

ARTICLE XVII.—*Notice of Geological investigations along the Eastern shore of Lake Champlain, conducted by Prof. H. M. Seely and Prest. Ezra Brainerd, of Middlebury College, with descriptions of the new Fossils discovered.* By R. P. WHITFIELD.

There are some of the formations of the New York Geological series which have thus far furnished but few fossil remains wherewith to identify them at localities other than the original ones studied. Among these the Birdseye limestone has been somewhat conspicuous. At the few localities where it was originally studied, it had been recognized largely from its lithological features, stratigraphical relations, and two peculiar plant-like organisms, which by the weathering of their ends on the horizontal surfaces of the rock, produces the peculiar feature which gives it the name Birdseye. This feature, however, is not always present, neither do the lithological features always hold good, or the stratigraphical relations prove clear; so that the want of fossil remains proves to be something of a drawback in studying its relations. If we examine Vol. 1 of the New York Palæontology for its peculiar and characteristic fossil remains, we find only fifteen species in all. These are *Phytopsis tubulosum* and *P. cellulosum*, Hall, the two plant remains mentioned above, one Lamellibranchiate of doubtful character; nine Gasteropods; two Cephalopods; and one Crustacean of undetermined relations. Besides these there is one Sponge; two Corals; two Bryozoans and one Gasteropod, *Trochomena umbilicatum*, Hall, which are also common to the Black River, or to the Trenton limestone above. Most of the specimens of these species originally figured were poorly preserved and very unsatisfactory. Hence, we may consider that any addition to the fauna of this bed would be of importance, and materially aid in their study. For this reason I have considered it of importance to science that the new forms herein described should be published.

During the past year, Prof. H. M. Seely and Prest. Brainerd, with several other members of the Faculty of Middlebury College, Middlebury, Vt., have undertaken the very praiseworthy task of working out more in detail the geological structure of the Vermont border of Lake Champlain and its islands, in the progress [Dec. 28th, 1886.]

of which they have obtained from a very restricted locality on the lake shore, a few miles from Vergennes, Vt., a group of fossils which they have placed in my hands for description. The locality had been known to consist of the Chazy, Birdseye and Black River limestones, recognized principally from stratigraphical evidence, and from the occurrence of Chazy fossils in the lower beds, while the upper beds had not afforded Palæontological evidence to any amount heretofore. The particular bed which I have here referred to the Birdseye limestone has yielded to these gentlemen so far, five Brachiopods; sixteen Gasteropods; twelve Cephalopods and one variety; two Trilobites and two bivalve Crustaceans; thirty-seven species and one variety, all in a recognizable condition, and are here illustrated. All but five of these are new to science; of the others, four are identical with forms originally described from the Quebec group of the Canadian Geol. Survey, or from their Calciferous (probably not the Calciferous of the New York Palæontology). The other one is *Asaphus canalis*, Con., of the New York Palæont., never before fully recognized or illustrated. Besides these, there are *Maclurea affinis*, Billings, and *M. Logani*, Salter; also a *Murchisonia*, closely resembling, if not identical with, *M. cicelia*, Billings, and several undeterminable Gasteropods. *Orthoceras bilineatum*, Hall, is quite common, and there are at least two other *Orthoceras* which are too poor for illustration; also three apparently undescribed trilobites and a species of Harpes closely resembling *H. Ottawaensis*, Bill.; but after strict comparison with an electrotype of the original I think can scarcely be identical. These undetermined forms are too poor for description and illustration, and must wait until better material is obtained.

Of the previously known forms from this locality:

*Orthis Evadne*, Billings?

*Hemipronites apicalis*, Bill.,

*Maclurea affinis*, Bill.,

*Pleurotomaria Etna*, Bill., and

*Murchisonia cicelia*, Bill., were originally referred to the Quebec

by Mr. Billings, and

*Holopea arenaria*, Bill.,

*Triblidium simplex*, Bill., to the Calciferous sandstone, while

[Dec. 28th,

*Maclurea Logani*, Salter,  
*Orthoceras bilineatum*, Hall, and

*Asaphus canalis*, Conrad, are from the Birdseye limestone, and the latter also from the Chazy limestone. The Quebec group beds, in which the five species above named occur are undoubtedly Birdseye or Birdseye and Black River limestones; and the formation in which the two occur, which are referred to the Calciferous sandstone, certainly cannot be Palæontologically identical with the Calciferous of New York. Considering the evidence furnished by these fossils, and the great prevalence of gasteropods and coiled cephalopods, I should consider the beds as undoubtedly of the age of the Birdseye limestones of other parts of the State. Prof. Henry M. Seely has been much inclined to place them with the Chazy limestone; but so far as I can determine there is not a single fully characteristic Chazy fossil in the entire assemblage.

There is yet an uncertainty as to where the limits between the Chazy limestone and the Birdseye should be drawn. In the true Chazy, as recognized in the Palæontology of New York, there is a peculiar group of Gasteropods, *Scalites*, and its congeners, which have so far, at least to my knowledge, never been found in any other bed. But *Maclurea* runs up and through the Trenton, so cannot be considered a strictly characteristic form of the Chazy, and as none of the *Scalites*-like forms are found in this bed, although only thirty feet or so above the recognized Chazy, I see no reason, Palæontologically at least, for considering it as Chazy. The bed in which these fossils occur is about twenty feet above the layer in which the gasteropod *Calaurops* occurs so abundantly, which if projected across the bay to the point north of Fort Cassin, would overlie the Chazy limestone which crops out there, and is filled with *Maclurea magna*. The *Calaurops* layer I suppose to be Chazy limestone, and is a tough, heavy-bedded limestone greatly resembling the *Maclurea* bed.

The following geological sketch of the locality and its surroundings, with the accompanying geological map, has been furnished by the parties making the survey, who are also responsible for the geological conclusions. Although I visited with them Fort Cassin and some of the points along the lake shore in August 1886.]

gust last, I did not see the rocks on the south shore of Field's Bay, the fossils from which are quite unsatisfactory.

#### AN ACCOUNT OF THE ROCKS AT FORT CASSIN AND VICINITY.

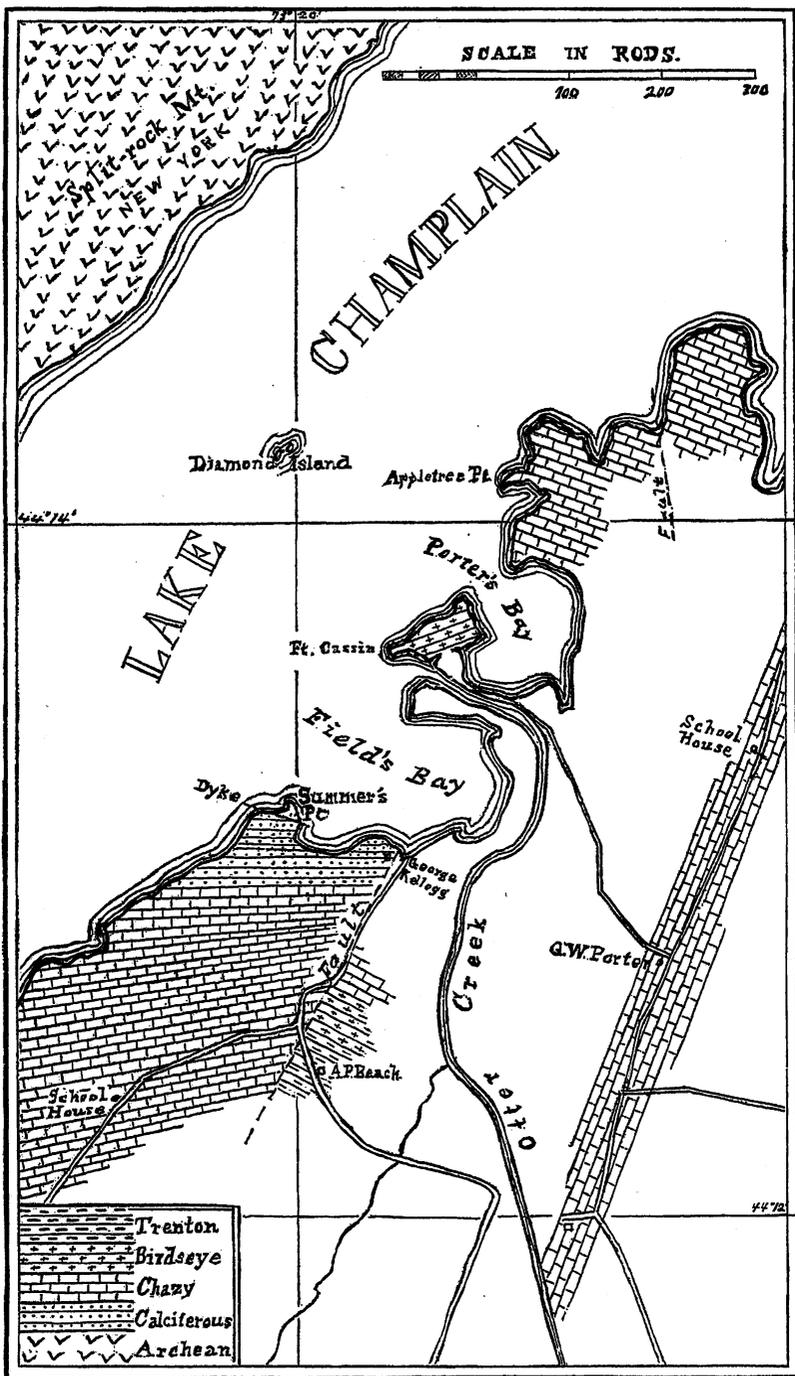
FORT CASSIN consisted chiefly of earthworks, erected by Lieut. Cassin at the mouth of Otter Creek during the war of 1812. On the very site of the fort has recently been discovered the remarkable group of fossils described in the accompanying paper.

The promontory, on the west end of which the fort is situated, seems to have been once a rocky island, now connected with the mainland by the alluvial deposits of the river. The strike of the strata on the northeast side is N.  $87\frac{1}{2}^{\circ}$  E. by the magnetic needle, the declination of which at this place, at the present time, is  $12^{\circ}$  W. The strike varies gradually until it becomes N.  $80^{\circ}$  E. at the southwest end. The dip is from  $6^{\circ}$  to  $8^{\circ}$  southerly. The fossils are for the most part from an upper stratum, which forms about two-thirds of the surface. On the north shore are disclosed 15 or 20 feet of lower strata.

The strata vary much in their lithological character. Near the top occurs a bed, one or two feet in thickness, of yellowish-weathering dolomite. The stratum from which most of the fossils were obtained is a pure, fine-grained, compact limestone. A few years since a persistent but unsuccessful attempt was made to manufacture hydraulic cement from the rock of these upper strata. The large building and the kilns built for this purpose are still standing on the south side of the promontory. The middle strata are thin bedded and shaly, and on the northwest side have been worn out by the action of the waves, forming in one place a grotto whose roof is supported by natural columns of the shaly rock. Beneath this are thicker strata of tough, somewhat impure limestone, in which the new genus *Calaurops* was discovered. And lowest of all, at the most northerly point, is a thick bed of sandy limestone weathering on the edges in prominent ridges about one inch in width.

Three hundred rods south of the fort, on the south shore of Field's Bay, occur massive beds of tough dolomite, dipping S.  $11^{\circ}$  W.  $> 5^{\circ}$  at George Kellogg's house, and S.  $33^{\circ}$  W.  $> 8^{\circ}$  at

[Dec. 28th, 1886.]



GEOLOGICAL MAP OF FORT CASSIN, VT., AND VICINITY.

Summer's Point. A dike, eight feet in width, of reddish porphyritic trap, extends across the base of Summer's Point. Farther south along the shore are seen higher strata of shale and impure limestone, the latter containing in abundance *Orthis costalis* and other fossils characteristic of the lower Chazy formation. At the bay, three-fourths of a mile south of Summer's Point, the massive beds of the Chazy containing *Maclurea magna* are first seen. Still farther south, higher and higher strata of this latter formation occur, the strike curving more and more to the south, until at Button Bay Island the Black River limestones are reached. The *Maclurea* beds extend eastward from the shore in high ridges for two or three hundred rods, terminating suddenly in a fault, which runs from near George Kellogg's house southerly through a point near the forks of the road. To the east of this fault the strata have a high dip to the southwest, and consist of the Chazy, Black River and Trenton rocks in succession. The dolomitic rocks on the south shore of Field's Bay are believed to be calciferous on account of their position beneath the Chazy, their lithological character, and the occurrence of obscure fossils, which resemble *Ophileta* and *Murchisonia Anna*, of Billings. A necessary inference is, that beneath the waters of Field's Bay there is either a fault running east and west, or an abrupt fold, bringing up the lower rock to the south.

The headland north of Porter's Bay, however, seems to be connected without a break with the Fort Cassin rock. It is composed of Chazy rock, of which over 300 feet in thickness is exposed. The dip is quite uniformly  $8\frac{1}{2}^{\circ}$  to the southwest. On the north shore of the headland the strike is N.  $45^{\circ}$  W., and the shaly layers and the fossils of the Lower Chazy are abundant. On the south shore the strike is N.  $56^{\circ}$  W., and the rock and the fossils are like those seen in neighboring exposures at the top of the Chazy. At the extreme southwest point and at Appletree Point, the strata are curved rapidly to the south, having a strike of S.  $50^{\circ}$  W., which, continued across the mouth of Porter's Bay, would bring these strata just beneath that of Fort Cassin.

The most northern promontory on the map appears to be separated from the one just described by a fault. The dip is S.  $33^{\circ}$

[Dec. 28th,

W. >  $9\frac{1}{2}$ ; and the rock at the northern point consists of the same shaly layers already described as at the base of the Chazy.

Still farther to the northeast are promontories not represented on the map, consisting mainly of Chazy rock, but in part also of the Calciferous and Black River. These, however, bear evidence of much greater disturbance. The strata are often abruptly folded; several faults occur; and the rock is frequently intersected with dikes of trap.

But a mile to the east of Fort Cassin occurs an uplift, which is more characteristic of the geology of the western part of Addison County. By a longitudinal fault, extending several miles in nearly a straight line, the older formations are brought up on the east side and thrust over on to the newer formations on the west. The uplift represented on the map consists of the upper strata of the Chazy, dipping on the average S.  $55^{\circ}$  E. >  $7^{\circ}$ . To the south of Mr. G. W. Porter's house occur higher strata, which appear to belong to the base of the Birdseye formation. This uplift, after a short interval, may be traced in the same line for four or five miles to the south of Otter Creek; and in this part of the monoclinical there are extensive exposures of the Black River strata. To the east of this long ridge is a wide valley covered for the most part with Champlain clays, but showing now and then hills of Trenton limestone or of Utica slate. On the east side of the valley occurs another monoclinical uplift, in which the massive limestones of the Lower Silurian are seen overriding the slates, especially at the Falls of Vergennes and at Ferrisburgh Center. This is the fault whose appearance seven miles south of Vergennes is described by Prof. Emmons in the *Geology of New York*, Pt. II, pp. 280, 281. Still farther east is seen "the great break," in which the rocks of the Potsdam Period are lifted up in some places a thousand feet above sea level, and form a series of hills stretching from Snake Mountain north into Canada.

The rocks along the shore, in the vicinity of Fort Cassin, seem to have been subjected to a more irregular disturbance, on account of their nearness to the Archæan terrane, which even now rises abruptly on the west shore of the lake. The waters of the lake here attain to their greatest depth of nearly 400 feet. Wedged

in between the firm mountain wall of the ancient shore and the moving mass of thicker strata on the east, it is not surprising that the rocks under discussion should have been profoundly folded and fractured.

## MOLLUSCOIDEA.\*

### BRACHIOPODA.

Genus ORTHIS, *Dalman*.

**Orthis Evadne**, Billings?

PLATE 24, FIG. 8.

*Orthis evadne*, Billings; Pal. Foss. Canada, Vol. I, p. 79, fig. 74.

A single valve somewhat smaller than the figure given by Mr. Billings in his Pal. Foss., Vol. I, p. 79, fig. 74, *a-d*, occurs in the collection from Fort Cassin. The specimen is figured in order to aid in its identification. It presents the aspect of a dorsal valve, but is destitute of any mesial sinus. In all other respects it agrees very well with that species, having coarse distant striæ, with finer intermediate ones and very fine wrinkled or squamose concentric lines, parallel to the margin. The Canadian examples were from the Quebec group at Point Lévis.

Genus HEMIPRONITES, *Pander*.

**Hemipronites apicalis**.

PLATE 24, FIGS. 1-5.

Compare *Orthis? apicalis*, Billings; Pal. Foss., Vol. I, p. 301, fig. 291.

Shell small, scarcely attaining a diameter of half an inch. Valves highly convex, the ventral having a rather high, somewhat pointed beak, scarcely or but slightly incurved. Outline transversely elliptical to semicircular in different individuals, with somewhat rounded cardinal angles, becoming more circular in outline with increased age. Hinge straight, nearly as long as the shell below in young specimens, becoming proportionally shorter

\*All species, when not otherwise stated, are from the Birdseye limestone at Fort Cassin, Vt.

with age. Area moderately high, obliquely striated, and divided in the center by a narrow, highly rounded, covered deltidium, the perforation through which has not been observed. Dorsal valve less convex than the ventral, the area inconsiderable. Surface of the shell marked by fine radiating striæ, which are rounded and even on the shell, but when partially exfoliated or on the cast, appear to alternate in size. In the interior of the ventral valve the dental plates do not converge and unite with a central septum, as in the Russian species *adopectans* and *hemipronites*, of Pander, but are directed at right angles to the area to near the middle of the valve, then slightly diverge until they unite with the outer shell. At near the middle of their length they are united by a transverse plate, as seen in section which is united to a central septum, thereby dividing the interior of the valve into five distinct chambers instead of into three, as in the Russian forms above mentioned, which are the types of the genus *Hemipronites*. This latter feature of the interior ought probably to be considered of generic importance, but as so few Palæontologists have seen fit to recognize *Hemipronites*, which I think one of the well marked genera of Brachiopods, I hesitate to separate this species under a new generic name. I have supposed this might prove identical with the form described by Mr. Billings, as above cited, although by no means certain. Mr. B. states that in his shells the deltidium is "apparently open," while in this form it is positively closed. The Canadian specimens were from the Quebec group at Point Lévis.

Genus STREPTORHYNCHUS, *King*.

**Streptorhynchus? primordiale**, n. sp.

PLATE 24, FIG. 7.

Shell small, and known only from a dorsal valve, which is flat and nearly semicircular in outline, being half as long as wide with the sides a little too full for a half circle, and the front margin of the valve a little straightened. Hinge line straight, a little longer than the shell below, with a narrow, almost linear area, divided in the centre by a proportionally large, covered deltidial callus, slightly imperfect in the specimen and showing the cardi-  
1886.]

nal end of a slight mesial septum in the interior of the valve. Surface of the shell marked by narrow, flexuose, elevated, radiating striæ, with finer striæ between them. On the centre of the valve the larger striæ have only one, or sometimes no finer ones between; but toward the ends of the valve they become gradually more and more distant, so as to have two, three, or even four of the finer striæ between. The striæ are also partially interrupted as well as flexuose, giving a somewhat broken and irregular appearance to them. There are also very fine transverse striæ, microscopical in size, which cross the radiating striæ and produce under a strong lens a somewhat granulose surface. Ventral valve and interior unknown.

I can find no record of anything approaching this shell in character having been previously described. In its striation it is peculiar in the Lower Silurian—differing very materially from the striation of *Leptæna incrassata* and *Strophomena (Leptæna) plicifera*, Hall, from the Chazy limestone, and resembling more in its general features the Streptorhynchoids of the higher formations, of which it is undoubtedly a forerunner.

Genus LEPTÆNA, *Dalman*.

**Leptæna**, sp. ?

PLATE 24, FIG. 6.

A single specimen of a large Leptænoid shell, in recognizable form, and one or two other fragments have been found. The shell has been about one and a quarter inches long on the hinge, with slightly mucronate points, and having a convexity of a trifle less than a quarter of an inch, with an outline somewhat triangular in general form. The surface has been marked with strong, distant striæ, having several finer ones between, the number of which is not determinable in the exfoliated condition. The species seems to bear some relationship in form, curvative and surface striæ to *Strophomena aurora*, Billings, Pal. Foss., Vol. 1, p. 218, from the Quebec group, four miles northeast of Portland Creek, Newfoundland, but is more triangular in outline and has more pointed cardinal angles. The specimens are too poor for description.

[Dec. 28th,

Genus TRIPLESIA, *Hall.*

***Triplesia lateralis***, n. sp.

PLATE 24, FIGS. 9-11.

Shell of medium size, moderately convex and very much wider than long, with a narrow, linear cardinal area on the ventral valve, and a straight hinge about two-thirds as long as the entire width of the shell. Ventral valve with a deep angular sinus, extending from a short distance below the beak to the front of the valve, which is bent upward, forming a broadly triangular extension. Dorsal valve transversely elliptical in outline, but with a moderately straight hinge, beyond which the small beak projects so as to present the elliptical outline of the valve; mesial portions of the valve, scarcely elevated to form a mesial fold, but usually nearly symmetrically convex, the front broadly elevated to accommodate the extension of the ventral valve. Surface of the shell marked by fine concentric lines of growth and a few stronger varices. There is also an appearance of very fine, hair-like striations apparent on most of the specimens, which appears to be an internal feature of the fibrous structure, very apparent on the weathered or exfoliated specimens.

The species differs from any of those in the Trenton limestones in the proportionally greater width of the shell and in the less marked and less prominent mesial fold.

*Formation and locality.*—The species is quite numerous at Fort Cassin in the beds with the Cephalopoda herein described, but is as yet known only from single valves, and they usually in a bad state of preservation.

## MOLLUSCA.

### GASTEROPODA.

Genus TRYBLIDIUM, *Lindström.*

In Dr. Lindström's Silurian Gasterop. and Pteropoda of Gotland (Kongl. Svenska Vet. Akad. Handl. Band. 19, No. 6), p. 52, he redescribes, and on Plate 1 figures, species of his genus 1886.]

*Tryblidium*, citing his *Fragmenta Silurica*, 1880, a work which I have not seen, for the original description. The description given in the first cited work is as follows :

“Shell patelliform, obovate, anteriorly acuminate, posteriorly enlarged, forming a very low cone. Apex anterior, nearly marginal, with only very little area beneath. Margin of the ovate aperture arched, so that the animal, when fixed, was not entirely hidden beneath its shell. Muscular scars in six disconnected pairs, arranged in an oblong circle, open or nearly so towards the front part of the shell. Intimate structure of the shell somewhat resembling that of a *Patella*, being composed of thin strata of polygonous cells.”

Among the fossils from Fort Cassin are several species of *Patelloid* or *Metoptoma*-like shells, which have nearly the characters of the above-described genus. But when strictly compared with the characters, as given in detail, vary considerable. Still I am unwilling to propose for them a new generic term, feeling that they should rightly be included with the Gotland species under the one name. All of the species differ from *Tryblidium* as characterized in having more than six pairs of detached muscular scars, and in having the basal margin straight, or so nearly so as not to be perceptibly curved in any of the examples seen ; or, if curved at all, to be in the opposite direction to that represented and described in the generic diagnosis. Some of them also differ in being symmetrically oval instead of ovate, while one of them is almost symmetrically conical instead of having the apex nearly marginal on the anterior end, as required by the description; consequently, if they are included under the same genus, these must be considered as inconstant features, and therefore only specific instead of generic. Another, and perhaps more important difference consists in the muscular scars being “open or nearly so towards the anterior end” in the Gotland specimens; while in the Fort Cassin forms the scars are decidedly continuous around and below the apex of the shell, in a deep and continuous line, from the elongated clavate scars on the sides of the beak or apex, as they are in *Nacella*; at least in *N. pellucida* and *N. cymbularia*. Considering the above facts it would appear that the generic separation from *Nacella* would rest principally upon the disconnected muscular scars. The intimate shell structure, at

[Dec. 28th,

least of one of the species, *T. ovatum*, is the same as in the Gotland specimens, composed of polygonal cells. Were it not for the separate and detached muscular scars there would be no valid reason for separating these shells from the living *Nacellas*, except their Palæozoic age.

**Tryblidium ovale**, n. sp.

PLATE 24, FIGS. 28 and 29.

Shell large for the genus, having a length of one inch and seven-tenths in the largest specimen, and nearly symmetrically oval in outline, being perhaps a trifle wider just forward of the line of greatest width than behind it, and a little more sharply rounded behind than in front. Greatest width equal to about three-fifths of the entire length on the base of the shell. Apex anterior, but little elevated above the margin and but slightly projecting beyond it. Surface of the shell highly convex transversely, very obtusely angular along the center from the beak posteriorly, a transverse section across the middle of its length being a very perfect paraboloid; the arcuation from the beak backward being a constantly decreasing or widening curve. Surface of the shell substance on the only fragment seen, which is near the beak, very finely striated concentrically. Shell substance rather thin. Muscular scars in detached pairs, of which seven are rather broad and somewhat rounded; the pair nearest the beak are elongate, narrow and curved, the anterior extremity being narrowest and curved downward, unites in a narrow raised line which passes beneath the beak in front. Apex of the beak, in the cast, marked by a small but distinct node, indicating an apical depression in the shell.

The distinctly oval and low convex form of this species, with the strongly arcuate medial line, will be the distinguishing features.

**Tryblidium ovatum**, n. sp.

PLATE 24, FIGS. 23-25.

Shell smaller than *T. ovale*, the specimens yet observed not exceeding one and a quarter inches in length, very distinctly and markedly ovate in outline, being narrow and almost pointed in  
1886.]

front and more broadly rounded behind, the point of greatest diameter being behind the middle of the length. Apex anterior, somewhat pointed, curved downward and slightly projecting forward of the anterior margin. Surface of the shell strongly convex, regularly rounded transversely, the point of greatest elevation being about half way between the apex and the middle of the shell. Surface of the shell marked by concentric lines of growth and by faint radiating striæ, the latter too fine to be perceived by the unaided eye. Muscular scars in eight detached pairs, very strongly marked on the casts, and constantly increasing in size from in front backward, each of them more or less round in form.

This species differs from *T. ovale* in the smaller size, ovate form, greater elevation, and in the form of the muscular scars.

**Tryblidium conicum**, n. sp.

PLATE 24, FIGS. 26 and 27, 32 and 33.

Shell rather small and broadly conical, with a nearly central or subcentral apex, the sides of the shell being in some specimens slightly convex, and in others almost straightly sloping; basal outline broadly oval or subcircular. Height of the cone nearly equal to the shortest diameter. Surface of the shell unknown. Muscular scars in eight detached pairs, subcircular in outline and surrounding the cast at about the middle of the height or a little above the middle.

This shell is nearly of the form and dimensions of *Metoptoma Montrealensis*, Billings, from the Black River limestones at Paquette Rapids on the Ottawa River, Canada, but there is no evidence on any of the specimens yet seen of radiating striæ as in that one. Otherwise it might readily be identical.

**Tryblidium simplex**.

PLATE 24, FIGS. 30 and 31.

*Metoptoma simplex*, Billings, Pal. Foss., Vol. I, p. 346, fig. 334.

Shell quite small, pileiform, with an elevated, anteriorly curved, narrow and pointed beak, behind which the shell is strongly and highly arcuate. Aperture broad-ovate or oval, or in small indi-

[Dec. 28th,

viduals almost subcircular. Shell substance rather thick for the size; surface structure smooth as far as seen.

This species is quite small and might readily be mistaken for the young of one of the other species having the anteriorly curved apex, but in the largest specimen seen, which is less than half an inch in its extreme length, the apex is more elevated above the apertural margin than in quite grown specimens of either of those species, while the back of the shell is very much more arcuate in proportion.

This species would appear to be parasitic to some extent, or at least sedentary, like the common *Crepidulas*, as it is found attached to fragments of other shells, in one case several being found upon a fragment of *Orthoceras Brainerdi*. The Canadian specimens were credited to the Calciferous formation near Merrickville, Canada.

Genus CLISOSPIRA, *Billings*, 1865.

*Geol. of Canada, Palaeozoic Foss.*, Vol. 1, p. 186.

Comp. *Onychocheilus*, *Lindström*, *Kongl. Sv. Vet. Akad. Hand.*, Vol. 19, No. 6, p. 196.

In 1865 Mr. Billings proposed the genus *Clisospira* for a sinistral, trochiform gasteropod, from the Quebec group of rocks near St. Antoine, above Quebec, and described and figured the species on the same page under the name *C. curiosa*. From these figures alone one would naturally suppose the object to be the filling or matrix broken from the umbilical opening of a *Bellerophon* or *Bucania*, but on page 420 of the same work he gives a figure of what he supposes to be a specimen of the same species preserving the shell and showing more its true nature, but which is much more likely a distinct species from the one first figured. In 1876, while working over some fossils from the Trenton group in Wisconsin, I came across a specimen of a species which evidently belonged to this genus, and in Vol. 4 of the final report of Wisconsin described it as *Clisospira occidentalis*. See *Geol. Wis.*, Vol. 4, p. 222, Pl. 5, fig. 21. From the study of this specimen I found it to be the cast of a complete shell, and not the filling of an umbilical cavity as I had supposed the Canadian examples might be. 1886.]

In the above cited Swedish work, page 166, Dr. Lindström proposes the genus *Onychocheilus* for a group of shells, between which and the American shells I can see no reliable distinction; at least there cannot be between the Wisconsin species and his *O. reticulatum*. Among the Fort Cassin fossils I find another shell, which, although represented only by a single individual, seems without doubt to belong to this curious group, and which I shall describe under the generic name proposed by Mr. Billings.

***Clisospira lirata*, n. sp.**

PLATE 24, FIGS. 16 and 17.

Shell small, sinistrally coiled, and consisting of not more than two very rapidly enlarging volutions, which are broadly convex on the upper surface and somewhat concave on the base. The aperture, which is imperfectly seen in the specimen, is somewhat semi-lunate and very oblique, the upper lip of the shell extending far over the lower one and rounded on the edge, while the lower one would appear to have been concave or receding on the edge. Surface of the shell marked by strong, oblique, lamellose ridges, parallel to the margin of the aperture, or crossing the volution obliquely backwards from the suture to the basal angle, and are separated by concave interspaces.

The lirate surface features will serve to distinguish this from any of the other described species.

Genus EUOMPHALUS, *Sowerby*.

***Euomphalus circumliratus*, n. sp.**

PLATE 24, FIGS. 18-21.

Shell small, closely coiled, spire but little elevated, the inner volutions being inclosed for more than one-half of their vertical diameter within the outer ones. Section circular, except for the indentation of the preceding volutions. Umbilicus narrow and deep, less than the diameter of the smaller half of the adjoining volution. Surface marked by spiral ridges or raised lines with concave interspaces. Nine or ten of the ridges may be counted on the larger volution, those on the upper surface most distant, becoming gradually narrower on the side and below, as well as

[*Dec. 28th,*

more distinct. Exterior surface unknown. Volutions three to four.

This species is known only from the internal cast; the shell, which is thick in substance, having adhered to the matrix. The nearest allied species is *Pleurotomaria? Calphurnia*, Billings, Pal. Foss., Vol. 1, p. 230; which differs very materially in the greater elevation of the spire, and stronger spiral ridges, as well as in the somewhat higher volution as seen in section.

Genus RAPHISTOMA, *Hall*.

**Raphistoma compressum**, n. sp.

PLATE 24, FIGS. 14 and 15.

Shell of medium size, very depressed convex above and sub-discoidal, volutions three and a half to four, transversely narrow-ovate, acute on the outer edge and rounded on the inner, the inner ones impressed below the outer at the suture lines, the upper surface being swollen just outside of the suture, and very moderately concave a little within the outer margin; giving the form known as an o-g. to a cross section of the upper surface. Outer edge sharply acute. Base of the shell broadly umbilicate and almost regularly convex, the greatest convexity being a little within the median line. Umbilicus one-third the entire width of the shell. Aperture transverse, almost symmetrically acute-ovate, rounded on the inner margin, the upper lip strongly receding from the suture to the outer edge of the volution, where it appears to have been somewhat deeply notched. Lower lip not definitely determined, but apparently nearly conforming to the upper, except in being less advanced near the suture. Surface of the shell marked only by transverse lines of growth on the upper side, which sometimes produce slight undulations on the surface parallel to the margin of the aperture.

This shell is of the type of *R. lenticularis*, Sow., and corresponds in general form with *Pleurotomaria Canadensis*, Billings, Pal. Foss., Vol. 1, p. 342, fig. 328, except that it is more compressed and has fewer and more rapidly increasing volutions. The *P. Harpya*, Billings, loc. cite., p. 227, not figured; would appear to be most nearly allied to our shell in its depressed form; 1886.]

but in that one the volutions must increase very much more rapidly, as there are only three allowed for in a specimen having a width of two and one-third inches, while this one possesses between three and four in a shell of only one inch and an eighth in its greatest diameter. No other shell has been described having greater affinities with this one, than the two above mentioned.

Genus HOLOPEA, *Hall.*

**Holopea Cassina**, n. sp.

PLATE 25, FIGS. 6 and 7.

Shell of more than an average size for the genus, attaining a height of about one and a half inches, by a transverse diameter of rather more than one and three-fourths inches, and consisting of three, or more than three, very ventricose and subangular volutions. Form broad-ovate, erect, or but little oblique, the volutions very rapidly increasing in size with additional growth of the shell. Body volutions very gibbous, subangular above the middle, and also showing a tendency to angulation again below the middle, forming a broad, somewhat obliquely flattened space on the middle of the volution. Sutures very deep and distinctly marked, the upper volutions of the spire being strongly exert, the apical angle being not much less than eighty degrees. Axis perforate and the margin of the umbilicus abrupt, the perforation being small and narrow. Aperture large, ovate, acute above and sharply rounded at the base, judging from the form of the volution. Substance of the shell moderately thick, and the surface marked only by fine transverse lines of growth.

This shell has its nearest ally in *H. ovalis*, Billings, Can. Nat. and Geol., Vol. 4, p. 351, fig. 2, from which it differs in the more ventricose and subangular volutions, and in the deeply marked sutures.

**Holopea arenaria.**

PLATE 25, FIG. 5.

? *Murchisonia arenaria*, Billings, Can. Nat. & Geologist, Vol. 4, p. 359, fig. 9.

A specimen of *Holopea*, which appears to be identical with that figured by Mr. Billings, loc. cite., occurs in the Fort Cassin col-

[Dec. 28th,

lection ; at least it corresponds so closely with the figure and description there given, that I do not feel safe in considering it as distinct. The specimen is however a true *Holopea*, and although being distinctly angulated along the middle of the body whorl, has certainly never possessed the characteristic slit of *Murchisonia*, as the lines of growth are shown on the shell surface to form only a very broad V shaped notch, which occupies the entire width of the volution, instead of only a narrow central band. If the Canadian shell shall prove to be a true *Murchisonia*, the above used specific name might be retained for the present species under *Holopea*, although by no means a descriptive one. The Canadian shell perports to have come from the Calciferous sandstone, at Godmanchester, Canada ; which fact might in itself, were it properly located, throw some doubt on their identity. As I have not seen that shell, I am unable to satisfactory decide the question.

The Trenton limestone, from its base upward, is characterized by a group of gasteropods which have heretofore been classed under the genus *Murchisonia*, but which differ in several essential points from that genus, if not from the entire family to which it belongs. This group may be said to be typified in the shell known under the name *Murchisonia bicincta*, Hall (= *M. Milleri*, Hall, S. A. Miller's Cat. Pal. Foss., p. 244), and its varieties. They have a general resemblance to *Murchisonia*, but are usually more tightly coiled; that is, they are wound more closely around their axis, and embrace the upper volutions lower down, leaving more of their height exposed above the sutures, so that the upper volutions may be said to be more exsert than in any of the true *Murchisonias*, usually to considerably below the middle, or to below the point of greatest diameter. They are also always characterized by one or more carina, or spiral ridges; one of which always marks the periphery of the volutions. This central ridge or carina marks also the bottom of a receding notch or sinus in the outer lip of the shell, of a greater or less depth, but not necessarily a slit like that of *Murchisonia* and *Pleurotomaria*. In very many of the specimens, especially of *M. Milleri*, Hall, this central ridge is occupied by a thin, flat, flange-like expansion, which is serrated on the edge like a circular-saw, and is not unfrequently

more than an eighth of an inch in width, while being nearly as thin as paper. This feature is seldom seen on the limestone specimens, as it is always left in the rock in separating it from the shell. But in the buff-colored dolomitic limestones of Southern Wisconsin, I have often seen it beautifully shown in the matrices where the shell substance had been removed, and its imprint left. Another feature in which they differ from *Murchisonia*, is in the tendency which they exhibit to uncoil, or for the whorls to become disconnected in the advanced stages of growth. This feature prevails to so great an extent among the specimens found at Beloit, Wisconsin, that few shells of more than an inch and a half in length fail to show it more or less. It is also well shown in the figures given by Mr. Salter in Decade 1, Can. Org. Remains, Pl. 4. They also differ in the form of the aperture, in that the columella is never solid, and that they are usually if not always minutely umbilicated, while *Murchisonia* proper has a solid axis. For this group of shells I propose the generic name *Lophospira*, in allusion to its keeled structure.

#### LOPHOSPIRA, New Genus.

Shells univalve, with elevated spires and strongly carinated or keeled volutions, whorls closely coiled in the upper part, but often becoming disconnected below from a too rapid descent of the coil. Central keel marking the position of a sinus or notch in the outer lip of the aperture. Axis usually minutely perforate when the whorls are not disconnected. Types *Murchisonia bincincta* = *M. Milleri*, Hall, and *M. helicteres*, Salter.

#### **Lophospira Cassina**, n. sp.

PLATE 25, FIGS. 1-4.

Shell unusually robust for the genus, being nearly as wide as high, with the body volution forming the great bulk of the shell. Volutions three to three and a half in large specimens, coiled considerably below the point of greatest diameter of the whorl above in the upper part of the spire, and still further below in larger ones, so as to leave a greater proportion of the upper one exposed. Volutions rounded on the periphery above, and be-

[Dec. 28th,

coming more angular with advanced age, the surface above the carination becoming flattened obliquely, and that below the carination more gently convex, the lower portion being extended and broadly rounded at the base below the columella. Aperture large, angular at the widest part, and the margin of the lip receding at this point; above, it is angular, and below rounded; columella coated by a flattened angular callus. Axis very slightly perforated. Surface of the shell comparatively smooth; no carina exists other than that forming the periphery of the volution.

The species is of the type of *Murchisonia ventricosa*, Hall, Pal. N. Y., Vol. 1, p. 41, Pl. 10, fig. 3, but is altogether more robust and less elongated proportionally. It bears also similarity, in its proportions, to *Murchisonia* (?) *varicosa*, loc. cite, fig. 7, in wanting the several carinæ of that species, and the varicose surface ascribed to it.

Both of the above-mentioned species are from the Birdseye limestone, and both will fall under the genus *Lophospira*. The present species being peculiar, as compared with them, and also with all other species hitherto described, in the downward extension of the columella, prolonging the aperture and forming a short beak-like process, while most species of the genus have the base of the aperture either obtusely or acutely rounded. In Vol. 4, of the Geol. of Wisconsin, Pl. 5, fig. 18, I have figured a specimen which I referred to *M. ventricosa*, Hall, but which is much shorter than the typical form of that species, and is probably distinct, but it differs from this one in the flattening of the upper side of the volution and in the less prolonged base, as well as in possessing an additional carina on the upper side of the whorls. This present shell may be said to bear some resemblance to a *Scalites*; but in *Scalites angulatus*, Con., perhaps the only true species of the genus yet known, there is, so far as I can obtain the information from the best specimens I have access to, a rather large open umbilicus, and a distinct notch at the inner base of the aperture, with a ridge above it, which I am inclined to think when properly understood will show close relations to the *Acteonidæ*.

Since the above has been in type I have obtained other and more adult specimens, which show a distinct callus coating on the columella, and an extension below of the aperture forming a  
1886.]

broad rounded base, the lower part of the columella being bent. There is also a greater variation in the form of the spire than I had supposed, some being much lower and the volution more angular than in those before used. There is also on one, figured on Plate 25, fig. 4, a ridge seen on the flattened part of the columella, the full value of which is not yet understood.

Genus *ECCULIOMPHALUS*, *Portlock*.

***Ecculiomphalus volutatus***, n. sp.

PLATE 25, FIGS. 8-11.

Shell somewhat larger than a medium size for the genus, measuring fully two inches in its greatest horizontal diameter on the largest individual before me; and consisting of from one and a half to fully one and three-quarter volutions, which are distantly and loosely coiled, being entirely disconnected and distinct from each other, and quite rapidly increasing in dimensions. The shell is flattened or flatly rounded on the lower side, if considered as a dextral shell, and rather sharply ridged on the upper side, and is coiled in the plane of the flattened surface, which leaves the spire depressed so as to resemble a loosely coiled *Maclurea*. Substance of the shell only moderately thick, and marked by transverse wrinkles of growth, or smooth. The internal cast where the shell is removed shows longitudinal ridges, faintly indicated.

This shell is a true *Ecculiomphalus*, according exactly with Col. Portlock's original description. In general appearance, it somewhat resembles *E. intortus*, Billings, Can. Nat. and Geol., Vol. 6, p. 321, fig. 5, but does not increase in size so rapidly and has an entirely different cross section, being acutely pyriform instead of nearly circular as in that one.

*CALAUROPS*, New Genus.

*Καλαῦροψ*, a *Shepherd's Crook or Staff*.

Shell univalve, discoidal, convolute, inner volutions closely coiled, outer one disunited and projected in a straight line. Type *C. lituiformis*.

This name is proposed for a fossil shell having some resemblance to *Ecculiomphalus*, Portlock, but differing in having the

[*Dec. 28th*,

inner volutions closely coiled, although not, in the type species, embracing. The inner volutions alone would present the appearance of a species of *Euomphalus*, from which it differs in having the outer volution disconnected and at length projected in a straight line. The *Eccuomphalus Canadensis*, Billings, from the Calciferous sandrock in Canada (Can. Nat. & Geol., Vol. 6, 1861, p. 320), will also fall under this genus. One peculiar feature noticed in all the specimens of the typical species, consists in the filling up of the earlier parts of the shell as the animal increases with age, and an apparent withdrawal of the animal from these parts. This is shown by the interior parts of the shell, as far as the animal occupied it at the time of death, being filled with foreign matter; while behind, the space is entirely filled with crystalline material, which has resulted from the thickening of the shell. This is sometimes carried on so far as to leave only the straight deflected part of the shell to be occupied by the animal.

***Calaurops lituiformis*, n. sp.**

PLATE 26, FIGS. 1-4.

Shell of moderate size, sub-discoid and convolute, consisting of about two and a half volutions, of which the inner ones are united but not impressed one into the other, and the outer or principal volution becomes disunited and free, and the outer part projected in a straight line to the extent of more than four and a half inches from the back of the volution. Spire very depressed convex, or perhaps sometimes even flat; the upper surface of the volutions being very moderately convex; below, the shell is more convex, being nearly semicircular, and the edges obtusely angular or rounded, the outer edge usually the most salient. Substance of the shell very thick and heavy, the surface as shown on some weathered portions, marked transversely by strong rugose ridges, though often apparently also smooth or nearly so.

I had at first supposed this to be identical with *Eccuomphalus Canadensis*, Billings, figured on page 320, Vol. 6, Can. Nat. & Geol., 1861; but on comparing it with the type specimen of that species which Mr. J. F. Whiteaves, Palæontologist of the Canadian Survey, kindly loaned me for comparison, I find it to differ in some [1886.]

essential points. The lower side of the Canadian species is very much more convex, in fact is much more than half of a circle and quite gibbous, and the decrease in size backward much more rapid than in this species, while the coil has been smaller and more abrupt.

*Formation and locality.*—This species is from the lowest rock exposure seen at Fort Cassin, which is a coarse, somewhat crystalline black limestone closely resembling the Maclurea beds, at Chazy, N. Y., and on Isle La Mott. It appears to have been very abundant in the rock, from the number of parts of individuals seen in the hand specimens, but no other fossil has been recognized in the same bed except the caudal plate of a trilobite of small size, resembling *Bathyurus extans*, Hall.

Genus PLEUROTOMARIA, *Defrance.*

**Pleurotomaria? Etna?**

PLATE 24, FIGS. 12 and 13.

? *Pleurotomaria Etna*, Billings, Pal. Foss., Vol. 1, p. 226, fig. 210.

Among the collections from Fort Cassin are parts of many specimens of a shell closely resembling the above-named species, but none of them in a sufficiently perfect condition to afford positive means of identification. Still they are so nearly like it as to make it quite unsafe to describe them under another name. The surface, as shown between the separated volutions, when broken, is beautifully marked with spiral striæ, but whether or not this may correspond to the "surface striated" as stated by Mr. Billings in his description of that shell, I am not sure. Mr. Billings's specimens were from the Quebec group in Newfoundland.

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

**Murchisonia? prava**, n. sp.

PLATE 24, FIG. 22.

Shell somewhat below a medium size, the type specimen measuring in the extreme but one and one-fourth inches, and consisting of about six volutions, allowing for the apex, which is absent in the specimen used. Volutions convex, somewhat regularly so, the upper four and a half regularly coiled and regularly increasing in size; below which point, that is, for the lower one and a

[*Dec. 28th,*

half volutions, they are irregularly coiled in the specimen, being more closely wound, so as to constrict the diameter and bend the spire over to the side of the outer lip of the aperture. In this condition it resembles the bent forms of *Subulites*. Aperture large, expanded laterally and below, with a short, nearly straight columella on the inside, which is not thickened, axis imperforate. Surface of the shell smooth, but marked by an elevated band along the middle of the volutions, indicating a slit in the outer lip of the aperture, which is imperfect in the example in hand.

The shell presents precisely the aspect of one of the bent forms of *Subulites*, except in the form of the aperture, and in the possession of the band on the middle of the volution. In separating the specimen from the limestone matrix, most of the substance of the shell remained in the rock, so that only a small portion of the surface can be seen, and the central part of the outer lip had been broken off, before the rock in which we found it, came into our possession, but on the lower two volutions of the cast the band is very distinctly marked, forming a raised double band, and, through the substance of the shell remaining in the matrix, the band can be readily distinguished, leaving no doubt as to the reality of this feature. The expanded form of the aperture is somewhat different from that common to the genus, as is also the bending of the spire from irregular coiling. This latter may possibly be an accidental feature, but it appears so extremely natural in its characters, and resembles so closely the bending in several forms of *Subulites*, and in many of the Pupa group of land shells, that I strongly incline to the belief that it is a natural feature of the species.

**Murchisonia (Fusispira?) obelisca.**

PLATE 26, FIGS. 5 and 6.

Shell above a medium size for the genus, having been from three to four inches in length, and having an apical angle of about twenty degrees. Volutions ten or more in number in the adult specimen, very moderately convex to depressed convex, or even flattened on the surface in the direction of the spire, but with the sutures rather deeply marked; the lower volutions rather more prominently rounded than those above, and when the shell is re-  
1886.]

tained appear obscurely angular a little below the middle of the exposed portion. Aperture elongate, semi-ovate, pointed, and extended somewhat below, with the columbella rather straight. Surface of the shell smooth, or with obscure lines of growth, their direction not traceable.

This species bears considerable resemblance to *M. Anna*, Billings, Can. Nat. and Geol., Vol. 4, p. 358, fig. 8 a.; but the volutions are more elongated than in that one, giving it a less compact appearance which is quite distinctive. It also has some resemblance to *M. Artemesia*, Bill., Pal. Foss., Vol. 1, p. 345, differing from it in the direct opposite from which it differs from the first. I am not positive this may not be a *Fusispira*, though the volutions appear to be slightly angular in the middle as in *Murchisonia*. The aperture bears some resemblance to the former genus.

Genus SUBULITES, *Conrad*.

**Subulites obesus**, n. sp.

PLATE 26, FIG. 7.

Shell rather large, short but very ventricose, composed of but few, but very rapidly enlarging volutions, probably not more than four to four and a half in number; very depressed convex on the surface, but with well marked sutures, giving the shell a very obese appearance. Aperture and anterior portions unknown. Surface of the shell comparatively smooth, or marked only by very fine lines of growth. Substance thin.

This species is of the general form of *S. Psyche*, Billings, Pal. Foss., Vol. 1, p. 187, fig. 169, but is considerably more rapidly enlarging and more obese, as well as of larger size. The anterior parts are lost in the only specimen collected, so their features cannot be determined. It has the general appearance of a *Subulites*, still it is not improbable it may be only another form of *Holopea*.

Genus BELLEROPHON, *Montf.*

**Bellerophon Cassinensis**, n. sp.

PLATE 26, FIGS. 8 and 9.

Shell of medium size, laterally compressed, rounded on the back, and nautiloid in form; with a solid axis. Aperture crescentiforme, or semi-oval, with the inner side strongly modified by

[Dec. 28th,

the intrusion of the inner whorl. Margin of the aperture or lip extended forward on the sides, and deeply sinuate on the back. Shell smooth as far as can be determined by the specimens in hand.

This species cannot be mistaken for or confounded with *B. bilobatus* of the formations above, as it is so much more compressed on the sides, which gives it almost exactly the form of *Nautilus pompilius* in miniature.

## CEPHALOPODA.

Genus ORTHOCERAS, *Breynius*.

**Orthoceras Brainerdi**, n. sp.

PLATE 27, FIGS. 14-16.

Shell moderately large, at least attaining a diameter of two and a half inches below the chamber of habitation, and the rate of increase so very gradual that this would give it a length of between three and four feet between this point and the apex. Another specimen, two and one-eighth inches in diameter at the upper end, decreases backward three-eighths of an inch in a length of seven inches, which would account for a length of about forty-five inches. Section of the shell broad oval, a section measured gives the diameters of one and seven-tenths inches, by two and two-tenths inches, or a little more than three-fourths as wide as long. Septa thin and fragile, very closely arranged, and scarcely increasing their distance with the increased growth of the tube. Specimens one and one-fourth inches in diameter have them fully as distant as the largest ones seen; their usual distance giving from seven to eight chambers to the inch; varying somewhat in different individuals. One specimen having a diameter of nearly two inches has only about six chambers to the inch, but they appear exceptionally distant in this one, among those present. The septa are peculiar in being undulated in their direction across and around the tube. The siphon, which is a straight tube, slightly constricted within the chambers, oval in outline, having nearly the same proportions as the outer tube but a little broader and of a diameter equal to about two-sevenths, or a little less than one-third of the transverse diameter of the outer tube at the same point where measured, is situated close to the side of the

1886.]

shell, and appears to be uniformly placed on the right hand side of the central line, when held toward you, with the larger end of the tube upward, so as to be always eccentric to the axis of the shell, causing an irregularity at this point in the margin of the septa, lifting them, as it were, upward at the point of its junction with the outer tube. There is then a gentle dip downward on each side of the siphonal line, and a broad curvature upward on each side of the outer tube, with two shallow, but rather sharp depressions on the opposite side of the tube, the most marked of which is diagonally opposite the position of the siphon. The septa, although somewhat deeply concave in the direction of the longer axis of the shell's diameter, is not very convex in the opposite direction, but is rather monoclinal from the inner side of the siphon to the opposite side of the tube, though in some specimens showing a slight convexity. The outer surface of the external tube, although preserved in patches on several individuals, does not show any particular markings, as they are more or less acted upon by the weather.

The very gradual increase in diameter of the outer tube, together with its large size, and the closely arranged septa and narrow chamber, will suffice to distinguish this from any other described species. In its narrow chambers it is related to *O. multicameratum*, Hall, from the Birdseye and Black River limestones, but in its more gradual rate of increase and the undulations of the septa, large size and lateral siphon, it is entirely distinct. It is also somewhat closely related to *Endoceras (Cameroceras) subannulatum*, Whitf., from the Beloit, Wisconsin, lower Trenton limestones (see Geol. Wis., Vol. 4, p. 230, Pl. 7, fig. 15), but the septa are more thoroughly undulated, the siphon much smaller in proportion, and the surface has not been annulated as in that one. The species would most likely pertain to the section to which Mr. Conrad gave the name *Cameroceras*, should it be accepted as a generic distinction.

***Orthoceras cornu-oryx*, n. sp.**

PLATE 27, FIGS. 1, 2 and 6.

Shell of small size, not exceeding three and a half or four inches in length, as far as shown by the specimens in hand. Sec-

[Dec. 28th,

tion circular, and the tube very rapidly expanding with increased growth. Tube strongly annulated, especially so near the upper part, but more obscurely so below, and somewhat gradually increasing in size; the annulations near the upper part of a specimen, which is less than three inches long, measuring one-fourth of an inch from crest to crest. Rate of increase in the size of the tube one in four, being a quarter of an inch to an inch of length. Septa moderately concave, very closely arranged, there being nine chambers in half an inch in the larger part of the septate portion of the specimen mentioned above, and the outer chamber, or non-septate part, extending more than half the length of the shell. Siphon very small, situated nearer to the outer shell than to the centre of the tube, very slightly enlarging in diameter at its junction with the septa. Shell substance thin, and so far as can be seen from adhering portions, appears to have been smooth on the surface.

The species is nearly allied to *O. priamus* and *O. Lamarcki*, Billings (Pal. Foss., Vol. 1, p. 253, fig. 239, and p. 347), but differs from the former, which it most nearly resembles, in being a little more rapidly tapering; in having more distant and differently constructed annulations, broader and not so deep; in the smaller sized and differently situated siphon, and in wanting the concentric surface striæ of that species. The shell appears to have been an abundant form, as fragments of two or three individuals are not uncommonly found in single hand specimens. The largest example in the collection is less than an inch in diameter at the top of the outer chamber.

Genus GOMPHOCERAS, *Sowerby*.

**Gomphoceras minimum**, n. sp.

PLATE 27, FIGS. 3-5.

Shell very small, scarcely reaching one inch in length even if continued to a point, and the largest diameter not exceeding three-eighths of an inch. Tube rather rapidly enlarging to the middle of the proportionally short outer chamber, above which it again slightly contracts. Section of the tube circular. Outer chamber measuring not more than about one-third of the entire length of

the shell. Septa very moderately concave and closely arranged, nine or ten chambers occurring in the length of one-fourth of an inch in the middle of the chambered portion. Siphon comparatively small, and situated near the margin. Surface of the shell, on a small fragment seen, extremely finely striated concentrically, and its substance proportionally thick.

This is an extremely diminutive species, but the form of the outer chamber and aperture shows it to be adult, or nearly so; as the terminal contraction is present, and although the aperture may not have been completed at the time of the death of the animal, it was so nearly so that the size of the shell would not have been materially increased. The small size of the species will insure its identification.

**Gomphoceras Cassinense**, n. sp.

PLATE 29, FIGS. 1-3.

Shell of about a medium size, the most entire specimen obtained indicating a length, if projected to a point at the lower extremity, which is imperfect, of about four inches, with a transverse diameter at the largest part of very nearly two inches. Section circular when not compressed, the tube very rapidly enlarging upward to the middle of the outer chamber, above which point it is again contracted to the upper margin. Outer chamber wider than high, those immediately below measuring about a sixth of an inch in depth, but very perceptibly decreasing downward, quite deeply concave and nearly direct across the tube. Siphon large, situated only about one-half its own diameter within the margin of the tube; its sides very slightly concave within the chambers. Outer shell surface apparently smooth, no perceptible surface structure being visible on portions preserved, even where no weathering has taken place. Lower chambers showing on the cast slight longitudinal furrows over some parts of their surface, resulting from the muscular pits visible also along the base of the outer chamber.

I do not find that any species of *Gomphoceras* have been described from the lower portions of the Trenton group of rocks in this country heretofore. *Oncoceras* have been somewhat common in lower Trenton in the West, and are not so extremely un-

[*Dec. 28th,*

common in the Trenton proper in New York; but no true *Gomphoceras*, so far as I can ascertain, have been recognized. The species here described may therefore be considered as the earliest forms of the genus until others are found below them. I think there can be no question as to the generic relations of this species, as there is not the slightest indication of curvature. A very slight expansion of the upper margin is indicated, like that often seen in *Oncoceras*, above the usually constricted aperture, but it is no more than might result from a thinning of the shell substance near the lip of the specimen.

Genus PILOCERAS, *Salter*.

***Piloceras explanator***, n. sp.

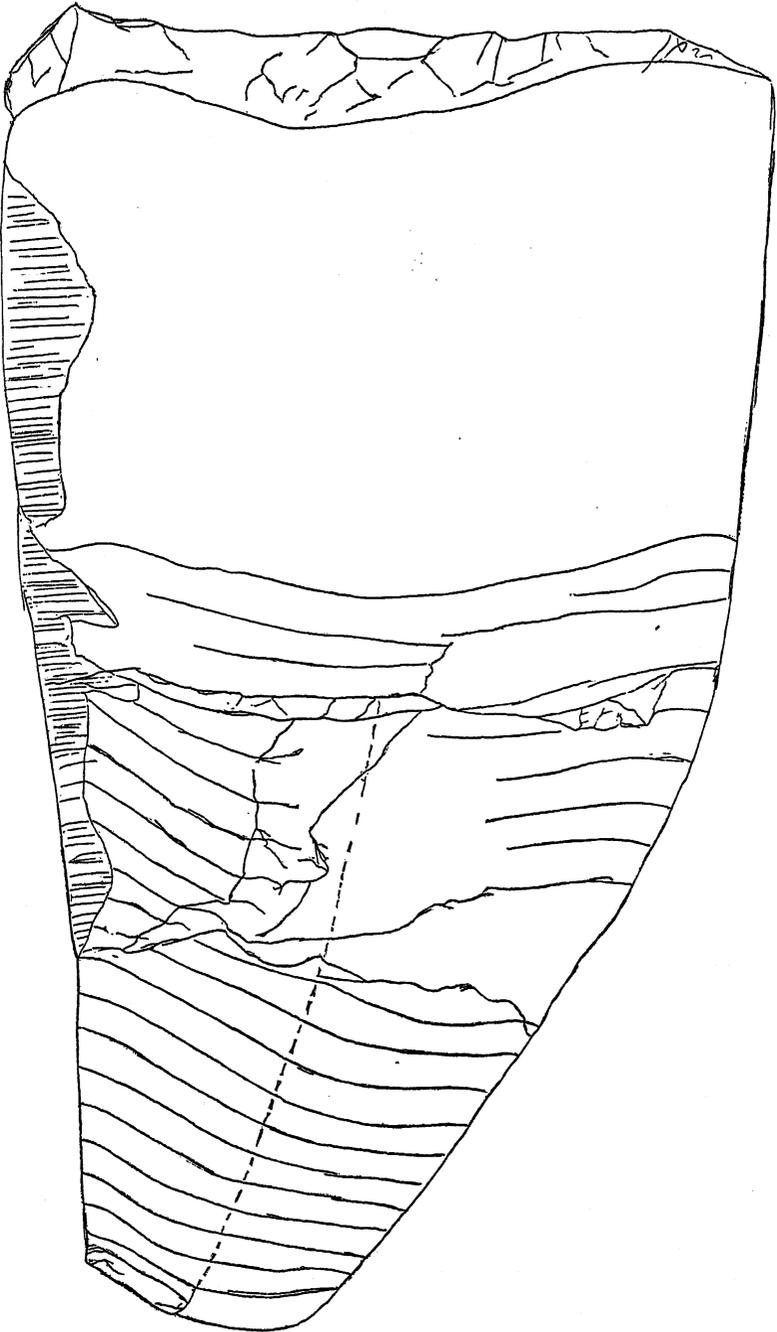
PLATE 28, FIGS. 1-4.

Shell large, at least ten inches in length by four and a half of five inches in width, strongly compressed laterally, and very elongate-ovate dorso-ventrally in section; the acute end of the section being the siphonal side or edge of the shell. Shell curved in a longitudinal direction, the siphonal side being nearly straight, while the opposite side is curved, according to the increased width of the tube, to a point a little below the base of the outer chamber, above which it is again somewhat contracted; thereby producing the curved feature noticed in nearly all the siphons which have been described under the name *Piloceras*. Externally the shell resembles a large, slightly curved *Phragmoceras*, broken off just below the apertural contraction. Septa rather numerous, being arranged at a distance of about one-fifth of an inch apart in the middle of the specimen's length; there being about that number of chambers to the inch, which are slightly decreasing in their distance from each other downward, as far as the specimens are preserved. The septa are strongly curved on the sides of the shell, being lowest on the middle of the side and advancing toward the edges, somewhat higher on the back than on the siphonal side; laterally they are only moderately concave. Siphon very large, attached to the inner surface of the outer tube on the straight side, obtusely pointed at its lower end, and very rapidly enlarging upward, so that at a distance of five inches from the 1886.]

point of the outer tube its diameter has become rather more than two inches, in one instance; and in another in a length of four and a half inches it has reached a diameter of two and a quarter inches in its greatest width. Its form is at first only slightly transverse in the direction of the flattening of the outer body, but as it advances upward it becomes more flattened. This may be to some extent the result of compression, but not largely so. The substance of the siphon is very thick, but it is not septate internally as described by Mr. Salter, but composed entirely of solid matter, crystalline in the specimens, with an internal cavity resembling that figured by Mr. Billings in his *Pal. Foss.*, Vol. 1, p. 256, fig. 240, *a*, but not so extreme; the inside cavity extending lower, and shallowing more gradually. The siphons, as found separate in the rock, are obtusely conical, slightly curved, nearly solid bodies; somewhat rounded in the lower part, but flattened above; the internal cavity extending more than half the length, and somewhat gradually tapering upward. The outer surface is strongly marked with encircling ridges, much advanced and acutely bent on the straight side or edge, rapidly descending on the sides and crossing the opposite edge in a broad curve, to meet the corresponding ridge from the opposite sides. These ridges mark the points of attachment of the septa of the outer chamber. The septa, where they unite with the siphon, are bent downward, becoming slightly funnel-formed near the junction. Surface of the outer shell comparatively smooth. A few transverse wrinkles of growth are visible on some fragments of the outer chamber preserved. Its substance is very thin, and through it, along the base of the outer chamber, can be traced the small rounded pits of muscular attachment seen in nearly all fossil cephalopods of this order, leaving indications of longitudinal lines or flutings on the cast of from fourteen to sixteen to the inch.

These specimens, so far as I am aware, are the first and only ones known, which show the outer chamber and parts of the organisms in connection with the peculiar solid siphons usually described as species of *Piloceras*. Whether they are congeneric with the specimens originally described by Mr. Salter, and on which he founded the genus *Piloceras* may be considered as yet questionable. If Mr. Salter's specimen was as distinctly septate

[Dec. 28th, 1886.]



PILOCERAS EXPLANATOR, Wh.,  $\frac{4}{5}$  Nat. Size.

as his figure would suggest, and he certainly was a good observer, I should incline to consider them as distinct; as in that case the animal must have had a siphonal sac, subject to periodic lifts, just as in the case of the main portion of the body in forming the septa, while in the case of our specimens the deposit of the solid part of the siphon was constant and gradual; differing in this respect from the formation of new septa in the outer tube. Moreover, the siphonal sac must have been obtusely rounded and entirely closed at the lower end; in this respect entirely differing from that of the generality of Cephalopods, at least from those of the Palæozoic rocks, where they were open at the lower end, or at least where no shelly deposit took place except from the sides of the sac, if they were closed.\*

Genus *CYRTOCERAS*, *Goldfuss*.

***Cyrtoceras Boycii***, n. sp.

PLATE 29, FIG. 4.

Shell of medium size, strongly curved and rather rapidly expanding from the point upward, the diameter increasing from one-fourth of an inch to an inch and a half in a length of about four inches, measured along the outside curve. Septa numerous and moderately concave, strongly arching upward on the outer side; eight chambers can be counted in one inch of length where the diameter is one inch at the middle of the space where they are counted. Siphuncle very large in proportion to the diameter of the shell, occupying nearly or quite one-third of the diameter and centrally situated; strongly lobed and rounded within the chambers, like that of an *Ormoceras* or *Actinoceras*. Outer chamber and surface of the shell unknown.

This species in its dimensions, curvature and closely arranged septa, very closely resembles *C. macrostomus*, Hall, from the Trenton limestones of Mineral Point, Wisconsin; but differs very materially in the form, size, and situation of the siphon, which will readily distinguish it whenever observed.

*Formation and locality*.—In the dove-colored limestone of the Birdseye, at Isle La Motte, Lake Champlain.

\*See observations on the vaginate Cephalopods in Bulletin No. 1, Am. Mus. Nat. Hist., pp. 25-27.

**Cyrtoceras acinacellum**, n. sp.

PLATE 27, FIGS. 10-13.

Shell small and slender, dorso-ventrally oval in section and not exceeding three-sixteenths of an inch in its greatest diameter; very slightly curved throughout, and but very moderately increasing in diameter with the increased length of the tube. Septa proportionally distant, only about four chambers occurring in a length equal to the dorso-ventral diameter at the outer one counted, very deeply concave, and very strongly arching upward on the outer edge, and but little less so on the inner side, while on the sides of the shell they are deeply bent backward. Siphon small, dorsally situated. Substance of the shell thick and the surface very minutely striated transversely.

This species is remarkable for its very small size and comparatively distant septa, which, like the outer shell, has been strong. No contraction of the aperture can be seen on the examples yet found.

**Cyrtoceras confertissimum**, n. sp.

PLATE 27, FIGS. 7-9.

Shell small, transversely oval in section, and very gently expanding with increased growth; a fragment of a specimen having a length of one inch and seven-tenths, measured on a straight line, increases only about one-tenth of an inch laterally and about three-twentieths of an inch dorso-ventrally. The curvature of the shell is moderately rapid, and slightly more so above than in the lower part. Septa moderately concave, very numerous and very closely arranged, there being ten and eleven chambers within the space of half an inch as measured at the opposite ends of the specimen. Siphon proportionally small, situated less than its own diameter within the outer margin of the shell, and very slightly constricted within the chambers. Surface unknown.

The species is remarkable for its transverse form and closely arranged septa. The specimen figured is the most entire one yet observed; several fragments of it have been noticed, but so imperfect as to show only a few chambers, and those mostly broken. It appears, therefore, to have been a very fragile shell and to have been easily destroyed after the death of the animal.

1886.]

Genus NAUTILUS, *Breynius*.**Nautilus Kelloggi**, n. sp.

PLATE 30, FIG. 1, and PLATE 31, FIGS. 4 and 5.

Shell, so far as known, only of very moderate proportions, the largest specimen yet observed being only two and three-eighths inches in its greatest diameter, and consisting of about three and a half volutions, which are essentially circular in a transverse section, being scarcely indented on the inner surface by the preceding ones. The tube, however, increases very rapidly in diameter in comparison to the additional length, and the dorso-ventral diameter is possibly a little greater than the lateral. At the outer end of the largest specimen, which is still septate, the dorso-ventral diameter is one inch and one-eighth, while the lateral diameter is perhaps a sixteenth of an inch less. Septa moderately distant, and gradually increasing in their distance as the shell advances in size, not very deeply concave, but somewhat more so dorso-ventrally than from side to side; which feature gives them a slightly concave or backward curvature on the sides of the tube, notwithstanding its circular section. Siphon rather large and the substance thick, at least twice as thick as that of the septa at the same part of the tube, straight, being neither enlarged or contracted in the chambers, and situated about its own diameter within the dorsal margin. Substance of the outer shell moderately thick, the surface marked by fine, even, thread-like concentric striæ, which cross the sides of the tube with a strong backward curvature from the suture, and forms a rather broad, though not deep sinus on the rounded dorsum.

This shell has rather strong affinities with *Lituites* (*Nautilus*) *undatus*, Conrad, but increases more rapidly in size according to the number of volutions, consequently in a shell of the same diameter it would have fewer volutions. Besides the section of the tube is so nearly circular that it cannot be said to have any other form, whereas that one is quite perceptibly quadrangular in the two figured specimens, Pal. N. Y., Vol. 1, Pl. 13, fig. 1, and Pl. 13 bis, fig. 1. So far as can be determined from the specimens in hand the surface of this species has not been undulated to the extent shown on the specimens of that species above mentioned,

[Dec. 28th,

but this feature cannot be relied on with certainty. I have placed it under *Nautilus* rather than under *Lituites*, as we have no evidence as yet for supposing either this or *L. undatus* ever becomes free at the outer part, as in *Lituites*; and the position of the siphon is not far enough removed from that of *Nautilus* to warrant a generic separation from that genus.

***Nautilus? Champlainensis*, n. sp.**

PLATE 31, FIGS. 1-3.

Shell below a medium size, discoidal and very broadly umbilicate, the outer volutions embracing the inner ones to only a very small part of their diameter, at most not more than one-third. Volutions about three and a half, slender, nearly circular in section, except for the emargination on the inner side and a very slight flattening, scarcely perceptible, on the back; the outer volution with a moderately expanded aperture when the shell is completely grown. Septa closely arranged and moderately concave nearly direct across the volution when not distorted, being very slightly advanced on the ventral margin and very little depressed in crossing the dorsum. Siphon of moderate size, subcentrally situated, being nearest to the dorsal side and very slightly constricted in diameter within the chambers. Surface of the shell marked by moderately strong striæ of growth, which are directed backward from the suture line to the sides of the dorsum, which they cross, forming a broad, deep sinus. On the outer chamber, or perhaps more properly on the outer half of the outer volution, the striæ are grouped to form strong, undulating folds on the surface, parallel to the margin of the expanded aperture, but far less in size than the final expansion.

This species bears considerable resemblance to *Lituites? Seelyi*, herein described, but differs in having a smaller number of volutions in the finished shell, and in their being very slightly more rapidly expanding, and less compressed laterally. But the principal distinction, and the only one which can be relied upon for the separation, is the expanded aperture. In the absence of this feature it is barely possible to distinguish the species, and until this feature was obtained more or less distinctly in two or three  
1886.]

individuals, I was unable to find characters by which I could separate them, having included both under that form. The final form, however, so far as yet seen, is never so large in the completed shell as in *L. Seelyi*, although the volutions are very slightly more rapidly expanding in diameter.

Genus LITUITES, *Montfort*.

**Lituites Seelyi**, n. sp.

PLATE 32, FIG. 1, and PLATE 31, FIG. 2.

Shell rather above a medium size, with somewhat closely coiled volutions, which increase but very gradually in diameter with the increased age of the shell; the inner ones imbedded within the outer scarcely one-third of its diameter. A specimen having a diameter of a little less than four inches possesses three volutions, with room for one or one and a half within the inner one counted, and has a transverse diameter of the outer tube of about one inch and one-tenth. A section of the tube is nearly that of a circle, with a scarcely perceptible flattening on the dorsum, and the ventral channel for the inner whorl on the inside; the lateral and the dorso-ventral diameters, exclusive of the ventral channel, being essentially equal. The shell substance is rather thick, and the surface marked by rather fine lines of growth which are strongly recurved on the sides of the tube from the suture outward, and in crossing the dorsum form a broad linguiform sinus, indicating a deep sinus in the dorsal lip. Septa numerous, and rather deeply concave, arranged at a distance of about a sixth of an inch from each other, near the outer portion of the chambered part of the large specimen figured, when measured on the middle of the side. On the dorsum, of course, they would be a little more distant. Their direction across the tube is generally nearly at right angles to the tube at any given one, though sometimes they are directed more strongly backward from the inner to the outer sides. Siphon small, situated a little outside of the centre of the tube, and apparently very slightly expanded at its junction with the septa, showing a very slight contraction in size between them.

This shell differs from *L. undatus*, Conrad, from the Black River limestone, in the more slender and less rapidly enlarging

[Dec. 28th,

tube, which is also more closely coiled, the outer volutions embracing the inner; whereas that one is only in contact, not imbedded, or but merely indented one into the other. They also differ in that one being very distinctly flattened on the dorsum, while the flattening here is barely or scarcely perceptible, neither does this one possess the strong undulations of the surface which is so strong a characteristic of that species. Among the several specimens which I have seen of this species I have observed none showing the deflection of the outer tube, though several fragments of a size somewhat larger than the figured specimen have been obtained. Therefore we may consider that it is capable of reaching a much greater size. The figured example is septate throughout, except the outer half of the last volution, and shows by the fragment of the outer shell adhering, that it has been about one and a half inches longer at the outer end, it follows that the chamber of habitation has been very long, at least two-thirds of the outer volution. The *L. undatus* is not known to possess nearly so long an outer chamber, although I have seen no perfect ones, nor have such been figured. The evidence afforded by the best I have examined would indicate only about one-third of the volution without septa, and the western representative of it *L. occidentalis*, Hall, shows scarcely one-third.

**Lituites Eatoni**, n. sp.

PLATE 32, FIG. 1, and PLATE 28, FIGS. 5-7.

Shell small, or below a medium size, consisting of about four volutions, which increase very gradually in diameter, and are neatly and compactly coiled, and embrace each other to a depth equal to nearly one-fourth of their diameter, but appearing more deeply imbedded from the tube being dorso-ventrally compressed. The outer coil becomes deflected in a straight line for some distance from the aperture at precisely four turns from the nucleus, and gradually becomes circular in section instead of transversely reniform like the inner coils; the aperture is unknown. Surface of the shell, which is thin, marked by fine, somewhat regular lines of growth, which are gently directed backward from the suture to the rounded dorsum; in crossing which they form a broad shallow sinus, indicating such a form in the lip of the aperture. Septa  
1886.]

numerous, and rather deeply concave, between four and five to the half inch on the dorsum a little back of the outer chamber of habitation, near to which they are more closely crowded. Near the suture line they advance very slightly in crossing the volution, then gently recede on the sides and again almost imperceptibly advance in crossing the dorsum. Siphuncle small, situated between the centre of the tube and the ventral margin; its diameter smaller between the septa than at their junction with it, as in *L. Seelyi* herein described.

This is a much smaller species than *L. Seelyi*, and more closely resembles *Trocholites ammonius*, Hall, from the Trenton limestone, but is a much prettier and more graceful species. The shell structure also somewhat resembles that of that species, but is less coarsely marked; the tube is also slightly different in a transverse section, not being so symmetrical on the sides, but more abrupt near the suture and flatter on the sides; the section having its greatest diameter within the central line. The form and features of the septa, and the position of the siphon, are very similar. The great difference, and that which is the soonest observed, is the greater lateral compression of the shell as a whole, which will distinguish them very readily.

**Lituites Eatoni** var. **Cassinensis**, n. var. PLATE 32, FIG. 2.

In subsequent collections, made since the above was in type, I find a strongly marked variety, which I am not sure ought not to be considered as an entirely distinct species; the section of the tube is much rounder on the sides, giving it a decidedly rounder form on the sides, but it is also very decidedly flattened on the back, and on the outer part of the last specimen is almost concave in the middle. The septa and siphon are much the same as in the typical form, while the surface striæ are slightly coarser than in any of those originally placed under *L. Eatoni*; consequently, I shall designate this for the present as *L. Eatoni* var. *Cassinensis*.

**Lituites internastriatus**, n. sp.

PLATE 29, FIGS. 5-8.

Shell, as yet known, of rather small size, the only specimen which retains the outer chamber being a little short of two inches

[Dec. 28th,

in its greatest diameter, and consists of between two and three volutions. Volutions nearly circular in general outline, being only very slightly compressed in a lateral direction, with a rounded dorsal margin, and scarcely embracing. Outer surface obliquely annulated, the annulations being strongest on the sides, rounded on the surface, and separated by equally wide, regularly concave interspaces. From the inner margin or suture the annulations are directed strongly backward on the side of the shell where they gradually die out and become obsolete or nearly so on the dorsum. Shell substance thick, the surface on the undulations and between marked by strong, almost lamellose striæ, which follow the direction of the undulations on the sides of the shell, while on the dorsum they form a deep retral sinus, indicating a deep sinus in the dorsal lip of the aperture. Interior of the shell throughout, as indicated by the cast wherever the shell is removed, marked by extremely fine, transverse, thread-like striæ, having a direction almost directly across the tube. These, as well as can be counted under a strong glass, will number about thirty in the space of one-tenth of an inch. Septa near the base of the outer chamber, which is at about the middle of the last volution, arranged about a tenth of an inch apart, and apparently rather deeply concave. Siphon comparatively large and situated near the inner margin of the tube.

This species is very distinct from either of the associated ones, especially differing in the surface undulations and striæ. But in the internal striations it differs from any species hitherto observed, so far as I know, even a small fragment of a cast would serve to identify it. The species is much less common than any of the others here described, evidences of only few specimens having yet been obtained. The specimen figured retains a large portion of the outer chamber, and although still in contact with the inner whorl at its extremity, was apparently about to separate to form the deflected portion showing its generic relations with *Lituites*.

## ARTHROPODA.

## TRILOBITA.

Genus SAO, *Barrande*.**Sao? Lamottensis**, n. sp.

PLATE 33, FIG. 9-II.

Body, considered as a whole, elongate-ovate in outline, widest anteriorly and with somewhat straightened sides, the head shield forming about one-third of the entire length.

*Glabella*, with the fixed cheeks, nearly semicircular in outline, and quite elevated, the dorsal furrows very strongly marked. The glabella, considered alone, forms the larger two-thirds of a broad-oval figure, as limited by the dorsal furrow, and is marked by two pairs of very strong, deep glabellar furrows, the posterior of which is the largest and strongest, and stands nearly parallel to the lateral margin, instead of being transverse; both pair seeming more like deep sharp pits than ordinary transverse furrows, and are confined to the side of the glabella proper. Fixed cheeks very rotund on the surface, rather more than half as wide, on the back part, as the glabella, rapidly contracted to the ocular sinus, and more gradually narrowed anteriorly to the middle of the frontal limb, which is narrow and rounded in front, the anterior margin of the shield being slightly elevated, forming a narrow border. Ocular furrows strongly marked and somewhat deeply sunken, curved in their direction across the fixed cheek. Occipital ring short, rounded, and highly arched but much lower than the surface of the glabella, the lateral portion being shorter and sharply rounded. Suture line cutting the posterior margin nearly at right angles, and gently curving inward in its course to the ocular sinus, which is only of medium size. In front of the sinus it is directed gently inward cutting the anterior border nearly on a line with the sides of the glabella. Surface of the glabella and fixed cheeks pustulose, the pustules of various sizes. There are six large pustules on the glabella proper, three on each side, and three on each fixed cheek, two behind the ocular ridge and one in front; over the rest of the surface the pustules are irregularly scattered and

[*Dec. 28th,*

are of smaller size. A single *Hypostoma* has been observed of a size suitable to the head shields. It has a great resemblance to that of *Conocephalus*, and is quite similar to that of *Sao hirsuta*, as shown by Barrande in Vol. 2, Syst. Sil. de la Boheme, Pl. 7, fig. 21, but the central part is more distinctly ovate and the border narrower.

*Movable Cheeks* not yet observed.

*Thorax* widest at the anterior end and almost gradually narrowing backward to the minute pygidium; twelve segments only have been observed, although more may occur in larger individuals, the largest one examined measuring scarcely six-twentieths of an inch as the length of the thorax alone. Axial lobe wider than the lateral lobes, very strongly arched; lateral lobes entirely flat to near their extremities. Segments marked on the central ridge by several nodes on each side of the lateral portions and the axial lobe bearing a central row of many very prominent nodes. The extremities of the pleura are short and pointed and directed slightly backward.

*Pygidium* minute, its details not made out.

The species as yet known is rather small, none having the entire organism complete have yet been successfully cleared from the rock; but taking the length of the best thorax and that of a glabella of equal proportions, the length combined is only nine-twentieths of an inch, with a width of five-twentieths for the upper end of the thorax. There is no certainty that the thorax taken is complete, therefore the number of segments that may exist is not definitely known, but there appears to be no reasonable doubt of its completeness. The species differs considerably from *Sao hirsuta*, Barrande, from Bohemia, in what might be considered as generic features, but as that one is about the only authentic species yet known it is difficult to say what the generic features may be. I know of no established genus which it so nearly resembles as *Sao*. The next nearest might be *Acidaspis*. In the structure of the pleura this species differs quite remarkably from *S. hirsuta*, being between that and *Acidaspis*, having a central ridge, which becomes obsolete, however, on the outer portions; also it differs in the backward bending and pointed structure of their extremities.

Since writing the above, larger heads have been obtained, some measuring fully three times the length of that mentioned.

*Formation and locality.*—The species is extremely abundant in some dove-colored layers of the Birdseye limestone from Isle La Motte, Lake Champlain, but the head shields are all separated from the other parts and appear scattered through the limestone in great numbers.

Genus ASAPHUS, *Dalman*.

**Asaphus canalis.**

PLATE 34, FIGS. 1-8.

*Isotelus canalis*, Conrad, in MS.

*Isoteles canalis* (Conrad), Hall, Pal. N. Y., Vol. 1, p. 25, Pl. 4 bis., figs. 17-19.

*Asaphus canalis* (Conrad), Hall, 12th Rept. State Cab., p. 70.

Not *A. canalis*, Billings, Pal. Foss. Can., Vol. 1, pp. 270 and 352.

? *Isoteles gigas*, Hall, Pal. N. Y., Vol. 1, p. 25, Pl. 4 bis., figs. 15 and 16.

? *Asaphus* ? *obtusus*, Hall, Pal. N. Y., Vol. 1, p. 24, Pl. 4 bis., fig. 14.

Not *Asaphus canalis*, Hall, 12th Rept. State Cab., p. 70, where reference is given to pp. 231 and 254 of Pal. N. Y., Vol. 1.

In Vol. 1, Palæont. New York, p. 25, Pl. 4 bis., figs. 17-19, Prof. J. Hall cites this species from MS. of Mr. T. A. Conrad's, and gives the following description: "Margin of caudal extremity broadly and deeply depressed, forming a channel; surface punctured. Judging from this fragment, the original was at least six inches in length."

It is to be presumed that the fragment above referred to is that of the thickened marginal rim of the pygidium, figured on Plate 4 bis, of Vol. 1, Pal. N. Y., which is of a species quite common in the Chazy limestone at Chazy and elsewhere on Lake Champlain, and also in the limestones above the Chazy. In the Birdseye limestone at Fort Cassin, Vt., fragments of it are quite numerous, especially of these thickened parts of the pygidium, and often of a size nearly double that of the one figured by Prof. Hall. The entire pygidial plates are occasionally found, most

[Dec. 28th,

frequently those of small size and rarely of larger size. Fragmentary movable cheeks of large size are also occasionally seen, especially the posterior spinose angle, which is much thickened, and has, therefore, been more readily preserved. Parts of the central portions of the head have been observed in a few instances, but rarely in a condition fit for illustration; but the thoracic segments are seldom seen in a condition for identification, and as yet none have been found fit for illustration. The characters of the parts obtained in a condition suitable for study may be described as follows:

The *head shield* appears to have been less pointed than that of *A. gigas*, as the front of the glabella has been bordered by the movable cheek to near the median line, and in this species is pointed in the center and somewhat excavated on each side, presenting a strong contrast between it and the form of the same part in that species. The central part of the glabella or boss is quadrangular in outline, rounded in front, and slightly constricted across the middle on a line with the eye lobes. In the young individuals the quadrangular form is very marked and the median line slightly angular, with a small node just in front of the occipital furrow in the cast. The larger glabellas show also a depression on the median line near the front and between the eyes, as shown on two separate examples. The anterior limb of the glabella is rather wide and slightly concave on the surface, the lateral edges being rounded, the line of the facial suture passing inward to the anterior angle of the eye. Palpebral lobe moderately large and slightly elevated, reniform on the ocular margin. Posterolateral limbs short-triangular, but wider than long, the sutural margin, from the posterior angle of the eye lobe to the posterior margin of the head, forming a sigmoidal line having a general angle of a little less perhaps than forty-five degrees to the median line of the head.

*Movable cheek* rather large, elliptically triangular in general outline, narrow in proportion to the length, projected backward at the angle into a long strong spine; the anterior limb is also extended; general surface concavo-convex, the margin being broadly concave and the inner area convex, without special limitation between. Ocular sinus of moderate size. In the young specimens 1886.]

the outer margin is somewhat rounded or thickened, but on the larger examples they are very slightly so, but are thick and round on the under surface, like the under margin of the pygidial plate; the thickening of the spine being principally on the under surface.

*Hypostoma* large, oval in general outline, straight or slightly emarginate on the articular border, strongly contracted a little below the top, and deeply excavated between the forked branches, which are thin and deep. Central body highly convex, ovate, widest in front, and margined by a curved fold on each side at the lower end. Lateral borders thin, broad, and the margins strongly arched outward, extending from the anterior constriction, which is near the front, to the extremities of the forked branches. Surface very strongly striate.

*Thorax* unknown.

*Pygidium* large, semicircular or paraboloid in general form, obscurely trilobed and only moderately convex, with a very broad, shallow channel occupying the outer half of its area; anterior margin nearly straight. Axial lobe narrow and obscurely marked, widest anteriorly, depressed and narrow just in front of the middle and more prominent and rounded toward the extremity; marked by eight or nine obscure annulations exclusive of the terminal ones. Lateral lobes marked by a single groove just behind the articular face of the anterior border, and in the very young specimens by several very indistinct segments just outside of the very faint dorsal furrows.

The thickened marginal rim of the tail, when viewed from below, is seen to be much broader on the sides than on the posterior median line, which gives it a somewhat V shape as seen from this side, presenting the form given in Vol. I, Pal. N. Y., Pl. 4 bis, fig. 17, though not as extreme as there represented, unless by distortion.

Surface of the crust generally smooth, the margin of the pygidial plate when perfect shows the peculiar striations common to trilobites. Other parts show, sometimes, a roughening, owing to a kind of maceration or erosion in the strata.

In the 12th Rept. State Cab., p. 70, *Isoteles gigas*, described on pp. 25, 231 and 254 of Pal. N. Y., Vol. I, are referred to *Asaphus*

[Dec. 28th,

*canalis*. On what grounds is not stated. *A. canalis* is certainly a very distinct species from those indicated, except that on p. 25, which is most probably a young *A. canalis*. The two species differ very materially in the particulars pointed out at the head of this description, in the form of the glabella and fixed cheeks, while the movable cheeks differ in the large strong spine of the genal angles. It also differs in the direction of the facial suture, particularly in front of the glabella, where it carries the movable cheeks further forward on the upper surface, and gives them a greater breadth across the extended limb. *A. gigas* never possesses the broad shallow channel around the head and tail possessed by this one, and they also differ very materially in the outline form of the tail piece, as well as in the breadth and form of its axial lobe. The large form of *Asaphus*, described as *A. megistos* by Dr. Locke, from the Cincinnati beds of Ohio, corresponds much better with this one in many particulars than do any of the New York Trenton specimens, as that one has the broad channel of the tail piece, and the same form of the axial lobe, and indistinct annulations. The head, however, differs in the direction of the facial suture, in the form of the glabella, and in having the cheek spines narrow and nearly cylindrical, even up nearly to their origin. The hypostoma also differs as does that of *A. gigas*. Considering these facts, I think there can be no question but that *A. canalis*, as identified in Vol. 1, Pal. N. Y., and in this paper, is a good and valid species.

Genus BATHYURUS, *Billings*.

**Bathyurus? Seelyi**, n. sp.

PLATE 33, FIG. 12-18.

Body, as indicated by the central portions of the head and movable cheek, of moderately large size, but only known from these detached portions, unless the pygidium described below shall prove to belong with it.

Glabella large, ovate, inflated and protruding anteriorly, somewhat constricted just in front of the occipital ring, where it is less rounded and less convex than in front, apparently marked by a single pair of slight furrows a little forward of the occipital furrow, 1886.]

making a band across the posterior part of the glabella not quite as wide as the occipital ring. No other furrows are known to exist on its surface. Near the base of the glabella, between the occipital ring and the palpebral lobe, there exists a rather large auxillary lobe on each side, like those of *Cyphaspis*, *Proetus*, etc., of a somewhat reniform shape, and which at their anterior end blend into the palpebral lobe without a distinctly defined channel between.

Fixed cheeks narrow, especially just in front of the eye lobe, anterior to which they are abruptly widened and again narrowed in front, forming a rounded lobe of nearly the same size and form as the eye lobe, which is proportionally large considering the width of the cheeks. Posterior to the eye lobe the cheek is narrowed, forming a deep and sharp sinus in the outline, from which the postero-lateral limbs run obliquely outward, constantly narrowing to a length equal to two-thirds of the width of the glabella, as measured along the base of the head, especially so along the lateral limbs. Anterior limb narrow and vertical, entirely overhung by the anterior lobe of the glabella.

Movable cheek of moderate size, having a tumid, convex surface, especially of the marginal rim, which is very narrow in front and vertical, and is less elevated but gradually widens backward to the genal angles, which terminate in a short, sharp spine. Ocular sinus large, semicircular.

Thorax unknown.

Pygidium found associated with the head and movable cheek, and believed to belong to the same species, nearly semicircular in form, or very slightly paraboloid and highly convex, very strongly marked by the furrows between the rings of the lateral lobes. Axial lobe rather prominent; about three-fourths as long as the whole length of the entire shield, and rather more than one-fourth of the greatest width; marked by four transverse rings, besides the terminal one, the anterior of which bears a small distinct node on its center. Lateral lobes convex for the inner two-thirds of their width, outside of which there is a rather wide, smooth, concave border, but which is slightly rounded just at the edge. These lobes are marked by four pairs of lateral ribs,

[Dec. 28th,

besides the anterior one. These ribs originate at the dorsal furrow as four on each side, but almost immediately divide into an anterior narrow and a posterior broad portion, the former terminating in a narrow point, and the latter widening at the extremity, becoming triangularly clavate at its outer end, terminating at the margin of the broad, concave border of the plate. On the lower surface of the pygidial plate the marginal portion, or "doublure," is entirely flat, and as wide as the concave, smooth space above.

Surface of the pygidium, movable cheeks and a large part of the head is finely pustulose. On the glabella, at least the anterior portions and sides, and the anterior part of the fixed cheeks in front of the eye lobes, the pustules pass into wavy lines more or less distinct, with fine, deep punctæ scattered between them.

I have provisionally placed this species under Mr. Billings's genus *Bathyurus* as being perhaps the most nearly allied genus yet established, not feeling at liberty to propose a new generic division until better material shall have been obtained. There are many features in which it differs from *Bathyurus*, principally however in the overhanging anterior end of the glabella; in the auxiliary lobes at the posterior angles of the glabella; in the direction of the suture line in front of the eye, and consequent form of the anterior fixed cheek and frontal limb of the glabella, and very markedly in the peculiar form and division of the lateral rings of the pygidium. In the form of the inflated glabella and auxiliary lobes it closely resembles *Cyphaspis*, but all similarity ends here. In the lobation of the lateral rings of the tail it somewhat resembles Salter's subgenus *Homalopteon* under *Barrandia*, McCoy, but the head differs entirely. To be sure there is no positive evidence as yet that these pygidia and heads here associated belong together, but as they are found in the same layer of rock, and the surface structure of the crust is the same on the fixed cheeks, movable cheek and tail; and as there is no other form associated with them to which these parts can be referred, it may be taken as presumptive evidence of their close relationship. There is a small *Bathyurus-like* head associated with them, which is highly pustulose, but of which the largest head is far too small for the smallest of these tails observed; while the specimens furnishing the measurements for the figure presented, is only about 1886.]

two-thirds as large as the largest one used. *Asaphus canalis*, Conrad, is the only other large species associated with it, but as all parts of it are known except the thoracic segments, no question can remain regarding it.

In an extract of this paper, distributed in August last, this species was mentioned in the remarks on the second page of the article as *Bathyurus extans*, Hall's species. That identification was based upon a very imperfect pygidium of small size. Subsequent collections, however, yielded better and larger examples, as well as other parts of the organism, proving the identification incorrect.

Genus LICHAS, *Dalman*.

**Lichas Champlainensis**, n. sp.

PLATE 33, FIGS. 6-8.

Species known only by the pygidial plate, which is of very fair size, transversely elliptical in general outline, very moderately convex, with a short, highly elevated, and subtriangular axial lobe, which at its anterior end is fully one-third of the entire width of the plate; its form from the anterior border backward is moderately narrowed for about half its length, then more rapidly narrowed to an elongated acute point at some distance within the posterior margin. The lobe is crossed by two very distinct furrows and two indistinct ones, forming four axial rings besides the terminal one. The lateral lobes are marked by two linear furrows on each side which are reduced to simple, impressed, almost thread-like lines, strongly inclined backwards with an outward curvature in their direction toward the margin. The anterior border is short in front and rapidly curved backward at the sides, the surface of the whole nearly flat between the furrows. The margin, which is imperfect, appears to have had two points on each side, besides the central plate or lobe; which also has the appearance of having been slightly notched in the middle. This however is somewhat uncertain. The entire surface of the plate is marked by fine pustules which are mostly triangular in form with the point directed backward, presenting a scaly appearance.

*Formation and locality*.—In the Birdseye limestone at Isle La Motte, Lake Champlain.

[*Dec. 28th,*

## PHYLLOCARIDÆ ?

Genus RIBEIRIA, *Sharp*.

The genus *Ribeiria* was described by Mr. Sharp at first under the supposition that it was a univalve shell, belonging to the *Calyptræidæ*. The objects have much the appearance of bivalve shells, but seem to have been considered as univalves principally from the position of the muscular imprint, which extends across the dorsal portion ; and from the occurrence of an internal plate which seems to divide the anterior end a little below the dorsal angle, forming a notch in the internal cast. This notch when taken in connection with the deeply impressed muscular scar, and considered as an evidence of a slightly projecting internal muscular plate, like that of many forms of the *Calyptræidæ*, certainly looks in the cast of the type species as if it were the remains of a laterally compressed form of a species of that group of shell ; while the exterior of the same species would just as readily pass for a bivalve shell, either of the *Crassatellidæ* or *Nuculidæ*. Mr. Billings, of the Canadian Geol. Survey, in his *Pal. Foss.* Vol. 1, p. 340, figures two additional species of the same group, which he refers doubtfully to Sharp's genus under the provisionally new generic name *Ribeirina*, but places them under unclassified forms, evidently being in doubt as to their true systematic position. Mr. Billings states in his observations on those bodies, that he thinks Mr. J. W. Salter has referred the genus *Ribeiria* to the Crustacea, but says he has not been able to see the publication. I have searched through all the articles of J. W. Salter's which I can find published between the dates of Mr. Sharp's original description (1853), and that of Mr. Billings's statements (1865), but can find no reference whatever to Mr. Sharp's genus. Still I may have overlooked one. I think there can be no question about their relationship to the *Ceratiocaridæ* (or *Phyllocaridæ*, if we adopt Prof. Packard's new name), and shall consider the two following species under that light. The two species evidently belong to two different sections of the genus, like those described by Mr. Billings, loc. cite., the one being thin and compressed, with a nearly straight dorsal margin, and the other full and gibbous with prominent umbos like a nuculoid shell. Still both forms have the

1886.]

muscular markings situated along the dorsal margin ; and although they are symmetrically placed on the opposite side of the ridge, there is no evidence of a median separation, as would be the case were they shells of bivalve Mollusks. Nor is there any evidence of any hinge, or any separations of the valves, even as would be the case in *Leperditia* and its allies, but on the contrary the shell appears to have been simply bent over along the dorsal line, and to have been continuous, or composed only of a single piece, while the muscular scars are situated exactly on the median line.

**Ribeiria compressa**, n. sp.

PLATE 33, FIGS. 3-5.

Carapace small and very much compressed laterally, about three-fifths as high as long, having an oblong or suboval outline, somewhat straightened on the dorsal margin, and with the sides very depressed convex. Antero-dorsal extremity, in the cast, pointed, with a notch below it, leaving the extremity more sharply rounded than the width of the valve would indicate were the substance of the carapace itself preserved, the pointed beak-like projection not extending as far as the rounded extremity below. Notch nearly an eighth of an inch in depth, and with a broad, shallow depression passing obliquely backwards from the end. Muscular scar narrow, situated on the rounded dorsal edge, and extending nearly two-thirds the length of the carapace. Anterior and posterior extremities both slightly gaping, the latter most conspicuously so. Surface smooth so far as can be determined from the casts.

This species somewhat closely resembles *R. ? longiuscula*, Bill., Pal. Foss., Vol. 1, p. 340, fig. 327, but is more distinctly oval in outline, less straightened on the dorsal margin, and not at all sinuate in the median ventral region.

**Ribeiria ventricosa**, n. sp.

PLATE 33, FIGS. 1 and 2.

Carapace small, the largest and most perfect specimen yet noticed being a little less than three-fourths of an inch in length, by less than half an inch in height, and nearly three-eighths of

[Dec. 28th,

an inch in thickness, being a cast of the interior from which nearly all the shell has been removed. The general appearance is that of a nuculoid shell of small size, with prominent, subcentral beaks, and with the valves oppressed both anteriorly and posteriorly, and the apparent hinge line considerably below the very prominent umbones. The anterior end of the carapace is narrowly rounded, slightly gaping, and having the longest point a little above the median line, and in the cast shows the marginal surface marked by ten or twelve slight transverse pits, showing the interior of the gaping end of the carapace to have been crenulated. From the anterior end, the basal margin is gradually receding obliquely backward, and the valve widening for two-thirds the length of the carapace, and is then rounded upward to the longest posterior point. On the median dorsal line, between the umbones, is situated a round elevated tubercle, which either marks an opening or a deeply sunken muscular scar, while a second similar one is situated about half way between the umbones and the posterior end, still on the median line; and between it and the umbones occurs an elevated, narrow, cordiform muscular scar. The dorsal line shows no evidence of a ridge marking the junction of two valves, as would be the case in a bivalve shell, but is smooth and regularly depressed, except on the thin anterior projection, where it is narrowly rounded, as if the covering had been continuous and simply bent over.

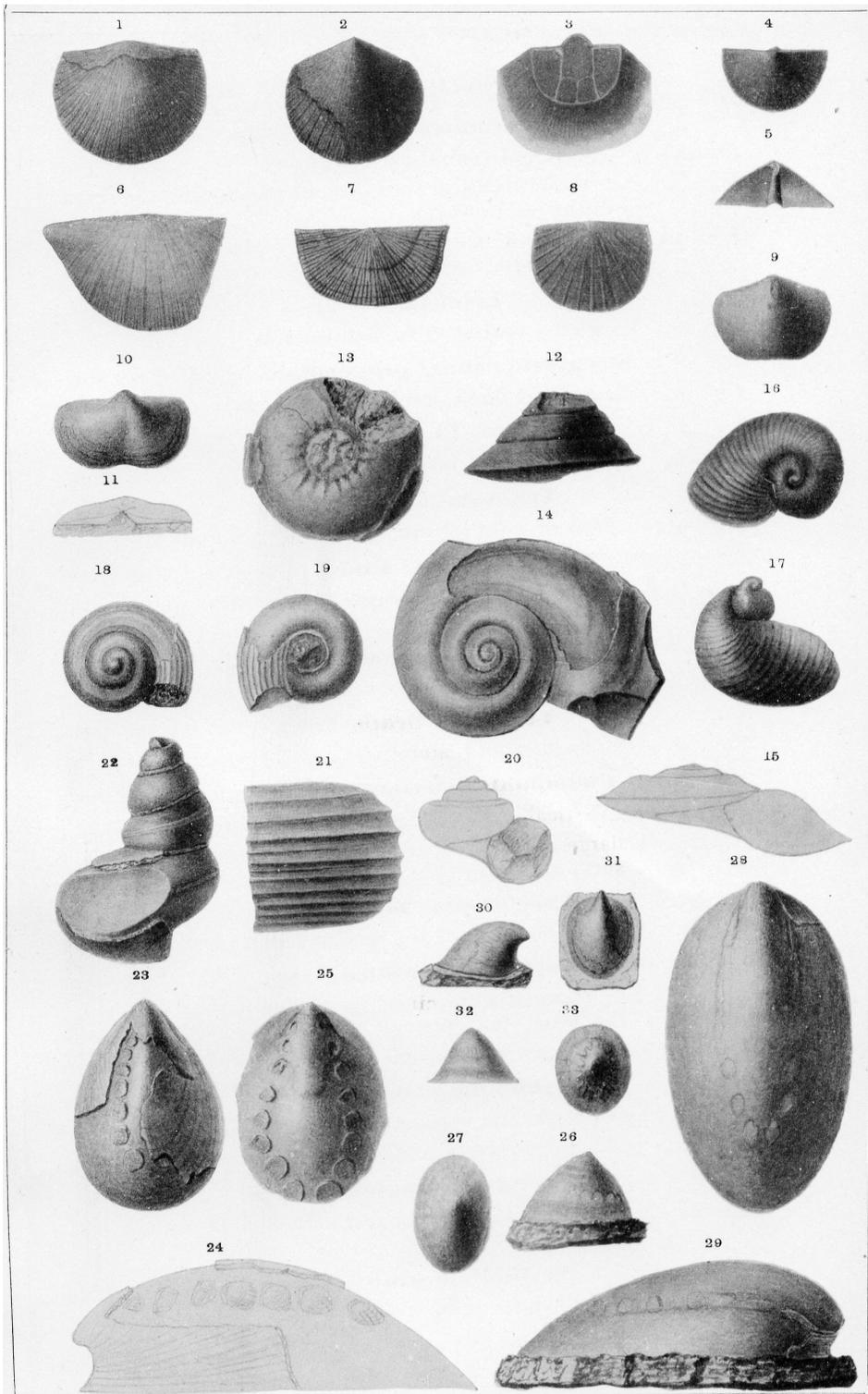
The casts of this species bear some distant resemblance to *R. ? calcifera*, Bill., Pal. Foss., Vol. 1, p. 340, figs. 326, *a*, *b* and *c*, but is more gibbous and less elongated behind, with much more prominent beaks.

One feature noticed on the casts of this species, is that the remains of the substance of the carapace of these bodies where preserved is crystalline, and does not present that homogeneous character common to fossil crustacean remains.

NOTE.—An extract of this paper, containing only a portion of the species here described, was distributed in August last. Since then large collections have been added, and the results here embodied.

EXPLANATION OF PLATE 24.

- Hemipronites apicalis**, Billings. Page 300.  
*Figs. 1 & 2.* Dorsal and ventral valves (2x).  
*Fig. 3.* A ventral valve with apex ground off, showing the septa in the interior (3x).  
*Figs. 4 & 5.* Apical and cardinal views of a ventral valve showing the deltidial callus.
- Leptaena**, sp. Page 302.  
*Fig. 6.* View of a ventral valve, natural size.
- Streptorhynchus? primordiale**, Whitf. Page 301.  
*Fig. 7.* View of the dorsal valve described (2x).
- Orthis Evadne**, Billings. Page 300.  
*Fig. 8.* View of a dorsal valve (2x).
- Triplesia lateralis**, Whitf. Page 303.  
*Figs. 9-11.* View of a dorsal and ventral valve, natural size.
- Pleurotomaria? Etna?** Billings. Page 316.  
*Figs. 12 & 13.* Lateral and basal views of a specimen referred to this species.
- Raphistoma compressum**, Whitf. Page 309.  
*Figs. 14 & 15.* Vertical view and outline profile of the type.
- Clisospira lirata**, Whitf. Page 308.  
*Figs. 16 & 17.* Vertical and lateral views of the specimen (2x).
- Euomphalus circumliratus**, Whitf. Page 308.  
*Figs. 18-20.* Vertical, basal and lateral views of the partial cast.  
*Fig. 21.* Enlargement of a part of the volution to show the surface striæ.
- Murchisonia? prava**, Whitf. Page 316.  
*Fig. 22.* View of the back of the specimen described.
- Tryblidium ovatum**, Whitf. Page 305.  
*Figs. 23 & 24.* Views of a specimen preserving part of the shell, the latter view enlarged twice.  
*Fig. 25.* Vertical view of a second specimen.
- Tryblidium conicum**, Whitf. Page 306.  
*Figs. 26 & 27.* Lateral and vertical views of a small specimen.  
*Figs. 32 & 33.* Similar view of a still smaller specimen.
- Tryblidium simplex**, Billings. Page 306.  
*Figs. 30 & 31.* Two views of the largest individual of the species observed.
- Tryblidium ovale**, Whitf. Page 305.  
*Figs. 28 & 29.* Two views of the type, natural size.



EXPLANATION OF PLATE 25.

**Lophospira Cassina**, Whitf. Page 312.

- Figs. 1 & 2.* Two views of the largest specimen seen.  
*Fig. 3.* View of a partially grown specimen.  
*Fig. 4.* Front view of an imperfect adult specimen, showing the columellar callosity.

**Holopea arenaria**, Billings. Page 310.

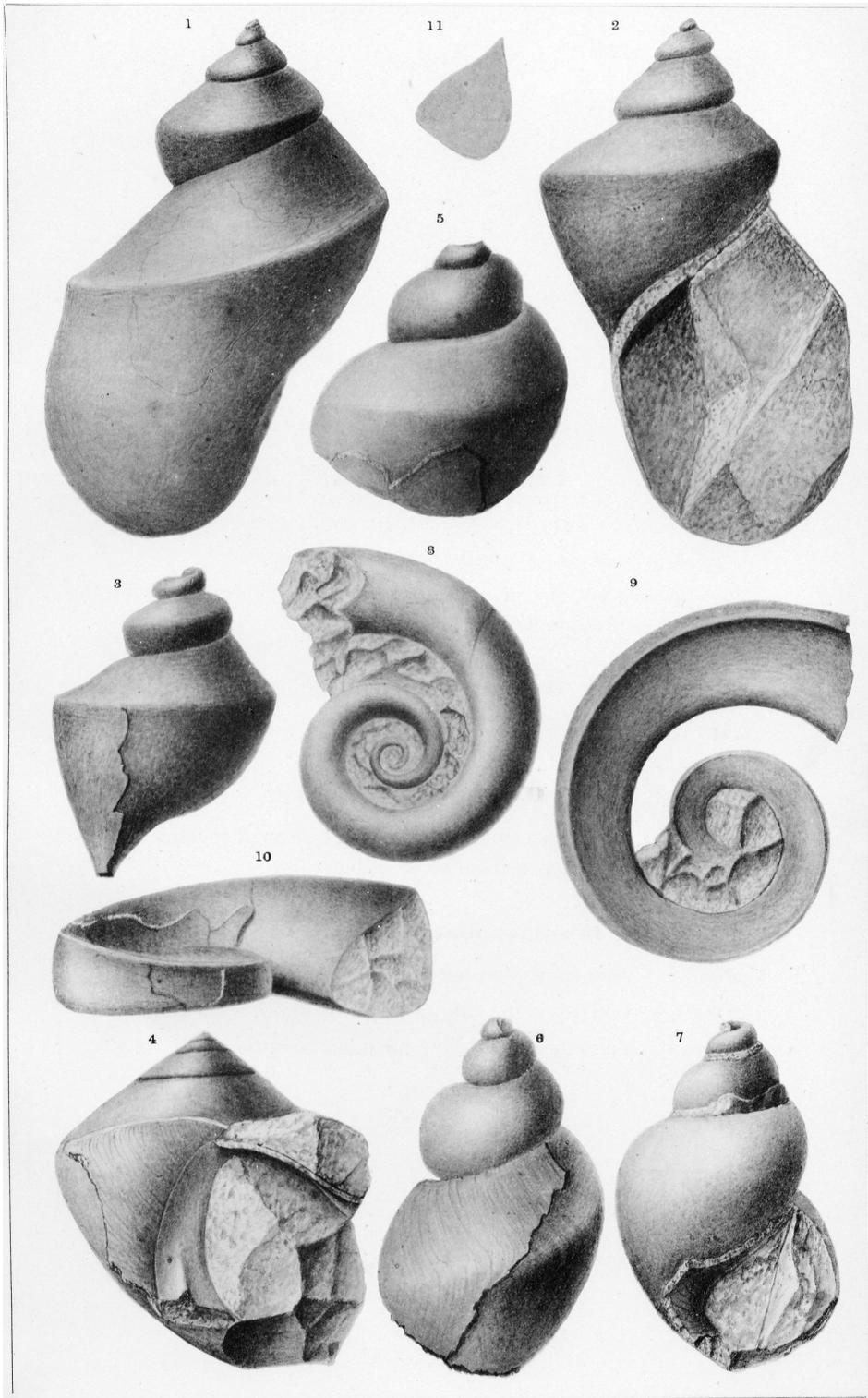
- Fig. 5.* View of the specimen identified with this species.

**Holopea Cassina**, Whitf. Page 310.

- Figs. 6 & 7.* Back and front views of a well-formed specimen, showing the surface striæ in part.

**Ecculiomphalus volutatus**, Whitf. Page 314.

- Fig. 8.* View of the under side of a partial cast.  
*Figs. 9 & 10.* Upper and lateral views of another specimen.  
*Fig. 11.* Diagram showing the form of a section of the tube.



EXPLANATION OF PLATE 26.

**Calaurops lituiformis**, Whitf. Page 315.

- Fig. 1.* View of a specimen showing the under side, the inner coils being filled with a deposit of lime. The shaded diagram gives the section of the inside at *a*.
- Fig. 2.* View of one showing the upper surface, the inner coils preserved. The diagram shows the form of a section at *b*, the flattened side being the top.
- Fig. 3.* Outline profile foreshortened.
- Fig. 4.* A fragment of the shell from the straight part of another specimen.

**Murchisonia (Fusispira) obelisca**, Whitf. Page 317.

- Figs. 5 & 6.* Two views of the most entire specimen collected.

**Subulites obesus**, Whitf. Page 318.

- Fig. 7.* View of the specimen described, the anterior part imperfect.

**Bellerophon Cassinensis**, Whitf. Page 318.

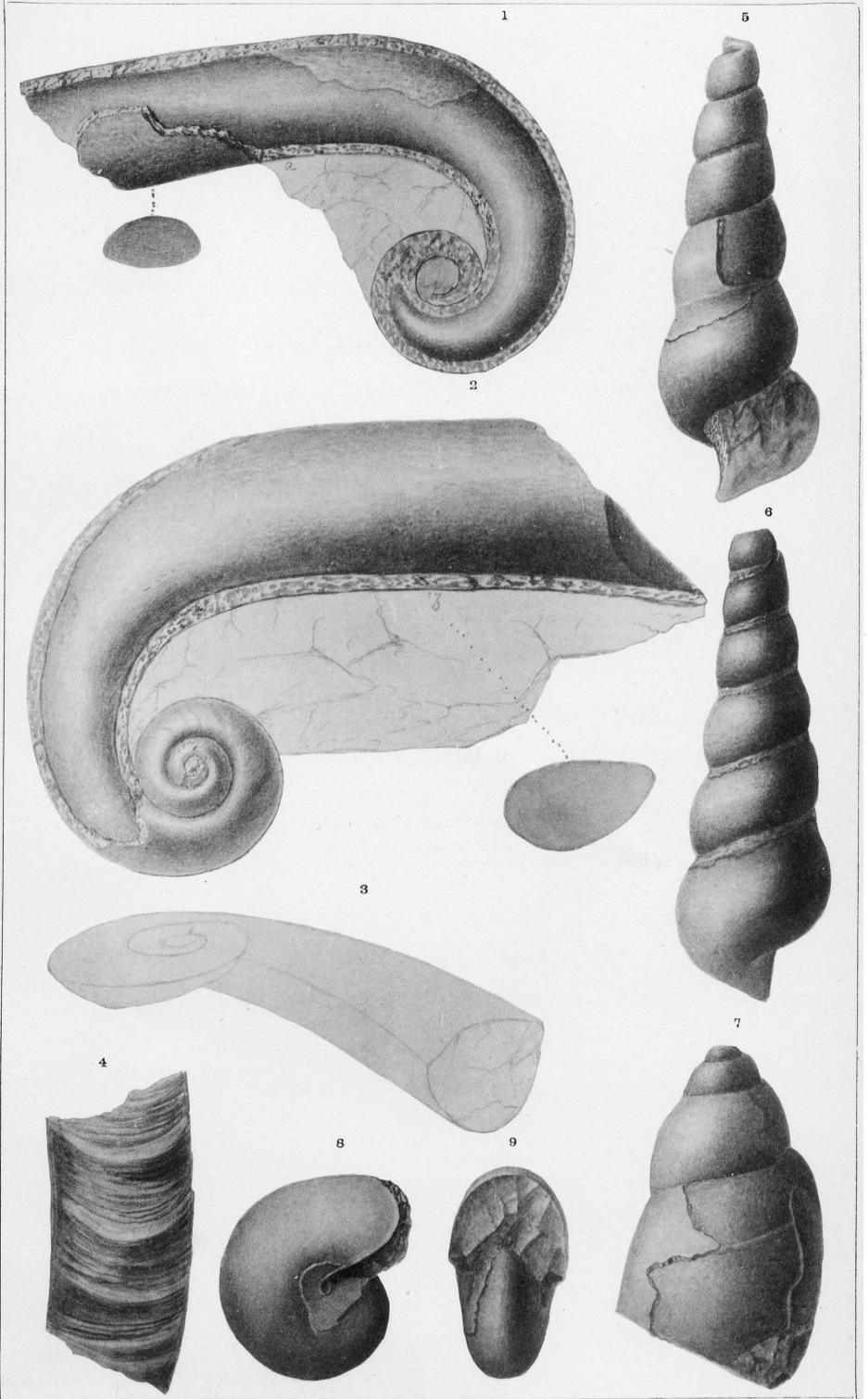
- Figs. 8 & 9.* Lateral and front views of a nearly entire specimen.

FORT CASSIN FOSSILS.

(Gasteropoda.

Bulletin A. M. N. H. No. 8

Vol. I. Plate XXVI.



H. P. Whitfield del.

E. Bierstedt Arotype.

EXPLANATION OF PLATE 27.

**Othoceras cornu-oryx**, Whitf. Page 320.

*Figs. 1 & 2.* Views of two different specimens, showing the prevailing features.

*Fig. 6.* Section of the septate part of one, showing the septa and siphon.

**Gomphoceras minimum**, Whitf. Page 321.

*Fig. 3.* Restored figure of the specimen comprised in figures 4 and 5.

**Cyrtoceras confertissimum**, Whitf. Page 327.

*Figs. 7 & 8.* Dorsal and lateral views of a specimen.

*Fig. 9.* Diagram showing form of the section and position of the siphon.

**Cyrtoceras acinacellum**, Whitf. Page 327.

*Figs. 10 & 11.* Lateral and dorsal views of the specimen, natural size.

*Fig. 12.* Enlargement of a part of the back, ground to show the siphon.

*Fig. 13.* Enlargement of a septum showing its convexity.

**Orthoceras Brainerdi**, Whitf. Page 319.

*Fig. 14.* View of the siphonal side of a fragment showing the undulations of the septa.

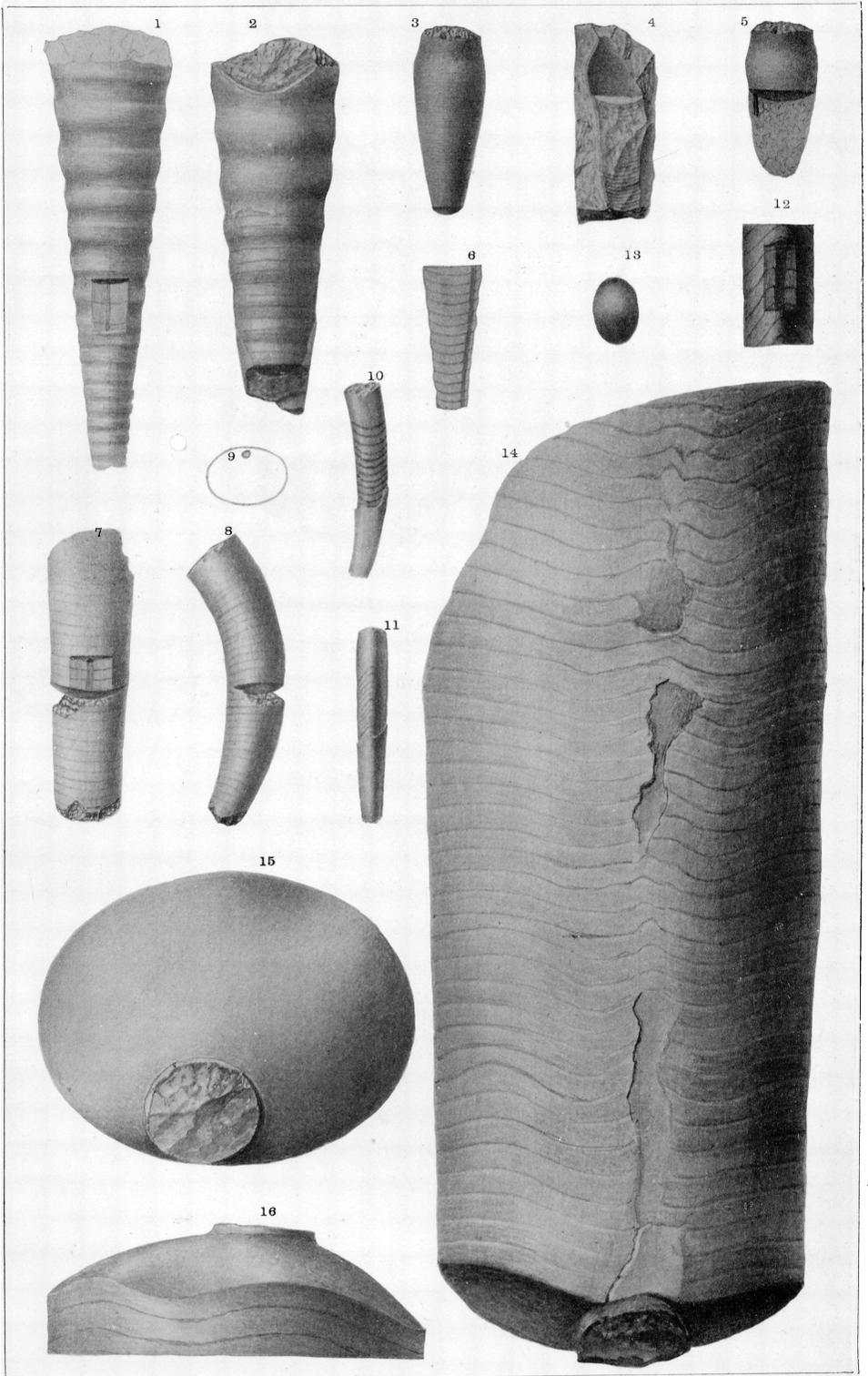
*Figs. 15 & 16.* Two views of the end, showing the siphon and convexity of the septum.

FORT CASSIN FOSSILS.

(Cephalopoda.)

Bulletin A. M. N. H. No. 8.

Vol I. Plate XXVII.



EXPLANATION OF PLATE 28.

**Piloceras explanator**, Whitf. Page 323.

- Fig. 1.* Side view of the lower end of a large specimen, which has the siphon protruding below the broken septa. The upper portion above that figured, has five other chambers besides the outer chamber. The specimen is about eight inches long above the projecting siphon.
- Fig. 2.* View of a longitudinal section of a specimen showing the septa. *a a* indicates the solid part of the siphon, and *b* the cavity of the siphon filled by foreign matter.
- Figs. 3 & 4.* Two views of a large siphon which has been broken open lengthwise. In *fig. 3*, *a* indicates the siphonal cavity; *a'*, solid matter filling it; *a''*, a layer of deposit which separates from those below it; *b*, several thinner layers of deposit, but not septa or proper divisions, such as those described by Salter; *c*, a faulted or disturbed layer of the deposit which appears to have been interrupted in its growth.

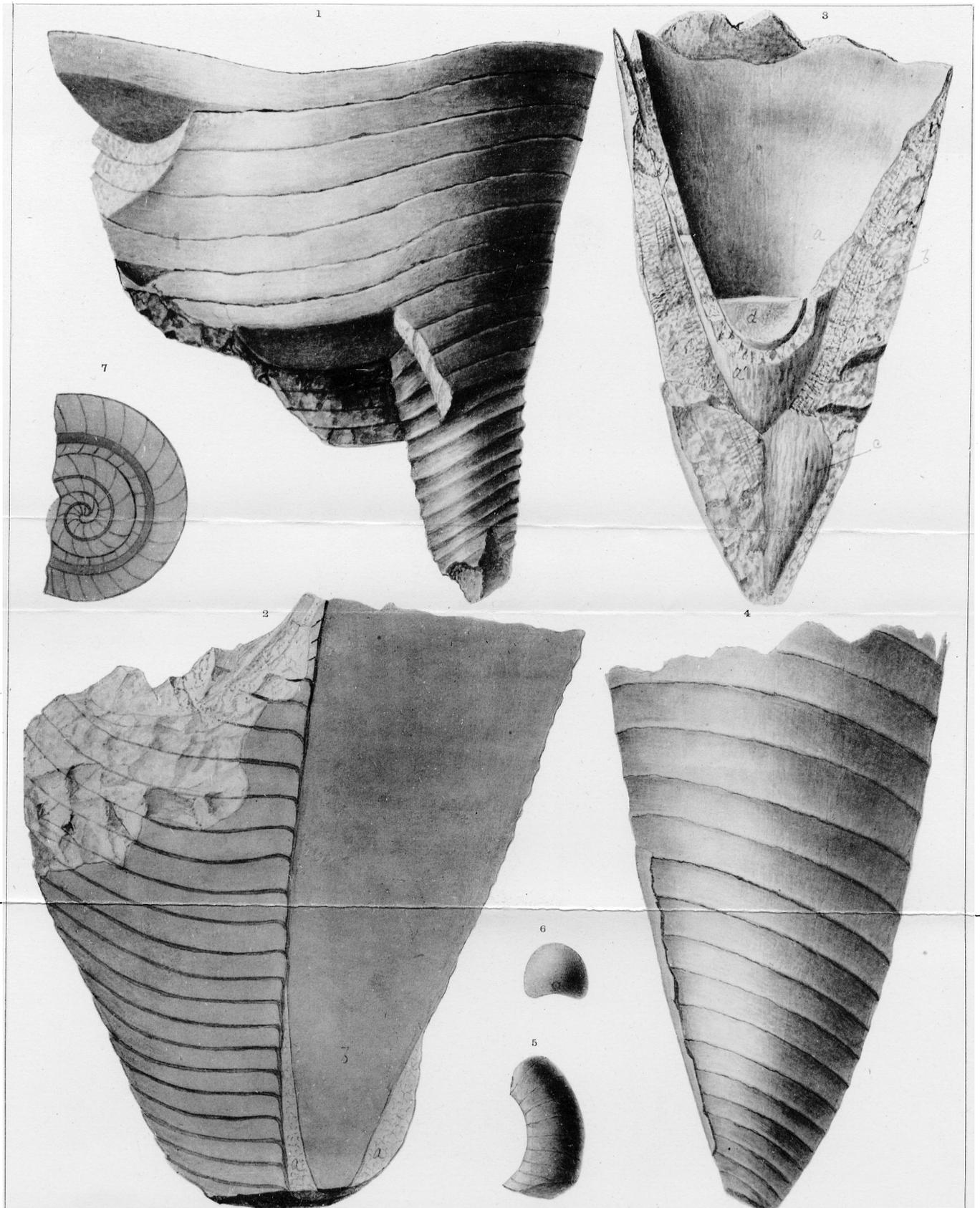
**Lituities Eatoni**, Whitf. Page 331.

- Fig. 5.* View of a fragment of a specimen of the species showing the septa.
- Fig. 6.* View of the upper end of the same, showing the form of the transverse section.
- Fig. 7.* Section through the center of the nucleus of a specimen showing the position of siphon and original septa and nucleus (3x).

FORT CASSIN FOSSILS.  
(Cephalopoda.)

Bulletin A. M. N. H. No. 8.

Vol. I. Plate XXVIII.



R. P. Whitfield, del.

E. Bierstadt, Artotype.

EXPLANATION OF PLATE 29.

**Gomphoceras Cassinenses**, Whitf. Page 322.

- Figs. 1 & 2.* Two views of a specimen showing the outer chamber and much of the septate portion. Part of the side is cut away in fig. 2 to show the siphon.
- Fig. 3.* View of a second specimen with four of the lower chambers, showing the convexity of the lower septum.

**Cyrtoceras Boycii**, Whitf. Page 326.

- Fig. 4.* View of the specimen described, which is a longitudinal section cut obliquely through, and imperfect at the lower end. The large beaded siphon is seen to be nearly central.

**Lituites internastriata**, Whitf. Page 332.

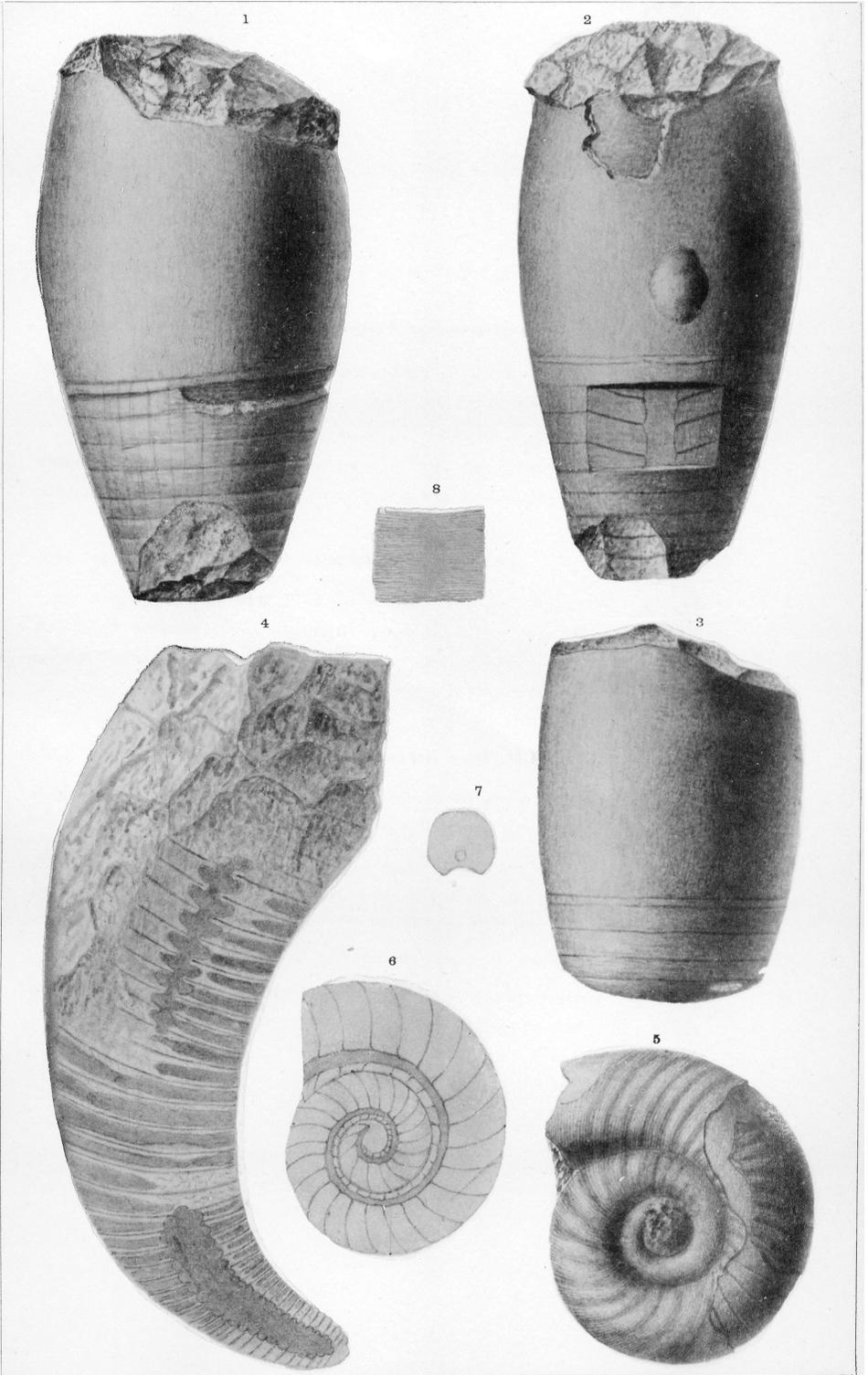
- Fig. 5.* Lateral view of a specimen retaining much of the shell showing the surface markings.
- Fig. 6.* Section (2x) through the centre of the inner coils, showing the septa, size and position of the siphon, and the nuclear septa.
- Fig. 7.* Diagram of a section of the tube.
- Fig. 8.* Enlargement of the striæ seen on the internal cast where not abraded or weathered.

FORT CASSIN FOSSILS.

(Cephalopoda.)

Bulletin A. M. N. H. No. 8

Vol. I. Plate XXIX.



L. P. Oratacap del.

E. Bierstadt, Artotype.

EXPLANATION OF PLATE 30.

**Nautilus Kelloggi**, Whitf.

Page 328.

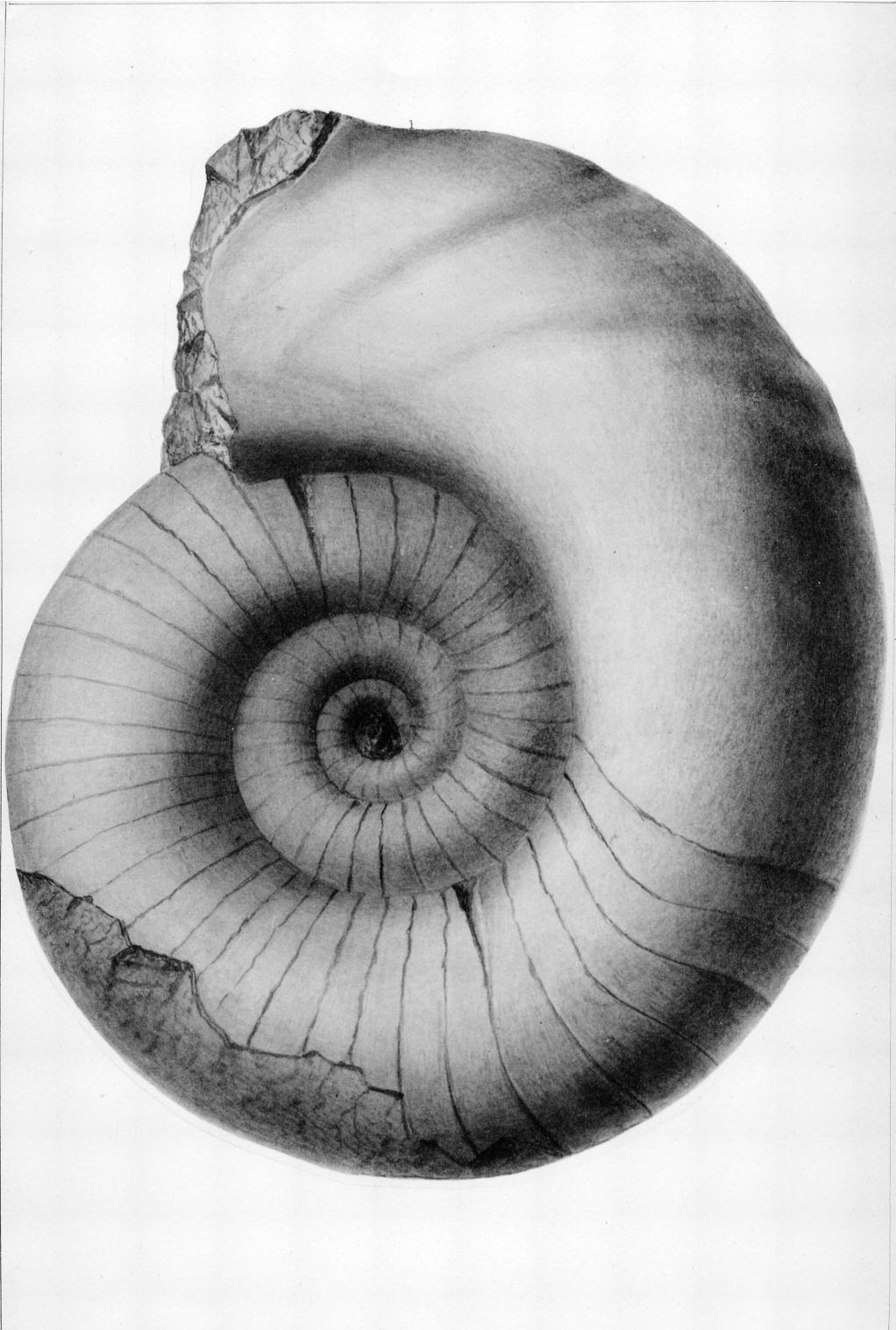
*Fig. 1.* Lateral view of the type specimen, showing the features of the species.

FORT CASSIN FOSSILS.

(Cephalopoda.)

Bulletin A. M. N. H. No. 8.

Vol. I. Plate XXX.



L. P. Gratacap, del.

E. Bierstadt Artotype.

EXPLANATION OF PLATE 31.

**Nautilus? Champlainensis**, Whitf. Page 329.

- Fig. 1.* Lateral view of a specimen showing the expansion of the aperture, the septa and general form.
- Fig. 3.* View of a section of the back of the outer volution of another specimen.

**Lituites Seelyi**, Whitf. Page 330.

- Fig. 2.* View of a section through the middle of a specimen showing the septa and siphon.

**Nautilus Kelloggi**, Whitf. Page 328.

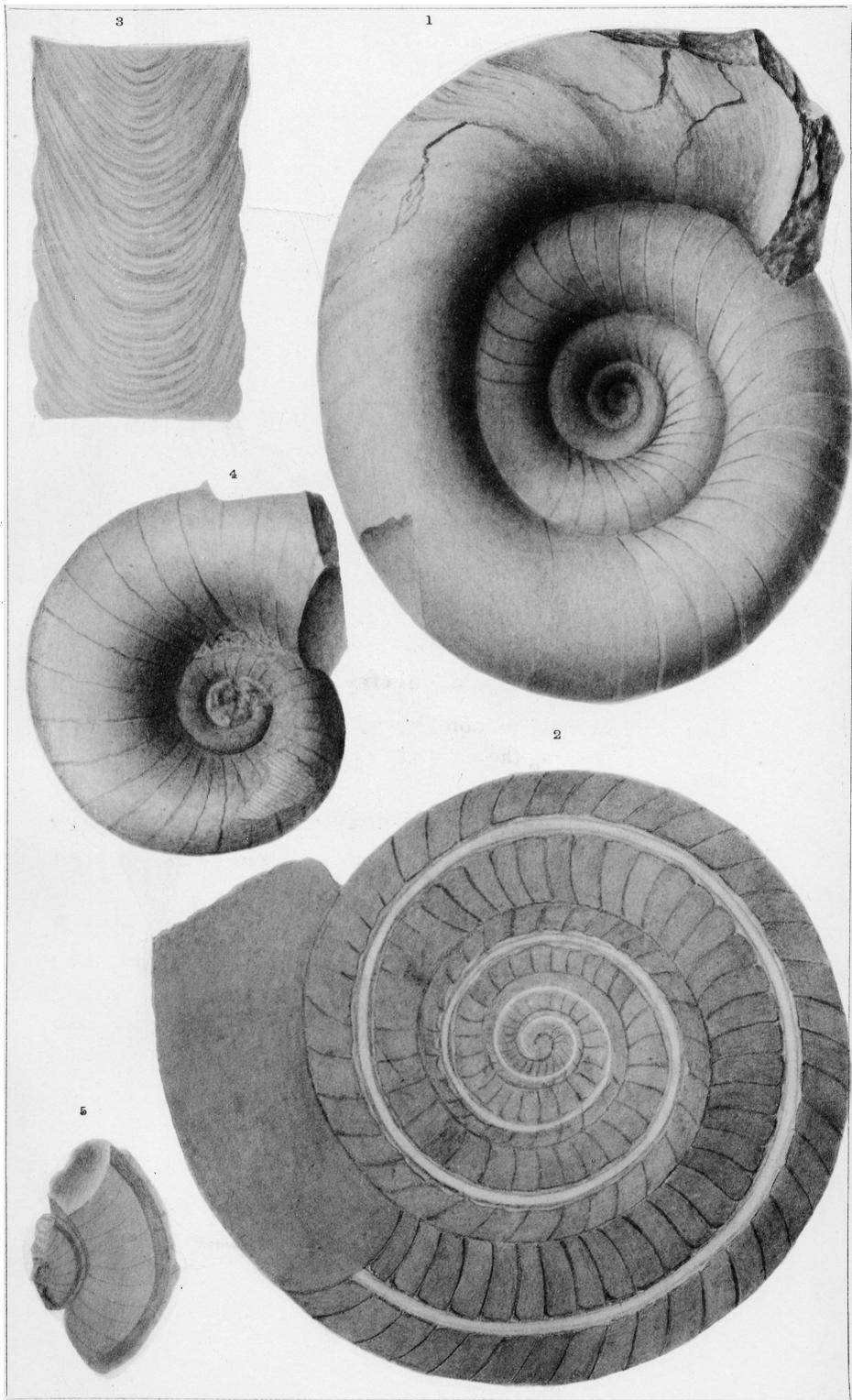
- Fig. 4.* View of a young specimen; on a part of the inner coil the shell is preserved, showing surface striæ.
- Fig. 5.* A section through a fragment, showing the position of the siphon.

FORT CASSIN FOSSILS.

(Cephalopoda.)

Bulletin A. M. N. H. No. 8.

Vol. I. Plate XXXI.



L. P. Gratacap, del.

E. Bierstadt, Artotype.

EXPLANATION OF PLATE 32.

**Lituites Eatoni**, Whitf. Page 331.

*Fig. 1.* Lateral view of the specimen first described, showing the outer chamber deflected.

**Lituites Eatoni** var. **Casinensis** Whitf. Page 332.

*Fig. 2.* Lateral view of the specimen, showing the round volutions and regular striæ.

**Lituites Seelyi**, Whitf. Page 330.

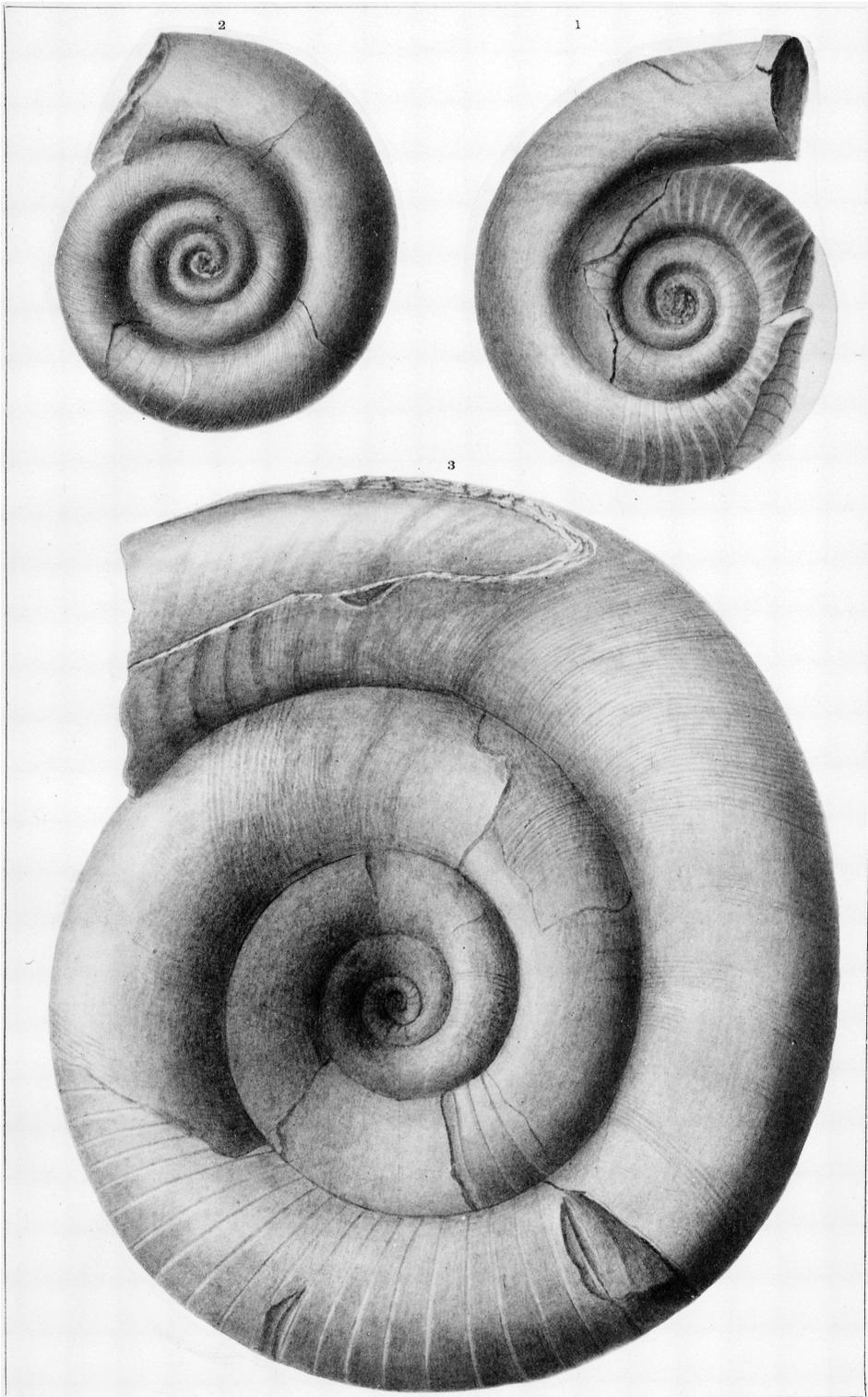
*Fig. 3.* Lateral view of a large individual, which retains the shell over a large part of the surface.

FORT CASSIN FOSSILS.

(Cephalopoda.)

Bulletin A. M. N. H. No. 8.

Vol. I. Plate XXXII.



L. P. Gratacap, del.

E. Bierstadt, Artotype.

EXPLANATION OF PLATE 33.

**Ribeiria ventricosa**, Whitf. Page 344.

*Figs. 1 & 2.* Lateral and dorsal views of a cast, enlarged two diameters, showing the general form and muscular markings.

**Ribeiria compressa**, Whitf. Page 344.

*Fig. 3.* Lateral view of the cast, natural size.

*Figs. 4 & 5.* Dorsal and lateral diagramic views of the specimen, enlarged.

**Lichas Champlainensis**, Whitf. Page 342.

*Figs. 6 & 7.* Vertical view and outline profile of the specimen described.

*Fig. 8.* Enlargement of the surface.

**Sao? Lamottensis**, Whitf. Page 334.

*Fig. 9.* Enlarged view of the glabella and fixed cheeks, showing the general form and surface markings.

*Fig. 10.* Outline profile of the same.

*Fig. 11.* Enlarged view of a thorax.

**Bathyurus Seelyi**, Whitf. Page 339.

*Figs. 12 & 13.* Vertical and profile views of the best preserved head, the glabella somewhat compressed.

*Fig. 14.* Outline of a glabella retaining its entire convexity.

*Fig. 15.* View of a movable cheek supposed to be of the same species.

*Fig. 16.* Restored pygidium, made from two individuals; one of this size, the other somewhat smaller.

*Fig. 17.* Outline profile from the same source.

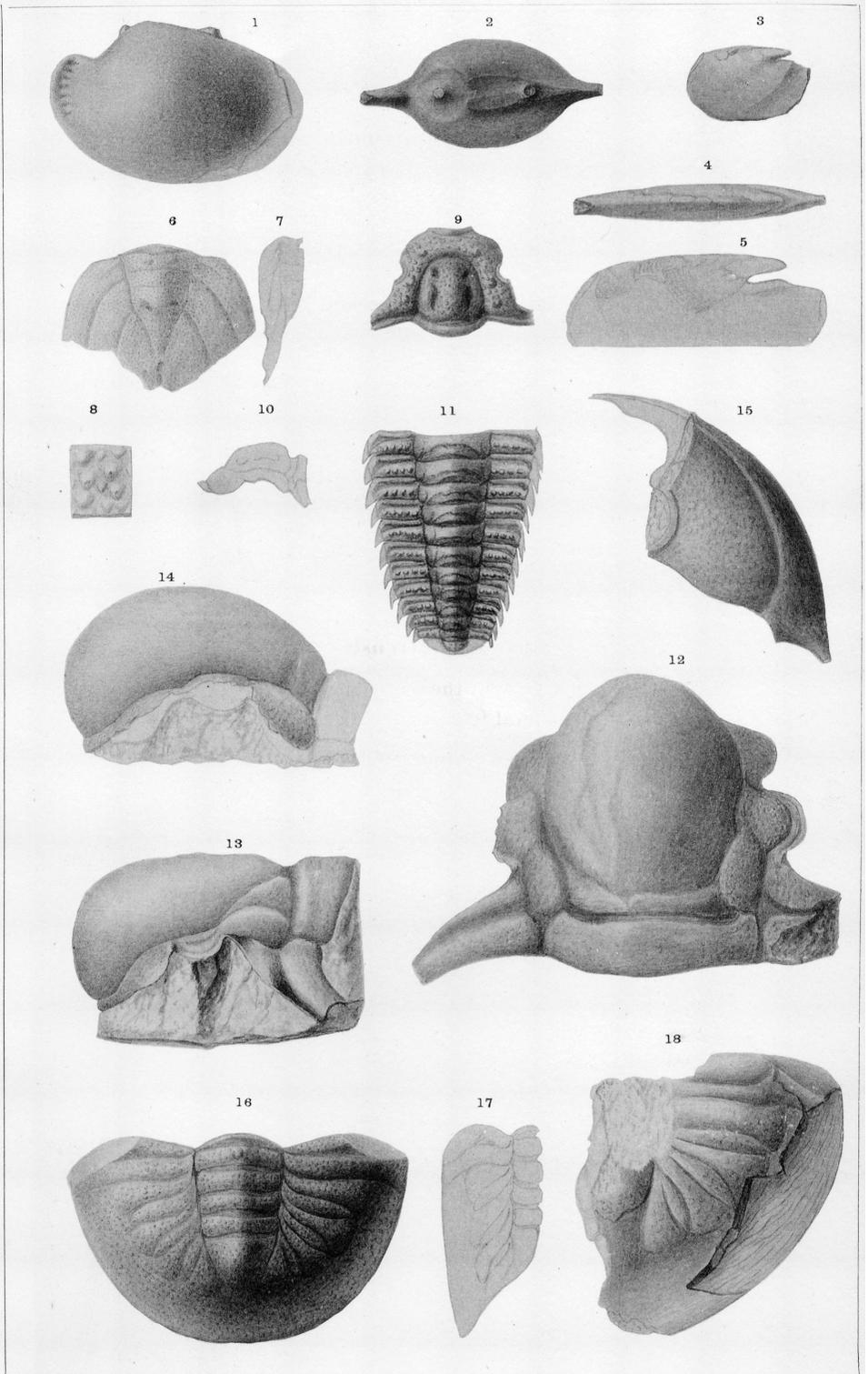
*Fig. 18.* Fragment of a larger pygidium. The flat under plate is seen on the right margin.

FORT CASSIN FOSSILS.

(Crustacea.)

Bulletin A. M. N. H. No. 8.

Vol. I. Plate XXXIII



EXPLANATION OF PLATE 34.

**Asaphus canalis**, Con., in MS. Page 336.

- Fig. 1.* View of a small glabella and fixed cheeks, showing the quadrangular form.
- Figs. 2 & 3.* Views of two imperfect glabellas, showing portions of the suture line.
- Fig. 4.* View of a small imperfect movable cheek.
- Fig. 5.* Part of a large movable cheek.
- Fig. 6.* An imperfect hypostoma as obtained from a gutta-percha impression in the matrix.
- Fig. 7.* View of a medium sized pygidium.
- Fig. 8.* A smaller pygidium which shows the annulations.

FORT CASSIN FOSSILS.

(Crustacea.)

Bulletin A. M. N. H. No. 8.

Vol I. Plate XXXIV

