

ARTICLE III.—*Observations on some imperfectly known fossils from the Calciferous sandrock of Lake Champlain, and descriptions of several new forms.* By R. P. WHITFIELD.

Up to the time of the publication of Vol. I. of the Palæontology of New York, little appears to have been known of the organic remains of the Calciferous formations of New York, either on Lake Champlain or in the Mohawk Valley. Dr. Vanuxem notices a few species from the Mohawk Valley in his Report on the Third District, two species of *Ophileta* being the most prominent; and Dr. Emmons gives others from Lake Champlain, but most of those referred to the Calciferous by this author in his Report on the Second District, have been referred to the Chazy limestone by later writers. In Vol. I., Pal. New York, the species then known to pertain to the Calciferous are brought together, and comprise three species of Plant remains from the Fucoid beds, one Brachiopod (*Lingula acuminata*, Conrad), eight Gasteropods and two Cephalopods. Among the Gasteropods, *Euomphalus uniangulatus* and *Ophileta complanata*, are generally considered as the most typical of the formation, and are felt to be the safest guides in determining the geological horizon of any beds with which they may be associated. In later years Mr. Billings, of the Canadian Geological Survey, added many species to the fauna of this group from the Canadian provinces. Up to the present time, however, little has been added to our knowledge of this group from any of the New York localities. Early in the spring of 1888, Prof. Henry M. Seely, of Middlebury College, Middlebury, Vt., sent to the Museum a box of fossils, among which *Ophileta complanata* was the most abundant, while *Maclurea sordida*, Hall, was quite common. Associated with these were a number of Gasteropods, several Cephalopods and two Brachiopods, most of which proved to be unknown species. Most of these are described in the following pages, and some of those previously described and figured from imperfect material have been illustrated from better specimens and redescribed.

During August of 1888 I visited the locality from which Prof. Seely obtained his specimens, in company with him and Mr. [March, 1889.]

Kirby, who owns and occupies the adjoining farm, together with the Rev. J. R. McLeod, of Kingsbury, Quebec, and obtained additional material. The locality is about one and a half miles north of Beekmantown Station, on the Delaware and Hudson Railroad, three miles north of Plattsburgh, N. Y.

The outcrop forms a low bank, exposing about seventeen or eighteen feet of rock at one point, and gives the following section, of which the thicknesses are estimated :

The lowest is a heavy bedded unfossiliferous limestone..	3 feet.
Crystalline limestone, bluish gray, with Gasteropods and Cephalopods.....	6 inches.
Compact limestone with <i>Bathyurus</i>	15 inches.
Thin sandy limestones with <i>Ophileta</i> at base, but barren above	5 to 6 feet.
Thin sandy layers with <i>Ophileta</i> abundant	2 feet.
Silicious limestones destitute of fossils.....	2 feet.
Thin sandy layers with Fucoids.....	3 feet.

Above the Fucoid beds there are other layers with abundance of *Ophileta*, many of the layers being composed chiefly of that fossil. These layers continue back into the field to a low ridge, adding, perhaps, twenty or more feet of thickness, and all bearing this same fossil, to a greater or less extent, but generally quite abundant. Within the grove just north of the outcrop, and into which the ridge of the outcrop extends, we found some rough, sandy limestones which had been quarried for the purpose of flagging, and upon one of these an imprint of *Maclurea matutina*, Hall, which measures two and three-fourth inches in its greatest diameter.

Beyond the species described in this paper, there are in the collection several species represented by specimens too imperfect for description and illustration ; among which is an *Athyris*-like Brachiopod, represented by only a single valve, a *Bellerophon*-like form with only a single volution (possibly a *Platyceras*), several specimens of *Raphistoma Laurentina*, Billings ; a new species of *Triblidium*, a Cyrtolites ? presenting the aspect of a broad-backed *Porcellia*, two or more additional species of Cephalopods, and two species of *Bathyurus*-like Trilobites, as well as several forms too imperfect for determination.

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The evidence furnished by the collection would indicate that of the forms previously known, as *Ophileta complanata* and *O. levata*, are only phases of the one species, the latter being only the inner coils or the partially grown forms of *O. complanata*. Also, that *Turbo? obscura*, Hall, Pal. N. Y., Vol. I, Pl. 3, fig. 8, may be the same as *Pleurotomaria? turgida*, Hall, of the same plate, *Holopea turgida* of this paper. *Turbo dilucula*, Hall, loc. cite., Pl. 3, fig. 7, is a distinct species and is probably also a *Holopea*.

DESCRIPTION OF SPECIES.

Genus ORTHIS, *Dalman*.

Orthis Macleodi, n. sp.

PLATE 7, FIGS. 1-4.

Shell small, lenticular, subcircular in outline; hinge line nearly two-thirds as long as the entire width of the shell; cardinal angles rounded, base more broadly rounded. Ventral valve most highly convex, beak projecting beyond the line of the hinge. Dorsal valve less highly convex than the ventral and with a slight mesial depression along the middle of the valve in some cases. Surface marked by strong radiating striæ, which are distinctly alternating in size and somewhat distant, on well preserved surfaces, the increase by implantation generally.

This species somewhat resembles *O. Evadne*, Billings, Pal. Foss. Vol. I, p. 79, fig. 74, but has a shorter hinge line which gives a more circular outline, and the striæ are more numerous and not so strong or ridge-like as given in his figures.

Formation and locality.—In the upper layers of the *Ophileta* bed, at Beekmantown, N. Y.

Genus TRIPLESIA, *Hall*.

Triplesia radiata, n. sp.

PLATE 7, FIGS. 5-8.

Shell small, the largest valve observed scarcely exceeding one-fourth of an inch in width, which slightly exceeds the length from the beak to the front of the valves, measured on the ventral

side. Valves quite ventricose, rounded on the sides and deeply emarginate in the center of the front border by the mesial fold and sulcus. Ventral valve with a deep, broad, triangular sinus extending from near the beak to the base; beak prominent, hinge line about two-thirds as long as the width of the shell below; area rather large, more than half as high as long, rounded at the margins and divided in the middle by a comparatively wide, triangular opening. Dorsal valve very convex, with a moderately elevated mesial fold, scarcely emarginate anterior margin, and very full, rounded beak. Surface of the shell marked by comparatively strong, rounded, radiating lines or striæ, which are increased by frequent bifurcation.

The shell presents much the appearance of a high-beaked, ventricose and deeply sulcated *Orthis*; but it is evidently a true *Triplesia*. The valves have not been found in contact, consequently the features of the hinge are difficult to ascertain, but in a single small individual the area and its deltidial opening has been distinctly observed, and in sections where broken across in several places. Most of the specimens observed in the rock are under an eighth of an inch in length, and the apex of the ventral valve is usually quite erect in these examples; only taking on the more incurved character at a later stage. The surfaces are also often quite smooth, from maceration, presenting in the matrix the appearance of having been dissolved by the action of water before being imbedded, thus obscuring the striæ.

I know of no *Triplesia* in this horizon or elsewhere that will need comparison with this for the purpose of distinguishing them, as the striation of this shell is its main specific feature.

Formation and locality.—In the hard, compact subcrystalline limestone of the Calciferous, at Beekmantown, New York, at from eight to ten feet below the principal *Ophileta* bed. From collections sent by Prof. H. M. Seely.

Genus METOPTOMA, *Philips*.

Metoptoma alta, n. sp.

PLATE 7, FIGS. 12 AND 13.

Shell of rather less than medium size, abruptly conical in form and laterally compressed, the section at the margin of the aper-

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ture being elongate ovate, widest anterior to the middle of the ovate figure. Apical angle on the type specimen about fifty-eight or sixty degrees, measuring the anterior and posterior lines, and that of the sides rather less than forty degrees. Anterior face of the shell slightly concave, and the posterior side very slightly convex. Lateral diameter of the shell a little more than two-thirds of the antero-posterior diameter. Surface of the shell apparently smooth.

This shell is most nearly allied in form to *M. Venellia*, Billings, Pal. Foss., Vol. 1, p. 88, fig. 80; but differs in want of the vertical sulcations. From *M. Melissa*, of the same author, p. 86, it differs in being more conical and in not being "obliquely conical," and in the base being ovate instead of "uniformly broad oval." In the specimen the shell has been very thin, and its substance is coarsely crystalline so as to show only a granulated structure. I cannot see the muscular imprints distinctly, but suspect they are like those of *Triblidium*, in which case it would have to be placed under that genus; but feeling uncertain I have left it under *Metoptoma*, from the appearance of the apex. There is also some probability, judging from the appearance of the apex, that the shell had the apex reversed, like several species from this same geological position, described in Vol. 4 of the Geol. Surv. of Wisconsin; see plate 3.

Formation and locality.—In the highly silicious sandy layers of the Calciferous sandstone at Beekmantown, N. Y.

Genus TRIBLIDIUM, *Lindstrom*.

Tryblidium? acutum, n. sp.

PLATE 7, FIGS. 9-11.

Shell small, acutely ovate as seen from above, the beak being pointed and directed backward almost on a plane with the aperture, the under surface of the apical portion being flattened so as to present the appearance of a flattened area like that of some forms of Brachiopods. Dorsal surface regularly convex from beak to base, and very obscurely subcarinate along the middle; widest part of the shell near the middle of the length, measuring from the point of the beak to the base. Substance of the shell

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very thin, the surface unknown, as all the specimens are denuded of the shell, but they show obscure lines which correspond to the lines of growth of the shell. Muscular imprints too obscure for absolute determination.

I am not quite satisfied of the accuracy of the generic reference of this shell, still the form of the posterior border of the under side would indicate that it probably belonged to the Genus *Tryblidium*.

Formation and locality.—From a highly crystalline limestone of the Calciferous sandrock, from four to six feet below the lower *Ophileta* beds, near Beekmantown, N. Y.

Tryblidium pileolum, n. sp.

PLATE 7, FIGS. 15-17.

Shell very small, seldom more than half an inch in diameter, circular in outline to very broad ovate, and quite variable. Apex subcentral to posterior, sometimes almost overhanging the posterior margin; height of the shell generally less than one-third of the width, and often less than one-fourth. Surface smooth so far as seen. Muscular scars unknown.

This shell resembles *T. (Metoptoma) simplex*, Bill., Pal. Foss., Vol. I, p. 346, fig. 334;—Bull. A. M. N. Hist., Vol. I, p. 306, Pl. 24, figs. 30 and 31, but is broader, less elevated and with the apex differently situated.

Formation and locality.—A few examples were noticed in the compact limestone near the base of the Beekmantown section of the Calciferous, but it is more common in the *Ophileta* beds above, where it occurs frequently, but from its small size and obscure form is easily overlooked.

Genus ECCULIOMPHALUS, *Portlock*.

Ecculiomphalus priscus, n. sp.

PLATE 8, FIGS. 19 AND 20.

Shell of medium size, laxly coiled, consisting of about two volutions, which increase rather rapidly in diameter and leave a space between them equal to about half the diameter of the tube opposite the space measured. Tube irregularly ovate, broadly

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curved on the base and on the outer surface, and acute at the upper edge. Shell moderately thick, and on the outer part of the outer volution presenting the appearance of having been lirate.

This species is closely related to *E. volutatus*, Whitf., described in Bul. No. 8, p. 314, Pl. 25, figs. 8-11, from the Birdseye limestones of Fort Cassin, and was for a time thought to be the same, but on working the specimen from the matrix it is found to increase more rapidly in size, and particularly in its depth, in proportion to the number of coils, and also to be more sharply rounded on the outer surface of the tube, while the tube is nearly an erect ovate in section, instead of irregularly and obliquely triangular, as in that one. The apparent liration on the outer half of the last volution is also a feature not shown on any specimen of that species.

Locality and position.—From a hard, dark-colored limestone layer near the base of the Calciferous limestone outcrop, near Beekmantown, N. Y., ten or twelve feet below the lower *Ophileta* bed.

Genus EUOMPHALUS, *Sowerby*.

Euomphalus calciferus, n. sp.

PLATE 8, FIGS. 12 AND 13.

Shell of rather large size, discoid in form, composed of four or more somewhat robust volutions, which have a nearly circular transverse section, and are coiled so as to be scarcely indented on the inner surface, and so nearly on the same plane that it is extremely difficult to distinguish which side is the deepest. In most of the specimens shown in section on the upper side, the inner whorl is seen to rest slightly on the outer, showing the shell to be less concave above. The substance of the shell is very thin and very crystalline, nearly always exfoliated, so that the markings of the surface are usually destroyed, but where the best preserved appears to have been nearly or quite smooth.

There appears to be considerable variation in the rapidity of increase in the diameter of the volutions of this species, and consequently some would appear to have had more volutions than others of the same diameter. It is possible that there may be

more than one species represented among them, but evidence sufficiently indicative of this is not present. On one of the individuals figured, the upper surface of the outer volution is obliquely flattened from just within the periphery to the next inner volution, but as it is only for a small part of the volution, it seems accidental and not a feature of the shell. From the symmetrical coiling of the shell one might suspect close relations with the Genus *Ophileta*, but the perfectly rounded lower side of the volutions would place it in *Euomphalus*.

Genus OPHILETA, *Vanuxem*.

***Ophileta complanata*.**

PLATE 7, FIGS. 18-25.

Ophileta complanata, Vanuxem; Geol. Rept. 3d Dist. N. Y., p. 36, fig. 2.—Hall, Pal. N. Y., Vol. 1, p. 11, fig. 2, and Pl. 3, fig. 6; also *O. levata*, Vanux.

Ophileta compacta, Salter; Can. Org. Rem. Decade 1, p. 16, Pl. 3.
? *Ophileta nerine*, Bill., New Palæozoic Foss., Vol. 1, p. 245, fig. 232.

This shell was originally figured from very imperfect material from Calciferous sandstone from the Mohawk Valley, where the specimens are usually broken in such a manner as to present on the surface of the block, the cast of the interior of the flat side of the shell, with the crystalline matter of the shell itself between the coils. This is produced by the entire flat surface of the shell being removed in a single plate on the matrix, exposing the cast of the coils below. This frequently gives them the appearance of having nearly double the volutions which they really possess, and of the volutions being correspondingly more slender than they really are. Shells of an inch in diameter have usually about four volutions; those of one and four-tenths, four and a half. Shells occur sometimes of nearly or quite two inches in diameter among collections from Beekmantown on Lake Champlain, where the species is extremely abundant. From these the following characters are obtained:

Shells discoidal, planorbiform, coiled on the same plane; flat or but slightly concave on the lower surface, and more deeply concave above, the increased height of the volution being upward

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on the outer coils so as to leave the outer edge of the inner coils but slightly above the succeeding volution. Periphery flattened obliquely, the lower edge of the volution being the largest, and rounded to the base, while the upper angle is sharply carinate. Upper surface of each volution rapidly and obliquely sloping to the volution within it, giving the depressed spire. Aperture trapezoidal, the columellar face, or that in contact with the inner coil being the shortest. Substance of the shell thick, the surface transversely striated on the top and below, with frequent strongly-marked undulations on the flattened side and back of the volution, the latter being directed strongly forward in the middle.

The inner two or two and a half coils of this species, when the shell is preserved, present precisely the appearance represented by Vanuxem's figure of *O. levata*, as given both by Vanuxem and Hall, and I am inclined to believe that the two species, as recognized by these authors, are only two phases of the same species under two conditions of preservation. In regard to *O. compacta* of Salter, described from Canada, there cannot be the least shadow of doubt of its being the same as the New York shells, only preserving the exterior instead of representing the broken internal casts.

Formation and locality.—Extremely abundant in the shaly and compact layers of the Calciferous sandstones at Beekmantown, N. Y. Collected by Prof. H. M. Seely.

Genus MACLUREA, *Lesueur*.

Maclurea sordida.

PLATE 8, FIGS. 1-4.

Maclurea sordida, Hall; Pal. N. Y., Vol. 1, p. 10, Pl. 3, fig. 2.

Ellipsolites (Vanuxem), Hall, loc. cites. (For *Ellipsolites*, Conrad, see Emmons, Geol. Rept. 3d District New York, p. 385.)

Straparollus sordidus (Hall), Emmons, Am. Geol., Vol. 1, p. 156, Pl. 3, fig. 6.

This species is very abundantly represented among collections from near Beekmantown, N. Y., both in the condition as figured by Prof. Hall, and with the shell preserved. Prof. Hall's descrip-
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tion, given in Vol. 1, Pal. N. Y., is as follows: "Shell discoidal; spire not elevated; mouth slightly expanded; surface apparently smooth." In this description it is supposed the flattened surface was looked upon as the spire. The better preserved specimens from the unweathered limestones, where the shell is preserved, show the following characters:

Shell subdiscoidal; whorls two to two and a half in number, very rapidly increasing in diameter with increased growth, slightly disconnected in most instances, strongly rounded on the upper side with the apex deeply sunken, flattened on the lower side, and the peripheral edge rather sharply rounded. Shell thick, the surface oftentimes smooth with only faint lines of growth, but many specimens show strong, even, rugose, transverse striæ, with more distant undulations. The transverse lines of growth show a broad forward curvature between the inner and outer margins of the volutions on the lower flattened surface, and a broad retral curvature on the upper or rounded surface. Aperture semicircular, receding on the upper side.

Were it not for the carina described and figured by Mr. Billings on his *Ophileta? disjuncta* (Pal. Foss., Vol. 1, p. 344, fig. 331, *a* and *b*), I should be inclined to consider it as identical with this one; but there is no such feature apparent on any individual of this species, among the many observed. The under surface, as shown in his figure 331 *b*, is so exactly similar to the flattened surface of this, that one would naturally suspect their identity.

Formation and locality.—Quite abundant in the different layers of the Calciferous sandrock at Beekmantown, N. Y. Collected by Prof. H. M. Seely.

Genus HOLOPEA, *Hall.*

Holopea turgida.

PLATE 9, FIGS. 3-7.

Pleurotomaria? turgida, Hall; Pal. N. Y., Vol. 1, p. 12, Pl. 3, figs. 9 and 10 and 8?—Billings, Pass. Nat. & Geol., Vol. 4, p. 350.

Prof. Hall described this species from two fragments, obtained from the cherty material, found loose in Saratoga County, N. Y.

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His description is as follows : " Depressed-conical ; whorls about four, subangular, rapidly increasing from the apex ; last whorl very large, ventricose, expanded ; height and greatest breadth about equal."

Specimens somewhat larger, less imperfect, and retaining nearly three volutions, occur in the collections from Lake Champlain, in which the form is uncompressed, and although mostly exfoliated, some of it retaining the surface is preserved. The form is extremely robust, full and round, having an apical angle of something more than ninety degrees ; the volutions are very ventricose, almost inflated, and very rapidly increase in diameter with the growth of the shell. There have probably been from four to four and a half volutions to the specimen where the spire was perfect. Suture deep and strongly marked. Aperture obliquely subovate, and slightly subangular on the lower side, without any apparent thickening of the shell on the inner side, leaving a rather distinct umbilicus. The substance of the shell is very thin, with a comparatively smooth surface.

The species is quite large, having had a transverse diameter of fully two inches, and a height of about one and three-fourth inches. It is closely like *H. obesa*, Whitf., described in Vol. 4 of the Geol. of Wisconsin, p. 348, Pl. 27, fig. 11, but the volutions are rounder and more upright, not being as obliquely compressed on the upper side as in that species.

Locality and formation.—In the compact, semisilicious layers of the Calciferous sandstone at Beekmantown, N. Y. Collected by Prof. Henry M. Seely.

Genus TROCHONEMA, *Salter*.

Trochonema exile, n. sp.

PLATE 9, FIGS. 1 AND 2.

A small species, known only by the cast, and from only one fairly perfect, with parts of a few others, occurs among the Calciferous limestone specimens. It is broadly conical, rather more than two-thirds as high as wide, and consists of about three volutions in the most perfect example. Apical angle about eighty degrees. Volutions, in the cast, nearly circular, as wide as high, 1889.]

with a perceptible flattening on the periphery, giving a slight angle above and below. Umbilicus rather small, not showing the upper volutions within its cavity. Surface features unknown.

Of the type of *T. umbilicata*, but proportionally higher, with a narrower umbilicus, and less distinctly angular volutions. It more closely resembles a small *T. Beachi*, or *T. Beloitense*, Whitf., from the Trenton limestones near Beloit, Wis. (see Geol. Surv. Wis., Vol. 4, 1882, pp. 212 and 213, Pl. 6, figs. 6, 7 and 8), but the volutions are so much more slender, proportionally, as to preclude the possibility of any specific relationship.

Formation and locality.—In the dark, crystalline layer of the Calciferous limestone, below the lower *Ophileta* bed, at Beekmantown, N. Y.

Genus RAPHISTOMA, *Hall*.

Raphistoma prævium.

PLATE 8, FIGS. 5-7.

Shell of medium size, compressed lenticular; upper surface more compressed than the lower; apical angle of the spire about one hundred and thirty degrees as an average of many specimens. Volutions four to five in number on examples of an inch to an inch and a quarter in diameter, flattened in the direction of the slope of the spire, and sharply carinate on the periphery, the sutures being invisible; lower side of the volution rather more abruptly sloping than the upper, sharply angular at the margin of the very broad open umbilicus, which forms more than one-third of the entire width of the shell; inner surface of the volution sloping into the cavity, so as to give an even surface on the sides of the umbilicus. Aperture trapezoidal or subtriangular, transverse and sharply angular at the outer edge, the lip rapidly receding both above and below toward the edge of the volution; surface striæ very faint on the upper surface, but forming rather distinct undulations on the under side.

This shell is more compressed than any of the previously described forms, but the most important specific feature consists in the very broad umbilicus.

Formation and locality.—Very numerous in the compact semi-

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crystalline limestones of the Calciferous sandstone, at Beekmantown, N. Y. In collections received from Prof. H. M. Seely.

Genus PLEUROTOMARIA, *De France*.

Pleurotomaria Beekmanensis, n. sp.

PLATE 8, FIGS. 8-11.

Shell small, highly conical, having an apical angle of from sixty-five to seventy-five degrees, with the surface of the volutions sloping smoothly in the direction of the spire. Volutions four and a half to five, trapezoidal in section, angular on the lower margin, and somewhat rounded below. Umbilicus large, forming one-third of the width of the base. Periphery with a very narrow flattened band at the base, which has been narrowly notched. Surface with fine transverse striæ which are directed strongly backward in crossing the volution from above, and on the base are directed strongly forward from the margin to the edge of the umbilicus.

This species is of the type of *Pleurotomaria Etna*, and *P. Ramsayi* of Billings; from the first it differs in the more conical form, and from the last, which it more closely resembles in the greater width of the umbilicus, which in the *P. Ramsayi* is scarcely visible, and in the fuller, more convex base.

Formation and locality.—In compact limestone layers of the Calciferous sandstone, at Beekmantown, N. Y. Collected by H. M. Seely.

Genus MURCHISONIA, *D'Arch. & Vern'l.*

Murchisonia gracilens, n. sp.

PLATE 8, FIGS. 14 AND 15.

Shell small to medium size, very slender, the apical angle being not more than from sixteen to eighteen degrees. Whorls very numerous, the upper quarter of an inch of the spire of a small individual having six or more in number, while other specimens, imperfect above, must have had a length of an inch or more. Volutions ventricose, smooth or with but a very slight angularity near the middle of the exposed portion; sutures deep and strongly marked. Columella and aperture unknown.

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This is perhaps more nearly allied to *M. gracilis*, H., than to any other Lower Silurian species, but is even more slender than that one, and the volutions increase more rapidly in length in proportion to their diameter, which gives it a more slender form. The band on the middle of the volution has not been observed, as the examples are mostly weathered on the surface.

Formation and locality.—Quite numerous on weathered surfaces of the Calciferous sandstone, holding *Ophileta complanata*, Vanux., in great numbers, at Beekmantown, N. Y., mostly in sections weathered down on the solid limestone surface. Collected by Prof. H. M. Seely.

***Murchisonia? confusa*, n. sp.**

PLATE 8, FIGS. 16-18.

Shell varying from three-fourths of an inch to about one inch in length, and composed of about six volutions in the longer specimens, with an apical angle of from twenty to twenty-five degrees. Volutions convex, angular in the lower part, with deep, well-defined sutures between them; lower side of the volution somewhat flattened. Surface, so far as can be determined, smooth, the sutural band not observed.

This species occurs in great numbers on certain layers of limestone and shale, the material being largely composed of the remains of this fossil, and in the limestone beds with a species of *Stromatopora* or *Cryptozoon*. The species differs from others described in the angularity of the volutions and in its more rapid increase than in most of those from this low horizon.

Formation and locality.—Some specimens of thin bedded semi-crystalline limestones, from Shoreham, Vt., thought by Prof. Seely to be of the same geological horizon as the Fort Cassin beds, which are probably Birdseye. But the limestones containing them unfortunately contain no other recognized form than *Primitia Seelyi*, herein described, so the horizon remains somewhat doubtful.

Genus LOPHOSPIRA, *Whitf.*

Lophospira Calcifera, n. sp.

PLATE 9, FIGS. 8 AND 9.

Shell, so far as known at present, of medium size, biconical, and broadly spreading, the apical angle of one example being over one hundred degrees, that of another, somewhat doubtfully referred to it, being rather less than ninety degrees. Volutions as seen on the above-mentioned examples two and a half to three, strongly convex, rapidly enlarging and strongly sub-angular in the middle, with the surface moderately convex between the suture or base and the median angulation. Aperture obliquely subquadrate, higher than wide; columellar lip thickened and tortuous, extending the aperture somewhat below. Surface of the shell unknown, but the cast is marked by undulations which recede from above and below to the angulation of the whorl, indicating a deep angular notch-like margin of the outer lip of the aperture.

This species closely resembles *L. Casina*, *Whitf.*, *Bull. A. M. N. H.*, Vol. 1, No. 8, Pl. 25, fig. 4, but not so much the typical form—and it is probable that there are two species included under that name.

Formation and locality.—Occurs in the dark blue crystalline layers of limestone, below the lower *Ophileta* beds of the Calciferous, at Beekmantown, N. Y.

Genus BUCANIA, *Hall.*

Bucania tripla, n. sp.

PLATE 9, FIGS. 12 AND 13.

Shell small, involutè, closely coiled, so as to bring the dorsum of the inner volution within the area of the aperture of the last one. Volutions three or more, increasing somewhat rapidly in width in proportion to the dorso-ventral diameter; umbilicus large, open, its margins narrowly rounded; aperture as wide again as long, trifoliate on the outer side, and modified on the inner by the preceding volution. Dorsal surface deeply trilobed by broad sulci on each side of the strongly elevated and rounded dorsal lobe, which is somewhat narrower than the lateral lobes at the same point. Surface smooth.

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This species is of the type of and closely resembles small specimens of *B. trilobata*, Con., from the Clinton group in Oneida County, N. Y., but may be distinguished by having the dorsal lobe proportionally narrower—while the species so far as known at present is much smaller, the largest individual of several being scarcely more than one-fourth of an inch in width.

Formation and locality.—Several specimens of this species occur in a small block, picked up loose at Providence Island, Lake Champlain, and is probably from the same horizon as the Fort Cassin beds, or Birdseye limestone. They are associated with *Leperditia Seelyi*.

Genus ORTHOCERAS, *Brynius*.

Orthoceras primigenium.

PLATE 10, FIG. 1.

Orthoceras primigenium, Vaunxem, Geol. Rept. 3d Dist. N. Y., p. 36, fig. 4.—Pal. New York, Vol. 1, p. 13, Pl. 3, figs. 11 and 11 a.

But little additional information is obtained about this species. A single specimen, a longitudinal section, nearly three inches long, of a specimen somewhat larger in diameter than the larger one figured by Prof. Hall in Vol. 1, Pal. N. Y., is present in the collection. It presents about the same rate of increase in diameter as Fig. 11 on Hall's plate, but the septa are much more distant; three of the chambers occupying the same space as five do on that one, and the septa are not so deeply concave. Still in both these features it agrees with another fragment from the Mohawk Valley, occurring on the same block with the type examples of *Maclurea matutina* figured by Hall. The shell is too highly crystalline to separate from the matrix so as to show the outside structure, and I am not certain even of having observed the siphon. But what I suppose to be that organ, where the specimen was broken for the purpose of obtaining it, is very small and subcentral.

Formation and locality.—The specimen mentioned is from the Calciferous sandstone at Beekmantown, N. Y., and was collected by Prof. H. M. Seely.

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Genus CYRTOCERAS, *Goldf.***Cyrtoceras Kirbyi**, n. sp.

PLATE 10, FIGS. 4-7.

Shell of moderate size, strongly arcuate and laterally compressed, having an ovate transverse section which is rather more than three-fifths as wide as long, and the widest part of the section within the median line as regards the curvature, and the narrowest at the dorsum, which is narrowly rounded; tube rather moderately increasing in dimensions with increased length. Septa deeply concave, strongly arcuate on the side and extended forward on the back of the tube, somewhat numerous and closely arranged, six of the chambers near the outer part, on the dorsal edge, measuring half an inch. Siphon rather small, in contact with the shell at the dorsal margin, exposing nearly its entire diameter where the shell is removed, and apparently slightly swollen within the chambers. Outer chamber proportionally long, not known to be constricted near the aperture. Surface of the shell smooth and moderately thick.

Somewhat resembles *Oncoceras plebium*, Hall, from the Trenton limestone, but is more compressed, more acutely rounded on the back, and has the septa much more closely arranged.

Formation and locality.—From the dark blue band of limestone of the Calciferos, below the lower *Ophileta* bed, at Beekmantown, N. Y.

Cyrtoceras Beekmanensis, n. sp.

PLATE 10, FIGS. 2 AND 3.

Shell of moderate size, nearly straight, the arcuation being not more than one-eighth of an inch in a length of three inches, or one-twenty-fourth of the length; tube laterally compressed, giving a very slightly oval section, the lateral diameter being somewhat less than the dorso-ventral. Septa numerous, seven chambers occur within the space of half an inch on the side of the tube near the upper end of the septate portion, not greatly arcuated and of but shallow depth, rather strongly advanced on the inner side of the tube. Siphon unknown. Outer chamber quite long. Surface of the shell apparently smooth.

This species is so slightly curved, that were it not for the arcuation of the septa and their forward extension on the edge of the shell, one might readily suppose it to be an *Orthoceratite*. But these features are so marked as to leave no doubt of its generic relations. I know of no species of the genus from the lower formations that approaches it in character.

Formation and locality.—In the crystalline limestone layer of the Calciferous, below the lower *Ophileta* bed, at Beekmantown, N. Y.

Cyrtoceras Raei, n. sp.

PLATE 10, FIGS. 8 AND 9.

Known only from a fragment having a length of one and three-fourth inches, preserving a small part of the outer chamber and a part of the septate portion. The shell has been strongly arcuate and rather rapidly increasing in diameter, while the surface has been marked by concentric undulations, about one and a half as distant from crest to crest as the breadth of the chambers at the same part of the shell. Tube of the shell transversely broad-oval. Septa moderately distant, seven to eight of the chambers equal in length to the transverse diameter of the shell at the middle of the chambers counted, moderately concave, rather strongly arching upward on the back of the shell, and concave on the sides. Siphon rather small, its diameter less than the height of a single chamber at the same point, somewhat expanded within the chambers, giving it a somewhat beaded character as seen on the back of the specimen, close upon which it is situated.

No annulated forms of *Cyrtoceras* have been heretofore described from this geological horizon so far as I can ascertain.

Formation and locality.—In the Calciferous sandstone at Beekmantown, N. Y. Collected by Prof. H. M. Seely.

Genus **PRIMITIA**, *Jones*.

Primitia gregaria, n. sp.

PLATE 13, FIGS. 3-5.

Largest valves observed somewhat less than one-sixth of an inch in length, of an obliquely oval form, the straight hinge line

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being less than the width of the oval, and equal to about three-fifths of the length of the valves; cardinal angles distinct. Surface highly convex, the greatest elevation being across the narrow end of the oval; sulcus poorly defined, extending from the hinge to near or beyond the middle of the height, broadly triangular in outline; tubercles variable, generally three, situated one on each side of the sulcus and one near its lower extremity; margin with an indistinct border in some cases, but not making a constant feature; surface of the crust marked by numerous rather distant pits.

This species is somewhat variable in its characters, although usually having the same outline; the tubercles and sulcus are extremely variable, the former in number and position as well as in their proportional size. Nor does this appear to be owing to the condition of preservation. On the smaller individuals the sulcus is usually the most distinctly marked, while the tubercle next behind the sulcus is often the largest in these small specimens, though in several of the most perfect the anterior tubercle is much the most distinct. These variations have led me to fear that possibly there may be more than a single species among them, still I fail to find distinguishing features. On several specimens the more central tubercle shows ramifying vascular lines running backward from its centre, these being evidently individuals which retain the crust.

Formation and locality.—Slabs of a black bituminous shale, from Cave Island, Ball's Bay, Vt., on the east shore of Lake Champlain, supposed to belong to the Calciferous formation, are densely covered with valves of this species and *P. cristata*. The geological horizon may be somewhat doubtful, but the best evidence obtained would place it at the above horizon. The limestones above and below this thin band are unfossiliferous, and the shales contain none except these two species.

***Primitia? cristata*, n. sp.**

PLATE 13, FIGS. 1 AND 2.

Valves attaining a length of one-sixth of an inch or over, transversely ovate and moderately convex, narrowed toward the anterior end and distinctly margined by a more abruptly spread-
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ing but not thickened rim, which extends all around except on the hinge margin, which is straight and about equal to two-thirds of the entire length of the valve; cardinal angles somewhat obscure. Sulcus well marked but not distinctly defined, situated anterior to the middle of the valve, but not extending much below the middle of its height; bordered by a tubercle in front and one behind, with a third in the line of the sulcus and just above the middle of the valve. Another elongated, transversely oblique, ridge-like tubercle, rises abruptly just in front and just below the centre of the valve and parallel to its basal margin. Surface marked with numerous scattered pits, more faintly marked and finer near the margins.

The distinguishing feature of this species is the obliquely transverse ridge-like tubercle, which is very prominent, but often broken off in separating it from the rock.

Formation and locality.—Occurs in the black bituminous shales, probably of Calciferous age, on Cave Island, Ball's Bay, Lake Champlain, associated with *P. gregaria*, and is somewhat abundant.

Primitia Seelyi, n. sp.

PLATE 13, FIG. 6.

Valves about one-sixth of an inch in length, and about two-thirds as wide as long, with the straight (dorsal) margin rather more than three-fifths of the entire length. Valves prominently convex and distinctly wider at one end than at the other; cardinal angles distinct but not very prominent. Anterior and posterior ends bordered by a proportionally wide, flattened margin, which gradually narrows along the basal border and becomes obsolete over one-third of its length. Surface covered with moderately large, depressed pits, most of which have an elevated granule in the centre. No true sulcus or tubercle appears on the specimens, but in the place of these features there is a nearly circular spot, and above it a rapidly widening area, extending to the dorsal border, which is destitute of the pits marking the remainder of the surface.

This species is so distinct from any other known that there can be little chance of mistaking it. The character of the

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punctæ and the naked spot representing the tubercle and sulcus, would be good distinguishing features.

Formation and locality.—Several individuals of large size occur in the dark blue layer of crystalline limestone, from Shoreham, Vt.; and in some water-worn fragments of a granular limestone from Providence Island, in Lake Champlain, they occur in great numbers, the limestone being largely composed of them. Prof. Seely thinks this geological horizon may be the same as the Fort Cassin rocks.

Genus BATHYURUS, *Billings*.

Bathyrus conicus.

PLATE 13, FIGS. 15-21.

Bathyrus conicus, Billings; Can. Nat. & Geol., Vol. 4, pp. 365 and 366, fig. 12c.—New Pal. Foss., Vol. 1, p. 352.

Several glabellas of this species have been observed among the fossils from the Calciferous sandstone. They are of about the size of the figure given by Mr. Billings, and agree perfectly in all particulars. The crust is usually left in the matrix, but the pustulose surface is perfectly shown on the glabella, fixed cheeks and frontal limb. The glabella is quite conical or slipper-shaped, rounded at the anterior end and nearly straight across the occipital border; no appearance of true glabellar furrows can be detected, but a slight constriction in width occurs opposite the anterior point of the palpebral lobe. The lobe is prominent and of moderate size, and the fixed cheeks and frontal limb within the anterior furrow narrow, and the latter is margined by a distinctly rounded, prominent border. Occipital ring low rounded and the furrow narrow but shallow. Pustules of the surface large and distant from each other about equal to their own diameter. Lateral limbs imperfectly observed, but apparently broadly triangular. A small fragment of a movable cheek shows four rows of pustules between the furrow outside of the palpebral lobe and the marginal furrow.

Pygidium semicircular, or transversely elliptical, with the anterior margin about two-thirds as sharply curved as the posterior or outer margin; the outer margin of the plate bordered by a
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narrow, flattened rim. Surface strongly and nearly equally trilobed, the axial lobe extending to the posterior margin, where it is obtusely pointed. Axial lobe marked by five transverse rings, including the terminal ones; rings short, strongly and almost sharply elevated, the intervening spaces being wider than the rings, each ring marked by a central spine-like tubercle, and one or two lateral nodes, the terminal ring having two principal tubercles. Lateral lobes marked by four rings, with from two to four nodes on each in one or two rows. Intermediate surface smooth.

Formation and locality.—In the subcrystalline layers of the Califerous at Beekmantown, N. Y. Collected by Prof. H. M. Seely.

Bathyurus Seelyi, n. sp.

PLATE 13, FIGS. 8-14.

This species is known from the imperfect central parts of the head, separated movable cheeks and pygidia. No thoracic parts have been observed in a condition to identify as belonging to the other parts.

The head shield, exclusive of the movable cheeks, is elongate quadrangular, being about four-fifths as wide across the eye-lobes as the length from the extreme of the occipital ring to the front of the anterior marginal rim. Glabella conical, rounded at the apex, and moderately convex, no glabellar furrows are visible on most of them, a single one showing faint indications of a single median pair in the constriction of the sides at this point; dorsal furrows distinct but not deep. Frontal border rather wide, nearly half as wide as the glabella, when the rim is included. Eye lobes large, elevated, situated opposite the middle of the glabella. Lateral limbs narrow but elongate. Occipital ring and furrow narrow. Front marginal rim elevated, but narrow. Surface smooth.

Movable cheek quadrangular, or trapezoidal, with a large, not deep, ocular sinus; rim elevated, rounded and narrow; disc convex and smooth.

Pygidium nearly semicircular, or somewhat paraboloid, the length and breadth being about as two to three, highly convex on

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the surface and with an extremely wide and rounded axial lobe, its width being but little less than one-half of that of the entire plate; sides of the axial lobe nearly parallel, its extremity extending nearly to the margin behind, and very obtusely rounded; rings of the lobe broad, slightly convex between the furrows, and three in number, exclusive of both terminal ones. Lateral lobes triangular, marked by three segments exclusive of the anterior one, each of which bears a very faint median furrow along its outer half. Margin of the plate very abruptly sloping, almost vertical and but little thickened. Surface smooth.

It is probable that this species is identical with one from Comstocks, Washington County, N. Y., mentioned by Mr. Billings as very closely allied to *B. Cordai* (see New Pal. Foss., Vol. 1, p. 260), but which I do not find elsewhere described. The species differs somewhat from *B. Cordai*, B., in the form of the glabella, too much to be classed as identical without a knowledge of the other parts of that species than the glabella alone, as there are fewer points of differences on that portion between different species than on almost any other part of the organism.

Formation and locality.—In the lower six or eight feet of the Calciferous sandrock as exposed at Beekmantown, N. Y.

EXPLANATION OF PLATE 7.

Orthis Macloedi, n. sp. Page 43.

Figs. 1-3. Views of a dorsal ? and two ventral valves.

Fig. 4. Enlargement of the striæ.

Triplesia radiata, n. sp. Page 43.

Figs. 5 & 6. Views of dorsal valves, enlarged.

Figs. 7 & 8. Views of ventral valves, enlarged.

Triblidium acutum, n. sp. Page 45.

Figs. 9 & 10. Enlarged back and lateral views of a specimen.

Fig. 11. View of the aperture, showing the flattening of the under side of the apex.

Metoptoma alta, n. sp. Page 44.

Figs. 12 & 13. Lateral and vertical views of the type specimen.

Triblidium pileolum, n. sp. Page 46.

Figs. 15 & 16. Two views, natural size, of an ovate form.

Fig. 17. Vertical view of a more circular specimen.

Ophileta complanata, Vanuxem. Page 48.

Figs. 18, 19 & 20. Lower and upper surfaces of a specimen of medium size, and an ideal section of the same.

Fig. 21. Lower surface of a specimen retaining the shell.

Fig. 22. Upper side of a small individual showing the depressed spire—*O. levata*, Vanux.

Fig. 23. Lower side of a smaller shell retaining the surface.

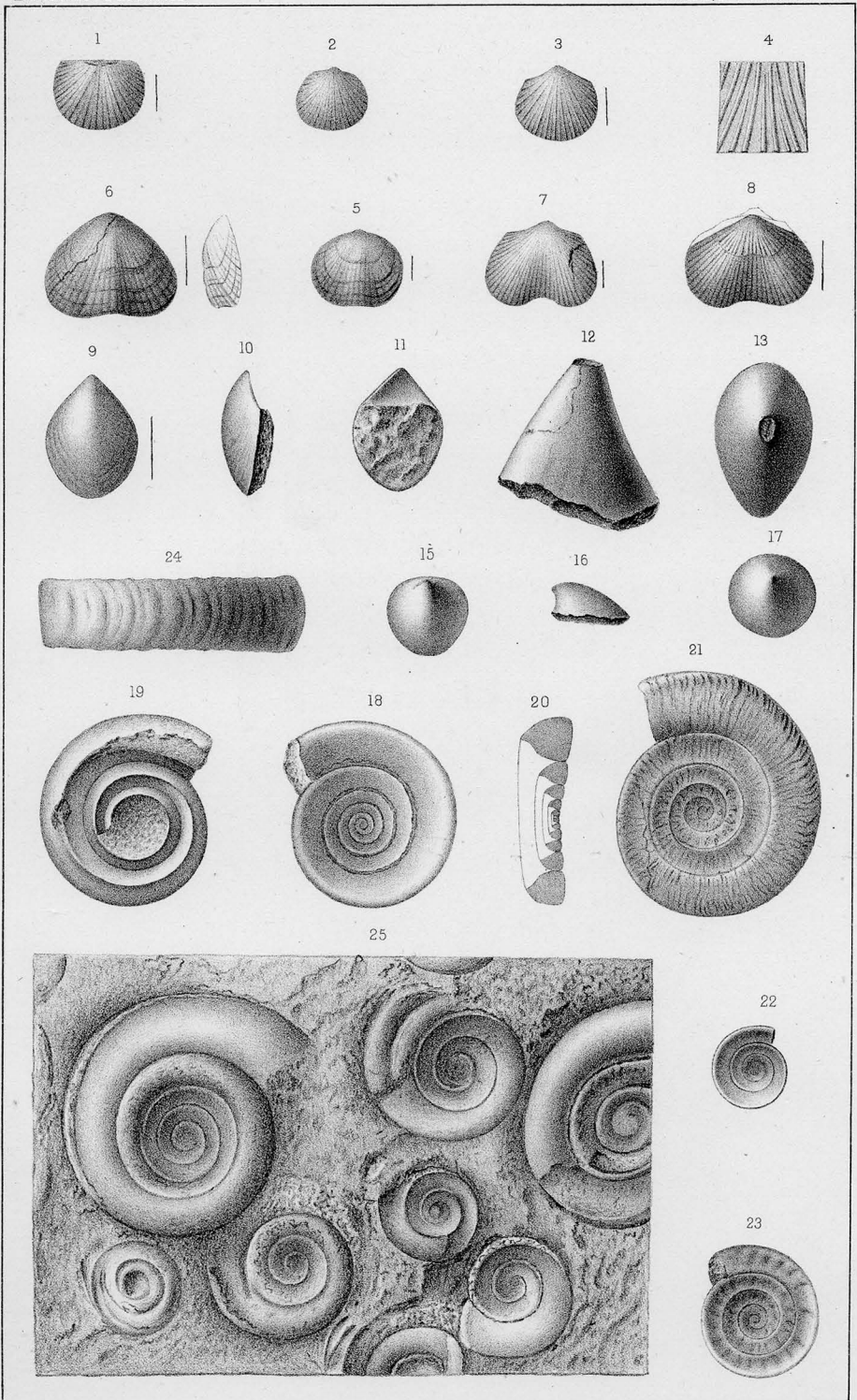
Fig. 24. Enlarged view of the back of specimen fig. 23.

Fig. 25. Surface of a slab showing the specimens as they occur on the rock for many square feet together.

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EXPLANATION OF PLATE 8.

Maclurea sordida, Hall. Page 49.

Figs. 1 & 2. Views of the lower sides of different specimens.

Figs. 3 & 4. Views of the upper and lower sides of a partial cast.

Raphistoma prævium, n. sp. Page 52.

Figs. 5-7. Upper, lower and profile views of a large specimen.

Pleurotomaria Beekmanensis, n. sp. Page 53.

Figs. 8-10. Three views of a nearly entire individual.

Fig. 11. Lateral views of a broader specimen.

Euomphalus calciferus, n. sp. Page 47.

Figs. 12 & 13. Views of two individuals, the latter restored over a part of the outer volution.

Murchisonia gracilens, n. sp. Page 53.

Figs. 14 & 15. Views of two different specimens, enlarged.

Murchisonia? confusa, n. sp. Page 54.

Figs. 16 & 17. Views of two individuals, natural size.

Fig. 18. View of a block of shaly limestone, showing their mode of occurrence.

Ecculiomphalus priscus, n. sp. Page 46.

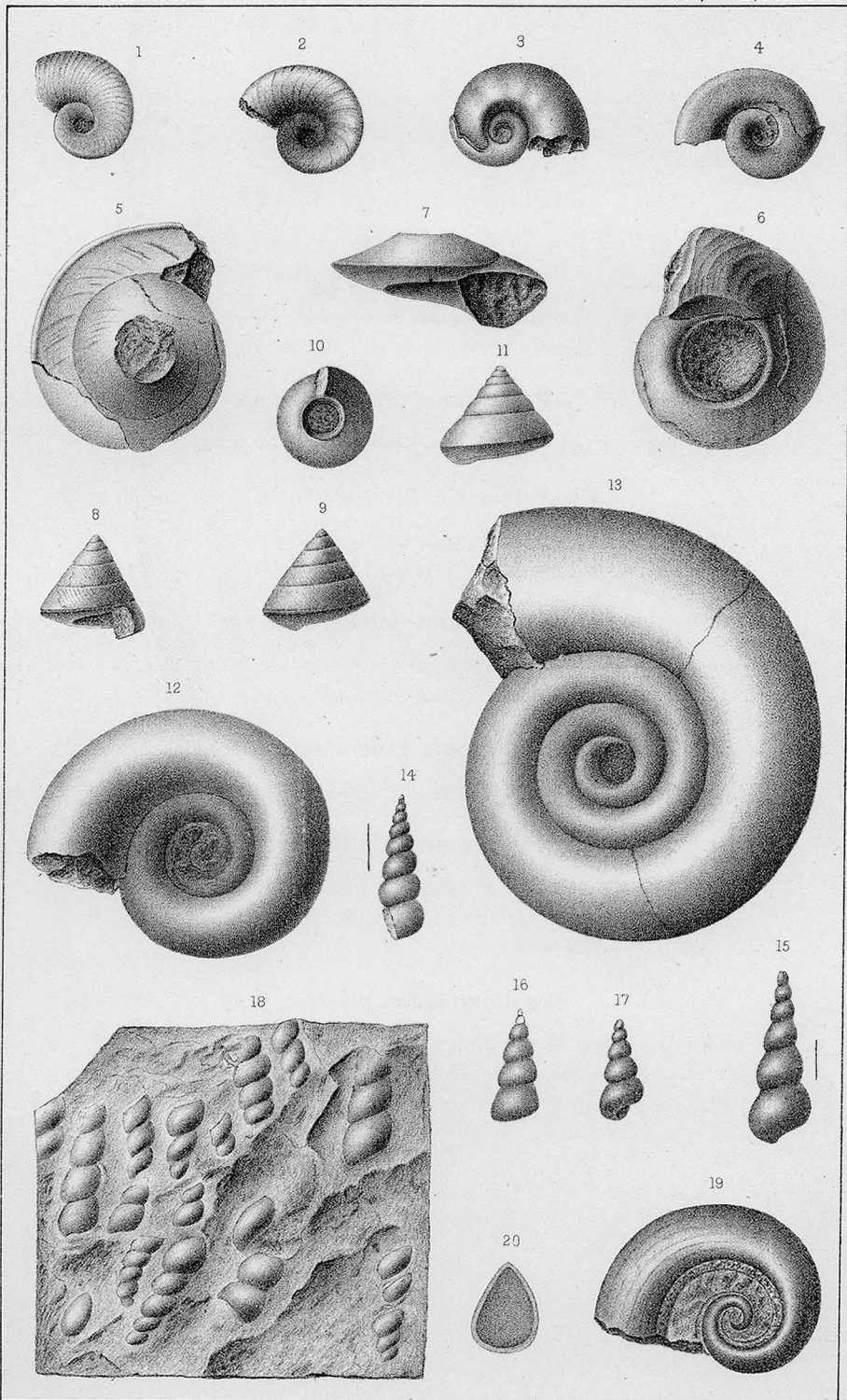
Fig. 19. View of the under side of a cast; the thickness of the shell can be seen in the rock between the coils.

Fig. 20. Section, showing the form of the tube.

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EXPLANATION OF PLATE 9.

Trochonema exile, n. sp. Page 51.

Figs. 1 & 2. Two views of a cast, enlarged.

Holopea turgida, Hall's sp. Page 50.

Figs. 3 & 4. Lateral and vertical views of a small specimen.

Figs. 5 & 6. Similar views of a large, slightly imperfect specimen.

Fig. 7. Lateral view of a large specimen with imperfect spire.

Lophospira Calcifera, n. sp. Page 55.

Figs. 8 & 9. Front and back views of a specimen, showing twisted columella.

Figs. 10 & 11. Similar views of a more slender, angular form.

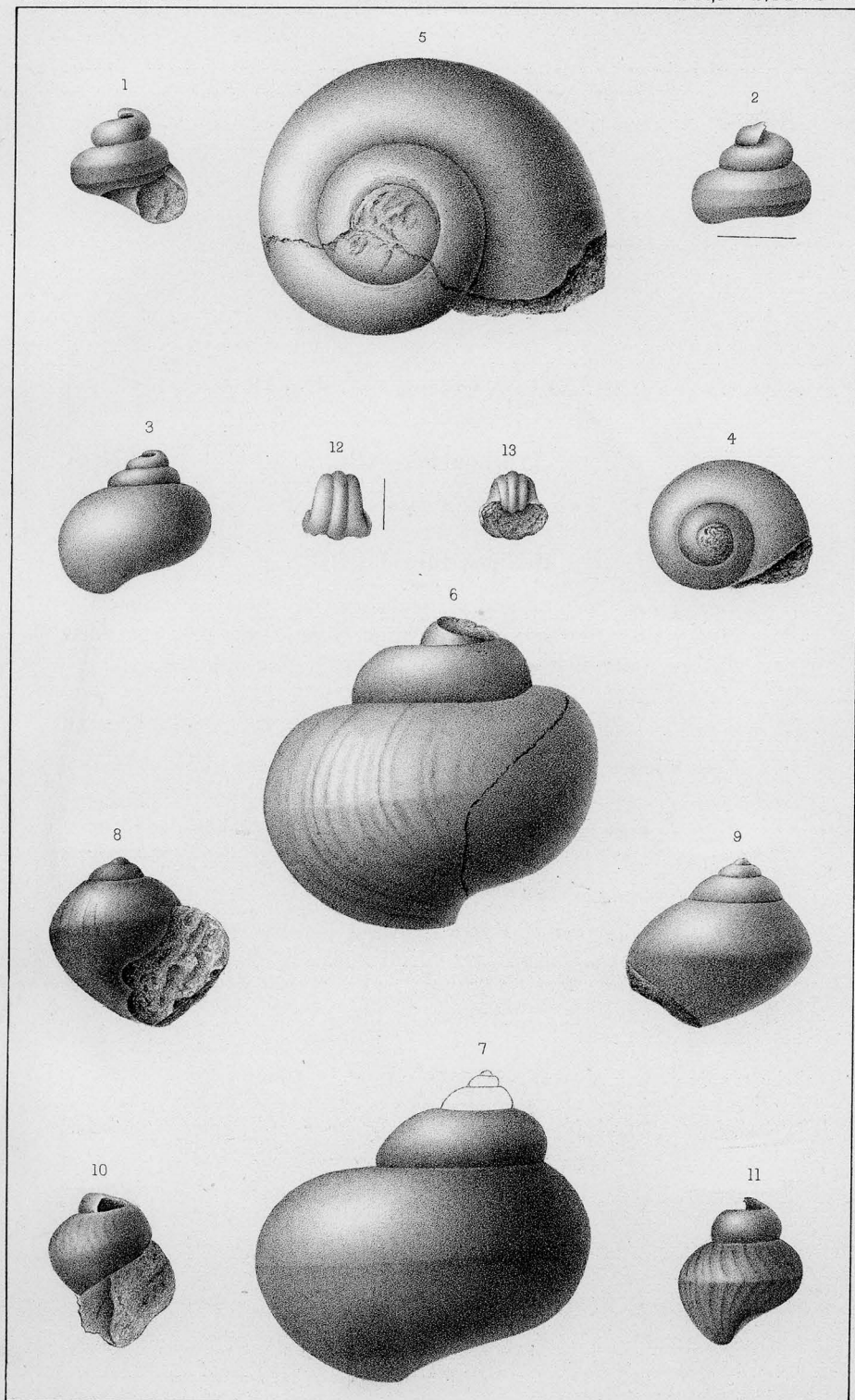
Bucania tripla, n. sp. Page 55.

Figs. 12 & 13. Dorsal and apertural views of the largest specimen observed.

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EXPLANATION OF PLATE 10.

Orthoceras primigenium, Hall. Page 56.

Fig. 1. View of a longitudinal section, showing septa in lower half.

Cyrtoceras Beekmanensis, n. sp. Page 57.

Figs. 2 & 3. Lateral and ventral views of a fragment, showing the septa and outer chamber.

Cyrtoceras Kirbyi, n. sp. Page 57.

Figs. 4 & 5. Dorsal and lateral views of a specimen, showing the form and proportions of the tube, also the siphon.

Fig. 6. The outer chamber separated; showing the depth of septum.

Fig. 7. Form of transverse section.

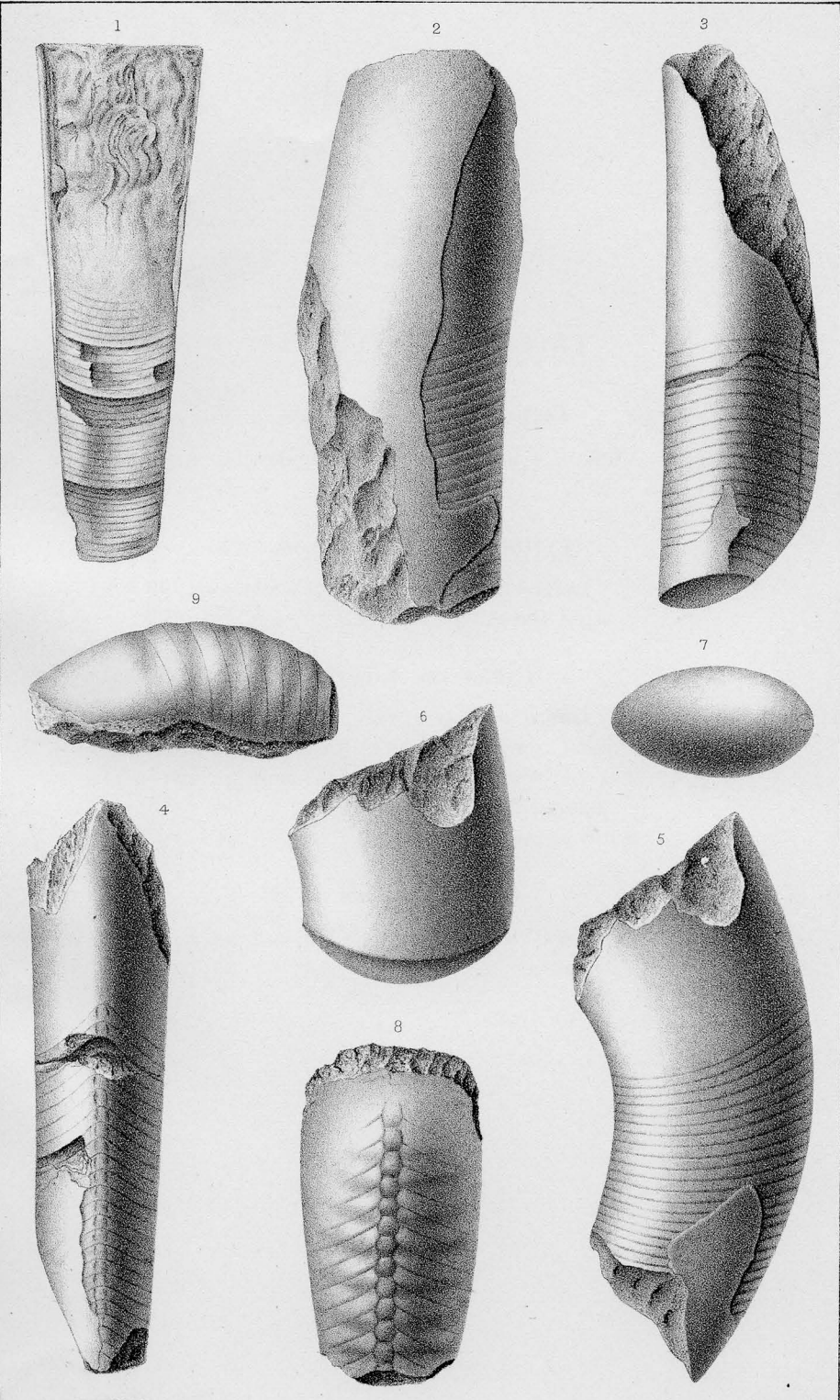
Cyrtoceras Raei, n. sp. Page 58.

Figs. 8 & 9. Back view, showing siphon, and lateral view of the fragment.

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EXPLANATION OF PLATE 13.

Primitia cristata, n. sp. Page 59.

Figs. 1 & 2. Views of opposite valve (4 diameters) and an outline profile of each, showing elevation.

Primitia gregaria, n. sp. Page 58.

Figs. 3 & 4. View of opposite valves (4 diameters), with outline profiles.

Fig. 5. View of an internal cast of the same.

Primitia Seelyi, n. sp. Page 60.

Fig. 6. View of a right valve with profiles (4 diameters).

Fig. 7. Enlargement of crust, showing the pits with granules in them.

Bathyrus Seelyi, n. sp. Page 61.

Figs. 8 & 9. View of a glabella and fixed cheeks, the frontal rim imperfect. Also outline profile.

Fig. 10. View of a left movable cheek, imperfect below.

Figs. 11 & 12. Another imperfect head and outline profile.

Figs. 13 & 14. Pygidium, (2 diameters), the marginal rim partly removed.

Bathyrus conicus, Billings. Page 61.

Figs. 15 & 16. View of the central parts of the most perfect head, and profile in outline.

Figs. 17-19. View of imperfect heads of this species.

Figs. 20 & 21. Views of a pygidium, enlarged twice.

Protobalanus Hamiltonensis, Whitf. Page 67.

Fig. 22. View greatly enlarged, to scale, showing the features described.

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