

- Cimoliasaurus magnus*. Cope: Pr. Bost. Soc. Nat. Hist. 1869, 266.  
*Cimoliasaurus vetustus*. Cope: Synopsis Ext. Bat. Rept., &c., 1869, 57.  
 Cretaceous of Alabama.
2. DISCOSAURUS GRANDIS.  
*Brimosaurus grandis*. Leidy: Pr. Ac. Nat. Sc. 1854, 72, pl. i, figs. 1-3.  
*Cimoliasaurus grandis*. Cope: Pr. Bost. Soc. Nat. Hist. 1869, 266; Synopsis  
 Ext. Batrachia, Reptilia, &c. 1869, 57.  
 Cretaceous of Arkansas.
3. DISCOSAURUS CARINATUS.  
*Elasmosaurus platyurus* and *Discosaurus carinatus*. Cope: LeConte's Notes  
 on the Geology &c. Union Pacific Railway, 1868, 68.  
*Elasmosaurus platyurus*. Cope: Pr. Ac. Nat. Sc. 1868, 92; Pr. Bost. Soc.  
 Nat. Hist. 1869, 266; Synopsis Ext. Batr. Rept. 1869, 46.  
 Cretaceous of Kansas.
4. DISCOSAURUS MAGNUS.  
*Cimoliasaurus magnus*. Leidy: Pr. Ac. Nat. Sc. 1851, 325; 1854, 72, pl. ii,  
 figs. 4-6; Cret. Rept. U. S. 1865, 25, pl. v, figs. 13-19, pl. vi. Cope:  
 Pr. Bost. Soc. Nat. Hist. 1869, 266; Synopsis Ext. Batr. Rept. 1869, 57.  
*Discosaurus vetustus* in part? Leidy: Cret. Rept. U. S. 1865, 24, pl. v, figs.  
 1-3, 7-9.  
 Cretaceous of New Jersey.
5. DISCOSAURUS PLANIOR.  
*Discosaurus vetustus* in part. Leidy: Cret. Rept. U. S. 1865, 23, pl. v, figs.  
 10-12.  
 Lower cretaceous of Mississippi.
6. DISCOSAURUS ORIENTALIS.  
*Elasmosaurus orientalis*. Cope: Pr. Bost. Soc. Nat. Hist. 1869, 266; Synop-  
 sis Ext. Batr. Rept. 1869, 54.  
 Lower cretaceous of New Jersey.

In the cervicals of *Discosaurus*, so far as can be ascertained by the material at command, there appears to be no subdivision of the articular process for the riblets, as in *Plesiosaurus*. In the latter the chevron bones consist of lateral halves, unnnited by osseous tissue. In the skeleton of the Kansas saurian, intervening between two of the caudals, there is a bone which looks as if it might be an inverted Y-shaped chevron, with one arm broken off. The spine broken at the end is about four inches long. The remaining arm, broken away at the articular end, is about three inches long.

On favorable report of the Committees, the following papers were ordered to be printed:

**Descriptions of new Species and Genera of Fossils from the Palæozoic rocks of the Western States.**

BY F. B. MEEK AND A. H. WORTHEN,

Of the Illinois State Geological Survey.

**FORAMINIFERA ?**

RECEPTACULITES FORMOSUS, M. and W.

Body obovate, the breadth being about three-fourths the height, and the widest point a little above the middle; upper end rounded, and without any umbilicoid concavity or opening, unless it may be a very small one; sides gradually tapering with a slight convexity from a little above the middle, to an apparently moderate sized base of attachment. Cell openings or depres-

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sions shallow, quadrangular, or transversely rhombic (those on the upper part being quadrangular, and those farther down becoming more rhombic, and wider than high), arranged in spirally ascending rows, which make nearly one turn in passing from the base to the centre of the top; each with a transverse linear central furrow, from which a similar furrow passes to the lower angle; central perforations of the cell depressions minute, and generally closed in the typical specimen.

Height, 1.75 inches; breadth, 1.22 inches.

This species differs from all others known to us, especially from any Upper Silurian horizon, in its elongated, obovate form, its outline being almost exactly obovate, excepting the truncation of the lower (smaller) end. In general appearance it perhaps most nearly agrees with a form found in the Galeua Limestone, and referred by us, doubtfully, to *E. globularis*, Hall, in the third vol. Illinois Geol. Reports, pl. 2, fig. 2 a, b. It differs, however, from that species in having the upper end more round, or less depressed, and without any umbilicoid impression. Its cell impressions are also very different, not being near so crowded, and instead of becoming more crowded and narrower on the lower half, they are less so there than above; while the central perforation of each is much smaller.

*Locality and position.* Bridge Port, near Chicago, Illinois. Niagara Group of Upper Silurian.

We are under obligations to the Rev. E. C. Bolls, of Portland, Me., for the use of the only specimen of this species we have seen.

## ECHINODERMATA.

### BARYCRINUS SPECTABILIS, M. and W.

Body attaining a large size, rather deeply cup-shaped, though wider than high; truncated below, with sides moderately expanding upward. Base basin-shaped. Basal pieces rather large, nearly twice as wide as high, pentagonal in form, with the mesial angle above deeply impressed, the impression being also continued down the middle to the lower edge, with a broad prominence or ridge on each side of it also extending to the lower edge, where each of these prominences terminates in a little angular projection, while the lateral margins are strongly and abruptly beveled, so as to form deep, wide notches at the sutures. Subradial pieces large, hexagonal, excepting one on the anal side, which is heptagonal; all very profoundly impressed at the corners, so as to form strong, radiating ridges, extending one to each of the sides, to connect with those on the other contiguous plates; sometimes these ridges terminate in pinched-up nodes on the central region. First radial pieces about twice as wide as high, being generally a little wider than the subradials, pentagonal in form, with superior lateral angles more or less truncated, and slightly projecting at the edge, each with its broad, very shallow sinus above, for the reception of the second radials, more than three-fourths as wide as its upper margin, while the deep impression at the lower angles form two broad, very strong ridges, extending downward to connect with those on the subradials; sometimes these terminate near the middle above, in sharp pinched-up, diverging nodes, or short carinæ, while between these and the superior lateral, truncated angles, one or two other sharp prominences are sometimes seen. Second radial pieces extremely short, or almost transversely linear, and not always entirely filling the broad shallow sinuses in which they rest. Third radials triangular, a little higher in the middle than the first, but wedging to a very thin edge on each side, or even sometimes thinning out so as to let the first brachial pieces rest, at the lateral ends partly upon the first and partly on the second radials. Anal pieces of moderate size, quadrangular in form, a little wider than high, and resting on the upper truncated edge of the heptagonal subradial, while its own upper edge is truncated entirely across, nearly on a level with the superior lateral angles of the first radial on each side of it.

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Arms two from each ray, rather long, rounded, and tapering; very stout below, where they are composed of thin (short) wide pieces, the first two of which, in each pair of arms, are joined together at their inner ends; above these the arms of each ray diverge more or less from each other, and throw off alternately on each side stout armlets from every second piece. Arm pieces above the wide ones at the base, somewhat longer in proportion to breadth than the latter, and more or less wedge formed, with each a little pinched or angular ridge or projection on each side, ranging transversely to the arms. Armlets stout, about eight to nine on each side of each arm, near half as thick as the arms just above the points where the two connect; composed of pieces of nearly the same form as the arm pieces, but generally showing a slight disposition to become a little zigzag, and, at least some of them, throwing off alternately on each side a series of smaller secondary armlets, exactly as they are themselves given off from the main arms. Secondary armlets showing a slight zigzag appearance, from the greater thickness and prominence of every second piece on opposite sides, so as to appear as if they may give off a tertiary series of armlets, or pinnulae, though the specimen does not show these if they exist.

Column very stout, nearly round, and composed, at least for about three inches or more below the base, of alternately thin and somewhat thicker pieces, the latter of which project outward a little beyond the others, and show a slight disposition to become nodular, or irregularly thickened on the edge. Internal cavity large, with an obtusely pentagonal section. Longitudinal sutures, dividing the column into five sections, partly ankylosed, but still visible.

Height of body, about 1 inch; breadth, about 1.70 inches; length of arms, 3.80 inches; thickness of do. at the base, 0.40 inch; thickness of column near base, 0.60 inch.

This fine large species seems to be most nearly allied to *B. Thomæ*, (= *Cyathocrinus Thomæ*, Hall), from the Warsaw Limestone, but differs in having the impressions at the corners of its body plates, and the ridges between the same, greatly more strongly defined, and its arms much stouter, and more rounded below. Its column is also proportionally thicker, with a more obtusely pentagonal internal cavity. The typical specimens of the *B. Thomæ*, which are now before us, are not in a condition to show much of the arms, but as far as they can be seen, they seem to be proportionally more slender, and we can scarcely doubt that they will show other corresponding differences in the details of their structure, when better specimens can be compared. We have ascertained, however, that the arm-pieces of the typical specimens of *B. Thomæ* have on their sides little pinched-up prominences, as in the species here described, which character was not mentioned in the description of that species.

The peculiarity of having the corners of the body plates impressed so as to form large ridges on the plates is very common in this group, but it differs in degree, or otherwise, in the various species, presenting corresponding differences in other parts. It is more strongly defined in the species here described, and the ridges more angular than in any other known to us. This species is also the first of the group in which we have clearly seen secondary armlets springing from the sides of the larger ones given off from each side of the arms; but since seeing this character in this species, we think we have been able to detect indications of it in others.

We hope those who may not be disposed to admit the genus *Barycrinus* as distinct from *Cyathocrinus*, will at least write the name of this species *Cyathocrinus (Barycrinus) spectabilis*.

*Locality and position.* Otter Creek, Jersey County, Illinois; from the St. Louis Group of the Lower Carboniferous.

CYATHOCRINITES ? POTERIUM, M. and W.

Body small, depressed-subglobose, somewhat flattened below and con-  
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tracted above. Basal plates of moderate size, pentagonal in form, and spread out horizontally so as to form a nearly flat pentagonal disc, excepting that the salient angles are curved upward a little; facet for the attachment of the column small, compared with the size of the base, round and not impressed. Subradial plates large, forming the widest part of the body, convex on the outside, but not from thickening; about as wide as long, hexagonal, with perhaps the exception of one on the anal side of heptagonal form; all curving under below to connect with the base. First radials somewhat smaller than the subradials, wider than long, pentagonal in form, and provided above with very small, shallow sinuses for the reception of the second, which are small, but more than filling the shallow little sinuses. Third radials, in two of the arms seen, small, and bearing on each of their superior sloping sides, a long, very slender, subcarinated arm, which bifurcates on the second piece above; while the divergent divisions subdivide two or three times again above, at intervals of three or four pieces; the divisions and subdivisions all being very slender, and composed of joints about twice as long as wide. In two of the rays seen, however, the free arms are simple from their origin on the first radials, at least as far up as to the sixth piece, inclusive, (which is as far as they can be traced in the specimen), and present the remarkable character of having the second, third and fourth pieces greatly dilated, or alate on each side, so as to be nearly two-thirds as broad as the whole body below; though the first piece next the body (second radial), is narrow, and nearly twice as long as wide, as are the fifth and sixth pieces. Surface smooth, or only finely granular; sutures close fitting, or not channeled. Anal plate and column unknown.

Height of body, 0.20 inch; breadth of do., 0.34 inch; breadth of the dilated part of one of the simple arms, about 0.22 inch.

It is possible that the dilated arms may bifurcate above the sixth piece, though the specimen from which the description is made out is not in a condition to enable us to settle this point. The fact that they become suddenly narrow above the fourth piece, would seem to indicate that they may possibly assume the character of the other arms farther up. As seen lying partly imbedded in the matrix, with the long-jointed, slender arms and their branches incurved, above the little globular body, the whole reminds one very much of the Jurassic genus *Saccosoma*, Agassiz.

The very remarkable characters of the arms in this little crinoid, if not due to abnormal development, would certainly seem to warrant its separation, at least subgenerically, from the typical forms of *Cyathocrinites*. It also seems very improbable that its ventral disc is constructed as in the typical forms of that genus. Should other specimens show the peculiarities we have mentioned to be normal, we would propose for this type the generic or subgeneric name *Saccosomopsis*.

Specifically this form, at least so far as regards its body, seems to be exactly like a species described by Prof. Hall, under the name *Cyathocrinites parvibrachiatus* (Jour. Bost. Soc. Nat. Hist., Vol. vii, p. 395, 1861); and it is worthy of note, that he describes its "subrachial" or free radial pieces as being "two to each ray, broad and strong, but varying in the different rays." As these pieces "vary in the different rays," may not those he saw, that were broad and strong, have belonged to dilated simple rays, as in our species, and these rays been broken off above the second pieces, in the specimen described? If so, his species would almost certainly belong to the same group as ours, but differs specifically in having its bifurcating arms shorter, more rapidly diminishing in size, with shorter pieces between the bifurcations, so as to bring the subdivisions closer together; also in having larger and deeper sinuses in its first radials for the reception of the second.

We are much inclined to believe there is a little group of species having essentially the form of body, and the peculiarities of the arms we have described, and that it will probably include *Cyathocrinites Saffordi*, the arms of which are unknown.

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*Locality and position.* Crawfordsville, Indiana. Keokuk division of the Lower Carboniferous series. The specimen from which our description was made out belongs to the collection of Mr. Corey.

POTERIOCRINITES (ZEACRINUS?) CONCINNUS, M. and W.

Body wider than high, rather rapidly expanding upward from the column. Base small, basin-shaped, about three times as wide as high, and truncated about three-fourths its breadth below by the facet for the attachment of the column. Basal pieces wider than high, pentagonal in form, and expanding upward from the column, which is rather stout, round, and composed near the base of thin pieces. Subradials of moderate size, not thickened or tumid, four hexagonal, and one on the anal side heptagonal. First radials as wide as the subradials, but shorter, pentagonal, and truncated their entire breadth above. Second radials as wide as the first but scarcely more than half as long, all transversely oblong in form. Third radials in the posterior and anterior lateral rays, of nearly the same size and form as the first, but of course with the sloping sides above. On these sloping sides they each support two unequal arms, the posterior one of which in one of the posterior lateral rays is smaller than the other, and can be seen to bifurcate on the fourth piece, while the other bifurcates on the second piece, and its subdivisions divide again at various distances above, several times, so as to make altogether about thirteen or more subdivisions in this ray. The anterior main division of one of the anterior lateral rays can also be seen to bifurcate on the fifth piece above the third radial, and one of its branches subdivides at different distances above into three subdivisions, and the other into four. Anterior ray simple to the eighth piece, the pieces between the first and last being short and somewhat wedge-form, while the last is pentagonal and supports two arms, each of which can be seen to bifurcate at least once some distance above. Anal pieces with the usual double alternating arrangement, the lowest piece being obliquely inserted between the upper sloping sides of two of the subradials, and partly under one side of one of the first radials, while a contiguous piece on the left above is supported on an upper truncated side of one of the subradials, and the latter are succeeded by others that connect with the base of the proboscis.

Arms long, slender, very straight, and gradually tapering; slightly convex on the dorsal surface, and flattened so as to fit closely together on each side, with all their divisions running up parallel, or showing scarcely any divergence at the bifurcations, and all composed of short wedge-formed pieces; axillary pieces not more protuberant than the others. Pinnulæ small, and arising one from the upper part of the longer side of each arm piece, alternately on each side, and rather closely approximated to each other.

Surface, in well preserved specimens, finely and obscurely granular, the granules showing on the arms (as seen under a magnifier) a tendency to arrange themselves in longitudinal rows, or to assume vermicular forms. Sutures between all the pieces merely linear.

Entire length of arms and body, 2.80 inches; height of body to the top of first radials, 0.27 inch; breadth about 0.43 inch. Thickness of column, at its connection with the base, 0.17 inch.

This species seems to combine, to some extent, the characters of *Poteriocrinites* and *Zeacrinus*. In general habit, especially in the somewhat flattened and closely contiguous characters of all the divisions of its arms, all around, when folded together, as well as, to some extent, in their mode of division, it reminds one of many species of *Zeacrinus*. In the form of its body, however, and particularly in having three primary radials, instead of only two, in each of the anterior lateral and posterior lateral rays, and about eight below the first bifurcation in the anterior ray, as well as in the general form of its body, it agrees more nearly with the typical forms of *Poteriocrinites*. We know of

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no species liable to be confounded with this when specimens can be seen with its arms well preserved.

*Locality and position.* Keokuk division of the Lower Carboniferous series, at Crawfordsville, Indiana. The typical specimen belongs to Mr. Corey, of Crawfordsville, to whom we are indebted for the loan of it.

SCAPHIOCRINUS DEPRESSUS, M. and W.

Body small, somewhat basin-shaped, about twice as wide as high to the top of the first radials, broadly truncated and concave below, with but slightly expanded or nearly vertical sides. Base occupying the concavity of the under side, and apparently flat or concave. First radial pieces about as high as wide, a little convex, rising vertically, except below, where they curve abruptly inwards to connect with the base; all seen, presenting pentagonal general outlines on their outer faces. First radial pieces nearly twice as wide as high, pentagonal in form, and truncated their entire breadth above for the reception of the second radials. Anal pieces unknown. Second radials longer than wide, strongly constricted in the middle with steeply sloping sides for the support of the arms above. Arms simple from their origin on the second radials, slender, and composed of long, rounded, somewhat constricted joints, which are obliquely truncated at the ends, with the upper end of all projecting, alternately on opposite sides for the support of long, very slender tentacles, composed of long joints.

Breadth of body, near 0.30 inch; height, 0.15 inch. Arms apparently about 1.12 inches in length, and only 0.05 inch in thickness at the constricted part of one of the lower joints; first four joints 0.32 in length.

In its depressed body, with nearly vertical sides, and broadly truncated, concave lower part, this species seems to resemble *S. unicus*, of Hall, as near as can be determined from a description alone. It differs, however, in having the arms simple from their origin on the second radials, with long instead of very short joints. It is peculiar in the broadly truncated and concave character of its under side, as well as in the slenderness of its arms and pinnae. The latter are also remarkably distant from each other, owing to the length of the arm joints.

*Locality and position.* Crawfordsville, Indiana. From the Keokuk division of the Lower Carboniferous series.

ZEACRINUS? ARMIGER.

Body small and depressed, or nearly basin-shaped, but with the under side rounded, and concave in the middle. Base very small and nearly or quite hidden in the concavity of the under side. Subradial pieces comparatively large and curving under below, but not tumid or convex; three with a general pentagonal outline, but probably having a sixth obtuse angle at the middle of each below; the other two, on the anal side, presenting a general hexagonal form, but truncated by the anal pieces in such a manner as to present a heptagonal form, exclusive of the very obtuse angle probably existing at the middle of the under side of each. First radial pieces twice as wide as high, pentagonal in form, and truncated across their entire breadth. Second radials as high as wide, each bearing two arms on their superior sloping sides, and developed into a long, slender, rounded, mucronate spine, which is directed nearly horizontally outward. Anal pieces small, and arranged in a double alternating series, the first on lowest piece being somewhat cuneiform and wedged obliquely down between one of the subradials and the under side of the first radial on the left, so as to touch, by a very short side, the next subradial on the left; second anal piece resting on the short truncated summit of one of the heptagonal subradials, and connecting on the right with one of the first radial pieces, and on the left with one of the upper sides of the first anal piece, and another piece resting on the latter. Above these,  
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others continue on up to connect with the base of the ventral extension of the body. Arms unknown; surface smooth; sutures not impressed.

Breadth of body, 0.39 inch; height of same to top of first radials, 0.17 inch; length of spines formed by the extension of the second radials, 0.40 inch.

In the peculiarity of having its second radial pieces developed into long slender spines, this species agrees with *Zeacrinus* (?) *microspinus* of McChesney, from the upper Coal-measures, and may be regarded as a representative form of that curious Coal-measure species, in the upper part of the Lower Carboniferous. It differs, however, specifically, from Prof. McChesney's species, not only in being much smaller and more delicate, but in having its subradial pieces much shorter in proportion to breadth and distinctly less produced and pointed at the ends. Its anal pieces are also very differently arranged, the first or lower one being wedged down obliquely under the first radial on the *left*, instead of under that on the *right* of the anal series, as in *Z. microspinus*. It is the first American species of the *Cyathocrinidae* we have ever seen with this reversed arrangement of the anal series, though Prof. McCoy has represented a similar arrangement of these parts in an analogous form from the Carboniferous rocks of Scotland. Until the arms of this crinoid can be seen, it is not possible to determine whether or not it belongs properly to the genus *Zeacrinus*.

*Locality and position.* Pope County, Illinois. Chester division of the Lower Carboniferous.

*ZEACRINUS (HYDREIONOCRINUS?) ACANTHOPHORUS, M. and W.*

Body below the top of the first radial pieces much depressed, or nearly saucer-shaped, but concave below. Base very small and almost entirely hidden in the concavity of the under-side when the column is attached. Subradial pieces small, four of them included in the concavity of the under side and projecting horizontally outward into rather acute angles between the first radials, so as to present a subtrigonal general outline, though they are really hexagonal, their lateral and inner edges being connected with each other and to the base, so as to form four very short sides with five obscure angles; fifth one larger than the others, proportionally longer, and curving upward at the outer end, which is truncated so as to form a short side for the support of one of the anal pieces. First radial pieces comparatively large, widening rapidly from below to the top, which is truncated evenly the entire breadth, and about twice as wide as the greatest height, all curving under to connect with the subradials below in such a manner that the body rests upon them when placed on a plane surface with the column removed. Second radials a little smaller than the first, nearly twice as wide as long, pentagonal in form, with lateral margins short and not constricted; each supporting two arms on its superior sloping sides. Arms rather slender for a species of this genus, not being wide enough to be in contact laterally all around when raised vertically; rounded on the dorsal side, rather rapidly tapering, and, so far as can be seen in the typical specimen, all bifurcating on the second piece; below the bifurcation the two pieces are each about as long as wide, the upper one being sometimes slightly constricted around the middle; arm piece above the bifurcation rather slender, longer than wide, rounded, and distinctly constricted around the middle.

First anal piece about twice as long as wide, and wedged so far down under one side of one of the first radials, by the side of the largest subradial, as to come nearly or quite in contact with the very small base. Second anal small and resting upon the short upper end of the larger subradial, between the upper part of the first anal on the right and the first radial on the left; above these the alternating series continues up to connect with the ventral extension.

Ventral prolongation, or so-called proboscis, about equaling the apparent

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length of the arms, comparatively rather narrow and sub-cylindrical below, but widening rather gradually upward above to the summit, where it flares suddenly out all around to about the breadth of the body below, its top being nearly flat, or much depressed, and composed of small, unequal, convex pieces; while each one of the marginal row of these top pieces, all around, extends horizontally outward in the form of a sharp spine about two-thirds as long as the entire transverse diameter of the flattened top itself.\* Plates forming the sides of the ventral portion, below its flattened spiniferous crown, probably more or less costated, or sculptured, in perfect examples, but the specimen seen is not in a condition to show this, though the usual pores can be seen passing through the sutures between the plates. Surface of body and arms apparently smooth.

Height of body to top of first radials, about 0.18 inch; breadth of do. 0.65 inch; height to top of ventral portion, including the body, 1.20 inches; breadth of the flattened top of the ventral portion, exclusive of the free marginal spines, about 0.50 inch; whole breadth across same to the extremities of the spines.

The form of the body and the arrangement of the anal pieces of this species are very similar to those of our *Z. discus*, from the Upper Coal-measures, but its under side is more decidedly concave, its first radial pieces proportionally higher, and separated by decidedly deeper sutures. Its subradials are also proportionally smaller. From *Z?* *microspinus*, of McCheaney, it is at once distinguished by not having its second radial pieces developed into spines, and by the different structure of its arms.

*Locality and position.* Fulton County. Associated with the lowest coal bed of the Illinois Coal-measures.

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\* On comparing this Crinoid with Prof. de Koninck's figure of the type of his genus *Hydreionocrinus* (*H. Woodianus*; Bull. de l'Academy Royale de Belgique, 2me serie, tome III, pl. II), we have been much impressed by the remarkable resemblance of the large ventral extension of its body with its depressed or flattened crown, surrounded by a series of marginal spines directed horizontally outward, to the part in Prof. de Koninck's type supposed by him to be formed by the lateral coalescence of the arms, in such a manner as to form a kind of cylindrical extension of the body upward. In our species, however, there are unquestionably well developed, free arms, independent of this part. It would be such an anomalous structure for a Crinoid belonging to the *Cyathocrinida*, and otherwise so similar to *Zacrinus* and *Poteriocrinus* as *Hydreionocrinus* is, to have no traces of free arms, that we are tempted to make the inquiry, whether Prof. de Koninck's specimen may not have had its arms broken away and the lower parts of the rays on which they rested accidentally pressed in so as to appear to support the ventral extension; or, in other words, so as to give this part the appearance of being actually composed of the arms themselves united laterally and crowned by a vault? If this upward prolongation of the body was really composed of the arms united laterally, and there were no free arms, with the usual ambulacral openings at their bases, the whole visceral cavity would seem to have been hermetically sealed, excepting perhaps the minute lateral pores we have found to exist in the ventral extension of many analogous forms. Prof. de Koninck distinctly states that he was unable to find any traces of an anal or buccal opening in his type, and we have been equally unable to find any traces of such openings in any of the numerous specimens of *Poteriocrinus*, *Scaphiocrinus*, *Zacrinus*, *Calocrinus*, and other analogous forms we have seen, that are provided with a similar large ventral extension of the body. But in all these types there are well developed free arms, with ambulacral openings at their bases. It will be remembered that the genus *Haplocrinus* was supposed to have its arms united to form a kind of conical vault, until Müller discovered a species with true free arms independent of this part.

If *Hydreionocrinus* really possessed free arms, it would otherwise agree so exactly with *Zacrinus* that it would seem to be impossible to separate them even subgenerically; in which case Troost's name would probably become a synonym under *Hydreionocrinus*, as Prof. de Koninck's name was, we believe, published a few months earlier than Dr. Troost's. It is to be hoped that those who may have an opportunity to examine other specimens than those studied by Prof. de Koninck, of the typical species of *Hydreionocrinus*,\* will examine them very carefully to see if some remains of free arms cannot be found.

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\* *Hydreionocrinus?* *globularis*, de Kon., seems to us to belong to a distinct genus nearly allied to *Agassizocrinus*, which in some species has its base distinctly divided into five parts.



## EUPACHYCRINUS BOYDII, M. and W.

Body much depressed, or twice and a half as wide as high to the top of the first radials, rounding inward above the second radials, and under to the very profound central concavity below; composed of thick, strong, slightly convex plates. Base very small, and deeply sunken in the concavity of the under side. Subradials comparatively large, convex and curving upward above, and under below, and then again upward into the concavity of the under side, where each of them has a mesial indentation or notch; each presenting a general pentagonal outline, excepting two on the anal side, which are modified for the reception of the anal pieces. First radial pieces about twice as high, convex, and equaling the subradials in breadth; all pentagonal in form. Second radial pieces convex, about half as large as the first, which they do not quite equal in breadth, although they are in contact with each other laterally all around, thus giving a contracted appearance to the body just above the first radials; each about twice as wide as high, pentagonal in form, and bearing on one superior sloping side an arm, while on the other there rests a smaller secondary radial bearing two arms; thus making, as far as can be seen, three arms to a ray, or if the same structure exists in all the rays, fifteen to the entire series. First, or subanal, rather large, nearly quadrangular in form, and resting between the sloping upper sides of two of the subradials, under one side of the first radial on the right, and connecting with the second radial on the left; but apparently not always extending up far enough to have its upper angle truncated by one of the succeeding anals above. Second anal piece considerably smaller than the first, and resting upon the upper truncated side of one of the subradials; above these two or three smaller pieces appear between the arms. Surface smooth. Sutures between the body-plates rather deep.

Arms slightly convex on the outer side, with lateral margins flattened and straight, so as to fit closely together when raised up vertically; each composed below of a single range of wedge-formed pieces, but soon passing into a double alternating series above.

Breadth of body across the middle, 0.90 inch; do. across the second radials, 0.64 inch; height to top of first radial pieces, 0.40 inch.

This is a very neat, symmetrical crinoid, unlike any other known to us, and remarkable for having its much depressed body rounding in above, at the top of its first radial pieces, so as to be very distinctly narrower across above the top of the first radials than below. Its sides also round very neatly under below, and so far into the deep concavity of the under side that the lower (inner) ends of the subradial pieces curve upward into the mesial concavity nearly as far up as their outer or upper ends. It seems to be the same form figured by Prof. Yandell and Dr. Shumard, in their "Contributions to the Geology of Kentucky," (see fig. 4 a, b), without a description or name, from near Grayson Springs, Kentucky. The specific name is given in honor of Dr. Boyd, of Chicago, to whom we are indebted for the use of the last specimen seen.

*Locality and position.* Chester, Illinois. Chester division of the Lower Carboniferous limestone series.

## HOMOCRINUS ANGUSTATUS, M. and W.

Body below the first radial pieces more or less obconic, or somewhat constricted below the middle. Base forming a narrow cup, sometimes nearly as high as wide, with vertical sides; composed of convex pieces, once and a half to nearly twice as wide as high. Subradial pieces as long as the basals, or sometimes a little longer, and always wider; more or less convex, all hexagonal excepting one on the anal side, which is heptagonal. First radial pieces nearly one-third wider than high, being as wide as the subradials, but shorter, and not so tumid; all pentagonal, with the upper side truncated their

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entire breadth. Succeeding radials, of which there are three in each of the rays seen,\* as wide as the first, but much shorter, or only one-third to one-fourth as long as wide, thus forming free arms so wide as to be nearly in contact all around, excepting on the anal side; last or fourth radial supporting upon its superior slightly sloping sides, the first divisions of the arms, which, at least in one of the posterior, and one of the lateral rays, bifurcate on the third piece, while some of the divisions appear to divide again on the fourth piece, which is as far as they can be traced in the specimens examined. Column large, or nearly two-thirds as wide as the base, at its connection with the latter; but suddenly tapering downward, and, at least in one of the examples, ending with the sixth piece in a rounded point, evidently showing this individual to have been free at maturity. Connecting, or upper joint, of the column in the only two examples seen, very thick, and in one quite tumid.

Height to summit of first radial pieces, 0.48 inch; breadth of do., 0.50 inch; height of base, 0.20 inch; breadth of do., 0.24 inch; breadth of rays below the first division, 0.17 inch.

This species seems to be most nearly related to *H. polydictylus* of Shumard, from which it differs in the remarkable narrowness of its base, and the proportional greater thickness of its column. It also differs in having only three to four primary radials to each ray, instead of five to six.

*Locality and position.* Mount Carroll, Illinois. Cincinnati Group of Lower Silurian.

#### Genus CODONITES, M. and W.

In the Proceedings for April of last year, page 84, we proposed, in a note, to found a new genus under the above name, for the reception of *Pentremites stelliformis*, of Owen and Shumard. This genus agrees with *Pentremites* in structure, excepting that its openings corresponding to those usually called the ovarian apertures (*Hydrospires*, of Mr. Billings), instead of forming with the larger opening, usually called the anus, five round apertures, appear at the surface as ten elongated slits, widest at the upper and inner ends, and situated one on each side of each of the so-called pseudo-ambulacra.† Again its aperture, corresponding to that usually considered the anus in *Pentremites*, is proportionally larger, more remote from the center of radiation, and completely disconnected from the so-called ovarian opening on each side of it. As in *Pentremites*, the central hiatus is covered by small plates in perfect specimens, and from this little disc of plates two rows of minute alternating pieces are seen to extend out, so as to cover each of the little ambulacral furrows, passing along the middle of each pseudo-ambulacral area and under the central disc, into the covered central aperture. These little covering plates of the furrows probably extended the whole length of the pseudo-ambulacra, but were doubtless movable, or capable of opening along the middle, being in fact marginal ambulacral pieces.

As in the genus *Pentremites*, we also observe in this type three pieces an-chylosed to the bottom of the busasal pieces, with the sutures between them exactly coinciding with those separating the three busas pieces; these we propose to call supplementary basal pieces.‡ The internal folds, or compressed

\*The right posterior ray seems to be an exception to this statement, as it appears to have only three radials including the first, with the second one nearly as large as the first. Its parts, however, are not well preserved.

†We regard these, as elsewhere stated, as really recumbent arms, similar to those of some Cystoids.

‡Mr. S. S. Lyon was the first author, so far as we are informed, who called attention to these lower pieces in *Pentremites*; and he showed that they are really separable from the basal pieces, in some cases (See Owen's Geol. Report of the Kentucky Survey, vol. 3, p. 468). He, however, regarded these pieces as the true base, and those usually so considered, as subradials. At one time we were inclined to adopt this view, as has been recently done by Mr. Billings, in an interesting paper on the structure of the Blastoids and other types, published in the American Journal of Sciences and Arts, for July, 1859. The fact, however, that these lower pieces do not alternate with the range above, that Mr. Lyon's view

tubes of thin calcareous matter under the pseudo-ambulacra, and connecting with the inner ends of the slits representing the so-called ovarian pores, are also constructed as in *Pentremites*, excepting that here there are twelve of these tubes under each pseudo-ambulacral area, while we have not seen more than eight in any of the true *Pentremites*, nor more than four in *Granatocrinus*, though we are not positively sure that these numbers will always be found to hold good as generic distinctions.

Compared with *Codaster*, the type under consideration is found to differ in having only two of the slits mentioned in each of the anal and interradial areas, instead of about eight to sixteen; while it has these slits equally in the anal and interradial areas, instead of only in the latter, as in *Codaster*. It also differs from that genus in having the internal folds or compressed tubers, under the so-called pseudo-ambulacra, instead of extending under the whole interradial areas.

Since proposing this new genus, we have received from Mr. Wachsmuth a fine specimen of another species of this type, which, although widely different specifically, from the typical species, still exhibits very clearly the same generic characters, as will be seen from the following specific description:

CODONITES GRACILIS, D. and W.

Body comparatively small, pentagonal-suboval, longer than wide, the widest part being at the lower extremities of the so-called pseudo-ambulacral fields, which terminate a little below the middle. Supplementary base small, very short, or only appearing to be composed of a single tripartite joint of the column. Base low, or near three times as wide as high, expanding rapidly upward, and pentagonal in outline, as seen from below; basal pieces of moderate size, two pentagonal and one hexagonal. Radial pieces nearly twice as long as wide, with a general oblong outline, though they are a little wider in the middle than above or below; while the superior lateral angles are a little truncated by the anal and interradial pieces, and the lower end is rounded, or somewhat obtusely angular in outline at the middle; all rather distinctly convex below the middle; so called pseudo-ambulacral sinuses narrow, and very slightly tapering,—extending down a little below the middle, where they each terminate at a little pointed projection, which is directed horizontally outward, so as to add to the pentagonal form of the body, as seen from above or below. Anal piece of moderate size, wider and more obtuse below than the interradials, and narrowed above, with a comparatively large anal opening, nearly dividing it a little below the middle, where it is very contracted.\* In-

would require should be considered subradials, would alone be an objection to this conclusion. It is also worthy of note, that when these lower pieces are removed, we find the next range of pieces above closed together, so as to form the bottom of the visceral cavity, as true basals. Again in those species of *Granatocrinus*, like *G. Norwoodii*, with a deep concavity in the under side, we find the pieces corresponding to those Mr. Lyon thinks are the subradials, as it were, pushed inward, and forming a little pyramid in the bottom of the visceral cavity, precisely as we see the true basals in various types of Crinoids with a sunken base. In addition to this, although adult specimens of the type here under consideration have this lower part, supposed by Mr. L. to be the true base, as solid as in the true *Pentremites*, young individuals show that it is actually composed of five or six of the upper joints of the column enlarged and ankylosed together. Similar enlargements of the upper joints of the columns of various types of Crinoids are known to occur, as, for instance, in *Forbesiocrinus* and its allies, in *Pteriocrinites*, *Apicrinites*, etc. It is true, that in these the enlarged part is not divided longitudinally by sutures, as in *Pentremites*, *Codonites*, etc. This fact, however, will be seen to be of less importance when it is remembered that there are examples of true Crinoids with the column longitudinally divided; such, for instance, as in *Barycrinus*, where we see the whole column divided into five sections longitudinally, through its whole length. And here the five sutures of the column coincide with those between the five true basal pieces, exactly as the three sutures between the supplementary basal pieces in *Codonites* and *Pentremites* coincide with those between their three basal pieces.

\* We have several times thought we could see indications of sutures dividing the anal piece of *Codonites stelfiiformis* and *Granatocrinus Norwoodii* into three pieces. That is, a transverse suture at the anal opening, and a longitudinal one dividing the upper or inner half into two pieces. Some casts of the interior of *G. Norwoodii* seem to show this distinctly.

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terradials more than twice as long as wide, the widest part being below, while the central region is much contracted, and the upper part, like that of the anal piece, somewhat dart-shaped, and a little concave, with a smaller tubercle occupying the middle of the little concavity.

So-called pseudo-ambulacral fields rather narrow, somewhat convex, with mesial or ambulacral furrows rather wide and deep, particularly above the middle; pore or arm-pieces, about twenty-two on each side of each area; lancet pieces very narrow, but thick, and rather deeply furrowed along the middle above, where they form the bottom of the ambulacral furrows; farther down, the pore pieces close in so as nearly or quite to cover the lancet pieces at the lower end. Elongated slits corresponding to the openings usually called ovarian apertures in *Pentremites*, widest at the upper end, and extending down apparently three-fourths of the length of the pseudo-ambulacral areas, so very close to the margins of the latter as scarcely to leave more than a thin intervening space above, and apparently none below. Central hiatus very small, and doubtless covered by minute plates in perfect specimens.

Surface distinctly ornamented with very regular, well-defined striae, running parallel to the upper margins of the basal pieces, and to the inferior and lateral margins of the radials. Along the margins of the pseudo-ambulacral areas, narrow flattened, or very slightly concave spaces are seen extending along the surface of the radial pieces, and corresponding to the rather broad, deep furrows seen occupying the same position in the typical species, *C. stelliformis*. (Column and pinnulæ unknown.)

Height, 0.60 inch; breadth, about 0.50 inch.

This species, although agreeing with *C. stelliformis* in the important characters distinguishing this genus from *Pentremites* and *Codaster*, differs so materially in form and other specific characters, as to render a comparison unnecessary. In general form it much more nearly resembles the true *Pentremites* than the typical form of *Codonites* does. It must be very rare, as we are not aware that more than the one specimen has ever been found.

*Locality and position.* Lower division of the Burlington group of the Lower Carboniferous, at Burlington, Iowa. Mr. Wachsmuth's collection.

#### PENTREMITES BURLINGTONENSIS, M. and W.

Body attaining a medium size, ovoid, or ovoid-subglobose, depressed and short below, and rounded and more produced above. Supplementary base very small, or only one-fourth as wide as the base, rounded and firmly ankylosed to the true base; short, or apparently composed of not more than three ankylosed segments from the upper end of the column. Base of moderate size, much depressed, or having the form of a pentagonal dish. Radial pieces once and a half as long as wide, rather narrow below, and widening upward to near the middle, above which they are very slightly contracted to the top; each divided three-fourths of its length by its rather wide pseudo-ambulacral sinus. Aual and interradial pieces very small, exposed part presenting an elongate rhombic outline, the upper part being more elongate and acute than the lower. So-called pseudo-ambulacral areas\* wide, moderately convex, tapering rather gradually below the middle, and more abruptly above; so-called pore pieces about 35 on each side of each area, less than half as long, transversely, as the breadth of the exposed part of the lancet pieces at their widest part, nearly transverse above, but becoming somewhat oblique toward the lower part of the area; supplementary pore pieces small. Lancet pieces exposing a wide, lanceolate form, being widest above the middle, gradually tapering below, and contracting abruptly above; each with its mesial or ambulacral furrow rather wide and deep, and minutely crenate within; transverse

\* Although we use here the usual term for these parts, we really regard them as recurrent arms, similar to those seen in some *Cystoidea*.

furrows well defined, and also minutely crenate. Central hiatus small. So-called ovarian openings small, and those distinct from the anal opening appearing at the surface as four pairs of closely approximated elongate-oval pores. Anal opening comparatively large, and, as usual in the genus, including one of the pores on each side. Surface ornamented with five parallel striae, running as usual in allied species.

Height of one of the smaller, less globose specimens, exclusive of the little supplementary base, 0.50 inch; breadth, 0.49 inch. Height of a large, more ventricose specimen, 0.87 inch; breadth of do., 0.84 inch.

This species has much the form and general appearance of the common *P. Godoni*,—so much so, indeed, that those who give wide limits to species would probably fail to observe any well defined differences. On comparison, it will be found to differ, however, in the following characters, viz.: In the first place, its pseudo-ambulacral areas are more convex, and not bounded by near such sharply elevated margins of the radial pieces. Its pore pieces are also larger, and scarcely more than half as numerous as in *P. Godoni*. Its anal and interradial pieces are likewise decidedly smaller than in that species, while it also presents the well-marked difference of having its so-called ovarian openings with each pair appearing at the surface, as two closely approximated, but distinct elongate-oval pores, instead of as a single round, larger opening. It moreover holds a much lower geological position than *P. Godoni*.

It is the first true, typical *Pentremite* we have seen with each pair of ovarian pores (so-called) appearing as two distinct pores at the surface. It must be quite rare, as only three specimens have come under our observation.

*Locality and position.* Upper division of the Burlington group of the Lower Carboniferous, at Burlington, Iowa. No. 387 of Mr. Wachsmuth's collection.

#### OLIGOPORUS COREYI, M. and W.

Body small, subglobose, or apparently depressed-globose, and deeply sulcate; composed of moderately thick plates; apical region sunken. Inter-ambulacral areas twice as wide as the ambulacral, very convex, and rounded over from side to side; composed at the middle by six ranges of plates, which decrease in numbers to apparently about three ranges, at the upper and lower extremities of the areas. Ambulacral areas deeply furrowed along each side, and rising into a rather prominent ridge along the middle; composed of somewhat irregular plates, as to size and form, but clearly showing but two rows on each side of the mesial zig-zag suture, the outer range being generally a little shorter in the transverse diameter than the inner; the two pores of each piece situated near its outer end. Apical disc unknown. Oral aperture, as seen in the test, comparatively large. Surface unknown.

Height, as near as can be determined from a somewhat distorted specimen, about 1.65 inches; breadth near 2 inches.

This species is most nearly allied to *O. Dana*, but differs not only in being much smaller, and apparently more depressed in form, but in having much more deeply furrowed ambulacral areas, and only six rows of interambulacral pieces at the widest part of the areas, instead of eight, the plates being also larger in proportion to the size of the body.

From our *O. nobilis* it will also be readily distinguished by its much smaller size, and more deeply sulcate ambulacral areas, which are also proportionally much wider. It also differs in having six rows of interambulacral pieces at the widest part of each area, instead of only five.

*Locality and position.* Crawfordsville, Indiana; from the Keokuk division of the Lower Carboniferous series. The specimen from which the description was made out belongs to Mr. Corey, of Crawfordsville, Ind., to whom we have dedicated the species.

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## BRACHIOPODA.

CHONETES?? MILLEPUNCTATA, M. and W.

Shell attaining a large size, very thin, transversely subsemicircular, or more than twice as wide as long, with lateral extremities rounded. Dorsal valve nearly flat, or but slightly and evenly concave; hinge line a little less than the greatest transverse diameter; cardinal process rather stout, with an obscure linear ridge (or sulcus) extending forward from its base nearly to the front; cardinal edge slightly thickened within, so as to form a faintly defined ridge extending about half-way from the cardinal process toward each lateral margin, but apparently without any trace of sockets for the reception of teeth in the other valve; muscular and other internal markings unknown; surface ornamented by numerous slender, exceedingly regular, closely arranged concentric lines, exactly parallel with each other and the front and lateral margins. (Ventral valve unknown.)

Length of a medium sized specimen, 1.30 inch; breadth, 2.95 inches. Largest examples seen, 2.10 inches in length, and of nearly the same proportional breadth as the others.

Of this very remarkable shell we have seen six or eight specimens, and some fragments of others. All of the specimens yet found, however, are dorsal valves only, the ventral valve being entirely unknown to us. The slightly worn, or more or less weathered condition of the specimens has obliterated whatever muscular or other internal markings there may have been. In most cases only patches of the shell itself remain, though, even in these cases, the general outline and external surface markings are very distinctly defined in the matrix. All of the specimens show a rather obscure, linear, internal sulcus extending from the base of the cardinal process nearly to the anterior margin. This, however, is probably caused by the accidental removal of a linear mesial ridge, because we also see it equally defined in impressions of the external surface of the valve left in the matrix, just as would be the case if a firm internal ridge had been, owing to the thinness of the shell, as it were, pressed through. The concentric lines of the surface present an extraordinary degree of regularity, both in size and arrangement. On a medium sized dorsal valve about sixty of these lines may be counted, while some of the largest show twice as many. They are of exactly the same size and distance apart on all the specimens, and of so nearly the same size on all parts of the same individual as to appear to the eye to be exactly uniform throughout. By measurement, however, we count fifteen of them in the space of 0.25 inch near the margins of a medium sized specimen, and twenty in the same space near the beak. In a few instances we have observed what seemed to be the faintest possible traces of a few larger radiating lines or costæ, near the middle of the anterior margin of the dorsal valve. None of the specimens show the cardinal process entire, but as far as its characters can be made out it seems to have been much as in *Chonetes*.

The most remarkable character of this shell, however, remains to be mentioned. That is, its extremely coarse punctate structure, and the unusually close arrangement of the punctures, which are so large as to be nearly visible to the unassisted eye. As seen by the aid of a common single pocket lens, they present, on the inner surface of the dorsal valve, much the appearance and arrangement of the cells of a delicate *Chonetes*, the spaces between them being much less than the diameter of the pores themselves. They appear to diminish rapidly in size, however, as they approach the external surface, near which they seem to be a little less than the diameter of the spaces by which they are separated. As we have never seen such a shell structure as this in any species known to possess the characters of the genus *Chonetes*, nor indeed in any other known Brachiopod, we are very strongly inclined to believe our shell really belongs to an undescribed genus. The fact that there appear to be no sockets in the cardinal margins of its dorsal valve, for the reception of

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teeth in the other valve, would also favor the conclusion that it is not a true *Chonetes*. Nevertheless, we prefer to place it provisionally in that genus, until specimens can be obtained showing the dorsal valve, with the muscular impressions and other generic characters. Should it be found, as we believe it will, to be a new generic type, we would suggest for it the name *Isogramma* (ἴσος, equal; γραμμῆ, a line), in allusion to the remarkable equality of the concentric lines of the surface.

To whatever genus our shell may really belong, it is evidently very closely allied, even specifically, to a form figured by Mr. Davidson from the Carboniferous limestone of Scotland, in his valuable Monograph of the British Carboniferous Brachiopoda, vol. ii, part v, pl. lv, fig. 13. Mr. Davidson referred his shell, with much doubt, on the authority of Dr. De Koninck, to *Chonetes concentrica*, of the latter author. We fully concur with Mr. Davidson, however, in the opinion that it is distinct from Prof. De Koninck's\* species, as it is much longer, and instead of being marked with only 12 to 13 large concentric ridges, has about 37 regular, more concentric lines. In our species there are about twice the number of lines seen on that figured by Mr. Davidson, in specimens of the same size; and as this character is remarkably uniform in all our specimens, we cannot believe it otherwise than a specific difference.

*Locality and position.* Upper Coal Measures, Marion County, Illinois, where it occurs associated with nearly all the fossils in the Upper Coal Measures of Kansas and Iowa, and in those in Nebraska referred by Profs. Marcou and Geinitz to the Permian.

#### SPIRIFER FASTIGATUS, M. and W.

Shell attaining a rather large size, moderately convex, very transverse, or distinctly more than twice as wide as long; greatest breadth on the hinge line; lateral extremities very attenuate and acutely pointed in young specimens, but becoming more obtuse in larger individuals; front and anterior lateral margins broadly and rather regularly rounded. Dorsal valve nearly as convex as the ventral; beak depressed, somewhat incurved, and scarcely projecting beyond the hinge line; area of rather more than usual breadth for that of a dorsal valve, and arched with the beak; mesial fold commencing at the beak scarcely larger than one of the ribs on each side of it, but increasing gradually in breadth and prominence to the front, where it is occupied by about six to eight costæ, which, however, coalesce into one or two at the beak. Ventral valve regularly convex over the central region, and somewhat compressed toward the lateral extremities; mesial sinus commencing narrow and very small near the beak, and widening and deepening gradually to the front, where it is occupied by about eight depressed, rounded costæ, which, like those on the fold of the other valve, coalesce with those on each side and with each other, so as to leave but one that extends quite to the beak; beak rather depressed and not projecting much beyond the hinge line, arched or moderately incurved; area rather narrow, and extending with almost perfectly parallel margins, quite out to the lateral extremities of the hinge, marked by the usual transverse and vertical striæ; foramen wider than high, rather large, and extending close up under the rather flattened apex of the beak.

Surface ornamented by depressed, rounded, bifurcating or trifid, more or less fasciculated costæ, about five of which, on each side of the mesial sinus and fold, are larger than the others, and divide before reaching the front, so as to form as many fasciculi of two or three ribs each, the furrows between which are less strongly defined than those between the bundles. Toward the lateral extremities some eight or ten smaller, simple, obscure costæ, that do not reach the beaks, may also be counted, on each side of each valve, gradually becoming obsolete near the ends. Crossing the whole, fine obscure, undulat-

\* It is due to Prof. De Koninck that we should state that it was only doubtfully he referred the English specimen to his species.

ing striæ, and a few stronger marks of growth may be observed on well preserved specimens, the striæ, however, excepting near the front and lateral margins, not being readily seen without the aid of a magnifier.

Length, about 1.45 inches; breadth, 2.20 inches; convexity, about 1.50 inches; height of area at the beak, 0.26 inch.

We have had specimens of this fine *Spirifer* under consideration for a long time, and after numerous careful comparisons, we have been unable to identify it with any of the described species. It seems to be most nearly allied to our common Coal-Measure species *S. cameratus*, of Morton, with which it agrees in the fasciculated character of its costæ, and in general appearance. It differs, however, in several characters by which it can be readily distinguished on comparison. In the first place, its larger fasciculated costæ are distinctly broader, and rather more depressed on the anterior slope of its valves, and proportionally less numerous. The incurved apex of the beak of its ventral valves is always less abruptly curved, and much more flattened. The most marked character, however, is to be observed in its cardinal area, which has its margins almost perfectly parallel, instead of being always sloping from the beak to the lateral extremities. The same characters and its narrow mesial fold and sinns distinguish it from the variety of *S. striatus*, with somewhat fasciculated costæ. It belongs to the subgenus *Trigonotreta*.

*Locality and position.* Keokuk division of the Lower Carboniferous series. at Crawfordsville, Indiana.

#### STRICKLANDINIA DEFORMIS, M. and W.

Shell (internal casts) longitudinally subovate, oblong, or sometimes in young examples nearly or quite as wide as long; valves very nearly equal, and sometimes showing very faint traces of an obscure mesial prominence on the dorsal valve, and of a corresponding depression near the front of the ventral valve; hinge line straight, and less than the breadth of the valves; surface apparently smooth, or only with concentric lines on the young shell, while casts of the adult show some traces of a few obscure, irregular, radiating ridges. Beaks, area and finer surface markings unknown.

Length of a young internal cast, 1 inch; breadth, 0.97 inch; convexity, 0.46 inch. Length of a large specimen, 1.93 inches; breadth, 1.58 inches; convexity, 1 inch.

This shell varied so greatly in form at different stages of its growth that it is very difficult to give a description that will convey a correct idea of it. Young examples from 0.70 to one inch in length, approach a broad obovate form, being truncated on the hinge line, and somewhat narrowly rounded at the middle of the front; while their posterior lateral margins are more or less straightened and inflected, as we often seen in *Rensselaeria*. After attaining this size and form, the shell, judging from some four adult examples we have seen, seems to have suddenly commenced a more vigorous growth, mainly forward and antero-laterally, so as to attain a much larger size, leaving the valves of the young shell, as it were, opened and spread upon the beaks, thus completely destroying the symmetry of the entire shell. At this stage of growth the shell has a curious constricted appearance at the connection of the young and adult shell; while the whole breadth posteriorly is only that of the young shell, and the widest part is then some distance in advance of this, and the posterior margins are strongly flattened by their sudden inflection towards each other there.

The casts show that the chamber in the beak of the ventral valve is of moderate size, and supported upon a rather short mesial septum. The socket processes are seen, by their impressions in the cast, to be small, not united, and scarcely assuming the character of plates; while the crural processes extended from their inner lower sides forward nearly parallel, so as to leave two slender, deep perforations in the cast. The surface of the young shell appears

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to have been smooth, or only marked with the concentric striæ, but internal casts of large individuals sometimes show very faint traces of a few broad irregular, radiating, flattened ridges.

It is probable that this species is most nearly allied to *Stricklandinia Davidsoni*, of Billings (Geol. Mag. vol. v, pl. iv, fig. 1, 1 a), which, in some stages of its growth, it resembled rather nearly in form. In all the large examples, however, it differs extremely from that shell, in its remarkable narrowness across the umbones, and its truncated or flattened posterior lateral margins. Its front is also less produced and less narrowly rounded in the middle in these larger specimens.

*Locality and position.* All the specimens of this species we have seen were found loose in Carroll County, Illinois, near rocks of the age of the Niagara group. They are all in the condition of white quartz casts of the interior.

## LAMELLIBRANCHIATA.

### MONOTIS ? GREGARIA.

Shell very small, extremely thin, compressed, oblique, varying from truncato-suboval to subcircular; hinge line less than the breadth of the valves; auricles small, obtusely angular, undefined by any sinuosity of the margins; posterior (?) margin rather regularly rounded in outline, and rounding into the pallial margin; anter. (?) border prominent below and rounding into the base, but straight and ascending with a backward slant to the hinge; beaks located near the middle of the hinge line, above which they seem scarcely to rise. Surface marked by extremely fine concentric striæ, and a few somewhat larger furrows or wrinkles of growth, crossed on the anterior (?) half of each valve by small radiating costæ, generally not defined near the anterior (?) margin.

Antero-posterior diameter, 0.25 inch; height, or diameter at right angles to the hinge, 0.20 inch; convexity unknown.

Of this little shell we have numerous specimens, all compressed to entire flatness on the surfaces of the laminae of shale, many of them lying with the two valves opened out and connected by their hinge margins. As thus seen, their small size causes them to appear much like the valves of *Posidonomia*, or those of some of the little phyllopod Crustacea. This form, however, is found, on closer examination, to be different, while their radiating costæ also indicate different affinities. Some individuals are a little wider proportionally, in their antero-posterior diameter, than that from which the above measurements were taken, and these have much the outline of the left valve of some forms of *Aviculopecten*, excepting that the auricles are not in the slightest degree defined (in either valve) by any traces of a marginal sinus.

It is possible that this little shell may be a true *Lima*, as it has much the form of some species of that genus, and there certainly are in the Western Coal-measures, two or more species apparently agreeing in all respects with that genus. If a *Lima*, of course the side we have described as the anterior must be the posterior, and *vice versa*. The reasons for doubting its relations to the genus *Lima*, however, are, (1), its extreme thinness; (2), the fact that it seems to have a prismatic structure; and (3), its very small size. It is possible, however, that the extremely thin fibrous shell, as we now see, may consist only of the external lamina, left after the decomposition of the inner layers. If so, and the fibrous appearance is really the original structure, it would most probably belong to some perhaps undescribed genus, allied to *Aviculopecten*, of the family *Aviculidae*. If a true *Monotis*, it would be the only known species of that genus in our Carboniferous rocks, the common Western Coal-measure shells usually referred to that genus, belonging to a very distinct group, to which Beyrich has applied the name *Pseudomonotis*.

*Locality and position.* Jacksonville Shaft, Illinois, from near the middle of the Coal-measures.

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## AVICULOPECTEN SPINULIFERUS, M. and W.

Shell of medium size, rather compressed, having a moderately oblique, truncato-suboval, or suborbicular outline. Hinge apparently nearly equaling the antero-posterior diameter of the shell; ventral margin forming a broad semiovalate outline, being more abruptly rounded up behind than in front. Posterior wing rather pointed, apparently not quite as long as the rounded margin of the valves below, from which it is separated by a rounded sinus. Anterior wing compressed, narrow, as long as the anterior margin of the valves; in the left valve pointed, and separated from the margin below by a narrowly rounded, rather deep sinus. Beak of the left valve moderately prominent, and placed a little in advance of the middle. Surface of same valve ornamented with numerous, distinct, unequal, radiating costæ, arranged usually with one or two smaller ones between each two of a somewhat larger series, the latter of which bear numerous little round, regularly arranged, somewhat oblique spines; crossing the whole there are also numerous minute concentric striæ. (Right valve unknown.)

Height of left valve, about 1.50 inch; antero-posterior diameter, near 2 inches.

This is a delicate species, apparently with thin valves. Its costæ seem to be nearly equally developed over the whole of the left valve, including the wings, or at any rate the posterior one. On the body of this valve, near the ventral margin, about five of the larger spiniferous costæ, and some six or eight of the smaller non-spiniferous ones may be counted in the space of half an inch. The spines of the larger costæ were short, round and pointed (not being formed by vaulted laminae of growth), and arranged along these costæ at regular intervals of about 0.10 inch apart, those at the ventral margin being larger than the others, and projecting a little below the border. An impression of a part of the anterior wing of the right valve shows that it was distinctly costate, two or three of the costæ running nearly parallel to the hinge margin, and bearing short spinules.

In casts of this species without the spines, the costæ present much the same subnodose appearance as those seen on *A. fallax* (= *Pecten fallax*, McCoy, Carb. Foss. Ireland, pl. 14, fig. 2), but that species seems to have had no spines. It is also much less oblique, and higher in proportion to its antero-posterior diameter.

We place this species in the genus *Aviculopecten* only provisionally, as we have not seen its hinge. It is highly probable that there are a number of undescribed genera among the Palæozoic species usually included in the genus *Aviculopecten*, or wrongly referred by some to the genus *Pecten*.

*Locality and position.* Crawfordsville, Indiana. Keokuk division of the Lower Carboniferous series.

## Genus CARBONARCA, Meek and Worthen.

Shell (as determined from internal casts) equivalve, inequilateral, very convex, transversely oblong or oval; umbones gibbous, prominent, and strongly incurved with subangular or prominent posterior slopes; valves closed all around, with smooth margins; ligament external; cardinal margin a little arched, with, at the anterior extremity in each valve, two rather oblique, comparatively stout teeth, and extending along its entire length from immediately behind these, a row of minute interlocking teeth or crenulations, as in *Area*.

This genus seems to belong to the *Arche*, near *Isoarca*. It differs, however, very decidedly from that genus, in having, in addition to the small interlocking crenulations along the whole length of the hinge, two well developed and independent larger teeth at the anterior end of the hinge. The specimens seen are all internal casts, but an impression of the hinge of a right valve, in the matrix, shows its characters very clearly. There is no

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gradation from the series of minute teeth into the two large ones at the anterior end of the hinge, the first of the smaller series immediately behind the two larger ones being as minute as any of those farther back, so that the contrast between the two sets of teeth is well marked and abrupt. The hinge margin was doubtless provided with a cardinal area, but as we only have internal cast, it has not yet been seen.

CARBONARCA GIBBOSA, M. and W.

Shell transverse, short-oblong, very convex; posterior side wider than the other, and vertically subtruncated; anterior margin rather narrowly rounded; ventral margin nearly straight along the middle, but sloping and rounding up anteriorly, and more abruptly behind, cardinal edge equaling two thirds of the whole length; larger anterior teeth inclined forward and upward, and those of the small series ranging nearly vertically, or slightly inclined forward anteriorly, and a little backward behind; umbones gibbous, but with their outer and upper surfaces a little flattened, so as to impart a slightly subangular or prominent character to the post-umbonal slopes; immediate apices of the strongly incurved beaks placed about one-fourth the entire length of the shell behind the anterior extremity. Surface markings unknown.

Length, 0.82 inch; height to top of cardinal margin (of cast) behind the beaks, 0.56 inch; do. to top of umbones, 0.65; convexity of the two valves, 0.57 inch.

*Locality and position.* Springfield, Illinois; Upper Coal measures. Also same horizon at Lasalle, Ill. The specimens from the latter locality are, in some examples, more depressed and oblique than the typical form from near Springfield, and these may possibly belong to a distinct species, if the differences noted are not due to accidental distortion. If really distinct, this form might be called *C. depressa*.

\* MACRODON DELICATUS, M. and W.

Shell small, about twice and a half as long as high, moderately convex, elongate rhomboidal in outline; posterior margin obliquely truncated, so as to be angular at the base; cardinal margin about three-fourths the entire length, and nearly parallel with the base; anterior extremity very narrowly rounded; basal margin nearly straight along the middle, but rounding very gradually upward anteriorly; beaks depressed, and placed about one-fourth the entire length of the valves behind the anterior extremity; posterior umbonal slopes subangular from the beaks obliquely backward and downward, to the sharply rounded or subangular posterior basal extremity, while the spaces behind and above these slopes are compressed or slightly concave. Surface marked by small ridges and lines of growth, which are crossed by raised radiating lines or linear costæ, rather widely separated posteriorly, but more closely arranged, and less strongly defined toward the front part of the valves. (Cardinal area, hinge and muscular impressions unknown.)

Length, 0.45 inch; height, 0.19 inch; convexity, about 0.11 inch.

This little shell will be readily distinguished from its associate, formerly described by us under the name *M. tenuistriatus*, by its much more oblique and less gibbous form; but more especially by having its linear radiating costæ separated by wide intervening spaces, instead of being closely crowded together. Indeed, we know of no species with which it could be confounded.

*Locality and position.* Springfield, Illinois. Upper Coal Measures.

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\* In the Proceedings of the Chicago Academy of Sciences for March, 1866, p. 17, we suggested that in case the name *Macrodon*, Lycett, could not be retained for this genus, because it had been previously used by Muller for a genus of fishes, that it might be called *Parallelodon*. In that case the name of this species would have to be written *Parallelodon delicatus*.

## MODIOLOPSIS SUBNASUTA, M. and W.

Shell rather small, elongate, narrow and slightly arcuate, rather distinctly convex, the most gibbous part being along the posterior umbonal slopes, above the middle; dorsal and ventral margins slightly diverging posteriorly, so as to make the widest (highest) part of the valves nearest the posterior end, while the most sinuous part of the ventral margin is a little in advance of the middle; anterior end narrow, a little produced, with an oblique forward slope of its upper margin, to its narrowly rounded extremity; posterior margin somewhat euneate, with an oblique truncation more or less convex in outline, to the posterior basal extremity, which is narrowly rounded; cardinal margin long and a little arched; beaks much depressed, and placed rather nearer the anterior edge than to the middle; posterior umbonal slopes prominent, and forming an obtuse ridge, which extends obliquely backward to the posterior basal edge of each valve; anterior muscular scar comparatively large, round, shallow, and placed near the edge of the valves; small pedal muscular scars distinct just above those of the anterior adductors; surface of internal cast showing moderately distinct, irregular, concentric undulations, which are most strongly defined below, and in front of the posterior umbonal slopes, on the flattened or concave flanks.

Length, 1.31 inch; height, 0.50 inch; convexity, 0.40 inch.

This is a neat, symmetrical shell, resembling *M. nasuta*, Conrad (sp.), but differs in having the narrowed anterior end less produced, the beaks being placed farther forward; while its posterior end is broader, and obliquely truncated, instead of being rounded. Its general outline is more like that of *Orthonota contracta*, Hall (Palæont. N. Y., vol. i, pl. 32, fig. 8), though its lower margin is less distinctly sinuous, its beaks more depressed, and its posterior margin more oblique; while it wants the oblique dorsal wrinkles seen on casts of that shell, being a true *Modiolopsis*.

Compared with foreign species, our shell is found to be very closely allied to an English Upper Silurian species described by Mr. Salter under the name *M. platyphylla*. Our shell, however, has the anterior end narrower and more produced, with more prominent posterior umbonal ridges.

*Locality and position.* Galena Limestone of the Lower Silurian, in Carroll County, Illinois.

## SCHIZODUS AMPLUS.

Shell attaining a large size, as determined from internal casts, moderately convex, oblong-suboval in outline, or about one-fourth of its length longer than high; anterior side short, rounding from above the middle into the base: outline of ventral margin forming a broad semi-ovate curve; posterior margin nearly vertically subtruncated, but rounding abruptly into the dorsal margin above and into the base below; cardinal border nearly straight, and sloping very slightly from the beaks posteriorly; beaks much depressed, nearly anterior, incurved, closely approximated, and directed forward and inward. Posterior adductor muscular scar shallow, rather large, suboval, and located close up under the posterior extremity of the hinge; anterior do., smaller, deeper, subovate, and placed very near the anterior margin a little above the middle, with rather distinct, nearly detached, pedal muscular scars at their upper ends. Posterior umbonal slopes with each a distinct sulcus extending from the beaks obliquely backward and downward, becoming wider and more shallow as they descend, so as to die out before reaching the posterior basal margin. (External surface unknown.)

Length of cast, 2.60 inches; height of do., 2.15 inches; convexity, 1.56 inches.

This is the largest species of *Schizodus* (if it belongs to that genus) we have yet seen. Our only specimen is an internal cast, giving no idea of the nature of the hinge. From its general appearance, however, and the nature of its 1870.]

muscular and simple pallial scars, together with the remains of its external ligament, we can have little doubt in regard to its being a *Schizodus*. In size and general outline, its internal cast closely resembles *Amphicælia Leidyi*, described by Prof. Hall from the Upper Silurian Limestone at Bridgeport, near Chicago. It has, however, obviously no near relations to that shell. For a *Schizodus*, its beaks are unusually depressed and oblique. We know of no other species resembling it in general form.

Compared with *Schizodus occidentalis* (= *Cypricardia ? occidentalis*, Swallow), which seems to be a true *Schizodus*, and agrees with our shell in size, it is at once distinguished by its much more depressed beaks, less convex valves, and broadly round posterior outline. Prof. Swallow's species also occurs in our Coal Measures, but we have yet only seen it from a higher part of the series, at Lasalle.

*Locality and position.* Seaville, Fulton County, Illinois, Coal No. 1, of Coal Measures.

#### SCHIZODUS (PRISCONAIA) PERELEGANS, M. and W.

Shell attaining a moderately large size, ovate-subcordate in general form, very gibbous, apparently closed all around, rather thin. Anterior and posterior views presenting a neat cordate outline. Pallial margin semiovalate, the most prominent part being in front of the middle; anterior side very short, and rounding up abruptly from below; posterior side narrowly rounded, or subangular; hinge line apparently rather short. Beaks very gibbous, prominent, pointed, and strongly incurved, so as to bring their points nearly or quite in contact; located near the anterior margin; lunule excavated, but not distinctly defined. Surface appearing to the unassisted eye almost perfectly smooth, excepting very regular, raised, concentric striæ, or small costæ, on the anterior part of the valves, with obscure traces of smaller striæ crossing the same. Under the highest power, however, that can be well used as a hand magnifier, the whole surface is seen to be covered by an extremely minute, perfectly regular, crowded sculpturing, as if made by crowded, microscopic cross lines, entirely invisible even under a good common pocket magnifier.

Height of a small specimen, 0.90 inch; convexity of same, 0.80 inch; length, about 1.18 inches. Other imperfect specimens show that the species sometimes attained three or four times the size of that from which the above measurements were taken.

The extremely minute ornamentation mentioned on this shell may be properly considered microscopic, being entirely invisible under a good common pocket lens, by the aid of which it shows apparently an almost polished surface. When examined in a strong light, however, with a sufficiently high magnifier, the finer markings are seen to present a delicacy, fineness, regularity, and beauty that art could scarcely attain, even by the aid of the most accurate mathematical ruling machine. In some specimens this delicate marking has been, in places, partly removed, as if by the abrasion of an extremely thin external layer, or epidermis, to which it appears to be, to some extent, confined. When this layer has been in this way removed, however, traces of the same marking can be seen on the surface of the layer beneath, by the aid of a sufficiently strong magnifier.

The stronger concentric, raised striæ, or small costæ, seen on the anterior part of the valves, do not run exactly parallel to the very obscure marks of growth, but cross them obliquely. On following these little costæ back toward the gibbous part of the valves, they all seem to become suddenly obsolete; but on examining them with a common pocket lens, they are seen to be continued over the convex part of the valves, as minute, impressed hair lines, very regularly disposed, so as to leave comparatively rather wide spaces between. Here, too, they are seen not to be exactly parallel to the faint marks of growth, and on following them back they are observed to terminate suddenly at a similar impressed hair-line, descending with a slight curve from

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the posterior side of each beak, apparently to near the middle of the posterior margin. Above and behind this oblique line, some three, four, or more similar parallel, regularly disposed lines also extend from the back part of each beak to the posterior margin of the valves, thus marking off, as it were, a kind of corselet, somewhat similar to what we see in *Protocardia*, excepting that these radiating lines are scarcely visible to the unassisted eye and separated by spaces many times their own breadth. In the spaces between these posterior radiating lines the magnifier also shows numerous minute, raised granules, but these are much larger and more prominent than, and entirely distinct from, the extremely minute, crowded sculpturing seen by the aid of a higher magnifier over the whole of the surface. It is probably mainly due to the fact that the specimens have had the whole substance of the shell replaced by brilliant iron pyrites, that the delicate ornamentation mentioned has been preserved.

We know nothing of the nature of the hinge and interior of this beautiful shell, and consequently only place it provisionally in the genus *Schizodus*. We only know that other species found in our Coal-measures, agreeing apparently in their internal characters with *Schizodus*, show the same kind of very minute sculpturing seen on this. As some of these are very similar to the type on which Mr. Courad proposed to found his genus *Prisonaia*, from the Coal-measures of Kansas, we requested him to examine his typical specimen to see if any traces of such minute surface markings could be seen on it by the aid of a strong magnifier, and he informed us that his shell shows the same sculpturing. As this marking is very peculiar, and entirely unlike any ornamentation we have ever seen on any other fossil, even in examples of various types in exactly the same state of preservation, it is not improbable that our shell will be found to possess the internal character of Mr. Courad's type.

*Locality and position.* From the shales over the fifth coal bed of the Illinois Coal-measures, at Danville, of that State. For the use of the typical specimens we are under obligations to Dr. J. C. Winslow, of Danville.

#### Genus CLINOPISTHA, M. and W.

Shell transversely oval, very thin, rather ventricose, equivalve, very inequilateral; beaks near the posterior extremity and directed backward; that of the right valve with its immediate apex curving under the beak of the left, which seems to be a little excavated for the reception of the same; ligament external, short, rather prominent, and occupying an oval, or lance-oval shallow cavity, formed by the slight inflection of the margins of the valves immediately behind the beaks; valves with their margins smooth within and closed all around; hinge apparently edentulous; surface polished, and with merely fine lines or marks of growth, sometimes crossed by very faint traces of radiating lines, which are usually obsolete externally, but often seen on internal casts; muscular impressions shallow, those of the anterior side larger than the others and subquadrangular in form, with a faint oblique ridge along the upper margin; posterior muscular impressions oval and occupying somewhat flattened spaces near the truncated margin; pallial line faintly marked and simple.

Although we have not seen very clearly the hinge of this shell, we have been able, from impressions of it in the matrix, to be satisfied that it is not crenated, as in the *Nuculidæ* and *Arcidæ*; and we believe it to be entirely edentulous. In regard to the affinities of this type, however, we are left in doubt. In its thinness, and the posterior position of its beaks, as well as in the form and general appearance of its muscular and pallial impressions, and its apparent edentulous hinge, it reminds one of *Solenomya*. It differs, however, from that genus, remarkably, in its short gibbous form, rather ventricose beaks, and general physiognomy, as well as in wanting the internal ridge extending downward from the beaks, and apparently the partly internal liga-  
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ment. It likewise differs from the existing species of *Solenomya* in having the valves neatly closed all around, and the beak of its right valve curving under that of the left. In this latter character, however, it agrees with the carboniferous species of the West that have been referred to *Solenomya*, all of which have the point of the right beak passing under that of the left, and Prof. McCoy has noticed this character in British carboniferous species. These carboniferous species, however, agree almost exactly in all their other known characters with recent typical species of *Solenomya*, even to the general form and the presence of an internal ridge under each beak, and differ as widely from our shell in all respects, excepting in the one character of the slight inequality of the beaks, as the recent species of *Solenomya* do.

We are aware that Prof. King proposed to found a genus *Janeia*, for the reception of the carboniferous and permian forms usually referred to *Solenomya*, and afterwards abandoned it, after farther comparisons with recent species. As he makes no allusion to the inequality of the beaks, it is probable he had no specimens of the fossil species with the two valves united. From this character, and the greater excavation for the internal part of the cartilage, under and extending a little in advance of the beaks, in the Western carboniferous species referred to *Solenomya*, that we have had an opportunity to examine, we think it not improbable that the name *Janeia* may yet have to be retained for the carboniferous and permian species, at least in a subgeneric sense. Even in this case, however, it would still be necessary to establish a new genus for our shell, in consequence of the differences already noted, which separate it nearly as widely from the forms for which *Janeia* were proposed as from the recent *Solenomyæ*.

It is proper to remark here, that some able conchologists, to whom we showed specimens of the form under consideration, did not think it related to *Solenomya*, as typified by the recent species, but more nearly allied to the *Anatinide*. As none of the numerous specimens of internal casts we have had an opportunity to examine, however, showed any indications of a cavity or process for the reception or attachment of an internal cartilage, as we see in that family, and the pallial line has no traces of the sinus usually (though not always) seen in the same, its relations to the *Anatinide* seem to us doubtful.

CLINOPISTHA RADIATA, var. LEVIS.

*Edmondia ? radiata*, Hall, (?) 1858. Iowa Geological Report, Vol. I, part 2, Palæont., p. 716, pl. 29, fig. 3.

Shell oval, approaching oblong, the height being from two-thirds to three-fourths the length, moderately convex in young examples, and becoming ventricose with age; anterior side much longer and wider than the other, regularly rounded in outline; posterior side very short, rather narrow below the beaks, and vertically truncated; ventral margin most convex a little in advance of the middle, thence round upward into the front, while behind the middle, or nearly under the beaks, it is slightly contracted, or sinuous; dorsal outline subparallel to the base, the margins of the valves being erect anteriorly and rounding into the anterior margin; hinge line rather short; beaks rather ventricose, rising above the hinge line and placed about half way between the middle and the posterior end; posterior umbonal slopes often rendered somewhat prominently rounded by a slight flattening of the valves behind the beaks, near the truncated margin; ligament lance-oval in form, rather short, and placed immediately behind the beaks, exactly in the position we would expect to see the lunule if the shorter side of the valves were the anterior; surface with a polished appearance, and generally only showing fine lines of growth, but in some examples also having obscure radiating marks near the ventral margin, which are nearly always defined on internal casts.

Length of a large specimen, 1 inch; height, 0.62 inch; convexity, 0.51 inch.

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A careful examination of the typical specimen (now before us) of *Edmondia? radiata*, of the Iowa Report, cited above, has clearly satisfied us that it has the ligament on the short side, and certainly belongs to the genus we have here described, and we can scarcely doubt that it is really the same species as our type. As none of our numerous specimens, however, show the radiating markings so distinctly as that described by Prof. Hall, we have concluded to view them as belonging to a smooth variety, which we propose to designate under the name *levis*.

*Locality and position.* Near base of Coal-measures, Seaville county, Illinois. Prof. Hall's specimen came from the upper beds of the Coal-measures at Grayville, Illinois.

## GASTEROPODA.

### DENTALIUM ANNULOSTRIATUM, M. and W.

Shell very small, rather distinctly tapering and slightly arched; aperture and section circular; surface ornamented by regular, distinct, annular costæ, which pass around a little obliquely and are separated by rounded furrows of the same breadth as the costæ themselves.

Length of a specimen incomplete at both ends, 0.28 inch; diam. at the larger end, 0.06 inch; do. at the smaller end, 0.04 inch.

Of this delicate little shell we have seen but a single specimen, which is imperfect at both ends. At a first glance, it might be mistaken for another more common species, of near the same size, occurring at the same locality, and which we are inclined to think is the *D. Meekianum* of Geinitz. On examining it under a magnifier, however, it can be at once distinguished by its comparatively strong, regular costæ, instead of mere microscopic lines of growth.

It is with some doubt that we have referred this little shell to the genus *Dentalium*, because its small size and comparatively strong, regular costæ give it much the appearance of the non-spiral part of the shell of a *Cucum*. It is more arched, however, and more tapering than we generally see in the body part of shells of that genus, which are likewise, we believe, unknown in any of the Palæozoic rocks.

*Locality and position.* Shales over the Danville Coal, holding a position about the horizon of the fifth Coal of the Illinois; or, near the upper part of the lower Coal-measures.

### STRAPAROLLUS (EUMPHALUS) PERNODOSUS, M. and W.

Shell attaining a rather large size, subdiscoidal, or with the spire nearly on a plane with the upper outer edge of the body volution; umbilicus broad, moderately deep, and showing all the inner turns; volutions about five and a half, flattened-convex, and a little oblique on the broad periphery, but distinctly carinated near the outer side above (the carina being rugose), while a little outside of the middle below, they are prominent and ornamented by a row of moderately distinct nodes, of which about sixteen may be counted on the last turn; those on the last half of the outer volution becoming nearly or quite obsolete toward the aperture. Upper side of each whorl flattened and sloping distinctly inward from the carina to the suture; lower side of same sloping rapidly inward and slightly concave just within the prominent nodose ridge, and then rounding rather abruptly into the umbilicus. Surface marked by distinct lines, and at some places ridges, of growth; on the upper side of the whorls these lines pass obliquely outward and forward from the suture to the carina, thence obliquely backward in crossing the periphery; while in crossing the under side they curve a little backward.

Greatest breadth of a specimen not quite complete at the aperture, 2.50 inches; height at the aperture, about 0.84 inch.

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This species is evidently closely allied to *E. nodosus*, of Sowerby, from the Mountain Limestone of England. It may be distinguished, however, by its much less convex periphery, and by having its carina on the upper side of the outer whorl, nearer the outer side, as well as more rugose from an apparent effort to form irregular nodes. The true nodes around the prominent portion of its under side are more numerous than in *E. nodosus* (which has ten instead of fourteen to each whorl), and differ in being more irregular and nearly obsolete on the last half of the outer whorl.

Even if Montfort's name, *Straparollus*, must be adopted for this genus, we think Sowerby's name, *Euomphalus*, should be retained in a subgeneric sense for these planorbicular species with angular whorls, such as *E. pentangulatus*, for which it was at first proposed.

*Locality and position.* Alton, Ill. Lower Coal-measures.

STRAPAROLLUS (EUOMPHALUS) SUBQUADRATUS, M. and W.

Shell attaining nearly a medium size, discoid or subplanorbicular, concave, and showing all the whorls both above and below, though the concavity is deeper below than above. Periphery nearly flat, rather broad, and generally more or less oblique, with a distinct carina at the upper and lower edges, the former of which is more acute than the other, and irregularly crenate, or subnodose, and projecting nearly upward, while the lower one is a little rounded and projects outward. Volutions five or six, not embracing, nor coiled exactly in the same plane; on the upper surface, each sloping, with a slight concavity, distinctly inward from the marginal carina to the suture, while the flattened outer side usually has an obscure longitudinal sulcus near the upper and lower angles, the upper one being a little deeper than the other. On the under side the whorls slope gently inward from the marginal angle, so as to form a broad, depressed-subconical umbilicus. Surface marked with rather strongly defined lines of growth, which, at places, become subimbricating, or form little irregular ridges. In crossing the upper side of the whorls, these lines start, at first, nearly at right angles out from the suture, but curve a little backward as they approach the marginal angle; and immediately after crossing this angle, and passing downward upon the nearly vertically flattened periphery, they are deflected a little forward, but soon after pass straight down to, and over the lower marginal angle to the under side, where they extend obliquely backward and inward, with a rather distinct curve, to the immediate vicinity of the suture, and then curve a little forward. Aperture and sections of interior of whorls subcircular, or transversely oval.

Greatest breadth of a specimen with apparently about one-third of the outer volution broken away, 1.25 inches; height, 0.50 inch. When entire, this specimen was probably not less than 1.43 inches in breadth.

From the foregoing description, it will be seen that this shell is nearly allied to the common western Coal Measure species figured and described by Prof. Hall, in his Jour. Geological Report, under the name *Euomphalus rugosus* (not *E. rugosus*, Sowerby\*). Indeed, it is so nearly like that species that we at one time suspected that it might be only a gigantic and more ventricose variety of the same. Yet on comparing our shell with an extensive series of good specimens of *E. rugosus*, Hall, it is found to be greatly larger than any known authentic examples of that shell, its breadth being a little more than twice and a half that of the usual mature examples of *E. rugosus*. Its umbilicus, and the concavity of its upper side, are also proportionally deeper, particularly the former, while the flattened outer side of its whorls is broader, and generally less oblique. Its lines of growth also differ in being rather distinctly deflected backward at the marginal angle of the upper side, so as to indicate an obscure sinus of the margin of the lip at the termination of this angle, though

\* If Sowerby's species is really congeneric, the American form called *E. rugosus* by Prof. Hall might be distinguished by the specific name *subrugosus*.

there are no traces of a band, as in *Pleurotomaria*. This character would probably place the species in the group for which the name *Schizostoma* was proposed by Bronn, but palæontologists have generally regarded the type for which that name was proposed, as not being sufficiently distinct from *Euomphalus* to be retained as a separate genus.

Associated with the above, a single specimen was found, of the same size, and agreeing very closely with that from which the foregoing description was drawn up, but differing in being proportionally wider, and not so oblique on the periphery, which is also more convex in the middle. The angle of its under side also differs in being a little farther in from the outer margin, and directed downward, instead of outward, while its umbilicus is proportionally deeper. This may be a distinct species, but without more specimens for comparison we do not feel willing to regard it as being entitled to a separate name.

These shells, including *E. rugosus*, Hall, and *E. catilloides*, Conrad (sp.), are related to *E. quadratus* of McCoy, from the Mountain Limestone of Ireland, though sufficiently distinct specifically. At one time we were inclined to think that *E. rugosus*, Hall, and *E. catilloides*, Conrad, together with a few others, should be separated from *Euomphalus*, under a distinct generic name; but after seeing the large species we have here described, which so closely connect these little shells with such forms as *E. pentangulatus* and *E. catillus*, upon which the genus was originally founded, we can no longer doubt that all of these shells really belong to one genus. This series of intermediate forms connecting the small, nearly planorbicular species mentioned above with the typical forms of *Euomphalus*, shows clearly that none of the former belong to the articulate genus *Spirorbis*, as has been thought by some, but that they are really true mollusks.

*Locality and position.* Upper Coal Measures, Montgomery County, Illinois. Collected by Mr. G. C. Broadhead, of the Illinois Geological Survey.

#### SUBULITES INFLATUS, M. and W.

Shell very ventricose, subfusiform; volutions about five and a half to six, those of the spire moderately convex in the (external?) cast; last one very large, ventricose, and composing much the larger part of the whole, produced and contracted below so as apparently to terminate in a short canal; aperture narrow, rhombic and pointed, or angular above and below; suture well defined in the cast; surface unknown.

Height of a specimen with apparently about two whorls at the apex, and portions of the lower extremity of the produced body whorl broken away, 1.85 inches; breadth of body volution, about 1.15 inches.

It is barely possible that this may be a ventricose, fusiform *Murchisonia*, as we only know it from rough casts, apparently of the exterior. As it shows no traces, however, of any revolving band or line, and has much the general physiognomy of *Subulites*, we have concluded to refer it provisionally to that group.

Its most marked character is the large size and very ventricose form of its body volution, in which it resembles some of the Carboniferous species of *Macrocheilus*. It differs from these, however, in the produced and subcanaliculate peculiarity of the lower part of its body whorl.

*Locality and position.* Galena beds of the Lower Silurian: Carrol County, Illinois.

#### CEPHALOPODA.

Genus NAUTILUS, Auct.

Subgenus SOLENOCHILUS,\* M. and W.

We propose the above name for a group of *Nautili* which we believe to be

\* σάλπιξ, a channel; χεῖλος, lip.

the same as *Cryptoceras* of D'Orbigny, published in 1850. This change of name becomes necessary, however, because Dr. Barrande had used the name *Cryptoceras* for another widely distinct group of *Cephalopoda* in 1846. It is true he has since changed the name of his genus to *Ascoceras*, for the reason that Latreille had applied the name *Cryptoceras* to a genus of *Hymenoptera* in 1804. But if Latreille's name *Cryptoceras* is not considered sufficiently distinct, on account of its different termination, from *Cryptoceras* (which we should think is the case), it would, for the same reason, of course, be equally necessary to change the name of D'Orbigny's group. On the other hand, if we regard Latreille's name as being distinct enough to permit D'Orbigny's name to stand also, or if Latreille's genus is not a valid one, in either case Dr. Barrande's original name *Cryptoceras* would have to be retained for his genus, and, as it has priority of date, it would still become necessary to find another name for the group described by D'Orbigny.

The type of D'Orbigny's group was *Nautilus dorsalis* of Phillips, only known, we believe, from a mere fragment, showing the siphuncle to be marginal, or on the outer side of the curve, as in *Ammonites*.\* In this country we already know several Carboniferous species that agree with D'Orbigny's type in the character or position of the siphuncle, and we find in all of these another remarkable peculiarity of the lip on each side. That is, it is drawn so as to form a kind of little canal, or spout-like channel, much as we see in *Argonauta gondola*, Adams. A good example of one of these shells is figured and described by Dr. White and Prof. St. John, under the name *Nautilus (Cryptoceras) Springeri*, in vol. i, p. 124, of the Transactions of the Chicago Academy of Sciences for 1867; and this may be regarded as the type of the group. It also includes our *N. (Cryptoceras) Leidyi*, *N. (Crypt.) cupax*, and the species described below, with possibly our *N. (Crypt.) Rockfordensis*.

The mere fact that these shells have the siphuncle marginal, as in *Ammonites*, would perhaps not alone be a sufficient reason for placing them in a separate group from the typical *Nautili*, since the siphuncle occupies various positions in the different fossil species of the latter. But when we take into consideration the additional fact that the marginal position of the siphuncle in these shells is always accompanied by the peculiar character of the lip we have described, it becomes of more importance.

#### NAUTILUS (SOLENOCHILUS) COLLECTUS, M. and W.

Shell thin, attaining a moderate size, slightly compressed or subglobose in general form; umbilicus rather small, but deep, perforated, and provided with very abrupt walls, particularly near the aperture. Volutions about one and a half, increasing rapidly in size, and a little wider transversely than their dorso-ventral diameter; moderately embracing, with a subquadrangular section, the angles being rounded, and the lateral and outer or ventral surfaces more or less flattened. Septa moderately concave, distant about one-fourth the transverse diameter of the volutions at the point of measurement, and showing a slight backward curve in crossing the sides and periphery; aperture large, and, as near as can be determined from the specimens, with a subquadrangular or subcircular outline, more or less sinuous on the inner side for the reception of the small inner turn; siphuncle small. Surface smooth, or only showing small lines of growth.

Greatest diameter of a small specimen, with body chamber broken away, 1.70 inch; transverse diameter of same, about 1.25 inch.

As in other species of this group, the small siphuncle is so very nearly in contact with the ventral, or outer side, that in casts with the shell removed it often gives the appearance of a very narrow, deep lobe along the middle of that side. It is easy to see, however, that this appearance is merely produced

\* M. Chenu figures on p. 72, vol. i, of his Manual of Conchology, under the name *Cryptoceras Bowerbanki*, Sowerby, a shell certainly not belonging to D'Orbigny's group as he understood it, but, if correctly figured, belonging to the *Ammonitidae*.

by the breaking away of a thin part of the matrix between the siphuncle and the outer shell. None of our specimens are in a condition to show the margins of the lip, but some of them show very clearly the commencement of the protuberance, or pinching up of the margin on each side near the umbilicus, evidently terminating at the aperture in the usual spout-like auricles. The lines of growth also show the same, by their flexures on each side.

Specifically this shell is probably most nearly allied to our *N. (Solenochilus) Leidyi*, from the Keokuk division of the Lower Carboniferous, though it differs in having more rapidly expanding and subquadrangular whorls, which are also slightly embracing at the aperture, instead of being merely in contact. Its volutions, however, are much less rapidly expanding than in our *N. (Sol.) capax*, or in *N. Springeri* of White and St. John, as well as different from both in their subquadrangular form.

*Locality and position.* New Providence, Indiana, from a limestone of the age of the St. Louis division of the Lower Carboniferous.

Subgenus TEMNOCHILUS, McCoy.

NAUTILUS (TEMNOCHILUS) LATUS, M. and W.

Comp. *N. nodocarinatus*, M'Chesney, 1865. Illustrations Palæozoic Fossils, pl. 3, fig. 6 (5 by error, in explanations of plate.) Not *N. nodocarinatus* of same author in text of same paper (1860) p. 66.

The only specimen of this fine species we have ever seen consists of about half of one volution, which, being without septa, must belong to the part composing the last or body chamber, originally occupied by the body of the animal. It is broken at both ends, and measures around the curve of the outer side, 8.50 inches, with, at the larger end, a dorso-ventral diameter of 2.10 inches, and a transverse diameter (including the nodes) of 3.60 inches. The dorso-ventral diameter at the smaller end is about 1.60 inches, and the transverse about 2.40 inches. A section of the body volution is transversely subelliptical, with a tendency to an oblong outline; the outer (often called the dorsal) side of the whorl being very broad and flattened convex, and each lateral margin, exclusive of the nodes, being rather narrowly rounded, or a little flattened, while the inner side is a little concave. The broad flattened outer side has two very obscure longitudinal ridges, with a distinctly flattened space between. Along each (so-called) dorso-lateral margin there is a row of prominent flattened nodes, arranged at intervals of about their own greater (antero-posterior) diameter. About sixteen of these nodes occupied each side of the outer or last volution. The inner side of the whorl rounds regularly into the umbilicus, which appears to be wider than the dorso-ventral diameter of the volution at the aperture. The surface is without longitudinal lines, but the striae of growth are moderately distinct, especially on the broad flattened outer side, where they make a deep backward curve in crossing, so as to indicate the presence of a very deep sinus in the lip on that side of the aperture of the shell.

In the specimen described, the substance of the shell is thin, and scarcely mineralized, though it retains no pearly lustre.

This species resembles very closely the form figured by Prof. M'Chesney in the memoir cited at the head of the foregoing description, and referred by him (by mistake) in the explanations of his plates, to his *N. nodocarinatus*.

Our shell differs, however, in not having so many nodes, as well as in having a proportionally wider umbilicus, and particularly in having the sides of its whorls rounding regularly into the umbilicus, instead of being subcarinate around its margins.

*Locality and position.* Carbon Cliff Mines, Rock Island County, Illinois. Lower Coal-Measures.

## NAUTILUS (TEMNOCHILUS) WINSLOWI, M. and W.

Shell attaining a moderately large size, subdiscoidal; periphery broad and nearly flat, the middle third being rather distinctly flattened, while on each side of this there is a very slight slope outward to the lateral margins. Umbilicus broad, moderately deep, and showing nearly the full breadth of each inner volution on each side. Volutions apparently about four and a half, with transverse diameter nearly one-third greater than the dorso-ventral; each ornamented around the lateral margins of the broad periphery by about sixteen very prominent, rounded nodes, which project obliquely outward, at an angle about intermediate between the general plane of the shell and that of the broad periphery, those on opposite sides being alternately arranged; from these rows of nodes the sides slope abruptly inward, with a moderate convexity, to their inner margins within the umbilicus. Surface marked by rather well defined lines of growth, which curve gently backward in crossing the sides of the whorls from the inner margin, and make a stronger backward curve in crossing the periphery, so as to indicate the presence of a deep rounded sinus in the outer margin of the lip. (Siphuncle and septa unknown.)

Greatest breadth of a specimen with a part of the outer volution broken away, 4.60 inches; transverse diameter of outer turn, measuring across the periphery without including the nodes, 2.46 inches; do. including the nodes, 2.95 inches; dorso-ventral diameter of the outer volution, 1.66 inches.

This species is evidently closely allied to the last, in form and general appearance, but differs in having its volutions proportionally narrower, measuring at right angles to the plane of the shell. Its most marked difference, however, consists in the form of its nodes, which are round, instead of being distinctly compressed. It seems to be also related to *N. tuberculatus* of Sowerby, but differs from the published figures of that species in having its periphery proportionally broader, and distinctly more flattened; while its nodes are placed nearer the outer margin of the whorls, as well as more prominent. From *N. occidentalis*, Swallow, (= *N. quadrangularis*, McChesney), it will be readily distinguished by the greater transverse diameter of its whorls, which are also without the flattened sides of that species, and differ in wanting the two mesial rows of nodes on the periphery.

This specific name of this fine *Nautilus* is given in honor of Dr. J. C. Winslow, of Danville, Illinois, to whom we are indebted for the use of the specimen from which the description was drawn up.

*Locality and position.* Danville, Illinois, from the shale over the fifth bed of coal, of the corrected Illinois section; being near the horizon of the upper part of the Lower Coal-Measures.

## NAUTILUS (TEMNOCHILUS) COXANUS, M. and W.

Shell rather small, subdiscoidal, broadly rounded, or depressed convex over the periphery; umbilicus wide, rather deep, perforated, and showing more than three-fourths of the dorso-ventral diameter of each inner turn. Volutions about two and a half to three, increasing gradually in size, wider transversely than dorso-ventrally, very slightly concave along the dorsal or inner side for the reception of the periphery of each succeeding turn within, more or less narrowly rounded (subangular in some small specimens) and ornamented by about fifteen small nodes around the middle of each side, from which point the inner side rounds very abruptly into the umbilicus. Septa separated, on the outer or ventral side, by space about one-fifth or one-sixth the transverse diameter of the volutions at the point of measurement; arching very slightly backward in crossing the periphery. Body chamber composing about half of the outer volution. Siphuncle small, and situated subcentrally, or somewhat nearer the outer side. Surface ornamented with distinct, regular, longitudinal, raised lines, or small costæ, narrower than the

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rounded furrows between ; those along the middle of the ventral or outer side being smaller and more crowded than those toward the lateral regions ; crossing these are numerous very fine, crowded striae of growth, which curve strongly backward in passing over the periphery, parallel to the margin of the very profound sinus in the lip on the ventral side.\* Aperture transversely oval.

Greatest diameter of a mature specimen, 2.23 inches ; thickness, or transverse diameter, about one inch ; dorso-ventral diameter of last turn near aperture, 0.86 inch.

Among the specimens before us there seem to be two varieties, which may possibly prove to be specifically distinct. One of these, which we regard as the typical form of the species, has the periphery very depressed-convex, while in the other, this part is distinctly more convex or rounded. As they agree, however, apparently almost exactly in all other characters, and both forms vary somewhat in the convexity of the periphery, we are inclined to view this as merely a sexual difference. In the more convex forms the lateral nodes seem to be generally a little more inclined to become slightly elongated in the transverse direction of the whorls, though this character appears not to be entirely constant. In both forms the longitudinal or revolving surface ridges and furrows become nearly or quite obsolete, toward the aperture, on the outer volution.

Internal casts of this species seem to be almost exactly like specimens figured by European authorities under the name *N. tuberculatus*, Sowerby. As that species, however, attains a much larger size, and has, according to Prof. McCoy's description, a very large siphuncle, while none of the figures or descriptions of it we have seen either show or mention the distinct longitudinal, or revolving costae, so well defined on the surface of our species, we can entertain no doubt in regard to its being clearly distinct. It is true the figures of *N. tuberculatus* alluded to all represent only internal casts, while the longitudinal markings mentioned on our shell are not seen on internal casts ; but it is scarcely possible that such markings would never have been observed, as impressions in the matrix, if not otherwise, had they existed in Sowerby's species.

This species is named in honor of Prof. E. T. Cox, State Geologist of Indiana.

*Locality and position.* Three miles west of New Providence, Indiana ; from a light gray, brittle limestone, of the age of the St. Louis division of the Lower Carboniferous.

#### LITUITES GRAFTONENSIS, M. and W.

Shell rather small, with isolated portion discoid, planorbicular, and slightly concave on both sides ; volutions four or more, slightly embracing, increasing very gradually in size, with transverse section nearly or quite circular, excepting the slight concavity on the inner side. Surface ornamented by numerous distinct, very regularly arranged costae, which cross the sides of the volutions very obliquely backward from the inner side, curving strongly backward as they approach the periphery, and after crossing the middle of the same, again deflected forward as on the opposite side, thus indicating a profound sinus in the outer side of the lip ; the sinus being very narrow, but not exactly angular at its termination, and widening rapidly forward ; fine, somewhat imbricating striae of growth also run parallel to the costae. Septa apparently moderately distant and running nearly straight across the sides. Siphuncle and free part of the body chamber unknown.

Greatest diameter of the coiled part, 2.10 inches ; transverse diameter, 0.54 inch ; dorso-ventral diameter of outer turn, about 0.52 inch.

\* This would be the dorsal side according to the nomenclature in most general use.

As we have not seen the siphuncle, or the free part of the body chamber of this species it may, possibly, not be a true *Lituite*. Still, as there is not the slightest appearance of any obliquity of the volutions, as in the genus *Trochoceras*, we have scarcely any doubt in regard to its being a true *Lituite*. Compared with *Lituites Marshii*, of Hall, (20th Ann. Rep. Regents Univ., N. Y., pl. 16, figs. 6 and 7,) from the same horizon, at Kankakee, in this State, our species will be at once seen to differ in having its volutions more compactly coiled together, much less rapidly increasing in size, and ornamented with smaller and much more closely arranged costæ. Its costæ also make a stronger or deeper backward curve in crossing the periphery, which is rounded instead of being flattened, as in the *Marshii*. In general appearance it is more like *L. (Trocholites) ammonius*, of Conrad, from the Lower Silurian, though its costæ are much more oblique, and differ in being separated by rounded furrows quite as wide as the costæ themselves; while its surface shows no traces of the finer sculpturing seen on that shell.

*Locality and position.* Grafton, Illinois; from a very light drab magnesian limestone of the age of the New York Niagara group. Upper Silurian.

## CRUSTACEA.

### PHILLIPSIA TUBERCULATA, M. and W.

Attaining a large size. Head and thorax unknown. Pygidium semielliptic, the length being very nearly four-fifths the breadth, very convex; posterior margin obtusely rounded; lateral margins diverging rapidly forward, with convex outlines. Axial lobe well defined, obtuse, and rather prominent behind, and gradually widening forward, with nearly straight sides; rather distinctly more elevated than the lateral lobes, which it nearly equals in breadth at the anterior end, as seen in a direct view from above, but one-fourth narrower than the latter, measuring over the curve of each; showing sixteen or seventeen straight, well defined segment, each of which is provided with six small tubercles, arranged so as to form six rows. Lateral lobes with about fourteen segments each, the very short posterior ones being nearly on a line with the axial lobe, while the others grow gradually more transverse anteriorly, so as to show only a moderate obliquity toward the front; all extending down so as to leave only a very narrow, undefined, smooth marginal space, and each ornamented by from two or three to about twelve tubercles, the number increasing regularly with the length of the segments toward the anterior. Surface between the segments and tubercles smooth.

Length of pygidium, 0.95 inch; breadth, 1.45 inches; convexity, 0.40 inch.

This fine species resembles *P. ornatus*, Portlock, perhaps more nearly than any other, but it attains a larger size, and its pygidium is more broadly rounded behind, with its mesial lobe less rapidly tapering posteriorly; while the rows of tubercles on the segments of its lateral lobes are distinctly more numerous. In general outline, its pygidium more nearly resembles a form figured by Prof. de Koninck, under the name *Phillipsia gemmulifera*, Phillips, (*Animaux Foss.*, pl. liii, fig. 4), though its axial lobe is distinctly narrower, while its lateral lobes are merely provided with tubercles, along the segments, instead of short spines.

*Locality and position.* Kinderhook, Pike County, Ill. Burlington division of the Lower Carboniferous.

### PHILLIPSIA (GRIFFITHIDES) BUFO, M. and W.

Entire outline elliptical, the breadth being to the length as 75 to 130. Cephalic shield forming more than a semi-circle, round in front and nearly straight behind; posterior lateral angles terminating in short, abruptly pointed spines extending back to the anterior edge of the third thoracic segment.

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Glabella rather depressed convex, wide anteriorly and narrowing posteriorly to the neck furrow, just in front of which, and connected with the palpebral lobes on each side, it has a single small, obscure lateral lobe; neck furrow broad, and well defined both across the glabella and across the posterior margins of the cheeks; neck segment rather wide, depressed below the level of the highest part of the glabella in front of it. Eyes of moderate size, reniform, nearly as prominent as the glabella, placed but little in front of the continuation of the neck furrow across the cheeks, apparently smooth, but showing, when the outer crust is removed, numerous very minute lenses beneath. Cheek sloping off rather abruptly from the eyes to the thickened margin, which does not continue around the front of the glabella; facial sutures cutting the anterior margin in front of the eyes before, and a little outside of them behind.

Thorax nearly twice as wide as long, distinctly trilobate; mesial lobe but moderately prominent, nearly twice as wide as either of the lateral lobes, its eight segments merely rounded and without furrows. Lateral lobes narrow; pleurae curving moderately downwards at less than half their length out from the axial lobe, but not distinctly geniculated, each provided with a furrow extending nearly half-way out. Pygidium approaching semi-circular, with the anterior lateral angles obliquely truncated; mesial lobe but slightly wider anteriorly than the lateral; segments about eleven; lateral lobes with eight or nine segments.

Surface finely granular, the granules being most distinct on the glabella, and the segments of the mesial lobe of the thorax.

This species will be at once distinguished from our *P. Portlockii*, from the same horizon, by its much broader and less ventricose glabella, and the peculiar tuberculiform eyes of that species, as well as by the broader and less prominent mesial lobe of the pygidium, in the form under consideration.

*Locality and position.* Crawfordsville, Indiana. Keokuk division of the lower Carboniferous series.

#### ASAPHUS (ISOTELUS) VIGILANS, M. and W.

Body small, elliptic in general form, and moderately convex. Head rather more than half as long as wide, approaching a subcrescentic outline, with the posterior lateral angles abruptly rounded or subangular; anterior margin apparently somewhat narrowly rounded; posterior outline broadly and distinctly concave, but rather straight along the middle, without any traces of marginal or occipital furrows. Glabella not rising above the general convexity of the head, and entirely undefined by any traces of dorsal furrows. Eyes situated about their own antero-posterior diameter in advance of the posterior margin, and apparently about half way between the latter and the front, rather widely separated from each other, and very prominent, nearly round, and truncate-sub-conic in form; visual surface elevated almost entirely above the general convexity, and curved around so as to form about three-fourths of a circle, presenting a smooth surface; palpebral lobes as elevated as the eyes, and much contracted, or merely connected with the glabella on the inner side by a narrow neck. Facial sutures extending obliquely outward and backward from the eyes behind, so as to intersect the posterior margin about half-way between a line drawn longitudinally through the middle of each eye, and the posterior lateral margins of the cheeks; and in front, at first curving slightly outward a little in advance of each eye, beyond which point they converge forward so as apparently to intersect the front margin in such a manner as to leave a rather narrow anterior edge to the glabella.\*

Thorax longer than the head or pygidium, as measured over the curve of a

\* As the specimen is imperfect here, it is possible these sutures may not reach the anterior margin in front.



rolled-up specimen, showing scarcely any traces of trilobation, and composed of eight segments. Mesial lobe, as indicated by very faint impression on each side of the body segment, very wide and depressed, with segments nearly flat. Lateral lobes very narrow, sloping off regularly from the mesial one on each side; pleuræ without furrows, and with the exposed surfaces seen in a rolled-up specimen, narrowing off laterally very rapidly, with a strong backward curve; all more or less angular at the extremity, the posterior ones being rather pointed; lapping surfaces apparently wide.

Pygidium subtrigonal and of near the same size as the head, entirely without any indications of trilobation or segments.

Whole surface smooth, excepting a minute pitting, most distinct on the movable cheeks.

Length (measuring over the curve of the specimen as rolled together), 2.75 inches; breadth, 1.30 inch; length of head at the middle, about 0.75 inch; breadth between the eyes, 0.47 inch; height of eyes on the outer side, 0.20 inch. Breadth of axial lobe of thorax, 0.85 inch; antero-posterior diameter of each of the first four or five segments of same near middle, 0.15 inch.

This species seems not to be nearly related to any of the described forms with which we are acquainted. Its most marked characters are the prominence of its eyes, and the almost entire absence of any traces of trilobation in its thorax and pygidium, as well as the great breadth of the mesial lobe of the same, as indicated by a very obscure depression, and a minute projection on the anterior margin of each thoracic segment, on a line nearly behind the outer edge of each eye. These little projections do not extend upward, but forward, and fit into corresponding notches in the posterior margin of each succeeding segment in front. As the anterior margin of its head and the posterior edge of its pygidium are in the specimens more or less imperfect, we cannot determine exactly their outlines.

In some respects this species resembles young individuals of *Isotelus megistos*, of Lock, though it differs in not having its cheeks produced into pointed terminations behind, while its eyes are more prominent and situated farther forward, and the mesial lobes of its thorax much less defined and distinctly wider. Its pleuræ also differ in being angular, or a little pointed, instead of rounded at the ends.

*Locality and position.* Carrol County and Osage County, Illinois. Cincinnati group of the Lower Silurian.

#### ILLENUS (BUMASTUS) GRAFTONENSIS, M. and W.

Attaining a rather large size. Head (as determined from internal cast) transversely subelliptic, as seen from above, when placed with the under side on a horizontal plane, its breadth being to its length very nearly as 50 to 30; moderately convex, the height being rather distinctly less than half the breadth, and the most prominent part a little behind the middle, while the curve over the middle, from its posterior to its anterior margin, forms about a quarter of a circle. Anterior margin, as seen from above, presenting a nearly transversely semi-elliptic curve, and a subrectangular outline, as seen in a side view; lateral margins rather narrowly and regularly rounded in outline, into the posterior side. Axial furrows distinct, converging forward to a point nearly opposite the middle of each eye, where they terminate in little flattened oval impressions. Eyes large, forming nearly semi-circular curves, with their posterior ends as near the posterior as to the lateral margins of the head; each with a broad, very deep, rounded furrow around beneath its outer side, so as to form a kind of obtuse shoulder below, from which the cheeks drop off nearly vertically, with a slight convexity of outline, to the inferior margins; palpebral lobes less elevated than the middle of the glabella, and sloping a little outward, with an even convexity over their whole surface; visual surface forming rather narrow convex bands, and showing (in the internal cast) under

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a magnifier numerous very minute reticulations. Facial sutures cutting the anterior margin distinctly within a line drawn antero-posteriorly through the inner ends of each eye, and intersecting the posterior margin nearly on a line with the middle of each eye. Rostral shield flat, with a subfusiform outline and obtuse lateral extremities; just three times as wide as its antero-posterior diameter. Surface of the internal cast of the whole upper part of the head without lines or furrows, but rather distinct transverse furrows are seen on the rostral shield. (Body and other parts unknown.)

Length of head, about 1.20 inches; breadth of do., 2.47 inches; height or convexity, 1.05 inch. Length of eyes, 0.55 inch; height of visual surface of same, 0.10 inch; distance between the eyes at posterior and anterior ends, 1.65 inch.

This fine species is perhaps most nearly allied to the common and widely distributed *I. Barriensis* of Murchison. It may be readily distinguished, however, by several important differences in the head, which is the only part yet known to us. In the first place, its head is much wider in proportion to its length, and has its lateral margins, as seen from above, much more narrowly and regularly rounded in outline, so that the cheeks do not project any farther out from the eyes posteriorly than laterally, the outline of the lateral margins having almost exactly the same curve as the eyes themselves. Its rostral shield also has a very different form from that of Murchison's species, being narrower in its antero-posterior diameter, and distinctly obtuse, instead of pointed, at the lateral extremities. Our species likewise shows no traces of the furrows on the cast of the upper side of the head, so strongly marked in *I. Barriensis*.

It is still more widely removed from *I. insignis* of Hall; and we know of no described species having the head so nearly elliptic in outline (transversely) as seen from above, excepting possibly *I. Salteri* of Barrande, which, however, differs widely in other characters, belonging, as it does, to the small-eyed section of the genus.

*Locality and position.* Grafton, Illinois, from the Niagara division of the Upper Silurian.

#### DITHYROCARIS CARBONARIUS, M. and W.

We only know this fossil from a specimen showing the caudal appendages,—that is, the telson and stylets.\* These are lanceolate in general outline, and rather flattened. The telson seems to be a little shorter than the stylets, and more rapidly tapering toward the extremity. Below it is flat, and has a faint, undefined, obtuse longitudinal ridge along the middle, with on each side an equally undefined, shallow sulcus between this and the lateral margins, which are sharp. On its upper side there is a well defined mesial carina, with a slightly concave slope on each side to the lateral margins, thus presenting much the form of a broad bayonet. The stylets have each, on the flattened under side, about six or seven small longitudinal ridges, and on the upper side a distinct longitudinal mesial carina, between which and the lateral margins there is on each side a smooth rounded concavity or broad furrow; along each lateral margin there are two closely approximated carinae, one above, and one below, with a narrow rounded sulcus between.

Length of telson, about 0.75 inch; breadth of do., 0.12 inch; length of stylets, about 0.80 inch; breadth of same near the articulating end, 0.12 inch.

This species will be readily distinguished from *D. Scouleri* of McCoy, by its proportionally broader and more lanceolate stylets and telson, the latter of which is also smooth instead of being marked by oblique divaricating striae, as

\* If the middle one of the three nearly equal caudal appendages in this genus is not articulated at its base, it would only be properly an attenuated terminal part of the telson, and not the whole of that segment.

in the *Scouleri*. Its stylets are also flattened and carinated, instead of being rounded. From Portlock's *C. Colei* it will be distinguished by having the carinae of its stylets and telson smooth, instead of crenate.

So far as we are informed, this is the first species of this genus found in America. It is another decidedly Carboniferous genus, found in our Coal Measures, directly associated with numerous fossils that occur in the beds on the Missouri, in Nebraska, that have been wrongly referred by some authors to the Permian (Dyas).

*Locality and position.* Near the middle of the Coal Measures at Danville, Illinois, associated with numerous Upper Coal Measure species.

**Descriptions of FOSSILS collected by the U. S. Geological Survey under the charge of Clarence King, Esq.**

BY F. B. MEEK.

WASHINGTON CITY, March 21st, 1870.

PROF. JOSEPH LEIDY,

*Dear Sir,*—I send herewith, to be presented for publication in the Proceedings of the Academy, descriptions of a few of the fossils brought in by the United States Geological Survey under the direction of Clarence King, Esq. You will please state, in presenting the paper, that the Trilobites described in it from Eastern Nevada, are decidedly Primordial types, and, so far as I know, the first fossils of that age yet brought in from any locality west of the Black Hills. Mr. King's collections also establish the fact that the rich silver mines of the White Pine district occur in Devonian rocks, though the Carboniferous is also well developed there. The Devonian beds of that district yet known by their fossils, seem mainly to belong to the upper part of the system. Mr. King, however, has a few fossils from Pinon Station, Central Nevada, that appear to belong to the horizon of the Upper Helderberg limestone of the New York series.

The Tertiary fossils described in this paper, from the region of Hot Spring Mountains, Idaho, came from an extensive and interesting fresh-water Lacustrine deposit, and are all distinct specifically, and some generically, from all the other Tertiary fossils yet brought from the far west. Two of the species belong to the existing California genus *Carinifex*, or some closely allied group, while another beautifully sculptured species was thought, by Mr. Tryon, to whom I sent a specimen of it, to be possibly a true *Melania*, and allied to existing Asiatic forms.

It is an interesting fact, that among all of our fresh-water Tertiary shells from this distant internal part of the Continent, neither the beaks of the bivalves, nor the apices of the spire in the univalves, is ever in the slightest degree eroded; even the most delicate markings on these parts being perfectly preserved, if not broken by some accident. From this fact it may be inferred that the waters of the lakes and streams of this region, during the Tertiary epoch, were more or less alkaline, as is the case with many of those there at the present day.

These descriptions, as well as others that I expect to send you soon, are merely preliminary and will be re-written, and presented with full illustrations, now in course of preparation, in Mr. King's report of his survey.

Very respectfully yours,

F. B. MEEK.

*Tertiary Species.*

**SPHÆRIUM RUGOSUM, Meek.**

Shell of medium size, rather gibbous, moderately thick, quadrato-suborbicular in outline, the length being a little greater than the height; greatest convexity slightly above the middle; anterior margin more or less regularly rounded; base semielliptic in outline; posterior margin generally a little wider than the anterior, and faintly subtruncate with an anterior slope; dorsal outline rounding into the anterior and posterior margins, but more regularly into the former. Beaks not eroded, nearly central, rather prominent and incurved, but not oblique. Surface ornamented by sharply defined, often elevated, concentric striæ, separated by rounded furrows, in which very minute lines of growth may be seen under a magnifier; the elevated concentric striæ becoming more regular, coarser, more distantly separated, and more prominent on the umbones. Cordinal margin and lateral teeth comparatively stout.

[April,