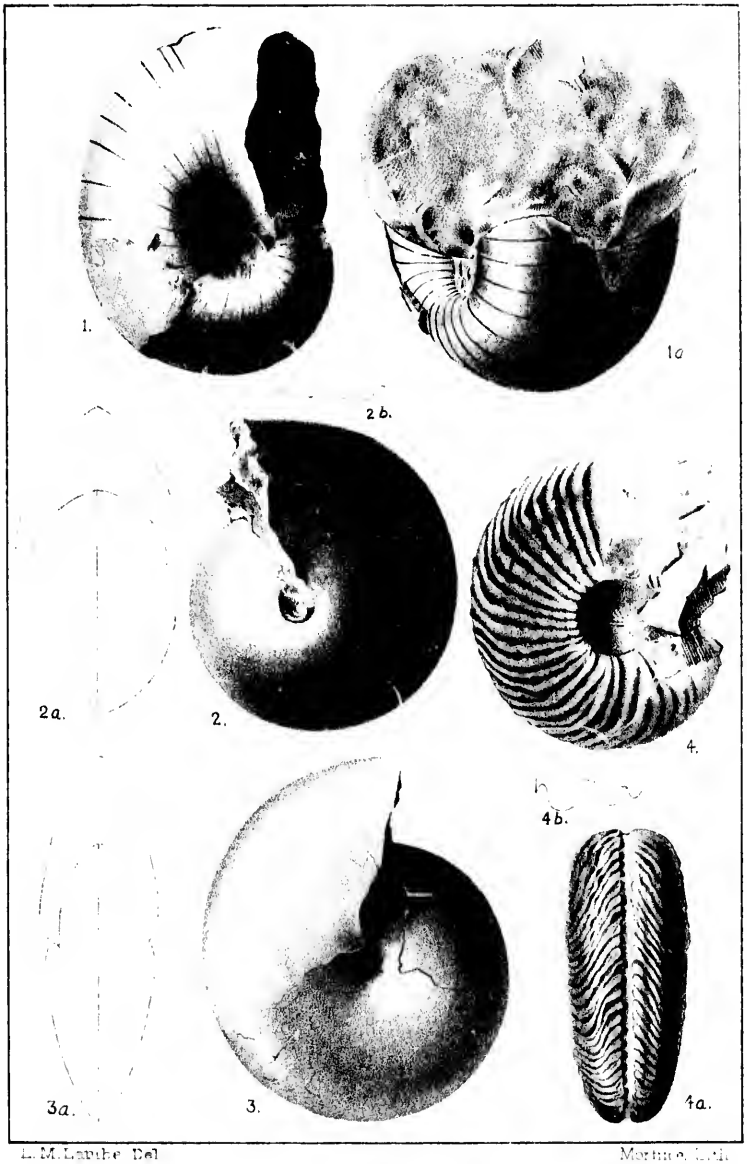
Figure 1. Side view of the type of this species.
Figure 1*a*. Front view of the same specimen.

POPANOCERAS McCONNELLI (page 138.)

Figure 2. Side view of a specimen of the *typical form*.
Figure 2*a*. Front view of the same specimen, in outline.
Figure 2*b*. Portion of the sutural line of another specimen.
Figure 3. Side view of a specimen of the *variety lenticulare*.
Figure 3*a*. Front view of the same, in outline.

TRACHYCERAS CANADENSE (page 142).

Figure 4. Side view of the type of this species.
Figure 4*a*. Front view of the same, showing the groove in the centre of the abdominal region.
Figure 4*b*. Portion of the sutural line of the same specimen.



L. M. Lambe Del. Mortimer Lith.

PLATE XIX.

ACROCHORDICERAS (?) CARLOTTENSE (page 141).

Figure 1. Side view of the larger of the two fragments upon which this species is based. The dotted lines indicate the probable outline of the shell.

ARNIOTITES VANCOUVERENSIS (page 146).

Figure 2. Side view of the type of this species and genus, from Crescent Inlet.

ARNIOTITES. Species uncertain. (Page 147).

Figure 3. Side view of the largest and most perfect specimen from Robson Island described on page 147.

ARNIOTITES or CELTITES. Species uncertain. (Page 147).

Figure 4. Side view of the large specimen from Forward Inlet, referred to on page 147.

BADIOTITES CARLOTTENSIS (page 148).

Figure 5. Side view of the type of this species from Houston Stewart Channel, Q.C.I. Four times natural size.

AULACOCERAS CARLOTTENSE (page 149).

Figure 6. Guard of the most perfect specimen known, of this species, also from Houston Stewart Channel, Q.C.I.

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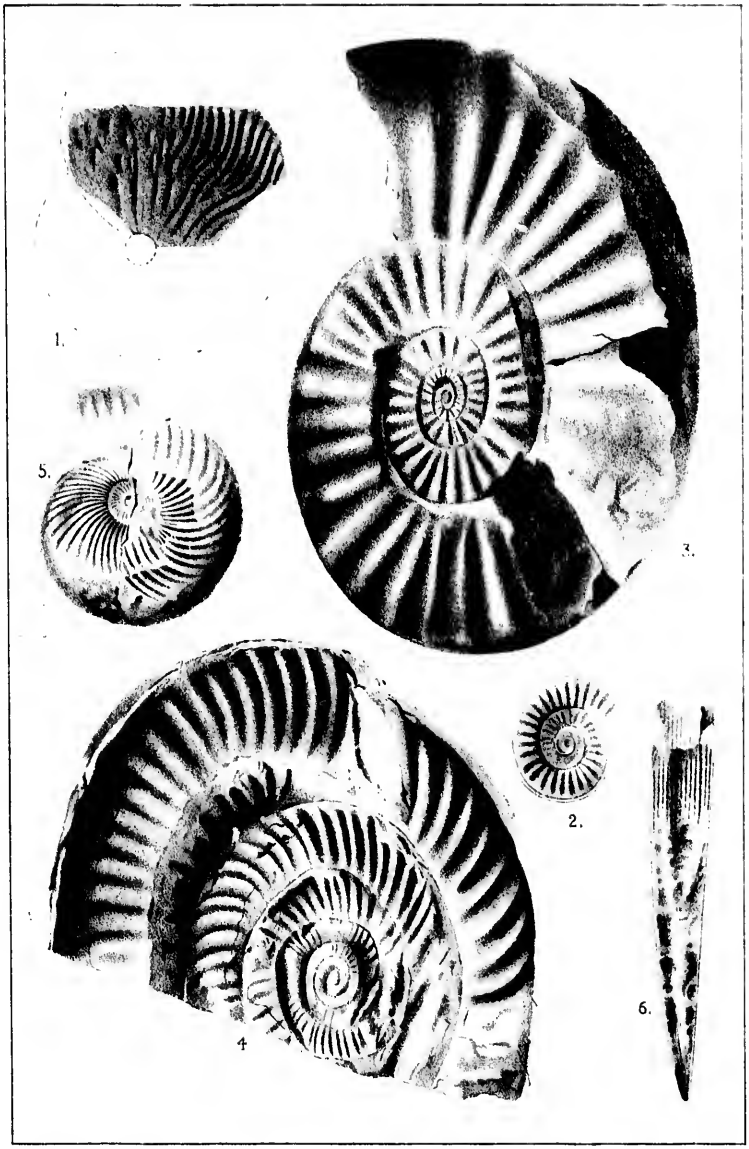

L. M. Lambe, del.

PLATE XX.

PLACENTICERAS (PEREZIANUM ? var.) LIARDENSE (page 158).

Figure 1. Side view of a small but nearly perfect specimen of this shell, from the Liard River near old Fort Halkett.

Figure 2. Side view of a fragment of a large specimen of the same species, and from the same locality.

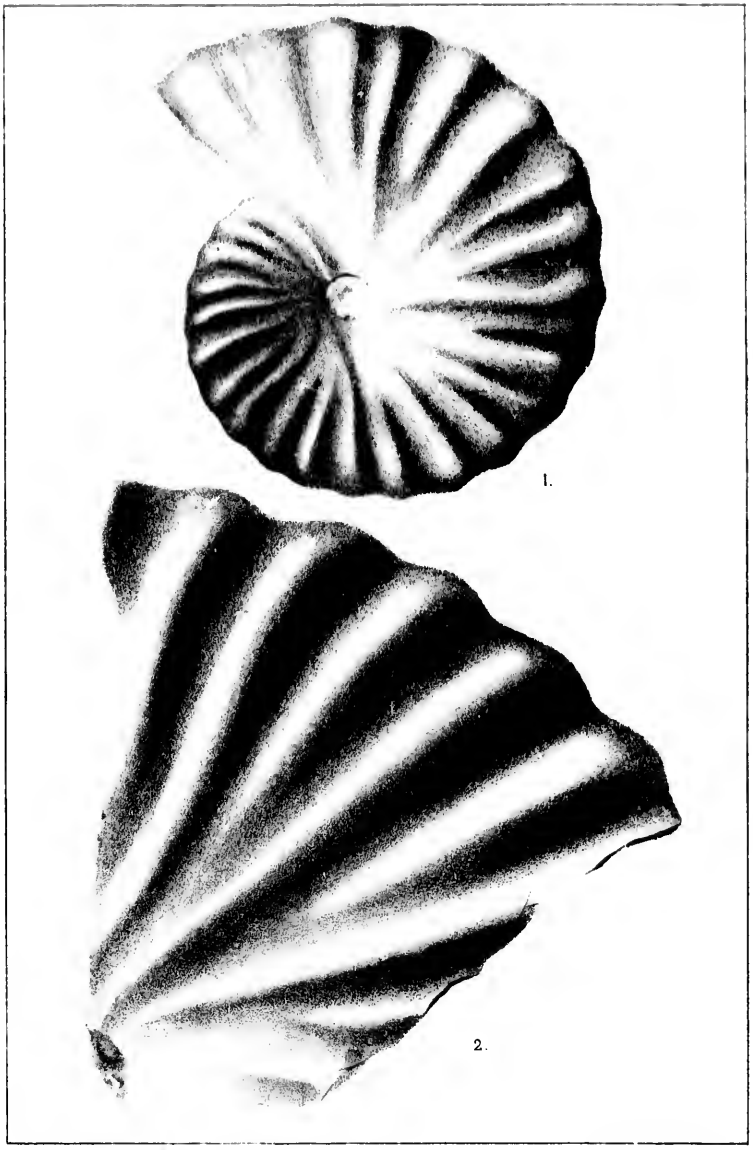

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PLATE XXI.

PLACENTICERAS OCCIDENTALE (page 155).

Figure 1. Side view of the type of this species from the K-uk River, B.C.

SCAPHITES QUATSINOENSIS (page 158).

Figure 2. Side view of the most perfect specimen of this species yet collected, from the east side of Winter Harbour, Quatsino Sound.

DISCINA PILEOLUS (page 159).

Figure 3. View of the most perfect of the two dorsal valves collected, as seen from above.

Figure 3*a*. Latoral view of the same, in outline only, to shew the relative height of the valve.

CYPRINA YUKONENSIS (page 160).

Figure 4. Side view of a right valve of this species.

SCHLOENBACHIA BOREALIS (page 160).

Figure 5. Side view of the largest and most perfect specimen of this species yet collected.

Figure 6. View of an *Aptychus* found associated with *S. borealis*.

ESTHERIA BELLULA (page 162).

Figure 7. Side view of the type of this species. Twice natural size.

Figure 7*a*. Side view of the left valve of a shell supposed to be referable to *E. bellula*. Twice natural size.

CANTRELL AN FAL. VOL. I

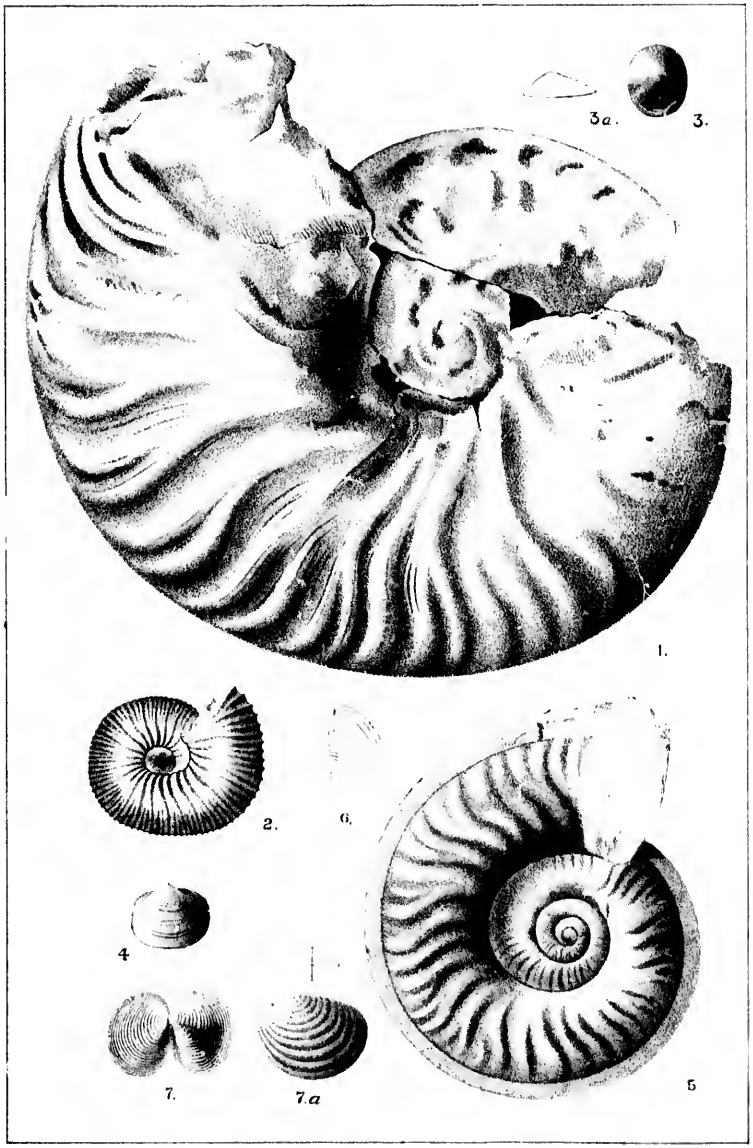

PLATE XXII.

TEREBRATULA ROBUSTA (page 163).

Figure 1. View of a rather narrowly elongated form of this species, showing the whole of the dorsal valve and part of the ventral.

Figure 1*a*. Profile view of the same specimen, in outline only.

Figure 1*b*. Front view of the same, also in outline only, to show the slight mesial fold and sinus.

Figure 2. View of a comparatively broad and short form of the species, shewing the whole of the dorsal valve and part of the ventral.

LIMA PEROBLIQUA (page 165).

Figure 3. Side view of the most perfect specimen (a cast of the interior of a left valve) yet collected.

Figure 3*a*. Fragment of a left valve with part of the test preserved, to shew the surface ornamentation.

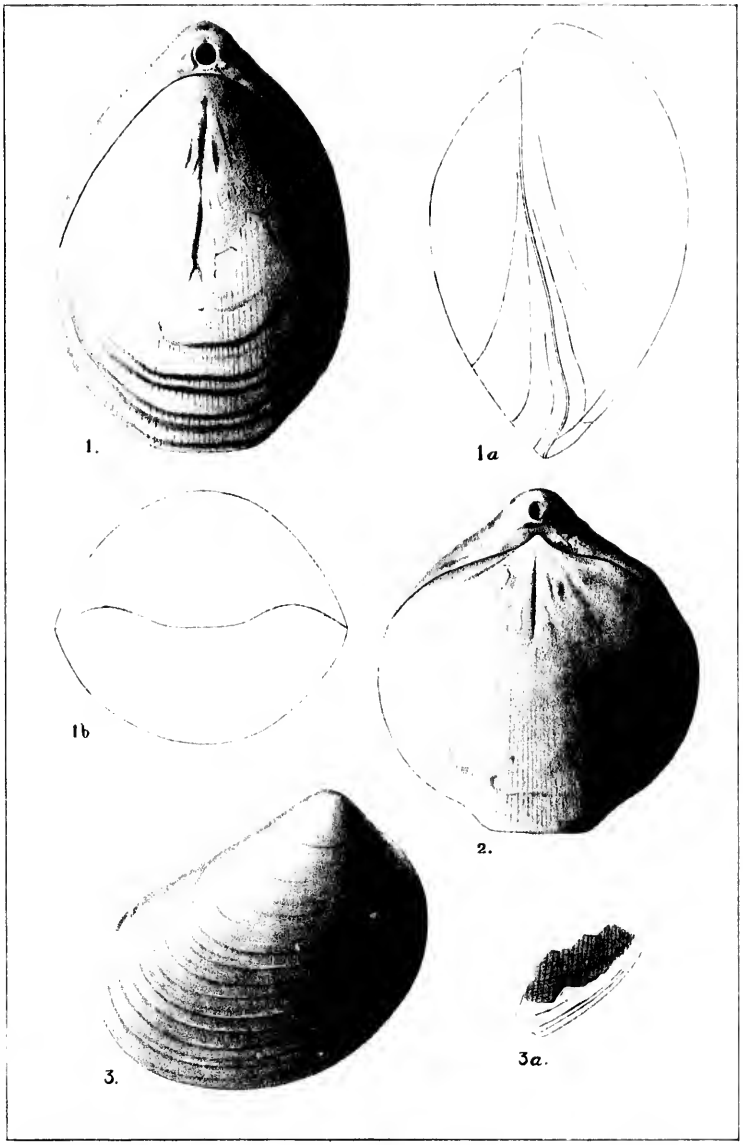
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PLATE XXIII.

PTERIA (OXYTOMA) CORNUELIANA (page 166).

Figure 1. Side view of a large and nearly perfect left valve, from the Rocky Mountains three miles north of the east end of Devil's Lake.
Figure 1*a*. An imperfect right valve from the same locality.
Figure 1*b*. Outline of another left valve from the same locality.

SCHLOENBACHIA GRACILIS (page 171).

Figure 2. Side view of the type of this species.
Figure 2*a*. Outline of the aperture of the same specimen. The unbroken line shews the breadth of the aperture at the summit of one of the ribs, and the dotted line the thickness of the shell in the interval between two of the ribs.

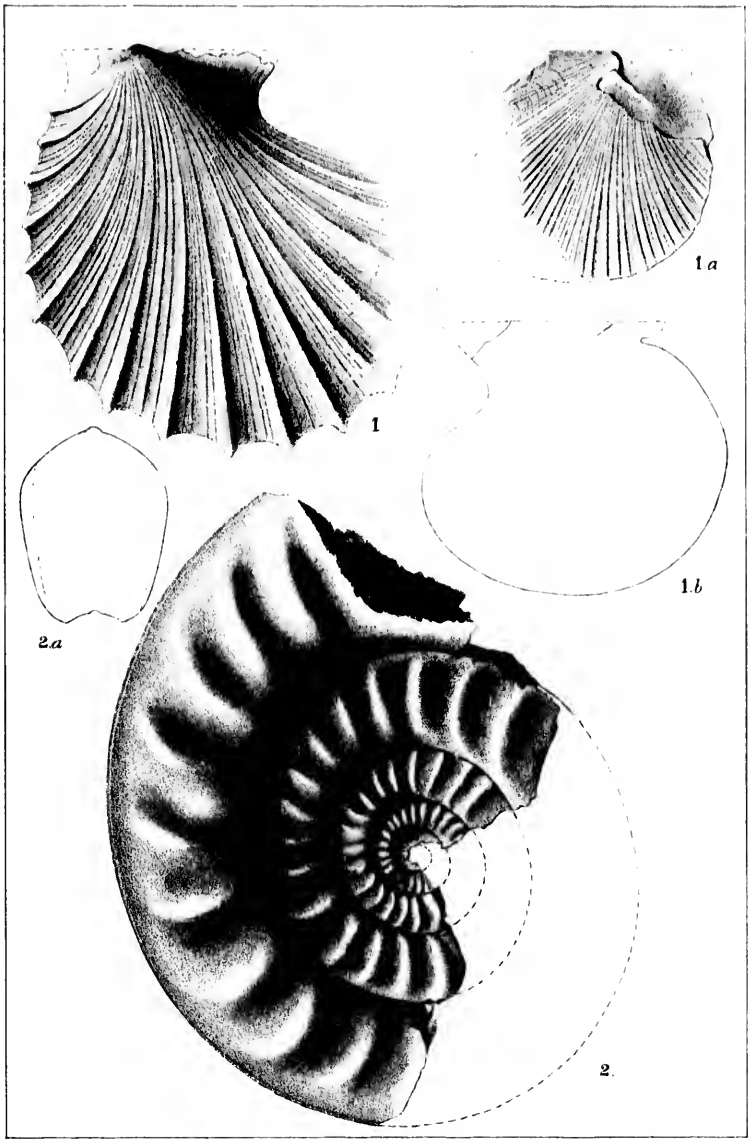
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PLATE XXIV.

PLACENTICERAS GLABRUM (page 172).

Figure 1. Side view of the type of this species.
Figure 1*a*. Front view of the same specimen, in outline.
Figure 1*b*. One side of a sutural line of the same.

CYPRINA SUBTRAPEZIFORMIS (page 176).

Figure 2. Side view of the most perfect specimen collected, with the test preserved and shewing the right valve.
Figure 2*a*. Similar view of a cast of the interior of a shell of this species, shewing the shape of the pallial line and muscular impressions in the right valve.
Figure 2*b*. Side view of another cast of the interior of a shell of this species, of somewhat different shape to the last.

LINEARIA FORMOSA? (page 177).

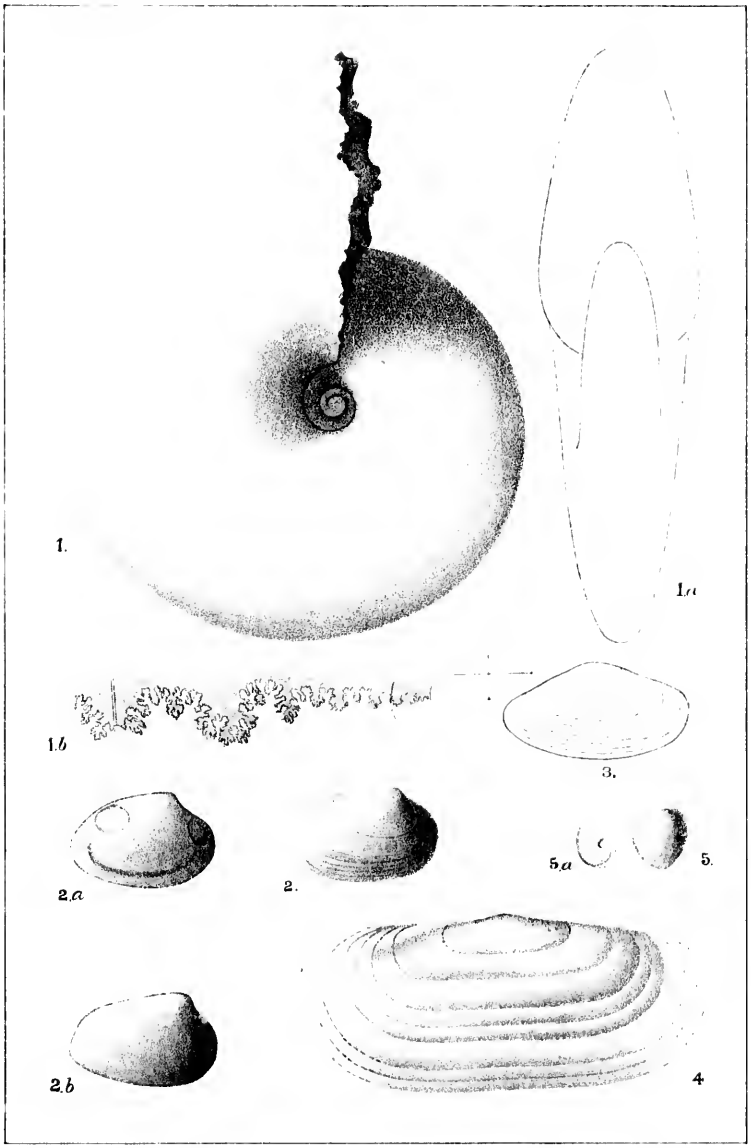
Figure 3. Side view of a perfect right valve of a shell which is supposed to be referable to this species. Twice the natural size.

SOLECURTUS (TAGELUS) OCCIDENTALIS (page 178).

Figure 4. Side view of the type of this species, slightly restored.

HYDATINA PARVULA (page 180).

Figure 5. Dorsal view of the type of this species.
Figure 5*a*. The same specimen as seen from above, to show the s en spire.



L. M. Lambe, Lel

PLATE XXV.

MARTESIA TUMIDIFRONS (page 179).

Figure 1. Side view of the type of this species, shewing the right valve.

Figure 1*a*. The same specimen as seen from above, to shew the amount of convexity of the closed valves. In outline.

Figure 2. Side view of another specimen of the same species, with a considerable portion of the test preserved.

PALÆASTACUS (?) ORNATUS (page 183).

Figure 3. View of the type and only specimen of this species known to the writer, as seen from above.


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PLATE XXVI.

SERPULA SEMICOALITA (page 185).

Figure 1. The type of this species as seen from above.

MODIOLA TENUISCULPTA (page 188).

Figure 2. Side view of the most perfect specimen known to the writer.
Figure 2*a*. A portion of the test enlarged, to show the sculpture.

BELEMNITELLA MANITOBENSIS (page 189).

Figure 3. View of the dorsal side of an unusually well preserved guard of this species, from the Ochre River.
Figure 3*a*. View of the ventral side of the same specimen.
Figure 3*b*. Outline of a natural transverse section of the same, at the larger end.

LORICULA CANADENSIS (page 190).

Figure 4. The type of this species, three times the natural size. c, the carina; L, L, the lateral plates; T, one of the terga; and S, the scuta. With the exception of the carina, the plates not shaded are those of the upper side of the specimen, and those shaded of the lower.
Figure 4*a*. The same specimen, of natural size.

PTYCHODUS PARVULUS (page 191).

Figure 5. Lateral view of the only specimen known to the writer, three times the natural size.
Figure 5*a*. Similar view of the same specimen, but of the natural size.
Figure 5*b*. The same tooth as seen from above and enlarged three times.

LAMNA MANITOBENSIS (page 192).

Figure 6. View of the inner or convex side of the most perfect specimen of this species yet collected.
Figure 6*a*. Profile view of the same tooth.
Figure 6*b*. View of the outer or flattened side of the same.

ENCHODUS SHUMARDI (page 194).

Figure 7. Outline of a dentary bone, with teeth, of a specimen from the Rolling River.
Figure 7*a*. Another dentary bone belonging to the same specimen, showing the external sculpture of its surface.
Figure 7*b*. One of the elongated fangs at the anterior extremity of the premaxillary of the same.
Figure 7*c*. Maxillary bone of the same specimen.

CLADOCYCLUS OCCIDENTALIS (page 195).

Figure 8. A comparatively narrow scale, which is somewhat pointed at both ends, of a fish which is here provisionally referred to this species.
Figure 9. A similarly sculptured scale, but of more nearly circular form, of a fish which is also presumed to be referable to this species.

CONTRIBUTIONS TO CANADIAN PALÆONTOLOGY.