MEMOIRS

OF THE

American Museum of Natural History.

Volume I, Part II.

REPUBLICATION OF DESCRIPTIONS OF FOSSILS FROM THE HALL COLLECTION IN THE AMERICAN MUSEUM OF NATURAL HISTORY, FROM THE REPORT OF PROGRESS FOR 1861 OF THE GEOLOGICAL SURVEY OF WISCONSIN, BY JAMES HALL, WITH ILLUSTRATIONS FROM THE ORIGINAL TYPE SPECIMENS NOT HERETOFORE FIGURED.

By R. P. WHITFIELD.

August 10, 1895.

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II.—REPUBLICATION OF DESCRIPTIONS OF FOSSILS FROM THE HALL COLLECTION IN THE AMERICAN MUSEUM OF NATURAL HISTORY, FROM THE REPORT OF PROGRESS FOR 1861 OF THE GEOLOGICAL SURVEY OF WISCONSIN, BY JAMES HALL, WITH ILLUSTRATIONS FROM THE ORIGINAL TYPE SPECIMENS NOT HERETOFORE FIGURED.

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PLATES IV–XII.

In a 'Report of Progress' of the Geological Survey of Wisconsin, published in 1861 by Prof. James Hall, many species of fossils were described, but without illustrations. When the purchase of the Hall Collection was made by the American Museum of Natural History the types of these species came into its possession. In previous publications[1] the Museum has given illustrations of many species not previously figured, repeating the original descriptions of the author, and in the following pages the species published in the above-mentioned 'Report of Progress,' the types of which are to be found in the Museum collections, are treated in the same manner. The illustrations are all from the specimens used in the original descriptions with the single exception of a specimen of *Lituites occidentalis*. The forms now given are mostly from the limestone and shales of the Trenton group, as those from the Niagara limestones, included in the 'Report of Progress,' except the Receptaculites, were illustrated and redescribed by Professor Hall in the Twentieth Report on the New York State Cabinet of Natural History in 1867.

In the arrangement of species the order in which they are given in the 'Report of Progress' is followed, except that the forms of Algæ have been

[1] 'Fauna of the Lower Carboniferous Limestones of Spergen Hill, Indiana,' Bulletin Am. Mus. Nat. Hist., Vol. I, No. 3, 1882; 'Carboniferous Crinoids,' Memoirs Am. Mus. Nat. Hist., Vol. I, No. 1, 1893.

placed first. These were arranged and considered as Graptolites in the above report. But as there seems to be no doubt as to their vegetable character, they have been changed in position to conform to that idea.

Within the past year some of the species included in the following pages have been redescribed and figured from other specimens by Mr. E. O. Ulrich of the Minnesota Geological Survey, in a work on 'The Lower Silurian Lamellibranchiata of Minnesota,' and I have been informed that others are at work on the Gasteropoda and Cephalopoda of the same formations in the same State. It is for the purpose of avoiding a redescription, under other names than the original ones, that it is deemed desirable to illustrate them from the specimens originally used. This has been done in all cases in this present paper, except in three instances, where figures of other and better specimens have been added for better or further illustration.

Genus **Buthograptus** *Hall.*

Buthograptus laxus.[1]

PLATE IV, FIGS. 1-3.

Buthograptus laxus HALL, Geol. Surv. Wisc. Rep. Prog. 1861, p. 19; Can. Org. Rem. Decade II, p. 49; 20th Rep. State Cab. N. Y. p. 185, fig. 27.
Bythograptus laxus (HALL), Miller's Cat.
See Observations on *Buthograptus* by R. P. Whitfield, Bull. Am. Mus. Nat. Hist. Vol. VI, p. 351.

In the 'Bulletin' of the American Museum of Natural History, Vol. VI, p. 351, I have shown that this organism is not Graptolitic, but a true Marine Alga, consisting of a midrib furnished with articulated pinnulæ, and that there are no true cells or serratures representing cells. The following remarks are quoted from the above-mentioned article.

"*Buthograptus* consists of a midrib, flattened as seen on the shale, which gives origin to a series of short, slender, slightly curved pinnules on either edge, somewhat closely arranged, and presents a feather-like aspect as it lies on the rock. There are no definite serratures or cells on either the midrib or on the lateral pinnules, but along the line of the midrib may sometimes be seen a series of dots or punctures which were supposed to represent the apertures of cells, analagous to those of Graptolites, but which now prove to be only depressions in its surface. When the stipe is placed under a sufficiently strong lens it is readily seen that the lateral pinnules are not a part

[1] The type and originally figured specimen of this species is still in Professor Hall's hands, not having yet been delivered to the Museum.

of the central stipe, but are separate organs articulated by a club-shaped end to the central stipe ; and it is the imprints of these club-like ends that has produced the punctures that in the description of *Buthograptus* are described as 'oval spots marking the form and place of the cellules.' No positive evidence has as yet been detected of articulations in the midrib or central stipe, and no really negative proof can be shown. The pinnules where perfectly preserved increase in width outwardly, from just above the club-shaped attachment to nearly twice that width near their extremity, and are rounded or obtusely pointed at the outer end.

"The absence of proper cells, taken in connection with the other features above mentioned, led me not only to question the animal origin of *Buthograptus*, but to examine critically the so-called *Oldhamia fruticosa* Hall, which is associated with it, and on placing them under a sufficiently high magnifying power the Algous characteristics were at once detected in their mode of growth and in the jointed bifurcations of the branches. This has led me to the conclusion that they are both of vegetable origin and belong to the true articulated marine Algæ. This was to me a somewhat astonishing result, as I can find no record of any *articulated* marine Algæ described from Palæozoic rocks.

"Among the living forms of marine Algæ on the Florida coast and elsewhere we have a form known as *Caulerpa plumaris*, which to the naked eye is so exactly a counterpart of *Buthograptus laxus* that a figure of one would answer equally well for that of the other, but when examined more carefully it is seen that in the living form the lateral pinnules are simply ramifications from the central axis or stipe, while in *Buthograptus* they are articulated pinnules which by maceration were readily separated from the central axis, as is plainly seen in the fossil specimens. The form of *Buthograptus* when living was most probably plumose with a cylindrical axis from which a series of pinnules arose on two opposite sides, not quite opposite to each other at their origin but slightly alternating. These pinnules were probably cylindrical and somewhat club-shaped or enlarging outwardly, and attached to the axis by the knob-like inner end. In the shale, by compression, these rounded parts are all flattened, so there is little left beyond the brown staining on the rock from the carbonaceous material of the plant substance.

"The name *Buthograptus* (or *Bythograptus*, as written by several authors) is a misnomer and misleading, as the termination 'graptus' seems to ally it with the Graptolitidæ, which we now see to be incorrect. Such a name as *Bythocladus* would be much more appropriate."—Bull. Am. Mus. Nat. Hist., VI, pp. 351–353.

Oldhamia fruticosa *Hall.*

This name is used by Professor Hall in the 'Canadian Organic Remains,' Vol. II, p. 50, but without definite description or figure, for a form which is found associated with the *Buthograptus laxus* of that author. It is also given in S. A. Miller's Catalogues in the same manner. The type specimens referred to by Professor Hall being in the Museum collections, it becomes necessary to notice them in this connection. In the same article in Vol. VI of the Museum Bulletin, where I have discussed *Buthograptus*, I have also considered these bodies, and find but little if any similarity between them and the *Oldhamia antiqua* of Forbes, which occurs fossil in the Cambrian of England. The *O. antiqua* has been considered by some authors as a Nullipore, and by others as a Sertularian; the first being probably a vegetable and the other an animal. The mode of growth in these Trenton forms positively indicates their vegetable character, and shows their close relations with the articulated marine Algæ of the present seas. In consequence of these very important differences I have proposed, in the article in the Bulletin, the generic name *Callithamnopsis* for the Trenton forms, the description of which is copied below.

Genus **Callithamnopsis** *Whitfield.*

"Frond articulate, branched, branches opposite in pairs, or in whorls near the upper end of the joints, and composed of single joints between bifurcations. Type *C. fruticosa*, Hall's sp. Geological position in the Trenton period."

Callithamnopsis fruticosa.

PLATE IV, FIGS. 4–8.

"*Oldhamia fruticosa* HALL, Can. Org. Rem. Decade II, p. 50. Name only.

"Frond consisting of thin filiform stems more or less distinctly jointed, with slender thread-like branches of half or less than half the width of the main stem, the extremities more or less bulbous where they unite with the stem or outer divisions. Outer divisions two or three, or in some cases four or more, diverging at an angle of about thirty degrees from each other, the branches being slightly curved; the whole having the appearance of a densely branched bush in miniature. Stipes and branches with parallel margins.

"In some cases the terminal branches only of a frond will be found forming a group together, when they are likely to present the appearance of whorls of many branches from their overlapping and interference one

with another, and so present a variety of forms. In one case, what seems to be a main stem with many branches attached shows the upper terminal point of the stem broad and rounded at the extremity, like a young growing shoot. In some cases the outer branches are short and the bifurcations quite close together, while in others they are long and very slender and the bifurcations quite distant. I have thought these last might possibly be specifically distinct from the type specimen of *C. fruticosa*, but after further study they seem to be connected by intermediate forms enough to unite them as one and the same.

"*Geological formation and locality.*—In dark brown or chocolate-colored shales of the Trenton group, at Platteville, Wisconsin."— Bull. Am. Mus. Nat. Hist., VI, p. 354.

Genus **Receptaculites** *De France.*

"*Generic characters.*—Body consisting of an infundibuliform spreading disc, more or less concave at the center, depressed-orbicular, and globose. The spreading discoid forms consist of a range of vertical cells in single series ; the orbicular discoid forms have radiated curving cells which are directed from the center or axis towards the margin, their length and curvature depending on the size and form of the mass ; the foramina or cells in all the forms become larger as they recede from the centre to the periphery, and again become smaller, on the lower side, in the globose forms. Cells cylindrical, contracted below the aperture, and thickened or expanded above, with rhomboidal openings at each extremity. On one side the openings sometimes show obsolescent rays ; the interior walls of the cells are often striated as if preserving the remains of transverse septa.

"In all these bodies the cells are arranged on curving lines which diverge from the center in a constantly enlarging circle ; these are crossed by similar lines in an opposite direction, which thus leave quadrangular or rhomboidal spaces, 'like the engine-turned ornament of a watch.' The form of these apertures depends upon the degree of curvature, or upon the form of the mass to which the curvature of the cell lines will conform. In all cases, however, the cell is cylindrical beneath the exterior.

"Since the cells vary in size at different distances from the center, the size of the cells in separate fragments affords no means, alone, for specific determination.

"Regarding the form and mode of growth, I have recognized the following species in the Galena limestone of the lead region."—Geol. Surv. Wisc. Rep. Prog., 1861, p. 13.

Receptaculites oweni.

PLATE V, FIGS. 8–11.

Receptaculites oweni HALL, Geol. Surv. Wisc. Rep. Prog. 1861, p. 13.
Coscinopora sulcata OWEN (not of GOLDFUSS), Mineral Region of the Northwest, 1844, p. 40.

"*Description.*—Body consisting of a broad expanded disc, from four to twelve inches in width, and from one-quarter to half an inch in thickness (rarely a little thicker). Surface undulating with an abrupt funnel-shaped depression in the center of the upper side, from which the cell rows radiate in curved lines.

"The thickness in the center is not more than one-eighth of an inch, and at a distance of three or four inches from the center is less than half an inch: cells cylindrical in the middle and contracted both above and below, the walls of the cavities, often showing transverse striæ, which appear like the remains of septa. The distance of the cells from each other is variable, those near the center being closer together, though, in receding from the center, there are at intervals intercalated rows of cells, which take the same direction, and give the cells a closer arrangement towards the margin than in the intermediate space before the intercalation of the additional rows. The apertures both above and below are essentially rhomboidal; but in well preserved surfaces there are remains of rays, which, however, are rarely observed; and I have not seen them on opposite sides of the same specimen.

"The various stages of decomposition, and degrees of preservation, present a great variety of surface aspect. In some conditions, there is visible a distinct groove, extending along the surface from one cell to the next, across the curving interspaces. I have not observed in any of these specimens evidences of the connecting stolons shown by Mr. Salter.

"*Geological formation and locality.*—In the Galena limestone of Wisconsin, Northern Illinois, and the eastern part of Iowa, this fossil is everywhere present, and is the most marked and characteristic form in the rock. It likewise occurs sometimes in positions where the Galena limestone is extremely thin, or not recognized as a distinct member of the group."—Geol. Surv. Wisc. Rep. Prog., 1861, p. 13.

Receptaculites globularis.

PLATE V, FIG. 7.

Receptaculites globularè HALL, Geol. Surv. Wisc. Rep. Prog. 1861, p. 16.

"*Description.*—Body globose or sub-globose, with an irregular base of attachment; transverse diameter usually greater than the vertical diameter;

[1] "This feature is very clearly set forth in a specimen from the collection of I. A. Lapham, Esq."

summit a little depressed ; cells arranged in radiating curved lines, the apertures rhomboidal and transversely elongated ; the concentric groove and raised ridges between strongly marked.

"This species is readily distinguished by its small globose form, which is usually not more than three-fourths of an inch in diameter. It is more rare than either of the others, though I am informed by Prof. Daniels, that more than twenty specimens were obtained at a single locality in Wisconsin. About twenty years since, I received a specimen of this species from Mr. Thorp, of Mount Morris, Illinois, and have seen others in Galena, and in the collection of Prof. Daniels.

" *Geological formation and locality.*—In the Galena limestone of the lead region of Wisconsin, Iowa and Illinois."—Geol. Surv. Wisc. Rep. Prog., 1861, p. 16.

Receptaculites fungosus.

PLATE V, FIGS. 5 AND 6.

Receptaculites fungosum HALL, Geol. Surv. Wisc. Rep. Prog. 1861, p. 15.

" *Description.*—Body very broadly subturbinate or fungiform ; rounded and very convex below, except the broad base of attachment ; upper surface deeply concave in the center, convex towards the margin, and curving abruptly at the sides. Cells small, cylindrical, little contracted at the aperture, arranged in radiating curved lines from the center to the periphery and continuing over the sides and base in the same direction. The central cells are vertical, but on approaching the periphery they are curved upwards and inwards ; the lateral cells are directed horizontally and gradually turning downwards are again vertical, opening in the opposite direction from those of the center above.

" Surface appearing reticulate from the concentric grooves which connect the cells upon the surface, and the parallel concentric ridges ; while these are crossed below by the double series of diverging curved lines.

"To conceive of the form of this species, one may fancy an expanded form of *R. oweni* to be bent abruptly over at an inch or two from the center, and the margins drawn together below, forming a base of attachment.

" The greatest diameter of this species, in the specimens examined, is about three inches ; and the greatest elevation from the center of the base to the summit, is one and three-fourths to two inches ; the depth of the central cavity below the plane of the summit being about half an inch. The

length of the cells in the thickest lateral portions of the body, is about three-fourths of an inch.

"This species is less common than either the *R. oweni* or *R. iowensis*. I have received, through Prof. Whitney from Capt. Beebe, of Galena, a very fine specimen for illustration, and others from Mr. Robertson, of Rockford, Illinois." – Geol. Surv. Wisc. Rep. Prog., 1861, p. 15.

Receptaculites infundibulum.

PLATE V, FIGS. 1 AND 2.

Receptaculites infundibulum HALL, Geol. Surv. Wisc. Rep. Prog. 1861, p. 16; *R. infundibulus* HALL, 20th Rep. State Cab. N. Y. p. 390 (Revised Edit. p. 435).
Ischadites tessellatus (WINCH. & MARCY) HALL, Mem. Bost. Soc. Nat. Hist. Vol. I, 1865, p. 35, pl. ii, fig. 1.

"*Description.*—Entire form of body unknown. The center is an infundibuliform cavity, having a depth of one and a half inches with the same diameter of the summit; cells arranged in radiating curved lines; the lines of cell wall in one direction apparently curving very little, while the other seems to have a greater curve; cell apertures quadrangular and nearly square within the central area, beyond this they are undetermined.

"This species is described from some fragments in the limestone of Racine, from the collection of T. J. Hale. The geological horizon is that of the Niagara group, of New York."—Geol. Surv. Wisc. Rep. Prog., 1861, p. 16.

Prof. J. Hall considers the specimen described and figured by Profs. Winchel and Marcy (loc. cit.) as identical. The cells are shown much larger in their figure, but the form is the same.

Receptaculites hemisphericus.

PLATE V, FIGS. 3 AND 4.

Receptaculites hemisphericum HALL, Geol. Surv. Wisc. Rep. Prog. 1861, p. 16.—WHITF. Geol. Wisc. Vol. IV, p. 269, pl. xiii, fig. 4.

"*Description.*—Body hemispheric, convex above, the center not depressed. Cells arranged in radiating curved lines, which cross each other as in the other species of the genus. Cell apertures sharply defined, rhomboidal, opening by a round contracted orifice into the cylindrical tubes below.

"The organic center from which the cells radiate (in two specimens) is elevated, and does not quite correspond with the center of the mass. The central cells are very minute, those near the margin having a diameter five or six times as great.

"This species has nearly the same diameter as *R. iowensis*, but the cells are proportionally large, and the rhomboidal apertures more sharply defined, while the center is not broadly depressed as in that one; but widely and sometimes almost hemispherically convex, with a slight depression on one side of the organic center.

"*Geological formation and locality.*—In the limestone of Racine of the horizon of the Niagara limestone of New York."—Geol. Surv. Wisc. Rep. Prog., 1861, p. 16.

Genus **Graptolithus** *Linn.*

Graptolithus (Diplograptus) peosta.

PLATE V, FIG. 12.

Graptolithus (Diplograptus) peosta HALL, Geol. Surv. Wisc. Rep. Prog. 1861, p. 17.

"*Description.*—Stipe (simple ?) robust, rounded on the surface, with section broad-oval; very gradually widening from base, having a width of about eight-hundredths of an inch; cellules narrow-elongate, about twenty-six in the space of an inch; length about three and a half times the width of the cell, the free portion being about one-third the length; inclined to the axis at an angle of about 35°; extremities of the cells truncate, the apertures somewhat quadrangular and rounded on the sides. Cell partitions strong and well defined, reaching nearly to the center of the stipe in its lower part, leaving a very narrow space for the common body, which becomes wider above. Surface transversely striated or wrinkled.

"*Geological formation and locality.*—In the shales of the Hudson River group in Wisconsin, Iowa and Illinois."—Geol. Surv. Wisc. Rep. Prog., 1861, p. 17.

This species occurs in the shales of Makoqueta Creek in Iowa, at an horizon which must be near that of the Utica Slate of New York.

Genus **Dictyonema** *Hall.*

Dictyonema neenah.

PLATE V, FIG. 13.

Dictyonema neenah HALL, Geol. Surv. Wisc. Rep. Prog. 1861, p. 17.

"*Description.*—Frond spreading, infundibuliform, reticulate, the radiating branches slender, direct, a very little undulating, the transverse connecting

filaments more slender than the branches; reticulations quadrangular or oval, the length from one and a half to twice the width; from six to seven and a half in the space of half an inch, and transversely from twelve to fourteen in the same distance. Serrations or cellules not determined.

"This species is deeply funnel-shaped, the branches but slightly diverging and the intercalated or implanted branches at distant intervals. The matrix is a compact granular limestone, a substance unfavorable to the preservation of the cellules or of the finer markings of the surfaces.

"In the form and proportions of the cellules and the greater proportional width of the connecting filaments, this species differs from any of those described.

"*Geological formation and locality.*—In the Trenton limestone of the Fox River, near Appleton, Wisconsin."—Geol. Surv. Wisc. Rep. Prog., 1861, p. 17.

CRINOIDEA.

Genus **Melocrinus** *Goldfuss.*

Melocrinus nodosus.

PLATE V, FIG. 14.

Melocrinites nodosus HALL, Geol. Surv. Wisc. Rep. Prog. 1861, p. 19.

"*Description.*—Body pyriform, base truncate, gradually expanding to the top of the radial plates; dome rounded and more or less convex. Basal plates four, strongly nodose, extended laterally, and one-half or more of the entire width occupied by the articulating facet of the column, which is deeply inserted. Radial plates three; the first largest and heptagonal; the second smaller and hexagonal; the third heptagonal. Interradial plates in series of one, two, and three: the first hexagonal and as large as the second radial; the second hexagonal and a little smaller than the third radials; the third smaller and somewhat irregular. The oval side is not usually distinguishable from the others, unless it be sometimes in a series of two larger plates above the second range in the interradial area. The dome consists of numerous small polygonal plates with a central or sub-central aperture or proboscis.

"The third radial is a bifurcating plate, and upon the upper sloping sides rest brachial plates; of which there are two or three ranges below the free arms. Arms two from each ray, the structure unknown. The surface is marked by strong rounded tubercles, a single one on each plate, which, at

its base, occupies the greater part of the area of the plate. These nodes are sometimes much elongated and smoothly rounded at the summit (and rarely, a little contracted below). The dome plates are slightly nodose, often a little pointed, but in this respect variable.

"This is a well-marked species, and the specimens vary in height from less than half an inch, to an inch and three-eighths without important differences. When well preserved, the projecting arm-bases give a somewhat pentalobate aspect when viewed from the summit.

"*Geological formation and locality.*—In the drift about Milwaukee, supposed to be from rocks of Devonian age."—Geol. Surv. Wisc. Rep. Prog., 1861, p. 19.

LAMELLIBRANCHIATA.

Genus **Tellinomya** *Hall.*

Tellinomya inflata.

PLATE VI, FIGS. 10–12.

Tellinomya inflata HALL, Geol. Surv. Wisc. Rep. Prog. 1861, p. 26; Geol. Wisc. 1862, p. 38, figs. 4 and 5, woodcut.

"*Description.*—Shell of medium size, extremely gibbous, and inflated at the middle of the sides, abruptly attenuate towards the posterior end; the length a little greater than the breadth, and the thickness a little less; the hinge line, from a little anterior to the beak to the posterior end of the shell, is nearly straight, the anterior end obliquely truncate above the middle, the basal margin strongly and regularly rounded from the anterior truncation to the posterior extremity of the hinge line—the meeting of the curved lower and straight upper margin giving a sub-nasute extremity. Umbones prominent, very full and rounded, the beaks closely incurved, the apices minute. Surface marked by concentric ridges of growth parallel to the margin of the shell.

"This species has some resemblance to *T. ventricosa*, in its form and general outline; but it is much broader in proportion to the length, less attenuate posteriorly, the beaks are nearest to the anterior, and the basal margin is destitute of the sinus which exists in that species.

"Length nearly seven-eighths of an inch, height three-fourths of an inch.

"*Geological formation and locality.*—In limestone of the age of the Trenton limestone; at Mineral Point, Wisconsin."—Geol. Surv. Wisc. Rep. Prog., 1861, p. 26.

Tellinomya alta.

PLATE VI, FIGS. 5–8.

Tellinomya alta HALL, Geol. Surv. Wisc. Rep. Prog. 1861, p. 27.
Compare *Ctenodonta ? astarteformis* SALTER, Can. Org. Rem. Dec. I, p. 39, pl. viii, fig. 7.
" *Ctenodonta intermedia* ULRICH, Low. Sil. Lamellib. of Minnesota, p. 601, pl. xlii, figs. 95–97.
" *Ctenodonta recurva* ULRICH, *ibid.* p. 603, pl. xlii, figs. 98–101.
" *Ctenodonta similis* ULRICH, *ibid.* p. 604, pl. xlii, figs. 102–106.
" *Ctenodonta compressa* ULRICH, *ibid.* p. 600, pl. xxxvii, fig. 29.

"*Description.*—Shell small, sub-triangular, with rounded basal margin; valves depressed-convex. The anterior and posterior portions of the hinge-line are nearly straight from between the beaks to beyond the muscular impression, and stand nearly at right angles to each other. The distance from the beaks to the base of the shell is usually equal or nearly equal to the length.

"The muscular impressions are large and moderately distinct; the posterior one elevated on the dorsal side with a broad, low ridge (depression on the cast) passing from near the beak to the scar. The hinge plate is marked by from twenty to twenty-five very small curved teeth on the posterior side, and from ten to fifteen on the anterior side.

"This species differs from *T. astartæformis* (*Ctenodonta ? astartæeformis*, Salter, Canadian Organic Remains, Decade I, page 27,) in the more erect beaks and in the different form of the posterior basal margin.

"*Geological formation and locality.*—In limestone of the age of the Trenton limestone; Dodgeville, Wisconsin."—Geol. Surv. Wisc. Rep. Prog., 1861, p. 27.

I am inclined to consider all the above-cited forms as specifically identical, as I find all of them represented among the specimens included under the name *T. alta* in the Hall Collection. They represent only individual conditions dependent upon the state of preservation, or as internal casts or exteriors of the shell. Those from Dodgeville and Beloit, Wis., being internal casts, show features like the casts figured by Mr. Ulrich; while those from Mineral Point, Wis., which retain the shell, present the features shown in Salter's figures and those figured under the names of *C. recurva*, *C. compressa*, and *C. similis* by Mr. Ulrich. I do not see where any specific line can be drawn between them. Among our specimens there might be other species made with equal reason were one so disposed.

Tellinomya ventricosa.

PLATE VI, FIGS. 1-4.

Tellinomya ventricosa HALL, Geol. Surv. Wisc. Rep. Prog. 1861, p. 27; Geol. Wisc. 1862, p. 38, fig. 3, internal cast.
Ctenodonta gibberula (SALTER) ULRICH, Low. Sil. Lamellib. of Minn. p. 587.

"*Description.*—Shell sub-rhomboidal, extremely ventricose, with strong incurved beaks, the anterior dorsal and ventral margins sub-parallel, the posterior end obliquely truncate, the anterior end broadly rounded, and continuing into the basal margin; posterior umbonal slope somewhat angular, with a slight sulcus just anterior to it, which passes from near the beak to the base. Surface marked by obscure concentric striæ of growth.

"The interior is marked by large, double, profoundly deep muscular impressions; the principal scars are abruptly depressed on the inner margins, the minor scars faintly marked except on old individuals. The hinge plates are of medium width and contain about eight or ten slightly-curved teeth on the anterior side of the beak, and from twelve to fourteen on the posterior side; beaks (in the cast) rather distant. The internal cavity of the shell is deep.

"This species somewhat resembles *T. contracta* (*Ctenodonta contracta*, Salter, Canadian Organic Remains, Decade I, Pl. VIII, Figs. 4 and 5); but differs in the greater proportional length, greater breadth of the anterior end, and greater obliquity of the posterior slope. The shell is more ventricose, the beaks nearest to the posterior end (instead of the anterior) and the muscular impressions more deeply marked.

"*Geological formation and locality.*—In the rocks of the age of the Trenton limestone group; the buff limestone, at Beloit, Janesville and Mineral Point, Wisconsin; at Dubuque, Iowa, the Falls of St. Anthony, and other places."—Geol. Surv. Wisc. Rep. Prog., 1861, p. 27.

I think there is much doubt as to this species being identical with the one described and figured by Mr. Salter in the Canadian Decade II, as *Ctenodonta gibberula*, as stated by Mr. Ulrich; there is a much greater disproportion in the length of the narrow end of the shells, the Wisconsin specimens being generally much longer accordingly than the Canadian ones. My own impression is that this species and *T. inflata* are much more nearly

related than this is to the Canadian form. In fact I am strongly of the opinion that they are identical, but I have not been able to get a good imprint of the exterior of *T. ventricosa* to compare with *T. inflata*. Mr. Ulrich figures on p. 599 of the work above cited a cardinal and a lateral view of what he calls *C. gibberula* Salter, from Tennessee. If his identification there is correct and his figures are correct, *C. gibberula* differs remarkably from *ventricosa* in the former having a strongly-impressed area (*lunule* or *escutcheon* ?) on one end of the shell which *T. inflata* does not possess.

Tellinomya ovata.

PLATE VI, FIG. 9.

Tellinomya ovata HALL, Geol. Surv. Wisc. Rep. Prog. 1861, p. 28.
Compare *Ctenodonta subnasuta* ULRICH, Low. Sil. Lamellib. Minn. p. 58, pl. xlii, fig. 30.

"*Description.*—Shell ventricose, sub-ovate ; cardinal line straight or very little curved ; anterior end broad, obliquely truncate; posterior end short, narrow; basal margin broad rounded, a line drawn from its junction with the anterior and posterior slopes passes across the middle of the shell ; beaks small, not prominent, curved, directed towards the anterior end. Valves gibbous at the anterior and attenuate at the posterior end; the length, breadth and thickness of the valves when compared are seven, six and five. Surface of shell smooth or marked by a few concentric lines of growth of moderate strength.

"This species resembles *T. nasuta;* but the beaks are more nearly central, and the posterior end is not produced in the same manner. The basal line is regularly curved and does not show the contraction on the posterior side of the middle of the base which is observed in that species.

"*Geological formation and locality.*—In the Trenton group (buff limestone), Beloit, Wisconsin."—Geol. Surv. Wisc. Rep. Prog., 1861, p. 28.

I see no reason to consider this as distinct from *T. nasuta*, the variation from the typical form being so slight as to be easily within the range of specific variation. The *Ctenodonta subnasuta* of Mr. Ulrich is probably only a young individual of the same species.

Genus **Cypricardites** *Conrad.*

Cypricardites rotundatus.

PLATE VI, FIGS. 13–16.

Cypricardites rotundatus HALL, Geol. Surv. Wisc. Rep. Prog. 1861, p. 29.—WHITF. Geol. Wisc. Vol. IV, p. 208, pl. v, fig. 11.
Compare *Vanuxemia dixonensis* ULRICH (not MEEK & WOR.), Low. Sil. Lamellib. of Minn. p. 550, pl. xxxviii, figs. 1–5, and var. *insueta*, figs. 6 and 7.
" *Vanuxemia suberecta* ULRICH, *ibid.* p. 553, pl. xxxviii, figs. 20–22.
" *Vanuxemia media* ULRICH, *ibid.* p. 553, pl. xxxviii, figs. 23–26.
" *Vanuxemia crassa* ULRICH, *ibid.* p. 553, pl. xxxviii, fig. 27.
" *Cyrtodonta obesa* ULRICH, *ibid.* p. 542, pl. xxxix, figs. 8–10; also *C. gibbera* ULRICH, p. 542, pl. xxxix, figs. 13–15.

"*Description.*—Shell sub-globose, height and width nearly equal and thickness about four-fifths as great as the height from beak to base; beaks slightly incurved, cardinal line curved, front rounded, surface smooth or marked by obscure concentric lines of growth. The interior of the hinge plates marked by two lateral teeth and about four oblique cardinal teeth. Anterior muscular impression of moderate size, distinct; posterior impression obscure, pallial impression very distinct on the anterior end.

"Length three-fourths to one inch; the greatest height a little more than the length.

"*Geological formation and locality.*—Trenton group (buff limestone), Beloit, Wisconsin."—Geol. Surv. Wisc. Rep. Prog., 1861, p. 29.

This is an abundant species at Beloit, Janesville and elsewhere in the Trenton beds of Wisconsin, and shows considerable variation in form and ventricosity, according to age and the thickening of the shell. In the breadth of the hinge plate and the development of the teeth, they vary in almost every individual as seen in the casts. I should consider all of the species cited above as belonging to this species, judging from the figures given by their author. There may be an exception possibly in case of the last two named, viz.: *C. obesa* and *C. gibbera*, but so far as one can see from the figures they may be only young shells. The tenuity of the posterior part of the valves is the only feature apparent that would be an objection to this view, in absence of a knowledge of the hinge structure, as in both cardinal views given on the author's plates, there appears to be an attempt at defining a cardinal area.

Cypricardites niota.

PLATE VI, FIGS. 17-20.

Cypricardites niota HALL, Geol. Surv. Wisc. Rep. Prog. 1861, p. 29; Geol. Wisc. 1862, p. 38, fig. 8.—WHITF. Geol. Wisc. Vol. IV, p. 208, pl. v, fig. 10.
Vanuxemia niota (? HALL) ULRICH, Low. Sil. Lamellib. Minn. p. 560, pl. xxxviii, fig. 35.
Compare *Cyrtodonta glabella* ULRICH, *ibid.* pl. xxxix, figs. 37-40.
" *Cyrtodonta rolulata* ULRICH, *ibid.* pl. xxxix, figs. 16-19.

"*Description.*—Shell broadly sub-ovate, broadest at the posterior end; umbones very gibbous; beaks incurved, little elevated, situated about one-fourth of the length of the shell from the anterior end. Cardinal line straight or little curved; anterior, posterior and basal margins rounded.

"Anterior muscular impression situated near to the cardinal line, well defined; posterior imprint obscure. Surface of the shell marked by concentric lines of growth.

"This species differs from *C. rotundatus* in being more oblique, in the straighter cardinal line, and less ventricose form. It is intermediate between that species and *C. ventricosus*, from which it differs in the less obliquity and the greater length from beak to base.

"Length one inch and a quarter, height one inch.

"*Geological formation and locality.*—In Trenton limestone (buff limestone), Beloit and Chaupierre, Wisconsin."—Geol. Surv. Wisc. Rep. Prog., 1861, p. 29.

This is a well-marked species, but like all shells is subject to some variation of form. This will be more extreme in internal casts than in the shells themselves, as the difference in size and age, in the thickening of the shell and width of the hinge plate, must exert an influence on the outline of the cast; also the possibility of the valves having been slightly separated, so that the sediment may have gotten between the hinge plates so as to cause them to be represented in a greater or less degree; while in case of single valves represented by casts, the outline of the entire hinge plate is often represented, which makes a very different figure from a cast of both valves together without the imprint of the hinge plate. All these features ought to be considered in the determination of a species. If one takes a pair of valves of any living Lamellibranch having a broad hinge plate, and makes a cast of its interior in different phases, as I have done in the study of the New Jersey Cretaceous fossils, he will soon be convinced that in casts of shells a considerable latitude is to be allowed for these variations, and will be convinced that nature did not produce so many species as are given by some authors. Mr. Ulrich expresses doubt as to the identity of the specimen

figured in the Geology of Wisconsin, Vol. IV, Pl. V, Fig. 10, and that described by Professor Hall; I can assure him that there is not the slightest specific or varietal difference whatever, nor do I believe there is between those and the forms cited at the head of this species.

Cypricardites rectirostris.

PLATE VI, FIGS. 21–25.

Cypricardites rectirostra HALL, Geol. Surv. Wisc. Rep. Prog. 1861, p. 29.
Compare *Vanuxemia wortheni* ULRICH, Low. Sil. Lamellib. Minn. p. 561, pl. xxxix, figs. 6 and 7.

"*Description.*—Shell somewhat elongate-ovate, gibbous in old specimens, young individuals moderately convex; beaks elevated, distant, scarcely incurved; hinge line but little curved; anterior end short, posterior end forming the greatest length of the shell; basal margin making nearly a semicircular curve. Interior (as shown in casts,) with strongly-marked muscular imprints; the anterior one having its cardinal margin excavated out of the hinge plate, not deeply seated, somewhat reniform; the posterior imprint situated at near half its diameter below, extremities of the lateral teeth irregularly oval; pallial impressions usually distinctly marked, sometimes bounded by an elevated ridge, in casts, showing a depression in the shell. Lateral teeth situated obliquely to the hinge line, four in number, cardinal teeth several, the precise number not determined. Cavity of the beaks deep. External surface of shell unknown. Length from one and a quarter inches to two inches, height from summit of beak to base greater than the length.

"This species differs conspicuously from all others except *C. rotundatus* in the highly elevated and nearly straight beaks; and from that species in the proportionally greater distance from the beaks to the base of the shell, and the less rounded outline. The beaks of that species are much more curved than in this.

"*Geological formation and locality.*—Trenton limestone group (Buff limestone), at Janesville, Wisconsin, and near Dubuque, Iowa."—Geol. Surv. Wisc. Rep. Prog., 1861, p. 29.

The casts of this species, when held with the line of the hinge in a horizontal position, have some resemblance to those of *C. niota* Hall, but the erect beaks, which are much more elevated and not incurved as in *niota*, will readily distinguish it.

Genus **Modiolopsis** *Hall.*

Modiolopsis plana.

PLATE VII, Figs. 12 & 13, AND 14 & 15?.

Modiolopsis plana HALL, Geol. Surv. Wisc. Rep. Prog. 1861, p. 30; Vol. I, 1862, p. 38, fig. 6.
Eurymya plana ULRICH, Low. Sil. Lamellib. Minn. p. 512, pl. xxxvi, figs. 27 and 28.
Compare *Vanuxemia decipiens* ULRICH, Low. Sil. Lamellib. Minn. p. 562, pl. xxxix, figs. 1–5.
" *Cyrtodonta obesa* ULRICH (pars.), *ibid.* pl. xxxix, figs. 11 and 12, *young*.
" *Cyrtodonta parva* ULRICH, *ibid.* pl. xxxix, figs. 24 and 25.

"*Description.*—Shell, small compressed, the length a little greater than the breadth, wider posteriorly. Cardinal line straight from the beaks to the posterior end, having a sub-alate appearance; somewhat narrowly rounded anteriorly, the basal margin straight, or but little curved, except at the anterior end. Posterior end obliquely truncate. Beaks small, but little or not at all incurved; umbonal slope moderately prominent, and sub-angular. In the casts, the anterior muscular impression is distinctly double, and well marked, the upper one situated close to the cardinal border; the posterior impression is larger and double, but less distinct, situated about two-thirds the distance from the beaks to the posterior margin; pallial line entire and somewhat distinctly marked.

"Surface marked by strong concentric lines of growth. Length about three-fourths of an inch.

"This species resembles the *M. subspatulatus* more than any other species known to me, but is much more oblique, has a proportionally longer hinge line, is more alate, and the umbonal slope continues to the junction of the basal and posterior margins. The truncation of the posterior end is a feature which will at once distinguish it from that species.

"*Geological formation and locality.*—In the Trenton limestone group (Buff limestone); at Beloit, Wisconsin."—Geol. Surv. Wisc. Rep. Prog., 1861, p. 30.

Modiolopsis ? superba.

PLATE VII, FIGS. 16–18.

Modiolopsis ? superbus HALL, Geol. Surv. Wisc. Rep. Prog. 1861, p. 31.

"*Description.*—Shell large elongate, sub-elliptical in outline; cardinal line very slightly curving throughout its entire length, and reaching no more than half the distance from the beaks to the posterior extremity of the shell.

The posterior margin from its junction with the hinge line, is but little curved till near the extremity of the shell, where it is abruptly rounded to the base line, which is gently arcuate throughout its entire length except a slight sinuosity caused by a gentle depression extending obliquely from the anterior side of the beaks to the basal margin a little behind the beaks, anterior end narrow and abruptly rounded. Beaks moderately elevated, gently incurved and approximate, situated about one-sixth of the entire length of the shell from the anterior end; a strong rounded or sub-angular umbonal ridge extends from the beaks to the postero-basal extremity of the shell, becoming more gently rounded as it recedes from the beaks.

"Surface marked by strong concentric undulations, parallel to the lines of growth.

"This is a large and fine species, equalling the *M. modiolaris* in size, but possessing some peculiarities which make the propriety of its reference to the genus doubtful.

"*Geological formation and locality.*—In limestone of the age of the Trenton limestone (Buff limestone), Beloit, Wisconsin."—Geol. Surv. Wisc. Rep. Prog., 1861, p. 31.

Genus **Ambonychia** *Hall.*

Ambonychia lamellosa.[1]

PLATE VII, FIGS. 5-7.

Ambonychia lamellosa[1] HALL, Geol. Surv. Wisc. Rep. Prog. 1861, p. 31.—WHITF. Geol. Surv. Wisc. Vol. IV, p. 205, pl. v, fig. 5.
Clionychia lamellosa (HALL) ULRICH, Low. Sil. Lamellib. Minn. p. 494, pl. xxxv, figs. 10-14.
Ambonychia erecta HALL, Geol. Surv. Wisc. Rep. Prog. 1861, p. 32.
Clionychia nitida ULRICH, Low. Sil. Lamellib. Minn. p. 495, pl. xxxv, figs. 15 and 16.

"*Description.*—Shell obliquely sub-ovate in outline, with ventricose valves, becoming compressed and attenuate towards the extremity of the hinge line. Beaks slender, pointed and directed forwards. Hinge line straight, a little less than the greatest width of the shell. Anterior margin rather deeply impressed in the upper part, and in some specimens showing a shallow sinus, making what appears to have been a byssal opening; the lower part is regularly rounded into the basal margin. The posterior end is somewhat squarely truncate from the extremity of the hinge line and gradually curving below.

[1] The name of this species was originally printed *A. cancellosa*, by typographical error, but is corrected in the margin in my copy of the Report of Progress to *A. lamellosa*.—R. P. W.

"Surface marked by numerous strong concentric flattened lamellose ridges, without visible radiating striæ in the partially exfoliated shell.

"On casts, the large muscular impression is of a circular form, and is situated on the posterior side of the shell at about half its diameter below the hinge line, leaving a distinct depression reaching nearly to the beak, from its advancing with the growth of the shell.

"This species is easily distinguished from any other known to me, by its form and lamellose surface, which is not strongly ridged as in the *A. undata* of the Trenton limestone in New York.

"*Geological formation and locality.*—In the Trenton limestone group at Mineral Point, and opposite to Dubuque, in Wisconsin."—Geol. Surv. Wisc. Rep. Prog., 1861, p. 31.

This species is subject to some slight variation in the casts, part of which may be due to compression exerted in different directions, some to the thickening of the shell at the beak, giving a longer or shorter and consequently more obtuse or a more attenuate cast of this part. Some of the variation is undoubtedly owing to a natural variation of the outline or to additional gibbosity of the valves in the living shell. The *Ambonychia erecta* of Hall is unquestionably specifically identical, at least in the two imperfect casts bearing his label in his own handwriting, now in the Museum collection. In one from Janesville, Wis., the beak is obtuse and the hinge-line and anterior border as nearly at right angles to each other as possible, while in the one from Beloit the beak is more attenuate and the angle formed by the two lines very slightly obtuse. Taking them all together I see no reason to doubt the exact identity of the two forms. *Clionychia nitida* Ulrich is probably a young shell of the same species.

Ambonychia planistriata.

PLATE VII, FIGS. 3 AND 4.

Ambonychia planistriata HALL, Geol. Surv. Wisc. Rep. Prog. 1861, p. 32.—ULRICH, Low. Sil. Lamellib. Minn. p. 491, pl. xxxv, figs. 3 and 4.

"*Description.*—Shell obliquely sub-ovate, with moderately convex valves, most convex a little anterior to the centre; the anterior side full and rounded, less ventricose posteriorly. Hinge line straight, less than the greatest width of the shell. Anterior and posterior margins broadly rounded. Beaks strong, projecting above the hinge and slightly incurved.

"Surface marked by distant concentric undulations, and by moderately fine radiating striæ, which are flattened and have very narrow interspaces.

"This species differs from the preceding in the less obliquity of the valves in the shorter hinge line and in the radiating striæ. It is more nearly related to *A. orbicularis*, of the New York rocks, but is a little more oblique, less extended anteriorly, not so ventricose, and the radiating striæ are stronger.

"*Geological formation and locality.*—In limestone of the age of the Trenton limestone of New York, at Mineral Point and Beloit, Wisconsin."—Geol. Surv. Wisc. Rep. Prog., 1861, p. 32.

Ambonychia erecta.

PLATE VII, FIGS. 1 AND 2.

Ambonychia erecta HALL, Geol. Surv. Wisc. Rep. Prog. 1861, p. 32.

"*Description.*—Shell sub-quadrangular in outline with convex valves, hinge line straight, as long as the greatest width of the shell, forming a little less than a right angle with the anterior border. Posterior slope nearly parallel with the anterior. Basal margin strongly rounded. Beaks in the casts, small, abruptly attenuate, projecting little above the hinge line.

"Surface (as indicated in casts) marked by concentric undulations only.

"This species differs from the preceding in the more quadrangular form and erect position of the beaks.

"*Geological formation and locality.*—In the rocks of the age of the Trenton limestone of New York, at Beloit, Wisconsin."—Geol. Surv. Wisc. Rep. Prog., 1861, p. 32.

See remarks on this species under *A. lamellosa*.

Ambonychia attenuata.

PLATE VII, FIGS. 8–11.

Ambonychia attenuata HALL, Geol. Surv. Wisc. Rep. Prog. 1861, p. 33.—WHITF. Geol. Surv. Wis. Vol. IV, p. 206, pl. v, fig. 6.

"*Description.*—Shell elongate-ovate, widest below the middle; width a little more than two-thirds the length; attenuate at the beaks; ventricose in the middle, regularly arcuate from the beak to the base; hinge line straight, a little more than one-third as long as the greatest length of the shell, and

very oblique to the axis. Beaks elevated and directed forward, obtusely pointed and incurved at their extremity. Surface character unknown, except a few undefined concentric undulations upon the casts.

"This species, in form, is somewhat like *A. bellastriata* of the Trenton limestone in New York; but the shell is proportionately more elongated, the anterior side straighter and the umbones and beaks less curved forward.

"*Geological formation and locality.*—In the Buff limestone, age of Trenton limestone of New York, at Beloit, Wisconsin."—Geol. Surv. Wisc. Rep. Prog., 1861, p. 33.

GASTEROPODA.

Genus **Pleurotomaria** *De France.*

Pleurotomaria niota.

PLATE VIII, FIG. 11.

Pleurotomaria niota HALL, Geol. Surv. Wisc. Rep. Prog. 1861, p. 33.

"*Description.*—Shell large, broadly sub-conical, the diameter through the last volution equal to about four-fifths of the height, consisting of six volutions, which are flattened on the periphery, with a very slightly concave space upon the upper side, extending to the suture; lower side rounded into the moderately large umbilicus, the last volution large and ventricose.

"Surface character unknown, except a few undefined undulations near the extremity of the last volution, which are more distinct below than above.

"This species is intermediate in form, between *P. subconica* and *P. bicincta;* resembles the first very closely in general outline, except that the volutions are a little too convex above the centre, and the flattening of the periphery is much greater than the narrow carina of that species; and in casts there is a more distinct suture line. From the latter it differs in its much greater size, in its greater breadth in proportion to its elevation, and in the volution being less angular above the centre, and in having a wide flattened space on the periphery, instead of the narrow carina of that species.

"*Geological formation and locality.*—In the Buff limestone, of the age of the Trenton limestone group of New York."—Geol. Surv. Wisc. Rep. Prog., 1861, p. 33.

Pleurotomaria nasoni.

PLATE VIII, FIGS. 4–7.

Pleurotomaria nasoni HALL, Geol. Surv. Wisc. Rep. Prog. 1861, p. 34.
Raphistoma nasoni (HALL) WHITF. Geol. Surv. Wisc. 1882, Vol. IV, p. 215, pl. vi, figs. 2 and 3.

"*Description.*—Shell very depressed conical, the elevation of the spire being little more than half as great as the breadth across the base, consisting of four or five volutions, which increase very gradually from the apex. The upper side of the inner volutions somewhat rounded, becoming more flattened in the outer ones, with a distinct depression near the outer angle which in some specimens extends a little more than half way from the edge of the suture. Under side obtusely rounded into the umbilicus, which (in casts) is large and shows about one-third the width of each of the preceding volutions.

"Surface characters unknown.

"This species is somewhat related to *P. lenticularis* of the Trenton limestone of New York, but the spire is much more elevated, the volutions more distinct and more elevated one above the other, and the lower side is more ventricose, giving a wider periphery.

"*Geological formation and locality.*—In the 'Buff limestone' of the age of the Trenton limestone of New York, at Beloit, Wisconsin."—Geol. Surv. Wisc. Rep. Prog., 1861, p. 34.

This shell appears to possess all the features requisite for a true *Raphistoma*.

Pleurotomaria semele.

PLATE VIII, FIGS. 8–10.

Pleurotomaria semele HALL, Geol. Surv. Wisc. Rep. Prog. 1861, p. 36.

"*Description.*—Shell sub-conical; spire ascending; height and breadth nearly equal, consisting of four or five rounded or sub-angular volutions, the last one ventricose, sub-angular on the periphery, regularly rounded below into the small umbilicus. Aperture round.

"Surface marked by a sub-angular carina a little below the suture, and on the periphery by a moderately broad revolving band, sharply elevated at the margins and concave in the middle. Entire surface marked by sharp, elevated, closely arranged, concentric striæ, which are curved abruptly backwards from the suture to the revolving band, on which they make a shallow retral curve, and below the band, have a gentle forward curvature in passing downward to the umbilicus. Height a little more than one inch; width three-fourths of an inch.

"This species differs from any other known in the lower Silurian rocks, in the form of the volutions and surface markings.

"It may be that this is a *Murchisonia*, the elevation of the spire being greater than the width of the shell; but the aperture is too imperfect to determine it.

"*Geological formation and locality.*—In the shales above the Galena limestone, at Makoqueta Creek."—Geol. Surv. Wisc. Rep. Prog., 1861, p. 36.

Although originally described as a *Pleurotomaria*, with an expressed doubt as to the correctness of the generic relation, I think there is no doubt that the shell is a true *Murchisonia*, unless it prove to be a *Lophospira*. The geological position being above the Galena limestone would make it either Hudson River or perhaps Utica, as it is in the graptolite horizon.

Genus **Maclurea** *Leseuer.*

Maclurea bigsbyi.

PLATE VIII, FIGS. 12–15.

Maclurea bigsbyi HALL, Geol. Surv. Wisc. Rep. Prog. 1861, p. 37.—WHITF. Geol. Wis. Vol. IV, p. 222, pl. vi, figs. 17 and 18.

"*Description.*—Shell thin, of medium size, discoid, consisting of about four volutions, with the umbilical (flat) side very slightly depressed in the middle, and having the outer margin of each volution slightly elevated above the inner or umbilical margin, which, although attached to the preceding one a little below the angle, gives a depression to the centre of the plane by reason of the greater breadth of the outer volution. Upper side very convex, giving an almost hemispherical outline to this side, with a rather broad umbilical cavity, the upper margins of which are rounded.

"Surface marked on the periphery by strong revolving striæ, and on the convex side by strong, closely arranged and but little elevated striæ. Diameter one to two inches.

"This species differs from the *M. magna*, of the Chazy limestone, in its greater depth and the more ventricose volutions. From *M. logani*, of Salter Canadian Organic Remains, Dec. 1, Vol. I, it differs in the less rapidly increasing volutions.

"*Geological formation and locality.*—In the limestone of the Trenton group (Buff limestone), at Mineral Point, Fulton and Janesville, Wisconsin."—Geol. Surv. Wisc. Rep. Prog., 1861, p. 37.

Genus **Ecculiomphalus** *Portlock.*

Ecculiomphalus undulatus.

PLATE VIII, FIGS. 1–3.

Ecculiomphalus undulatus HALL, Geol. Surv. Wisc Rep. Prog. 1861, p. 37.

"*Description.*—Shell consisting of one or two volutions, spirally coiled, but distantly separated from each other, rapidly increasing in size from the apex, and of a sub-triangular or ovato-triangular form, the upper side being convex and curving to the ventral margin; the dorsum is somewhat flattened, and the lower side sloping with a gentle curve from the lower lateral angle to the ventral side, which is narrow and sharply rounded. Along the ventral side and a little below the centre there is a narrow, abruptly depressed groove, which extends the entire length of the shell.

"Surface of the shell marked by obscure undulations, which are most distinct on the lower lateral angle, also on the lower side by two or three revolving ridges. Fine transverse lines of growth parallel to the margin of the aperture, are visible over the greater part of the surface of the specimen, which is essentially a cast of the interior.

"*Geological formation and locality.*—In the Buff limestone of the Trenton limestone group, at Beloit, Wisconsin."—Geol. Surv. Wisc. Rep. Prog., 1861, p. 37.

This species differs from others of the genus described in the undulations of the surface, which on the cast are strongly marked, and also in the spiral or revolving ridges.

CEPHALOPODA.

Genus **Lituites** *Breyneus.*

Lituites undatus, var. occidentalis.

PLATE X, FIG. 7; PLATE XI, AND PLATE XII, FIG. 3.

Lituites undatus, var. *occidentalis* HALL, Geol. Surv. Wisc. Rep. Prog. 1861, p. 38.

"In the 'Buff limestone,' of Wisconsin, there occurs a large Lituites, which has usually been referred to the *Lituites undatus* of the Black River limestone of New York. On comparing specimens of the two together, I

find several important differences, which could scarcely be expected to happen in so well-marked a species as the *L. undata*, as it occurs in the New York rocks. In specimens of about the same size, the volutions of the Western one are much wider in proportion from the ventral to the dorsal side, they are more flattened on the sides, and the back is squarely truncated; the New York specimens being rounded on the sides and moderately flattened on the back. The volutions in the latter have apparently a greater proportional lateral diameter, and the septa are more distant.

"In consideration of these differences, I have proposed to indicate it as a distinct variety, which hereafter may prove to be specifically distinct.

"*Geological formation and locality*.—In the lower part of the 'Buff limestone,' at Beloit and elsewhere, in Wisconsin."—Geol. Surv. Wisc. Rep. Prog., 1861, p. 38.

Lituites robertsoni.

PLATE X, FIGS. 4-6.

Lituites robertsoni HALL, Geol. Surv. Wisc. Rep. Prog. 1861, p. 38.

"*Description*.—Shell discoid, consisting of three or four volutions. Volutions ventricose, very slightly embracing, rounded on the sides and somewhat flattened on the middle of the back, the ventral sides being slightly concave, giving a very obtusely quadrangular section to the volution, the lateral diameter of which is a little greater than the dorso-ventral diameter.

"Septa concave, numerous, these being on the back, about six in the space equal to the lateral diameter at the same point. Siphuncle small, situated on the back of the volution, outer chamber very gradually expanding.

"Surface marked by obscure undulating folds, which commence upon the vertical side of the volution, and arching backwards unite with those from the opposite side in low ridges which are bent backwards in a broad sinus upon the dorsum. Lines of growth parallel to the undulations cover the entire surface.

"This species differs conspicuously from *L. undatus* of the Trenton limestone of New York in the much more closely arranged septa, those of that species being less than half the number in the same space where the diameter of the volution is the same.

"*Geological formation and locality*.—In the 'Buff limestone' of the Trenton limestone group, at Beloit, Wisconsin, and Rockford, Illinois."—Geol. Surv. Wisc. Rep. Prog., p. 38.

Genus **Cyrtoceras** *Goldfuss.*

Cyrtoceras whitneyi.

PLATE IX, FIG. 5.

Cyrtoceras whitneyi HALL, Geol. Surv. Wisc. Rep. Prog. 1861, p. 39.

"*Description.*—Shell robust, elongate arcuate, somewhat rapidly tapering, laterally compressed, giving an elliptical section, the lateral diameter being equal to three-fourths the ventral diameter, outer chamber short, septa numerous, but little concave, and exteriorly are directed forward on the dorsum, more closely arranged towards the apex and generally becoming more distant as the shell expands towards the aperture. On one specimen, at a point where the dorso-ventral diameter measures three-fourths of an inch, there are twelve septa in the length of one inch on the dorsum, while in the outer part, where the diameter is less than one inch and one-fourth, there are but six septa in the length of one inch.

"The surface of the shell is exfoliated, but there are distinct traces of longitudinal ridges which are situated at about three times their diameter from each other. In another specimen preserving a portion of the shell, fine concentric lines of growth with more closely arranged longitudinal ridges, are visible.

"*Geological formation and locality.*—In the shales above the Galena limestone, on Makoqueta Creek in Iowa, and also on the east side of the Mississippi River, the particular locality unknown."—Geol. Surv. Wisc. Rep. Prog., 1861, p. 39.

Cyrtoceras neleus.

PLATE IX, FIGS. 10 AND 11.

Cyrtoceras neleus HALL, Geol. Surv. Wisc. Rep. Prog. 1861, p. 40.

"*Description.*—Shell of small or medium size, very gradually expanding from the apex and strongly curved, transverse section circular, or sub-circular, very obtusely sub-angular on the back in casts, most ventricose on the ventro-lateral region. Septa closely but not evenly arranged, averaging about nine in a space equal to the transverse diameter of the shell, curving forward on the dorsal side, their margins undulated especially towards the outer chamber, where they become crowded. On the ventral side the septa have a broad advancing curve. The exposed surface of the septa show the greatest concavity a little on the ventral side of the centre. Siphuncle dorsal, comparatively large.

"Surface marked by transverse, slightly undulating annulations, which are strongly and abruptly curved backwards on the dorsum. Diameter of large specimens five-eighths of an inch.

"This species differs from *C. lamellosum* Hall, 1847; *C. halleanus* D'Orbigny, 1850; *C. billingsi* Salter, 1859 (Canadian Organic Remains, Decade I.), not *C. lamellosum* of De Verneuil, 1842, in the more gradual and equal curvature, the much less rapid expansion, (the expansion being only one-sixteenth of an inch in a length of one inch and a quarter), and in the position of the siphuncle, which is situated close to the dorsal side.

"*Geological formation and locality.*—In the 'Buff limestone' at Beloit, and forty feet above the base of the Trenton limestone group, Platteville."—Geol. Surv. Wisc. Rep. Prog., 1861, p. 40.

Cyrtoceras eugium.

PLATE IX, FIGS. 3 AND 4.

Cyrtoceras eugium HALL, Geol. Surv. Wisc. Rep. Prog. 1861, p. 40.

"*Description.*—Shell of medium size, strongly curved and very gradually expanding from the apex. Section oblate, very obtusely sub-angular on the back, rounded on the sides, and depressed convex on the ventral side, giving the form of section described, the transverse diameter of which is greater than the dorso-ventral diameter. Septa moderately convex, gently curved forward on the dorsum, and nearly straight on the ventrum; the greatest concavity being a little on the ventral side of the centre. Seven septa measured on the back, occupy a space equal to the transverse diameter. Siphuncle small, dorsal.

"Surface marked by concentric lines of growth.

"This species is remarkable for the oblate, obtusely triangular section, and its very gradual depression towards the aperture, the amount of increase in a length of one and a half inches being scarcely more than one-tenth of an inch. In two specimens examined the septa are more distant and are not crowded towards the aperture as in the preceding species, nor are they bent forward on the ventral side. The siphuncle is proportionally smaller, and the specimens preserve no markings beyond the striæ of growth.

"The specimens are casts and imperfect, the largest one having a diameter of three-fourths of an inch.

"*Geological formation and locality.*—In the 'Buff limestone' of Trenton limestone group, at Beloit, Wisconsin."—Geol. Surv. Wisc. Rep. Prog., 1861, p. 40.

Of the four individuals of this species used in the original description, that now figured is the only one retaining enough of the cast to give specific features more than barely enough for identification.

Cyrtoceras loculosum.

PLATE IX, FIGS. 6–9.

Cyrtoceras loculosum HALL, Geol. Surv. Wisc. Rep. Prog. 1861, p. 42.

"*Description.*—Shell robust, somewhat rapidly increasing in size and strongly curved, abruptly rounded on the dorsal and ventral sides and much compressed laterally, becoming distinctly bilobate towards the outer chamber from the deep rounded channel on each side, which is a little on the dorsal side of the middle.

"In three specimens examined, the dorso-ventral diameter is nearly or quite twice as great as the transverse diameter in the outer portions of the shell, while on the older parts the diameters are more nearly equal, and the depressions upon the sides scarcely marked. Septa moderately concave, numerous, and sometimes very much crowded, strongly undulated across the depressions on the sides; strongly arched forward and produced on the back, the number ranging from sixteen to twenty-four in the space of an inch upon the back, while on the ventral side they are sometimes barely separated.

"Position of the siphuncle and surface characters of the shell unknown.

"This species is quite distinct from any other known to me, in the numerous crowded septa and the strong depressions along the sides, which occur in three specimens in the same relative position. The specimens are casts in magnesian limestone, and no remains of the surface markings are preserved.

"*Geological formation and locality.*—In limestone of the age of the Trenton group of New York, at Madison, Wisconsin."—Geol. Surv. Wisc. Rep. Prog., 1861, p. 42.

The depression on the sides of shells of this species, although appearing as if accidental, are really a feature of the species. They do not affect the septa, as may be seen by clearing one of them; the sides of the septa are sinuate, but not crushed or distorted. The siphuncle I find, by breaking, to be on the inside. It is large and marginal, with the markings of the septa clearly indicated on it.

Genus **Oncoceras** *Hall.*

Oncoceras abruptum.

PLATE X, FIGS. 1–3.

Oncoceras abruptum HALL, Geol. Surv. Wisc. Rep. Prog. 1861, p. 44.

"*Description.*—Shell small, gradually expanding from the outer chamber, and contracted again at the aperture. Very little curved, transversely round-oval, the greatest diameter being in a dorso-ventral direction, the two diameters being as seven and eight. Septa but little concave, not very distant, there being nine in the length of three-fourths of an inch from the outer chamber, counting on the side. Siphuncle dorsal.

"Surface marked by longitudinal ridges, the remains of which are preserved on the cast.

"This description is drawn from two fragments, one of which is nearly an inch and a half long, retaining eleven of the septa and a portion of the outer chamber; but the abrupt expansion of the shell, together with other characters, are sufficient to distinguish it from any described species. The transverse diameter of one fragment, where broken off, at the smaller end is seven-sixteenths of an inch, and at a distance of three-fourths of an inch it has increased to a diameter of seven-eighths of an inch.

"From the *O. constrictum*, of the Trenton limestone of New York, it differs in its more closely arranged septa, which are not arched forward on the dorsum as in that species, and also in its greater proportional transverse diameter.

"*Geological formation and locality.*—In the Trenton limestone group, at Platteville, and in the same position at Beloit, Wisconsin."—Geol. Surv. Wisc. Rep. Prog., 1861, p. 44.

Oncoceras plebeium.

PLATE IX, FIGS. 15–19.

Oncoceras plebeium HALL, Geol. Surv. Wisc. Rep. Prog. 1861, p. 44.

"*Description.*—Shell of medium size, rapidly expanding in the apical half, less rapidly in the middle, and again contracting near the aperture. Transverse section ovate, the diameter as seven to eight and a half, the longest diameter in the dorso-ventral direction, narrowest at the dorsum. Septa at medium distance, there being six in a space equal to their lateral

diameter, little arched forward on the back, and but moderately concave. Siphuncle dorsal, of medium size, expanded in the chambers.

"Surface unknown.

"This species is subject to some variation in its curvature at different stages of growth, and also in the transverse diameter, some specimens being more compressed than others. It resembles *O. constrictum*, of the Trenton limestone of New York, in the unequal expansion, and in the flatness of the septa; but the expansion is not so abrupt, and the transverse section is proportionally much narrower.

"*Geological formation and locality.*—In the Buff limestone of the Trenton limestone group at Beloit."—Geol. Surv. Wisc. Rep. Prog., 1861, p. 44.

Oncoceras pandion.

PLATE IX, FIGS. 20–22.

Oncoceras pandion HALL, Geol. Surv. Wisc. Rep. Prog. 1861, p. 45; Geol. Surv. Wisc. 1862, p. 41, fig. 3.

"*Description.*—Shell robust, strongly curved, very rapidly expanding to near the outer chamber, which gently decreases in size for nearly two-thirds of its length, and then becomes suddenly constricted to nearly half its former dimensions; broadly ovate or sub-circular, the greatest diameter in the dorso-ventral direction. Septa moderately distant, strongly curved forwards on the dorsal side, the greatest concavity on the ventral side of the centre. Siphuncle large, dorsal.

"Surface unknown.

"This species most nearly resembles in form the *O. constrictum* of any species yet found in Wisconsin. The differences consisting in the greater proportional transverse diameter, the absence of a prominent or ventricose space on the ventral side at the point of greatest diameter, the greater concavity of the septa, and the more sudden contraction of the aperture.

"*Geological formation and locality.*—In 'Buff limestone' of the Trenton limestone group, at Beloit, Wisconsin."—Geol. Surv. Wisc. Rep. Prog., 1861, p. 45.

Oncoceras lycus.

PLATE IX, FIGS. 13 AND 14.

Oncoceras lycum HALL, Geol. Surv. Wisc. Rep. Prog. 1861, p. 45.

"*Description.*—Shell somewhat gently curving, gradually expanding from the middle to the outer chamber, which is marked by a broad, deep constriction just posterior to the aperture, the margin of which is expanded or

sub-reflex. Transverse section very broadly ovate, the diameters as nine and ten, the longest being in the dorso-ventral direction; very obtusely sub-angular on the back. Septa slightly concave, about a line apart, one or two of the outer ones a little more approximate. Siphuncle of medium size, expanded within the chambers, placed at about its own diameter within the dorsal margin. Length of fragments, one to two inches. Entire length of larger specimens, three or four inches.

"This species bears some resemblance to *O. pandion* in the form of the transverse section, and the constriction near the aperture, but differs in the curvature of the shell, in having less concave septa, and in the position of the siphuncle.

"*Geological formation and locality.*— In the 'Buff limestone' of the Trenton limestone group."—Geol. Surv. Wisc. Rep. Prog., 1861, p. 45.

Oncoceras alceus.

PLATE IX, FIGS. 23-26.

Oncoceras alceus HALL, Geol. Surv. Wisc. Rep. Prog. 1861, p. 46.

"*Description.*—Shell robust, nearly straight or but slightly arcuate, rapidly expanding from the middle of the shell and swelling out more abruptly at the distance of an inch below the outer chamber, which gradually diminishes towards the aperture and constricted behind the margin. Transverse section elliptical, the longest diameter being as nine to twelve and a half. Septa about seven or eight in the space of an inch, very slightly concave. Siphuncle large, slightly inflated between the chambers, dorso-lateral or dorsal, being on the margin, half way between the line of the transverse and longitudinal diameters.

"Some remains of strong lamellose striæ of growth are preserved on the outer chamber. Length preserved, two and a half inches; the greatest diameter a little more than one and a quarter inches.

"This species is remarkable for the straightness of the shell, and the elongate-elliptical form of the section. The position of the siphuncle may be considered as dorsal, it being upon the outside of the curve, the inner side of the curve and greatest attenuation of the septa being opposite. At first sight the position of the siphuncle appears to be due to distortion, but the relations of the parts have not suffered, and it does not seem possible that it could have been moved by pressure without distorting the form and proportions of the parts.

"*Geological formation and locality.*—In the 'Buff limestone' of the Trenton limestone group, at Beloit, Wisconsin."—Geol. Surv. Wisc. Rep. Prog., 1861, p. 46.

A fragment of the core which had filled the siphon still remaining in the cavity left by the removal of the substance of the siphon, shows a lirated surface within the chambers, and a stellate character at points of junction or between, showing that its siphon was constructed like those of *Actinoceras* Stokes.

Genus **Orthoceras** *Breyn.*

Orthoceras sociale.

PLATE VIII, FIGS. 16–23.

Orthoceras gregarium HALL, Geol. Surv. Wisc. Rep. Prog. 1861, p. 46.
Orthoceras sociale HALL, Miller's Cat. Am. Pal. Foss. p. 245, 1st Edit.

"*Description.*—Shell of medium size, gradually expanding from the apex; transverse section circular. Septa deeply concave, not very distant, varying from six to nine in the space of an inch, according to age. Siphuncle central in young specimens, often becoming sub-central or quite excentric in old individuals.

"Surface smooth, except fine concentric lines of growth.

"This species somewhat resembles some specimens of *O. proteiforme* of the Trenton limestone of New York; but it differs in the uniformly smaller size, greater concavity of septa, and more central siphuncle; while in that species the siphuncle is sub-marginal.

"*Geological formation and locality.*—Abundant in the lower part of the shales above the Galena limestone; at Makoqueta Creek, in Iowa; in Scales Mound, in Illinois; and, more rarely, in the beds of which this group have been penetrated in the mining district of Wisconsin."—Geol. Surv. Wisc. Rep. Prog., 1861, p. 46.

The siphuncle in this shell is quite small and but very little swollen within the chambers. The septa appear to have been very delicate and easily broken, as is indicated by the fact that very many of the specimens inclose others within their tubes, to the number of three and four, which have been drifted into each other probably by the action of the waves; although at the same time the septa show distinctly on the outer ones. Some of these I have figured.

Orthoceras planoconvexum.

PLATE VIII, FIGS. 24 & 25, AND PLATE IX, FIGS. 1 & 2.

Orthoceras planoconvexum HALL, Geol. Surv. Wisc. Rep. Prog. 1861, p. 47.—WHITF. Geol. Rep. Wisc. Vol. IV, 1882, p. 228, pl. vii, fig. 14.

"*Description.*—Shell of medium size, gradually expanding from the apex towards the outer chamber, plano-convex; transverse section semi-circular or sub-triangular, the diameters as five to nine. The convex side is a little depressed on each side of the middle, the opposite side nearly flat, the edges abruptly rounded. Septa moderately concave, arching upwards on the sides, somewhat closely arranged, about five in half an inch. Siphuncle small, central. A specimen of the outer chamber, apparently of this species, is a little more than two and a half inches in length, and one inch and an eighth in width, the short diameter being half an inch; the septa are about one-tenth of an inch distant.

"Surface unknown.

"*Geological formation and locality.*—In the Buff limestone of the Trenton limestone group, at Mineral Point and Beloit, Wisconsin."—Geol. Surv. Wisc. Rep. Prog., 1861, p. 47.

Genus **Gonioceras** *Hall.*

Gonioceras occidentale.

PLATE XII, FIGS. 1 AND 2.

Gonioceras occidentale HALL, Geol. Surv. Wisc. Rep. Prog. 1861, p. 47.

"*Description.*—Shell elongate, very compressed, extremely expanded laterally, the upper part with curved outline, beyond the middle the edges are more nearly parallel; the length (when entire) having been a little less than twice the greatest diameter. Upper and lower surfaces convex, the one twice as convex as the other; the two diameters as one to seven; lateral expansions very thin. Septa deeply concave, numerous, closely arranged, twelve to the inch in the central lobe; arching forwards on the sides with a sharp retral curve a little within the margin, and running backwards in a narrow extension to the edge at a point opposite or below their junction with the siphuncle in the central lobe. Siphuncle oblate, of medium size

where passing through the septa, expanding in the chambers to more than one-half the smaller diameter of the shell, somewhat bilobate from a constriction above and below.

"Surface apparently smooth, or with only concentric lines of growth.

"This species differs from *G. anceps*, of the New York rocks, in the less rapid and irregular lateral expansion from the apex, in being thinner in proportion to the breadth, in the more regularly convex sides, and in the form of the septa, which are more deeply concave in the middle lobe; this part being narrower in proportion to the entire breadth. In the lateral expansions or outer lobes the septa are recurved towards the apex, and gradually approach each other towards the margin; while in the *G. anceps* they make a gentle backward curve and terminate on the edge at nearly their full width.

"*Geological formation and locality.*—In limestone of the age of the Trenton group, at Platteville, Wisconsin."—Geol. Surv. Wisc. Rep. Prog., 1861, p. 47.

CRUSTACEA.

Genus **Illænus** *Dalman.*

Illænus taurus.

PLATE XII, FIGS. 4–9.

Illænus taurus HALL, Geol. Surv. Wisc. Rep. Prog. 1861, p. 49.

"*Description.*—Ovate, distinctly trilobed; the central lobe fully once and a half as wide as the lateral lobes. Head large, gibbous, extremely arched; the dorsal furrows continued but little more than one-fourth its length, distant from each other a little more than one-third the entire width of the head; anterior margin straight to a point a little beyond the suture line on each side; cheeks making a little less than one-sixth of the entire width of the head, measured on the curve, the anterior margin slightly sinuous near the suture. Eyes close to the posterior margin, large, conical, the palpebral lobe projecting laterally at right angles to the axis; genal angles rounded.

"The thorax has ten segments, the axis regularly and moderately convex, its sides gradually converging to the pygidium; the lateral lobes have a flat space outside of the dorsal furrow, reaching to the fulcra of the pleura, which is equal to one-third the width of the axis; at this point the pleura

bend abruptly downwards. The pygidium has less than half the area of the head, broadly rounded on the posterior side and broadly truncated laterally, almost at right angles to its anterior margin.

"A single entire specimen only has been seen; and this gives the following measurements:

"Entire length of a rolled specimen, measured on the curve, four and a quarter inches: of this the head measures more than two inches; its direct length being one inch and three-eighths. The thorax and pygidium measure two and a half inches; the width of the head to the extremities of the eyes, measures two and a quarter inches.

"*Geological formation and locality.*—In the 'Buff limestone' of Beloit, and at Mineral Point, Wisconsin. I have also seen the same species from Rockford, Illinois."—Geol. Surv. Wisc. Rep. Prog., 1861, p. 49.

EXPLANATION OF PLATE IV.

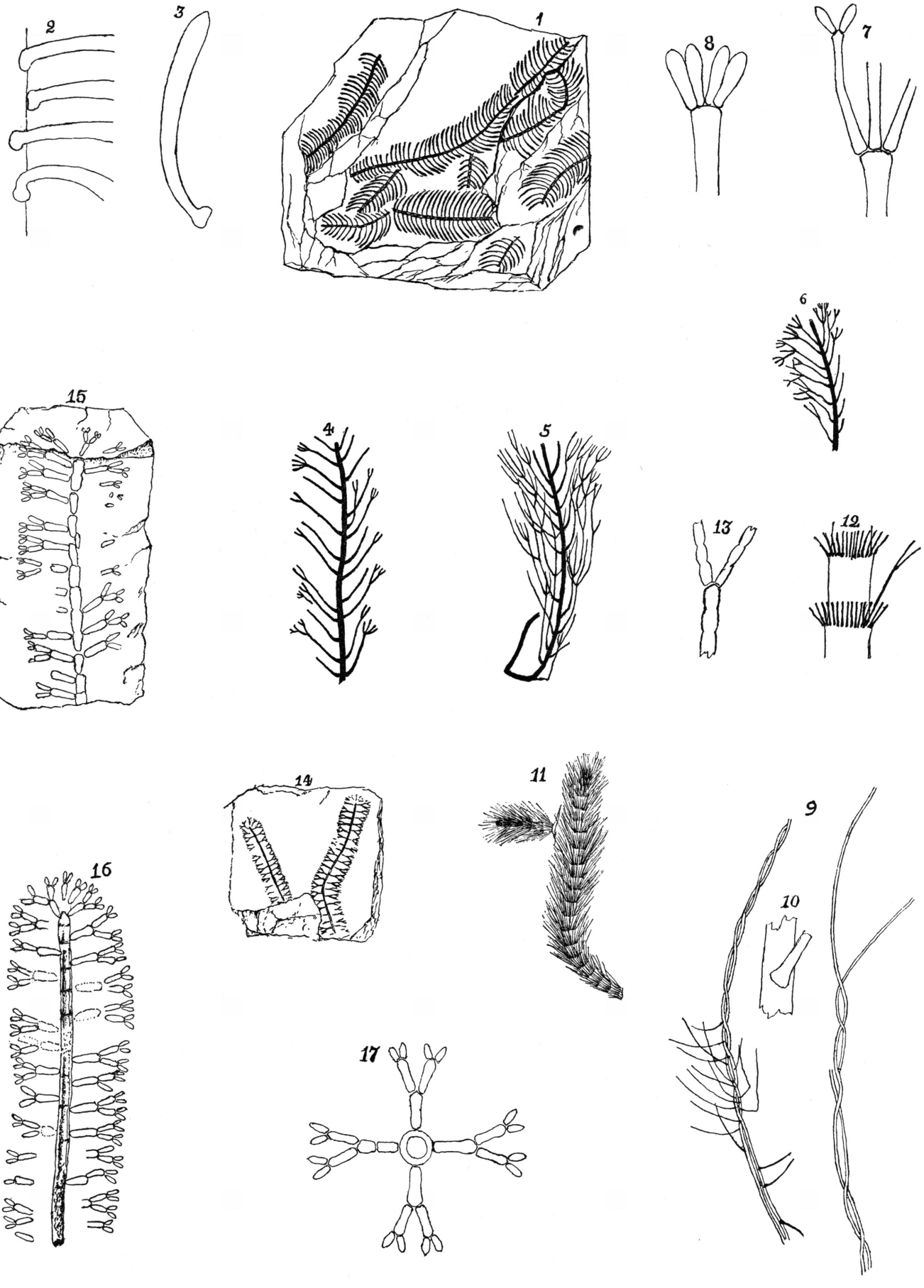
Figs. 1–3.—**Buthograptus laxus** Hall ; p. 40. Fig. 1, view of a block of shale containing several stipes. Fig. 2, diagram showing the manner in which the pinnules are attached to the midrib. Fig. 3, one of the pinnules enlarged.

Figs. 4–8.—**Callithamnopsis fruticosus** =*Oldhamia fruticosus* Hall ; p. 42. See Bull. Am. Mus. Nat. Hist., Vol. VI, p. 354.

Figs. 9 and 10.—**Chætomorhpa ? prima** Whitf. Bull. Am. Mus. Nat. Hist., Vol. VI, p. 355. = *Oldhamia fruticosa* Hall in part; p. 42.

Figs. 11–13.—**Chætocladus plumula** Whitf. See Bull. Am. Mus. Nat. Hist., Vol. VI, p. 356.

Figs. 14–17.—**Primicorallina trentonensis** Whitf. See Bull. Am. Mus. Nat. Hist., Vol. VI, p. 357.



R. P. W., del.

LOWER SILURIAN ALGÆ.

EXPLANATION OF PLATE V.

Figs. 1 and 2.—**Receptaculites infundibulum** Hall; p. 46. Figs. 1 and 2 are lateral views of small individuals.

Figs. 3 and 4.—**Receptaculites hemisphericus** Hall; p. 46. Specimens showing the convex surfaces.

Figs. 5 and 6.—**Receptaculites fungosus** Hall; p. 45. Fig. 5, lateral view of a large specimen. The figure shows the base upward. Fig 6, a section of the same.

Fig. 7.—**Receptaculites globularis** Hall; p. 44. Enlarged a little more than two diameters.

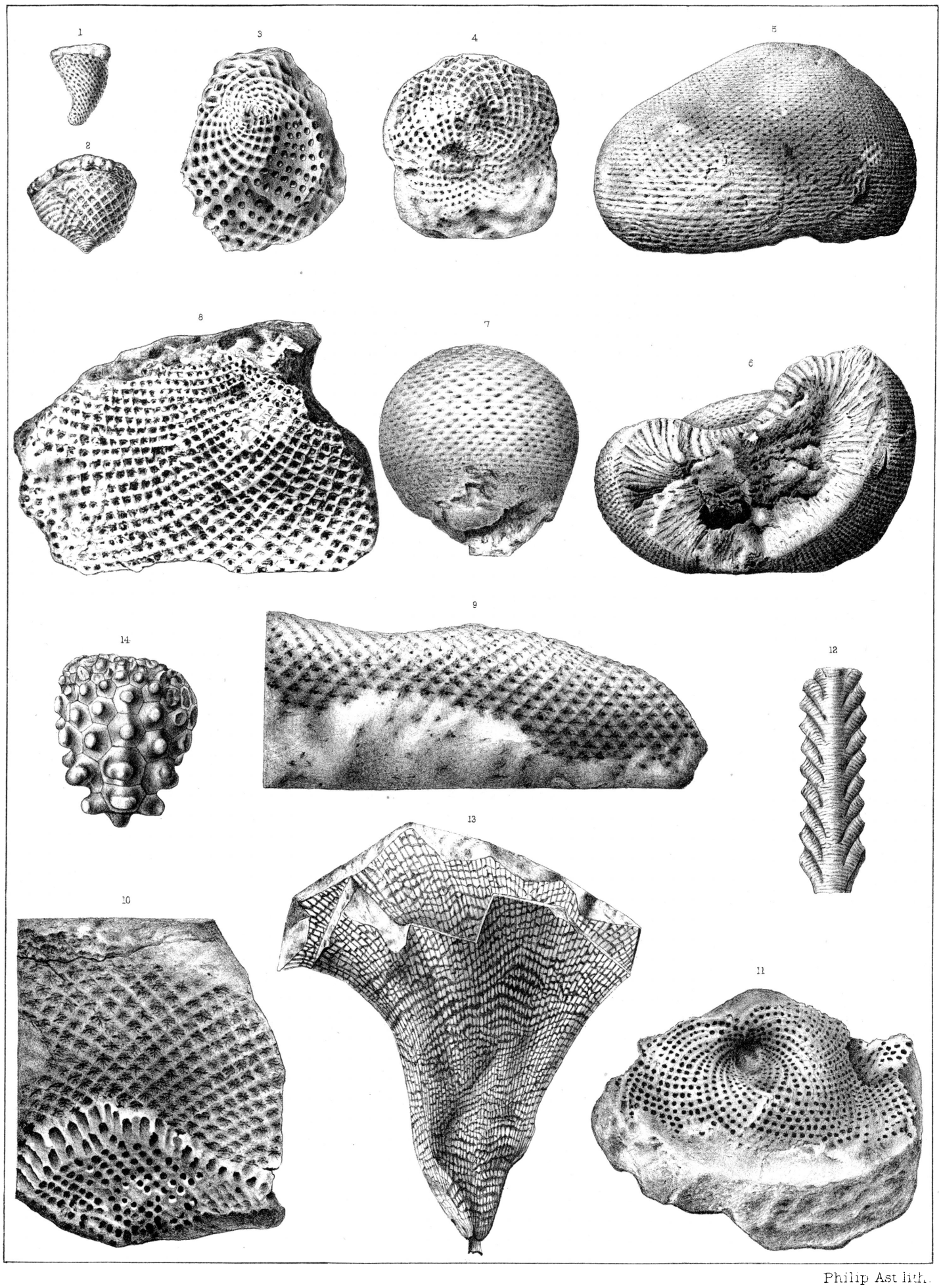
Figs. 8–11.—**Receptaculites oweni** Hall; p. 44. Fig. 8, view of the upper surface of a fragment in chert. Fig. 9, the outer rim of a fragment of a large specimen. Fig. 10, imprint of the upper surface of a fragment of large size. Fig. 11, view of the center of an undulating fragment. Figures all natural size.

Fig. 12—**Graptolithes (Diplograptus) peosta** Hall; p. 47. Figure enlarged six diameters.

Fig. 13.—**Dictyonema neenah** Hall; p. 47. View of the type specimen. Natural size.

Fig. 14.—**Melocrinus nodosus** Hall; p. 48. View, natural size, of the largest of the type specimens, looking upon the right antero-lateral ray.

NOTE.—The figures 5 to 11 on this plate are made from photographs from the specimens by Mr. L. P. Gratacap. The others are from drawings by L. H. Joutel.



Philip Ast lith.

RECEPTACULITES &c.

EXPLANATION OF PLATE VI.

Figs. 1–4.—**Tellinomya ventricosa** Hall ; p. 51. Figs. 1 and 2, views of internal casts of a right and a left valve, natural size. Fig. 3, cardinal view of a small cast, and Fig. 4 of a much larger cast.

Figs. 5–8.—**Tellinomya alta** Hall ; p. 50. Fig. 5, view of a cast of a left valve of one of the extremes of the type series, natural size. Figs. 6 and 7, view of the left side of a shell of the other extreme and the profile in outline. Fig. 8 is the outline, natural size.

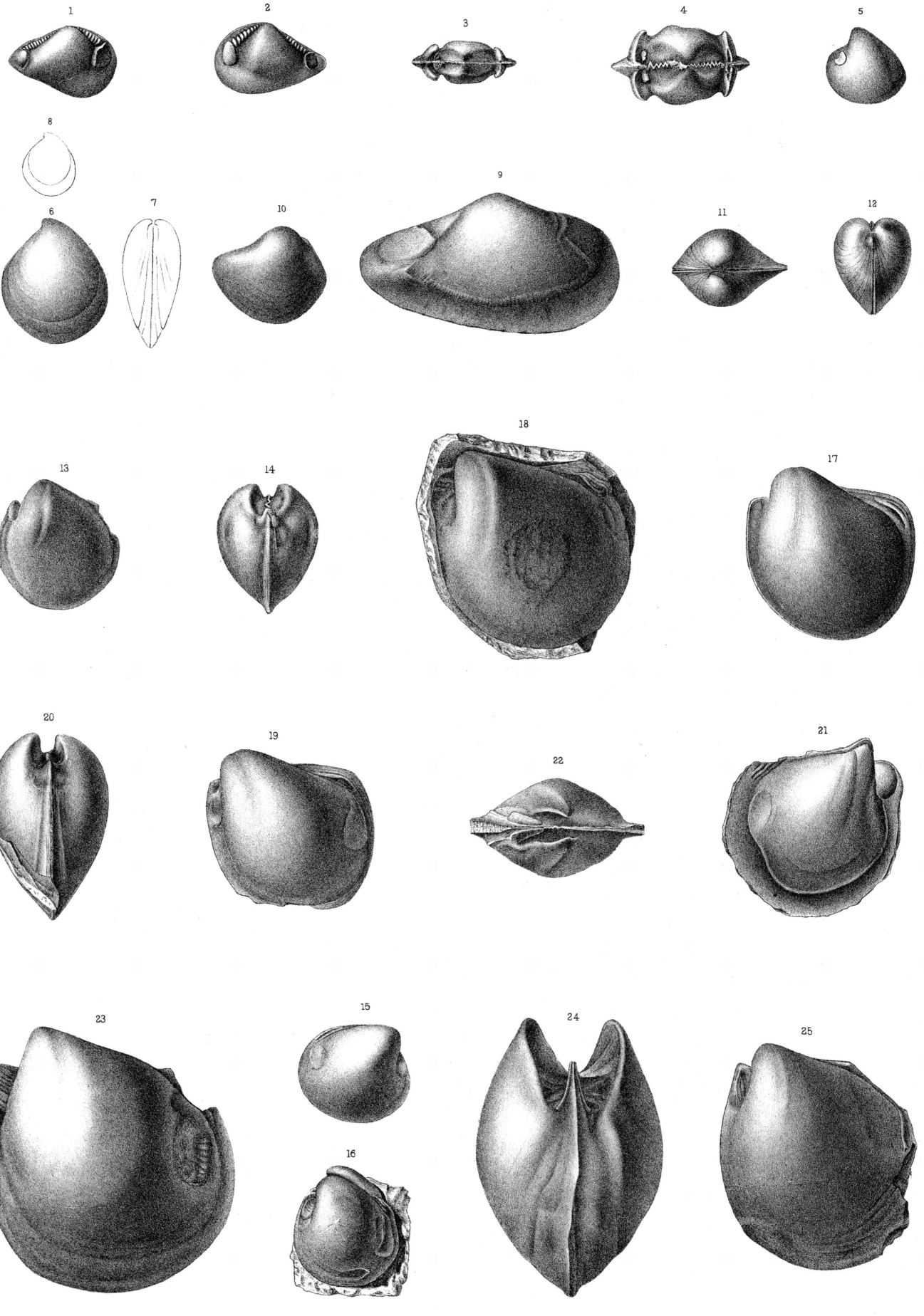
Fig. 9.—**Tellinomya ovata** Hall ; p. 52. Cast of a right valve of one of the types.

Figs. 10–12.—**Tellinomya inflata** Hall ; p. 49. Three views of the type specimen, natural size.

Figs. 13–16.—**Cypricardites rotundatus** Hall ; p. 53. Figs. 13 and 14, left and anterior views of a cast retaining both sides. Fig. 15, view of a smaller right valve, the shell not thickened by age. Fig. 16, view of a slightly distorted cast of both valves.

Figs. 17–20.—**Cypricardites niota** Hall ; p. 54. View of one of the types, the same figure from which the cut on page 38 of the Wisc. Geol. Rep. 1862 was made. Fig. 18, view of a larger left side. Figs. 19 and 20, left side and anterior views of a specimen similar to that of Fig. 17.

Figs. 21–25.—**Cypricardites rectirostris** Hall ; p. 55. Figs. 21 and 22, two views of cast in chert. Figs. 23 and 24, two views of a cast in limestone, representing an old and much-thickened shell. Fig. 25, view of the left side of a smaller cast.



R.P.W. & L.H.Joutel del. Philip Ast lith.

TRENTON LAMELLIBRANCHIATA.

EXPLANATION OF PLATE VII.

Figs. 1 and 2.—**Ambonychia erecta** Hall; p. 58. Fig. 1 shows the imprint of the hinge and posterior margin. Fig. 2, a cast of a right valve of very convex form.

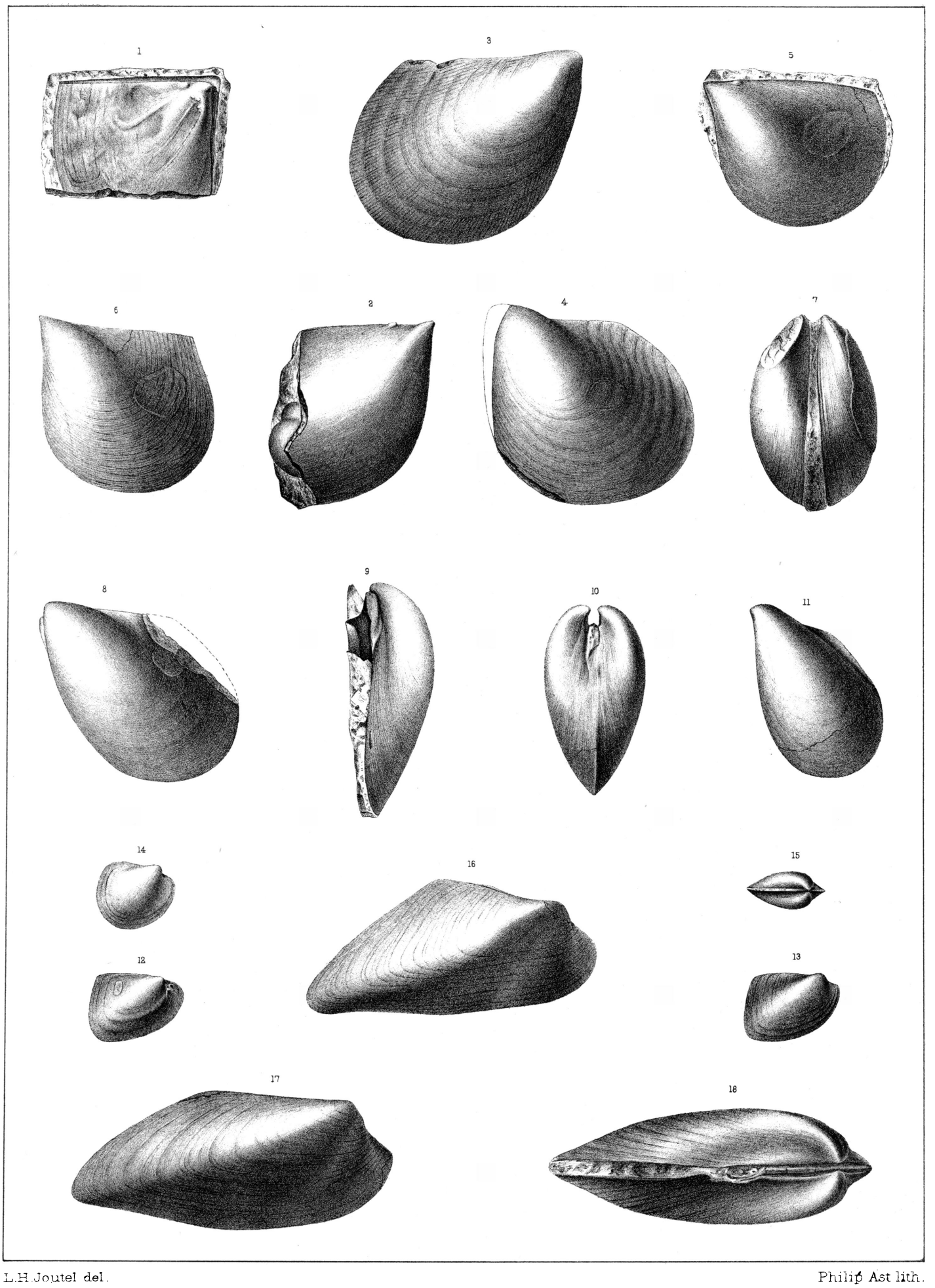
Figs. 3 and 4.—**Ambonychia planistriata** Hall; p. 59. Fig. 3, a right valve showing the flattened striæ. Fig. 4, an imperfect left valve, with undulations of the surface but no striæ.

Figs. 5–7.—**Ambonychia lamellosa** Hall; p. 57. Fig. 5, view of a perfect cast of a left valve. Fig. 6, a left valve of different form, restored on the cardinal border. Fig. 7, profile from the anterior side of a partial cast of both valves.

Figs. 8–11.—**Ambonychia attenuata** Hall; p. 59. Figs. 8 and 9, cast of an imperfect left valve and profile of the same. Figs. 10 and 11, anterior profile and left side of a smaller specimen, which is restored in plaster at the lower extremity.

Figs. 12–15.—**Modiolopsis plana** Hall; p. 56. Fig. 12, view of a cast, and Fig. 13, of an imprint in the matrix of the same specimen. Figs. 14 and 15, two views of a shell from the type series, but which correspond more nearly to *Cyrtodonta tenella* Ulrich, except in size.

Figs. 16–18.—**Modiolopsis superba** Hall; p. 56. Fig. 16, right side of one of the shorter forms. Figs. 17 and 18, right and cardinal views of a somewhat longer specimen. The other type used was still more elongated, but was borrowed.



L.H. Joutel del. Philip Ast lith.

TRENTON LAMELLIBRANCHIATA.

EXPLANATION OF PLATE VIII.

Figs. 1–3.—**Ecculiomphalus undulatus** Hall; p. 63. Figs. 1 and 2, under and upper sides of the cast used for description. Fig. 3, profile of the same.

Figs. 4–7.—**Pleurotomaria (Raphistoma) nasoni** Hall; p. 61. Figs. 4, 5 and 6, three views of a cast of the ordinary form. Fig. 7, the umbilical side of a second specimen.

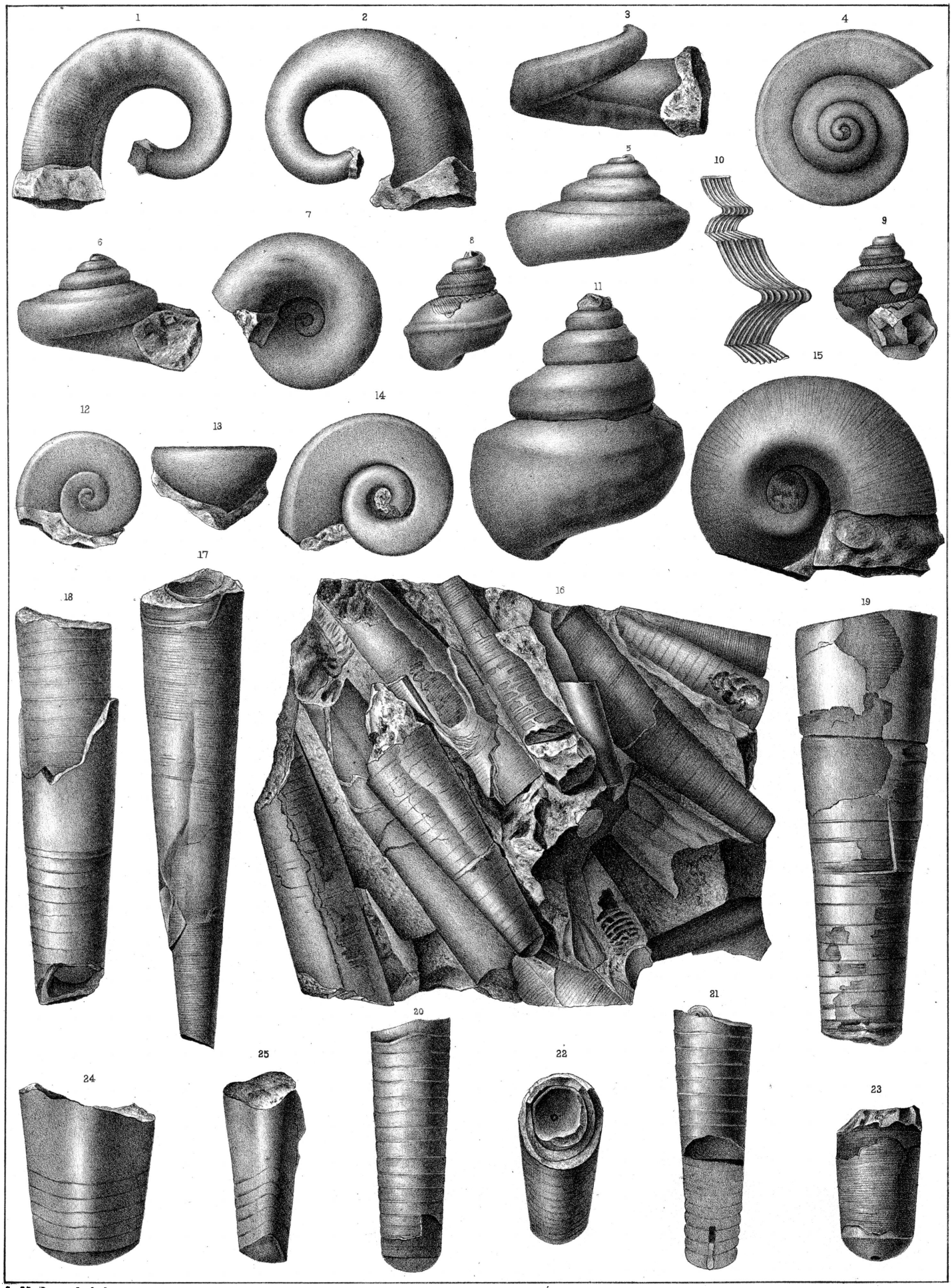
Figs. 8–10.—**Pleurotomaria semele** Hall; p. 61. Figs. 8 and 9, opposite views of the specimen. Fig. 10, enlargement, showing the bending of the surface striæ.

Fig. 11.—**Pleurotomaria niota** Hall; p. 60. View of the only example, natural size.

Figs. 12–15.—**Maclurea bigsbyi** Hall; p. 62. Figs. 12 and 13, two views of a small specimen, the latter showing the acute edge. Fig. 14, view of the flat side of a cast. Fig. 15, view of the depressed side of a still larger specimen preserving some of the shell.

Figs. 16–23.—**Orthoceras sociale** Hall, vide *O. gregaria*; p. 71. Fig. 16, view of a block showing the tubes packed together in the layer of shaly limestone. Fig. 17, a specimen retaining the shell. Fig. 18, an example showing one shell ensheathed in another. Fig. 19, a large specimen, partly of outer chamber. Figs. 20 and 21, a smaller shell showing septa, and on the latter figure the siphon. Fig. 22, a specimen showing three shells ensheathed. Fig. 23, a fragment showing the shell and the convexity of the septum, as well as the position of the siphon.

Figs. 24–25.—**Orthoceras planoconvexum** Hall; p. 72. Fig. 24, view of a fragment from the convex side. Fig. 25, profile of the same.



L.H. Joutel del. Philip Ast lith.

GASTEROPODA AND CEPHALOPODA.

EXPLANATION OF PLATE IX.

Figs. 1 and 2.—**Orthoceras planoconvexum** Hall; p. 72. View of the flat side and profile view of the largest type specimen.

Figs. 3 and 4.—**Cyrtoceras eugium** Hall; p. 66. Lateral and dorsal views.

Fig. 5.—**Cyrtoceras whitneyi** Hall; p. 65. Lateral view of the type specimen.

Figs. 6–9.—**Cyrtoceras loculosum** Hall; p. 67. Fig. 6, view of the inner side of a specimen showing the siphon in place. Fig. 7, lateral view of the same showing the crowded septa. Fig. 8, lateral view of a larger specimen. Fig. 9, profile view from the convex side.

Figs. 10 and 11.—**Cyrtoceras neleus** Hall; p. 65. Lateral and dorsal views of the best type specimen.

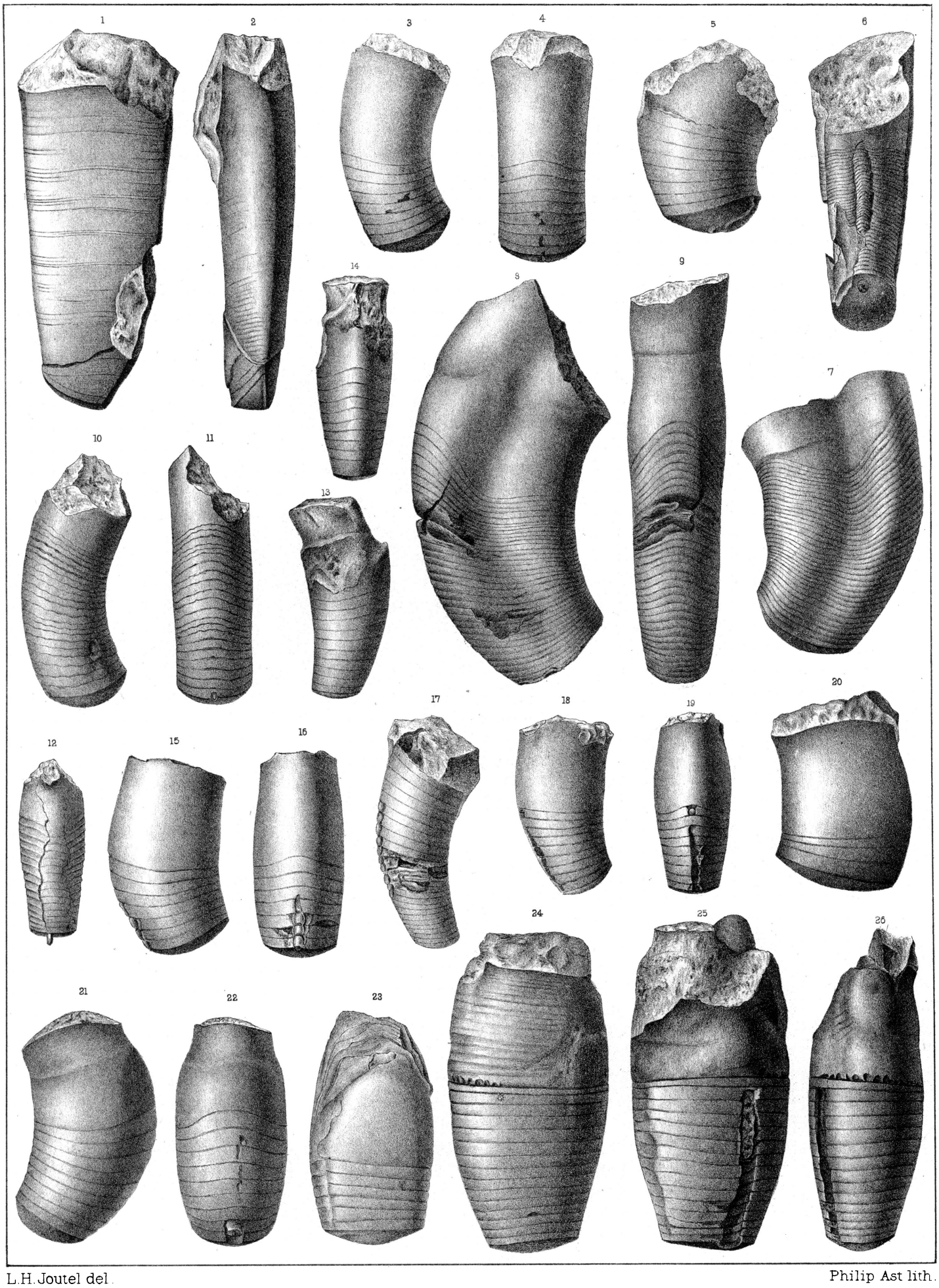
Fig. 12.—**Cyrtoceras tenuistriatum** Hall. Vide *C. corniculum*, Geol. Rep. Wisc., 1862, pp. 41 and 441. Dorsal view of an example showing a form of undulation of the surface. See S. A. Miller's Am. Pal. Foss., First Ed., p. 243.

Figs. 13 and 14.—**Oncoceras lycus** Hall; p. 69. Lateral and profile views of type.

Figs. 15–19.—**Oncoceras plebeium** Hall; p. 68. Figs. 15 and 16, lateral and profile views of a specimen showing seven septa and the siphon. Fig. 17, lateral view of the septate portion, also showing the siphon. Figs. 18 and 19, lateral and profile views of another example retaining nine chambers below the upper one, also the cavity of the siphon.

Figs. 20–22.—**Oncoceras pandion** Hall; p. 69. Fig. 20, view of the outer chamber and three of the smaller ones. Figs. 21 and 22, lateral and dorsal views of another of the types.

Figs. 23–26.—**Oncoceras alceus** Hall; p. 70. Fig. 23, view of the upper portion of a crushed specimen. Figs. 24 to 26, three views of a larger example where the siphon is off on one side, which does not appear to be owing to compression, but a natural feature.



L.H. Joutel del. Philip Ast lith.

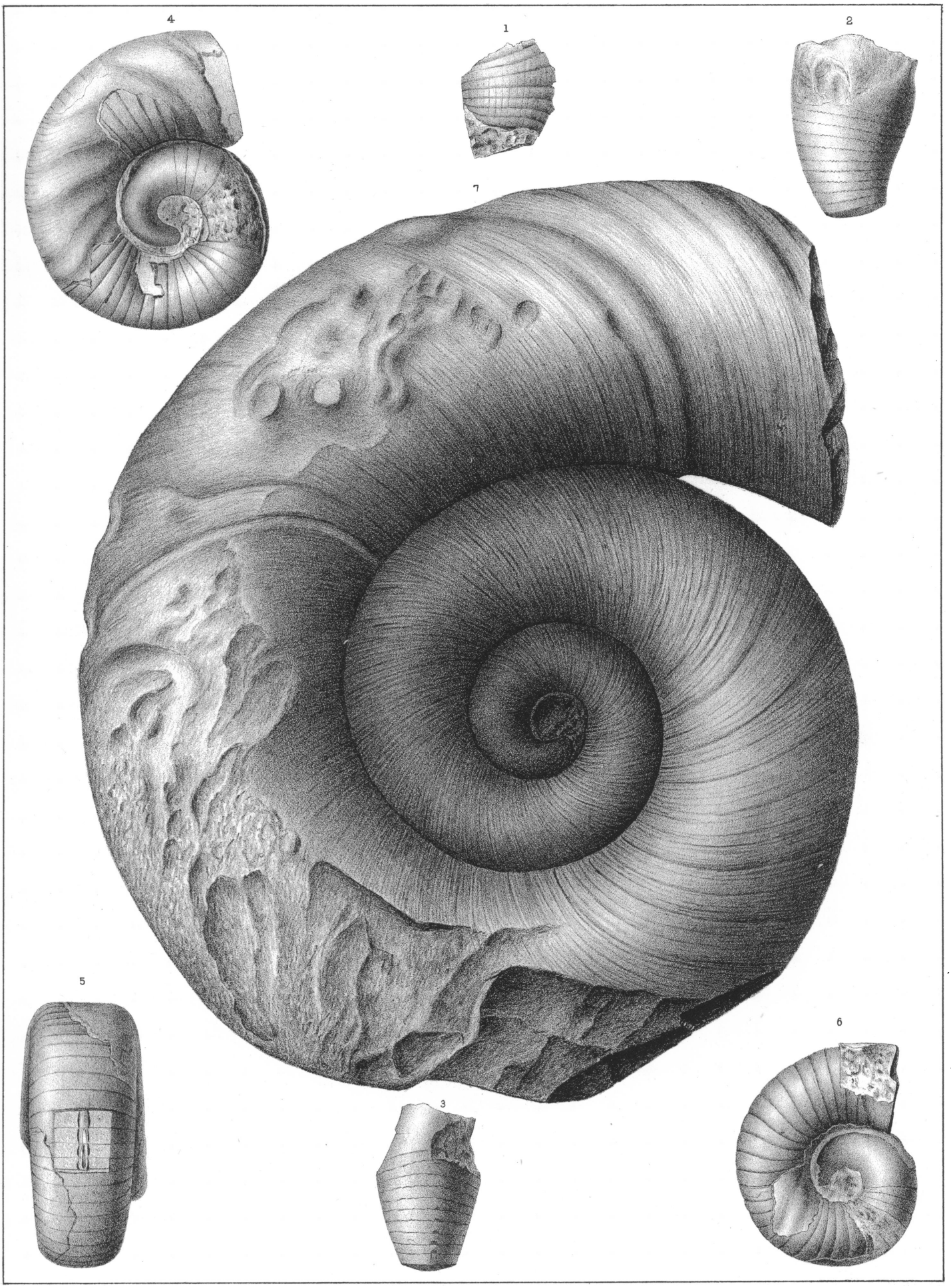
TRENTON CEPHALOPODA.

EXPLANATION OF PLATE X.

Figs. 1–3.—**Oncoceras abruptum** Hall ; p. 68. Fig. 1, a fragment, preserving a few of the casts of chambers and showing longitudinal flutings. Figs. 2 and 3, two views of another specimen.

Figs. 4–6.—**Lituites robertsoni** Hall ; p. 64. Fig. 4, lateral view of the larger specimen. Fig. 5, dorsal view of the same, cut to show the siphon. Fig. 6, lateral view of the smaller individual.

Fig. 7.—**Lituites undatus,** var. **occidentalis** Hall ; p. 63. A lateral view of the type specimen used in the original description.



R.P. W. & L.H Joutel del. Philip Ast lith.

TRENTON CEPHALOPODA.

EXPLANATION OF PLATE XI.

Fig. 1.—**Lituites undatus,** var. **occidentalis** Hall; p. 63. Lateral view of a specimen in the Museum collection which shows the features of the species much better than the type specimen, Fig. 7 on Plate X. See also Plate XII, Fig. 3, for view of the aperture and undulations of the flattened dorsum.

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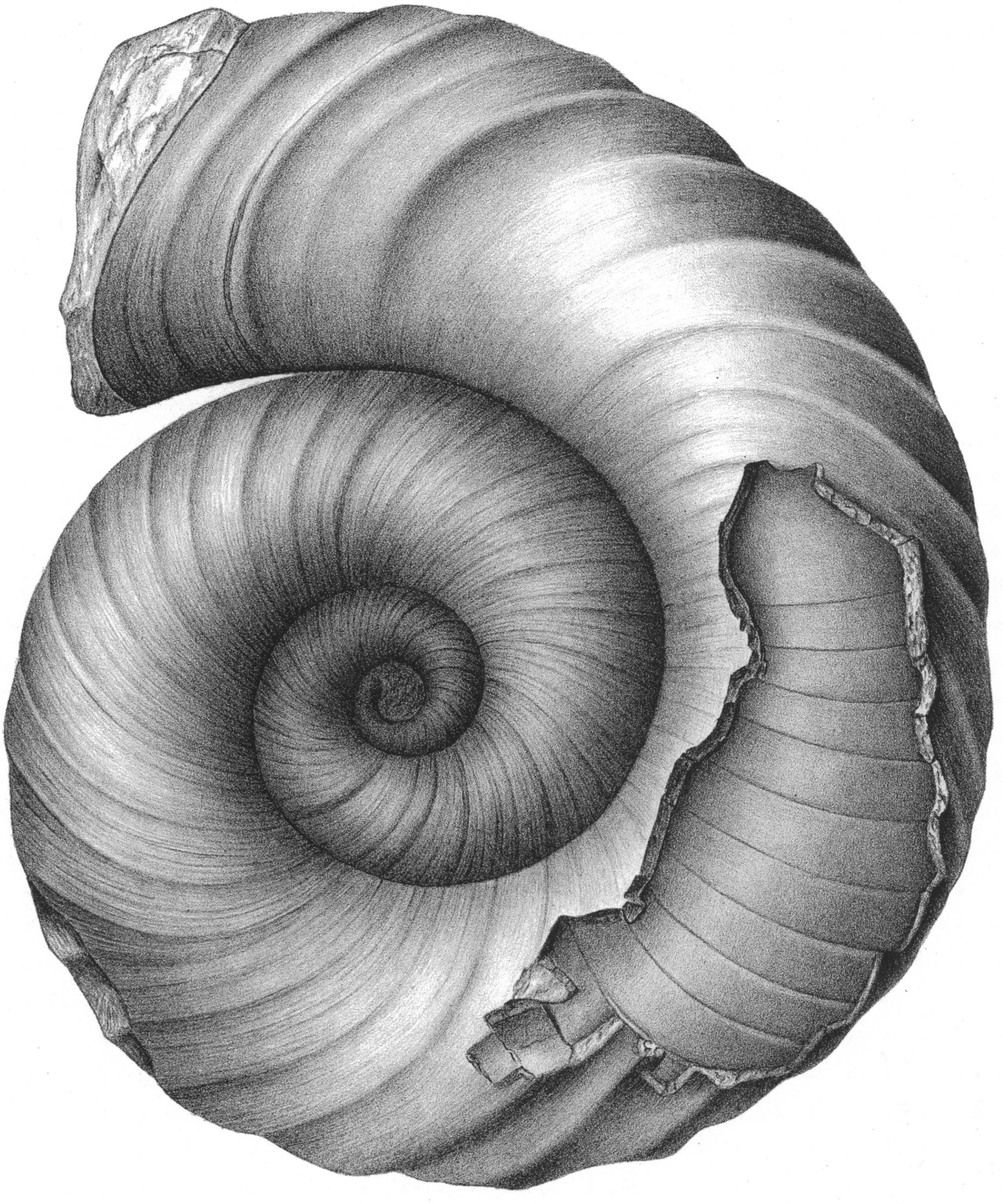

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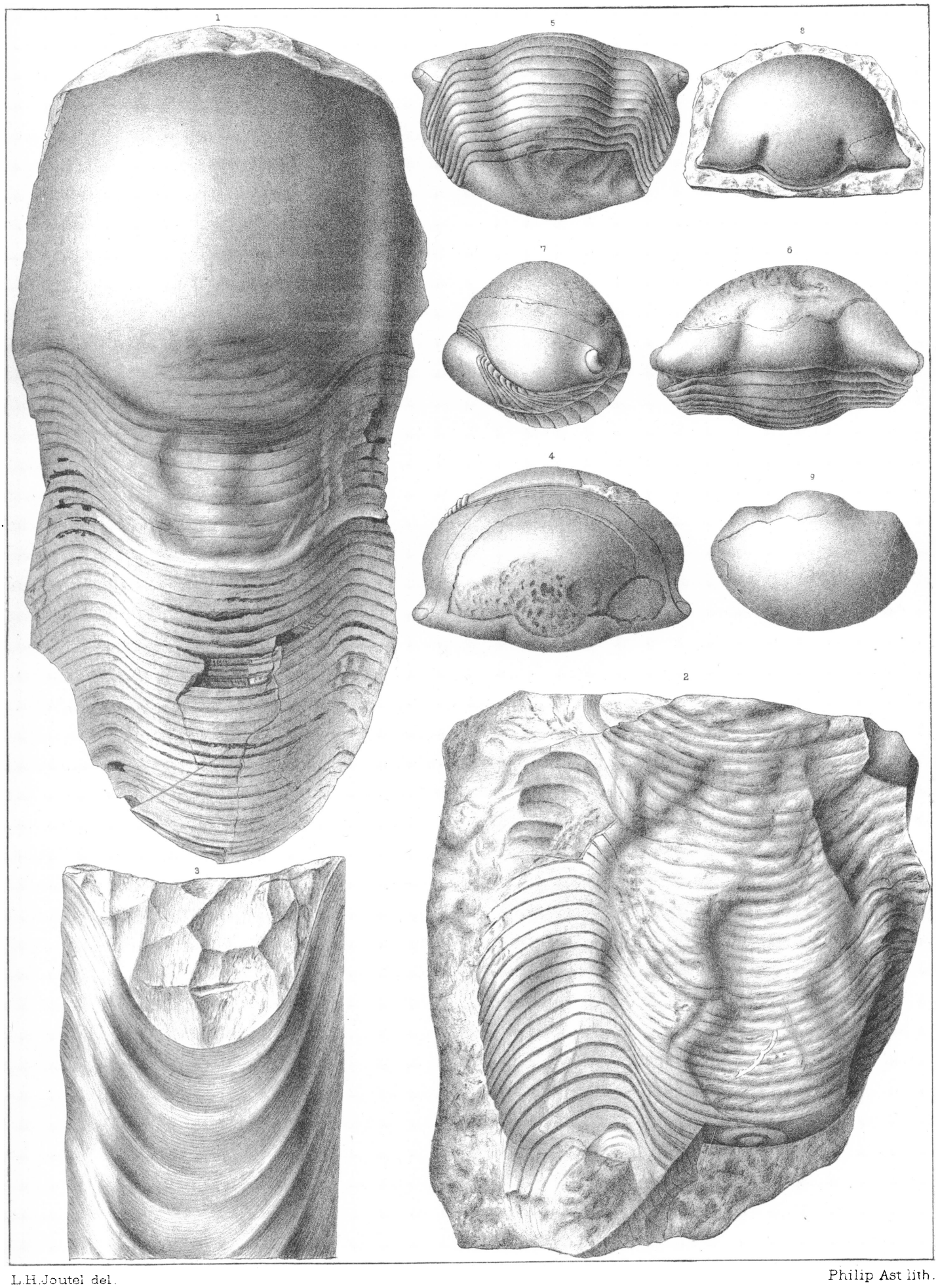
TRENTON CEPHALOPODA.

EXPLANATION OF PLATE XII.

Figs. 1 and 2.—**Gonioceras occidentale** Hall; p. 72. Fig. 1, view of the convex surface of one of the types. Fig. 2, view of the flat side of another of the types, which also shows the position and size of the siphon.

Fig. 3.—**Lituites undatus,** var. **occidentalis** Hall; p. 63. View of the dorsal side of the aperture as seen on the specimen illustrated on Plate XII, Fig. 1.

Figs. 4–9.—**Illænus taurus** Hall; p. 73. Fig. 4, view of the head-shield of a nearly entire specimen, somewhat crushed and partly denuded of the crust on the glabella. Fig. 5, dorsal view, also showing the pygidium distorted and seen foreshortened. Fig. 6, view from the back of the head, showing the glabella. Fig. 7, profile view. Fig. 8, view of a cast of a head from the Galena limestone, and Fig. 9 of a pygidium retaining the test.



L.H.Joutel del. Philip Ast lith.

CEPHALOPODA AND TRILOBITA.