pl. 1, f. 3,) from the same locality, will be at once distinguished by its more spreading rays, greater interradial and interbranchial spaces, and particularly by its proportionally smaller and shorter interradial pieces, as well as by having the latter resting upon the superior lateral truncated sides of the first radials, instead of upon one of the second, while it has no interaxillary pieces as seen in *T. interscapularis* It likewise shows some differences in the bifurcations of its arms, after the first division.

A marked feature in the specimen from which the description was made out, is the extraordinary development of the right margin of one of the second primary radial pieces, by which it is made to fill the entire adjacent interradial space. This, however, as already stated, is probably abnormal.

Locality and position. New Buffalo, Iowa. Hamilton division of the Devonian.

Descriptions of new species of CRINOIDEA, &c., from the Palæozoic rocks of Illinois and some of the adjoining States.

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

RADIATA.

ECHINODERMATA.

CYSTIDEA.

Genus COMAROCYSTITES, Billings, 1854.

Comarocystites, Billings, Canadian Journal, vol. ii. p. 269, 1854; Report Geol. Survey Canada, p. 288, 1856; Decade iii. Canadian Organic Remains, p. 61, 1859.

"Body ovate, the smaller extremity being the base; pelvis small, of three plates, above which are from eight to eleven irregular rows of plates, mostly hexagonal; mouth near the summit provided with a valvular apparatus; arms free, grooved, and composed of a single series of joints bearing pinnulæ; ambulacral orifice in the apex between the arms; column round and smooth. The plates of the only species that has been collected present, in some conditions of preservation, a peculiar vesicular structure of their exterior surfaces, while sometimes they are solid and smooth."

"Generic name *Comaron*, a strawberry."

COMAROCYSTITES SHUMARDI, M. & W.

Body obovate, the summit being more broadly rounded than the lower extremity; height about one-tenth greater than the breadth. Basal pieces wider than long, irregularly heptagonal and octagonal, extending out horizontally from the column, and having, at two of the sutures, small supplementary pieces wedged in between, so as to come nearly in contact with the end of the column. Succeeding ranges of plates above, five, very irregularly arranged, and differing in size and form, but increasing in diameter from below upwards, mostly hexagonal or heptagonal in form; all deeply concave on the outside, with prominent sharp carinæ at the sutures; when these angular prominences are weathered or worn, slit-like pores are seen passing through the sutures, which they cross at right angles, being partly common to each of the contiguous plates. Height, 1·50 inch; breadth, 1·30 inch; greatest breadth of one of the plates next to upper range, 0·44 inch. Arms and openings of the summit unknown.

This species is nearly allied to *C. punctatus*, Billings, the type of the genus, from which it may be distinguished by having only five ranges of plates above the base, instead of seven or eight, as well as by the greater size of the plates

near the summit, some of which measure as much as three times the diameter of those of the corresponding pieces in the Canadian species of equal size. It is true these are probably, to some degree, variable characters in this genus, but not, we should think, to the extent exhibited between the Canadian species and our specimens, in which latter they are constant. Again, where the sutures of our species have been worn so as to expose the perforations, they are seen to be less crowded, and not so numerous as in *C. punctatus*, while none of the plates, even where apparently perfectly preserved, show any traces of surface striæ.

The deep concavity of the external surface of the plates in this genus, and the sharply carinated character of the sutures between, together with the irregularity in the size, form and arrangement of the plates, give a very peculiar appearance to the fossil, that might, at a first glance, cause it to be mistaken for a coral. When only found in the condition of detached plates, they present a singular appearance, well calculated to mislead even an experienced palæontologist who had not seen the entire fossil, or enough of the plates united, to show their true characters. The fact that they are all deeply concave, and when unworn, smooth on the outside, while the inner side is convex and strongly rayed, would naturally lead to the conclusion that the outside is the inner side, and *vice versa*. When a few of the plates are found united, however, it is at once seen that the deep concavity is on the outside, and the convexity and rays within. These rays extend one from the prominent middle of each plate to each of its sides, where they connect with those coming from the middle of the adjacent plates. When three or four of the united plates are placed with the inside upwards, the spaces between the rays are seen to present the form of deep, triangular pyramidal cavities, the apex of each cavity terminating at the meeting of the corners of each three of the contiguous plates. The rays are as prominent as the convex centres of the plates, and quite narrow or linear within, but widen rapidly towards the outside of the plates. They are also each split longitudinally into parallel laminæ by a series of profound slits extending nearly to the outer surface of the plates, and it is these slits that are seen, like pores, at the prominent angular sutures, where the edges of the plates at the latter have been worn partly away. It is difficult to understand the use of these deep slits, or divisions of the internal rays, since, as noticed by Mr. Billings, they seem never to pass entirely through the plates, excepting where the prominent edges of the latter have been worn away.

Named in honor of Dr. B. F. Shumard, of St. Louis, whose labors in western geology and palæontology are well known.

Locality and position.—Cape Girardeau, Missouri. Trenton division of Lower Silurian.

Comarocystites Shumardi, var. obconicus, M. & W.

A single specimen in the collection from the same locality and position as the species just described, differs in being obconical instead of obovate, its lower half tapering downwards gradually to the column. Its basal plates also rise nearly vertically from the column, instead of extending out horizontally as in the typical form of *C. Shumardi*. It has a part of the column attached, showing it to be very nearly cylindrical, and composed of thin plates. In form this specimen agrees nearly with Mr. Billings' figure 2, plate 5, decade iii., Geol. Survey of Canada, from which it differs in having only five ranges of plates above the base. It also agrees with the species we have just described, in having its plates above the middle proportionally larger, one of these plates in a specimen only 0·72 inch in height, measuring nearly a third more in diameter than those of Mr. Billings' species near 1·50 inches in height.

It is quite probable this form may belong to a distinct species, but as we

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are not clearly satisfied that this is the case, we merely call attention to it as a variety of *C. Shumardi*.

Locality and position, same as last.

CRINOIDEA.

Genus POROCRINUS, Billings, 1856.

Porocrinus, Billings, Report Geol. Survey of Canada, 1856, p. 279; Canadian Org. Rem. 1859, Decade iv., p. 33.

Generic formula.—Basal plates 5. Proper interradials 0.
Subradials 5. Anals . 2.
Radials 1×5.

"Cup conical; basal plates five, pentagonal; subradials five, three hexagonal and two heptagonal; primary radials five; one large azygos interradial supported on the truncated summit of the anterior subradial, and one small one, situated over the suture between the anterior subradials, and having above it on one side the large azygos, and on the other the left anterior primary radial; several small pectinated rhombs similar to those of the *Cystidea*." [Billings].

As remarked by Mr. Billings, this genus has the structure, so far as the form and arrangement of the plates forming the base and lateral walls of the cup are concerned, of *Poteriocrinus* and *Cyathocrinus;* from both of which it differs in the important character of having pectinated openings analogous to those of the *Cystidea*.

Our specimens of the following described species also show that this interesting type also presents another character in common with some of the *Cystidea*—that is, the possession of several large rounded, non-pectinated openings above. Of these openings there are three, one on the anal side, and two on the anterior side. They are all nearly on the same horizon as the bases of the free arms, though the anal opening is a little lower than the other two.

So it would seem this genus presents, as it were, a combination of the characters of the *Crinoidea* and *Cystidea*. With the regularity of structure and arrangement of parts of a true *Crinoid*, it has the pectinated and other openings of a *Cystidean*. It differs, however, from the *Cystidea* in having the pectinated openings located at the junction of the *corners* of the plates, instead of *passing through them near one of the sides*, while the little bars protecting these openings are arranged obliquely, instead of at right angles to the margins of the plates, as in the *Cystidea*.

Our species also shows that the conical form of the cup is not a generic character.

POROCRINUS CRASSUS, M. & W.

Body subovoid or a little higher than wide. Base depressed, rather widely truncated below, pentagonal in outline, two and a half to three times as wide as high, with a comparatively large pentagonal central perforation; basal pieces wider than long, pentagonal in outline. Subradial pieces twice to three times as large as the basal, about as high as wide, three hexagonal, and two on the anal side heptagonal. First radial pieces of about the same size as the subradials, apparently all irregularly heptagonal, each with, near its upper extremity, a small outward sloping subcordate, or oval, flattened surface for the articulation of the second (first free) radial piece; four of them with each one, and the fifth with two, of the superior lateral margins deeply sinuous and forming in part the margins of the large rounded openings of the summit. Anal pieces two; the first smaller than the other, quadrangular in form, resting between the superior sloping sides of two of the subradials, and supporting, on its right upper sloping edge, one side of one of the first radials, and on its left one of the oblique sides of the second anal piece.

Second anal oblique, wider (obliquely) than its diameter in the direction of its vertical axis, irregularly pentagonal, resting with its base upon the upper truncated side of one of the subradials, and its left side against one of the first radials; while its upper right margin connects with another, and its sinuous oblique superior side forms the under margin of the anal opening. Pectinated areas situated in deep excavations, those at the angles of the basal and subradial pieces largest, and obscurely trilobate; the smaller ones at the angles above oval or subcircular. Surface ornamented with strong radiating costæ extending from the centre to each of the sides of the plates, and all widening from the centre outwards. Sutures distinctly furrowed, even on the truncated under side of the base.

Length 0·72 inch; breadth about 0·66 inch.

This species will be at once distinguished from *P. conicus*, of Billings, the typical species of the genus, by its oval instead of obconic form, (being widest a little below the arms, and rounded in above), and the strong radiating costæ of its plates. We know of no other form with which it need be compared.

Like the typical species, its free arms commenced with the second radial, and were evidently slender, and nearly cylindrical, or a little compressed laterally, and provided with a very small furrow above. We have not seen the column, but it appears to have been large at its connection with the base.

Nor have we been able to see the structure of the small crown occupying the narrow space within the area surrounded by the arms, but it seems to consist of about three or four comparatively large plates.

Locality and position. Oswego, Kendall Co., Ill. Cincinnati Group,* Lower Silurian System.

Porocrinus pentagonius, M. & W.

Body pentagonal-obovoid, being more or less rounded above, and tapering at an angle of about sixty degrees from the middle of the prominent subradials to the summit of the column; base forming about one-fifth of the entire height, and having the form of an expanding pentagonal basin, with flattened sides; basal pieces pentagonal, and nearly twice as wide as high. Subradial pieces as long as wide, and equalling nearly half the length of the body,—the only one visible on all sides in our specimens, hexagonal in form; each prominent in the middle, from which point a well-defined ridge radiates so as to connect with similar ridges on each of the surrounding plates; the ridges passing laterally and upwards intersect the sides of the plates, but the one passing downwards from the middle of each subradial coincides with its central inferior angle, where it connects with a corresponding ridge extending up the sutures between the basal pieces; the arrangement of the ridges being such as to divide the surface into a series of large triangular, slightly concave areas, in which are placed the pectinated openings. These openings at the corners of the basal and subradial pieces consist of about twelve of the linear fissures to each plate; those at the junction of the plates above smaller, with a proportionally smaller number of fissures. Form and arrangement of the anal and radial pieces, as well as of the arms, unknown.

Surface finely granulo-striate, the granules being ranged in lines parallel to the ridges, particularly on the ridges below the middle of the subradials, so as to present, as seen under a good magnifier, a finely substriated appearance.

Column rounded, and expanding rapidly upwards near the base, where it is composed of very thin segments with minutely crenated edges; farther down the segments are proportionally thicker and more coarsely crenate.

Length of body, 0·43 inch; breadth at the middle of the subradials, 0·40 inch. Breadth of column at its connection with the base, 0·15 inch; do. 0·72 inch below, 0·05 inch.

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* See Note at the end of this paper.

This species will be readily distinguished from *P. conicus*, of Billings, by its broader, more ovoid, and more angular form, owing to the much greater prominence of its subradial pieces, and particularly by the well-defined ridges radiating from the centre of the plates. In the latter character, it approaches more nearly the last described species, *P. crassus*, from which it differs in a marked degree, in having its under side below the middle of the subradial pieces greatly more tapering, and base much smaller, and not wider than the head of the column, as well as proportionally higher. It also differs in having its greatest breadth at the middle of the subradial pieces, which are much more prominent; while its pectinated openings are not sunken, nor its sutures furrowed as in the last.

Locality and position.—Trenton Limestone, of Lower Silurian; Dixon, Ill.

Genus HETEROCRINUS, Hall, 1847.

Heterocrinus crassus, M. & W.

Body robust, but rather small compared with the arms and column, wider above than the length from the base to the summit of the first radials; distinctly truncated at its connection with the column, from which point the sides expand rather distinctly upwards; subpentagonal in outline as seen from below. Basal pieces pentagonal, wider than long, and all excavated or indented on the outside at the superior angle and down the middle. First radial pieces longer than the basal, about three-fourths as long as wide, broadly truncated above, and regularly pentagonal in form, excepting two on the anal side, which appear to each have one of the superior lateral angles a little truncated for the reception of a small anal piece; all deeply indented at their inferior lateral angles, so as to leave a broad, rounded, undefined ridge or prominence descending from the middle to the basal pieces. Succeeding radial pieces forming free arms, nearly as wide as, but much shorter than, the first; in four of the rays all transversely oblong, and about three or four times as wide as long, excepting the fourth or fifth pieces, which is pentagonal, and supports, on its sloping upper side, the first divisions. In one ray on the anal side the second piece is pentagonal, larger than that of any of the others, and gives off a lateral branch from its short sloping side on the left,* above which the other pieces present the same size and form seen in the other rays.

Arms after the first division on last radial, bifurcating again on the sixth or seventh piece, after which they are known to divide again in one arm, on the sixth piece, which is as far as our specimens show the structure.

Surface usually appearing smooth, but sometimes showing traces of scattering granules. Column comparatively large, distinctly pentagonal, and expanding upwards near the base of the body, where it is composed of irregularly alternating thicker and thinner segments; central perforation small and round.

Height of body from base to the summit of first radial pieces, 0·35 inch; breadth at summit of first radials, about 0·67 inch; length of five succeeding radial pieces, 0·46 inch; breadth of do. about 0·15 inch. Breadth of column at its connection with the base, 0·32 inch.

This is perhaps the largest and most robust species of the genus known. It is composed of thick, strong plates, and the indentations or excavations at the points where the superior angle of each basal plate connects with the inferior lateral angles of the first radials, together with the more shallow depressions extending down from these points to the lower margin of the basal pieces, give a pentagonal outline to the body—the five angles being coincident with those of the column.

* From some of the specimens it appears somewhat doubtful whether this may not be a range of anal pieces, instead of a branch of the arm.

Locality and position.—Cincinnati Group of the Lower Silurian series; Kendall Co., Illinois.

HETEROCRINUS SUBCRASSUS, M. & W.

This species agrees so nearly with the last in most of its characters as to render a detailed description unnecessary. It will be readily distinguished, however, by its smaller size, as well as its less robust appearance, and the different aspect of its arms. This latter difference consists in the more slender appearance of all the divisions, and particularly in the joints of which they are composed having their upper margins projecting beyond the base of each succeeding piece above, so as to present a kind of upward imbricating appearance and roughness, not seen in the arms of *H. crassus*.

As in the last, its rays bifurcate first on the fifth and sixth pieces, and one of them gives off a branch (?) on the left side of the second radial, above which it bifurcates regularly on the sixth piece. After the first regular division on the last radial piece, some of the arms are seen to divide again on the fourth, others on the fifth, and others on the sixth pieces, after which one division is known to bifurcate on the sixth piece, and still again on the thirteenth.

Breadth of body at the summit of the first radial pieces, 0·27 inch; height of do., 0·13 inch; length of rays from top of first radial pieces to the first bifurcation, 0.21 inch; entire length of arms from first division to extremities, about 1·50 inches. Breadth of column at its connection with the base, 0·15 inch.

Locality and position.—Cincinnati, Ohio. Cincinnati Group of Lower Silurian.

HETEROCRINUS? INCURVUS, M. & W.

Subgenus *Anomalocrinus*, M. & W.

Body expanding rapidly from the base to the summit of the first and second radial pieces, where it is more than twice as wide as high; composed of the five basal, five first radial, and two second radial pieces. Basal pieces pentagonal, of moderate size, wider than long, and forming together a low rapidly-expanding, pentagonal cup. First radial pieces in three of the rays from three to five times as large as the basal pieces, wider than long, two hexagonal and one heptagonal,—all with their superior lateral angles strongly incurved between the arms, and each with a small protuberant, rounded facet above, for the reception of the small succeeding radials. In the remaining two rays, the first pieces are smaller and lower than those of the others, and each pentagonal in form, with the upper side horizontally truncated its entire breadth, for the reception of a larger second radial, which in these two rays agrees in size and form, as well as in being included as a part of the walls of the body, with the large first pieces of the other rays. Succeeding radials not more than one-third as wide as those included in the walls of the cup, and forming small, rounded, widely separated free arms, consisting of one to three quadrangular and one pentagonal pieces to each ray. Arms above the first bifurcation on the second or third pentagonal free radial, in two of the rays seen, bifurcating again on the third piece, and, in one instance, sending off nearly at right angles from the second piece after the first division, a strong tentacle, or small lateral branch.

First anal piece pentagonal, longer than wide, and resting between the left sloping side of a large second primary radial and the right sloping side of a first primary radial, with rather less than half its length projecting above the former, and without extending down so as to bring its base in contact with any of the other plates below. In the individual examined, this piece is strongly incurved, and supports on its inner truncated end an oblong, narrow second anal, which in its turn supports a smaller third piece, all of which are arranged in a right line, and probably form one side of a proboscis.

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Surface smooth, or only with traces of fine granules. Sutures a little concave. Column comparatively strong and rounded near the base, where it is composed of short joints, and marked with obscure, regular longitudinal striæ.

Height of body on the anal side, 0.28 inch; do. on the opposite side, 0.22 inch; greatest breadth above (allowing for a slight accidental compression) about 0.38 inch; breadth of free arms at their connection with the body, 0.08 inch; breadth of column at its connection with the base, 0.16 inch.

This species presents points of analogy both to *Heterocrinus*, Hall, and *Hybocrinus*, Billings, and yet seems to differ from both to such an extent, that if we could be sure some of its peculiarities are not abnormal in our specimen, we would be inclined to view it as the type of a new genus. As we have seen but the one specimen, however, which is not complete in all its parts, we have concluded to place it, for the present at least, as the type of a subgenus under *Heterocrinus*. It differs from the typical species of that genus in having the column round instead of pentagonal, and in having only the first primary radial pieces in three of the rays, and two in each of the others, included as a part of the walls of the body; while its preceding primary radials are very narrow, and form small, rounded, distantly separated arms, instead of being nearly as wide as those soldered in the walls of the cup. Another peculiarity is the strongly incurved superior lateral angles of the large radial pieces around the margin of the cup between the arms.

In the rather unsymmetrical form of the body, the slender proportions of the free arms, and its general aspect, it resembles *Hybocrinus*, from which it differs in having but one anal piece connected with the walls of the cup, and in having two of the rays and two of the primary pieces included in the wall, while its free arms bifurcate twice or oftener, instead of being simple from their origin.

Locality and position.—Cincinnati, Ohio. Cincinnati Group of Lower Silurian.

Genus ERISOCRINUS, M. & W.

Erisocrinus, M. & W., Am. Jour. Sci. xxix. p. 174, March, 1865.
Philocrinus, M. & W., ib., May, 1865; not Koninck, 1863.

Generic formula.

Basal pieces, 5
Subradials, 5 } united to form the walls of the body.
Radials, 2 × 5
Anals and interradials, 0.

Soon after publishing the description of this genus, we were led by its similarity to a genus described by Prof. Koninck, from the Carboniferous rocks of India, to believe it identical, and ranged our species under that name. Later comparisons have caused us, however, to doubt the correctness of this conclusion. If there is no mistake in regard to *Philocrinus* being without a range of subradial pieces, then the two types would be clearly distinct. The fact, however, that the basal pieces in *Erisocrinus* are small, and might be easily overlooked in imperfect specimens, taken in connection with the fact that the lowest range of pieces represented in Prof. Koninck's figure, if true basals, would have to present a singularly elongated cuneiform outline, leads us to suspect there may be another range of small true basal pieces below them, but not visible, from some imperfection in the specimen in Prof. Koninck's type. If so, then the identity of our Crinoid with our Indian type would be complete. Until this question can be satisfactorily settled, however, we have concluded to retain our name *Erisocrinus* for the *American* type. Should they prove identical, however, of course Prof. Koninck's name will have to take precedence, since it has priority of date.

1865.]

ERISOCRINUS CONOIDEUS, M. & W.

Body small, below the summit of the first radials obconic, nearly twice as wide as high; basal pieces a little wider than long, pentagonal as seen projecting beyond the column, and forming together a small low cup with diverging sides; subradials near three times as large as the basal pieces, a little wider than long, and all hexagonal; first radial pieces half as long as wide, about twice as large as the subradials, and all broadly truncated on the same horizontal plane above, for the reception of the second radial pieces. Surface smooth; sutures linear, not impressed; plates not convex. Column and all the parts above the first radial pieces unknown.

Height to summit of first radials, 0·20 inch; breadth of do. 0·34 inch.

This species will be at once distinguished from young specimens of the last of its own size, by its obconic, instead of basin-shaped cup. From Prof. Koninck's species *cometa* (in case our species should really belong to his genus) it will be distinguished specifically by the less convex outline of the sloping under sides of its cup, as well as by its shorter and proportionally wide first radial pieces. It will of course have to take the name *Philocrinus conoideus*, in case Prof. Koninck's species should prove generically identical with these American forms.

Locality and position.—Springfield, Ill., Coal Measures.

ERISOCRINUS TUBERCULATUS, M. & W.

Although we only know this fine species from its detached plates, these agree so exactly in form with the corresponding parts of our *Erisocrinus typus* from the same beds, that scarcely a doubt can be entertained in regard to their belonging to the same genus; while they differ so remarkably in their surface characters as to be distinguished at a glance, specifically, from that or any other Crinoid known in our Coal Measures. This difference consists in their entire external surface being covered with regularly disposed, narrow, prominent tubercles, instead of being smooth.

Of these tubercles there are, on a first radial plate measuring 0·90 inch in breadth and 0·54 inch in height, about thirty in number, arranged so as to form two rows of about eight each, ranging parallel to the inferior sloping margins, and one row of about eight along the superior margin. Between this latter row and those below, there are usually a few tubercles either isolated or forming a third transverse row. There is likewise usually one or several others at the lower middle angle outside of the regular rows. This arrangement of the tubercles into rows is not, however, always obvious at a first glance, but a tendency to such a disposition can always be seen.

On the second radials the tubercles are arranged in a single row along the lower and each superior sloping margin, with one or more in the middle between the rows. In the articulating, or connecting surfaces of the radial plates, we observe no differences between these pieces and those of the corresponding parts of *E. typus*.

Some of the plates indicate a transverse diameter of 1·40 inch for the entire body.

If our proposed genus *Erisocrinus* is, as we have suspected, identical with *Philocrinus* of Koninck, the name of this species will have to be written *Philocrinus tuberculatus*.

Locality and position. Upper Coal Measures. Sugar Creek, Sangamon Co., Ill., and near Brighton, Jersey Co.

Genus CYATHOCRINUS, Miller, 1821.

CYATHOCRINUS QUINQUELOBUS, M. & W.

Body broad basin-shaped, composed of very thick, strong plates; height to

summit of first radial pieces, less than half the width. Base small, a little concave below, or forming a nearly flat pentagonal disk; basal pieces about half hidden by the column—the portion of each exposed pentagonal in form. Subradial pieces much larger than the basal, four of them hexagonal, and one on the anal side heptagonal; each having a strongly elevated, bicarinate protuberance, extending out horizontally almost its entire length, like the rays of a star, upon which the body rests when placed with the under side down. First radial pieces two and a half to three times as wide as high, pentagonal, and all transversely truncate their entire breadth above, for the reception of the succeeding radials, so as to present a broad, moderately concave, outward sloping facet above; those of the two antero-lateral rays each nearly twice as long as the others, and provided near the middle of the upper margin with two angular nodes or prominences; sutures close fitting, and not very apparent. First anal piece small, quadrangular, a little wider than high; resting upon the truncated upper side of one of the subradials, and connecting on each side with a first radial, above which it does not project.

Columnar facet of moderate size, a little concave, with a rather small, rounded, central perforation, and traces of radiating striæ around the margin. Surface finely and regularly granulose.

Height to summit of first radial pieces, 0·55 inch; greater transverse diameter, at summit of first radials, 1·04 inches.

This species is evidently allied to *C. sculptilis** of Hall, from the Burlington limestone; but it is much more robust, and has more prominent subradial pieces, with the prominences more grooved along the middle. Its base is also more concave, and its first radial pieces, particularly the anterior and postero-lateral, proportionately shorter; while it shows no tendency to develop ridges across from the subradials to first radials, nor has it any surface striæ.

Locality and position.—Warsaw, Ill. Keokuk division of subcarboniferous series.

CYATHOCRINUS SUBTUMIDUS, M. & W.

Body below the summit of the first radial pieces, cup-shaped, robust, rather deep, somewhat rounded below, with nearly vertical sides. Basal pieces well developed, pentagonal, convex, about as wide as long. Subradials four or five times as large as the basal pieces, thick, and very strongly convex, slightly higher than wide, four hexagonal and one apparently heptagonal. First radial plates about the size of the subradials, having a general pentagonal outline, with the two superior lateral angles usually a little truncated, apparently by the first series of the vault pieces—not tumid, like the plates below; each with a moderately concave outward-sloping facet for the reception of the next radial above. Succeeding primary radials (of which one ray shows two, and another three,) about half as wide as the first radial pieces, all rounded on the back, two in one ray, and one in another, transversely oblong; the last one in each of these rays proportionally a little larger than the others, and supporting on its superior sloping sides the arms, which, in the anterior ray, bifurcate again on the second piece. (Number and arrangement of the anal pieces unknown.)

Breadth of body, 0·90 inch; height of body to summit of first radials, 0·72 inch.

This species has the general aspect of *Cyathocrinus bullatus* and *C. protuberans*, Hall, (Iowa Report, 624 and 626,) but differs from both in having its

* We now regard our *C. scitulus* (Proceed. Acad. Nat. Sci., Phila., Sept., 1860, p. 393,) as a synonym of *C. sculptilis*, Hall. Our description was going through the press when we first saw Prof. Hall's Supplement to the Iowa Report, in which he described his *C. sculptilis*, and, owing to the necessary haste with which our comparisons had to be made, and the fact that Prof. Hall had inadvertently described one of the subradial pieces of his species as the first anal piece, and the first anal as the second, caused us to overlook their probable identity.

basal pieces proportionally much larger and more tumid, and its radials above the first narrower and proportionally longer. From *C. protuberans* it also differs in not having its first radial pieces tumid, while one of its arms after the first division is seen to bifurcate again on the third piece, instead of merely giving off small lateral branches, as in *C. protuberans*.

Our specimen being defective on the anal side, we have been unable to determine whether it has one only, or two anal pieces soldered in the wall of the cup, though it appears to have but one.

Locality and position.—Keokuk limestone, of subcarboniferous series. Near White Hall, Green County, Ill.

CYATHOCRINUS ENORMIS, M. & W.

Poteriocrinus? enormis, M. & W. Proceed. Acad. Nat. Sci., June, 1861, p. 137.

Although this species possesses the structure and arrangement of the parts composing the walls of the body, including the anal pieces, of *Poteriocrinus*, the fact that it has a slender lateral proboscis, not larger than one of its arms, instead of a large trunk nearly as wide as the body, as seen in typical species of *Poteriocrinus*, leads us to the conclusion that it more properly belongs to the allied group of *Cyathocrinus*. This conclusion is also sustained by the appearance of an opening in the summit, near the small lateral proboscis. These differences in the structure of the summit will probably be found of more importance as a distinction between these two groups, than the fact of one or two more or less anal pieces being included as a portion of the walls of the body.

Genus POTERIOCRINUS, Miller, 1821.

POTERIOCRINUS (ZEACRINUS) CARBONARIUS, M. & W.

Poteriocrinus (*Scarphiocrinus?*) *carbonarius*, M. & W. Proceed. Acad. Nat. Sci., June, 1861, p. 140.

This species has the elongated and constricted second radial pieces, as well as the gaping sutures between these and the first radials, characterizing *Scarphiocrinus*, but differs from the typical forms of that group in having a concave base. In the latter, as well as some of its other characters, it agrees with *Zeacrinus*, to which it seems to more properly belong.

Genus ACTINOCRINUS, Miller, 1821.

ACTINOCRINUS PISTILLUS, M. & W.

Body, exclusive of the proboscis, sub-pyriform; the sides rising nearly vertically from the base to the summit of the first radial pieces; thence gradually expanding to the secondary radials, after which they expand very rapidly, so as to cause the brachial pieces to be directed horizontally outwards, or nearly so, at about the middle of the body. Above the horizon of the arm bases, the dome rises at first vertically, but very soon rounds inward, and rises with a moderately convex slope to the base of the subcentral proboscis. Base truncated and flat below, with a thick dilated margin notched at the suture, so as to present a trilobate outline, as seen from beneath; columnar facet a little concave, and about one-third as wide as the base. Basal pieces twice as wide as high, and hexagonal in form, the inferior margin being much longer than any of the others. First radial pieces wider than long, smaller than the basal; three of them heptagonal, and two hexagonal. Second radial pieces very small, twice as wide as high, and transversely oblong, or sometimes with one of the superior lateral angles truncated by one of the interradials, so as to present an irregular pentagonal form.

Third radials a little larger than the second, pentagonal or hexagonal in form, and supporting on each superior sloping side, a secondary radial piece,

each one of which is succeeded by another. Upon the superior sloping sides of the latter, in the anterior and one of the lateral rays, commence the brachial pieces, of which there are two ranges, upon the last of which commence the free arms, thus giving origin to four arms in each of these rays. In the two posterior rays, however, and one of the lateral, after the second bifurcation on the last secondary radial, the latter supports on the outer sloping side a tertiary radial, which gives origin to two brachial pieces, making five arms to each of these rays, or twenty-three to the whole series.

After the first bifurcation on the third radial pieces, all the succeeding pieces of each ray are in di ect contact, so as to leave no spaces for interaxillary plates : while the outer brachial pieces of each two contiguous rays connect over the anal and interradial spaces, so as to nearly or quite isolate the pieces filling those spaces, from the dome.

First anal piece of the same form as the subradials, but rather smaller than those of the anterior and antero-lateral rays ; surmounted by three smaller hexagonal and heptagonal pieces in the second range, and three or four in the third, making seven or eight altogether. Interradial pieces four, (rarely five,) those of the inferior range being larger than the others.

Surface without costæ or visible granules, but roughened by the tubercular character of the plates. The tubercle occupying each first radial and the first anal, is larger than those on any of the other pieces of the side walls above ; where they become smaller and less distinct with each succeeding range, until they are nearly or quite obsolete a few ranges below the arms. Upon the dome, however, the tubercles are prominent and well defined. The proboscis is unknown, but its base is stout, and rises rather abruptly from the dome, being placed nearly its own breadth nearer the anal than the opposite side.

The arms are also unknown. They evidently projected at first horizontally outwards from the body, and their bases are so crowded as to form an almost continuous rim around the body.

Height from base to horizon of arm openings, about 0·64 inch ; height to base of proboscis, 1·22 inches. Breadth of dilated margin of base, 0·46 inch ; breadth of same just above, 0·38 ; breadth of body at top of first radials, 0·55 inch ; breadth of same at arm openings, 1·05 inches ; breadth of base of proboscis, 0·43 inch.

This species belongs to a peculiar group of *Actinocrinus*, as generally understood in this country, of which *A. pyriformis*, Shumard, (Missouri Report, pl. A, figs. 6a, b,) may be regarded as the type. It also includes our *A. pistilliformis*,* and *A. clavigerus*, Hall. These species differ remarkably in form from typical species of *Actinocrinus*, such as *A. triacontadactylus*, *A. lævis*, &c., of the old world, in having the body very narrow and attenuate below the arms, so as to form, as it were, a kind of handle to the upper half, giving the whole, when the arms and proboscis are removed, somewhat the form and appearance of a pestle. They also differ from the old world species regarded as typical forms of *Actinocrinus*, in having the arms springing from the body in a continuous series, instead of being in five groups. Should it be considered desirable to separate this little group as a section of *Actinocrinus*, it may be called *Uperocrinus*, from its resemblance, when the arms and proboscis are removed, to a short-handled pestle. If Casseday's group *Batocrinus*, however, should be adopted as a distinct genus from *Actinocrinus*, this should be ranged under it as a subgenus.

Specifically, the form under consideration differs from *A. pyriformis* in having its first anal, first radial, and basal pieces, proportionally much shorter, its base more flattened below, and more dilated around the margin ;

* In indicating this form under the name *A. rudis*, (Proc. Acad. Nat. Sci, June, 1861, p. 131,) we had overlooked the fact of that name having been used by Prof. Hall for another species, in the Supplement of the Iowa Report, p. 33; hence we now propose to call it *A. pistilliformis*.

as well as in the plates of the lower part of its body being much more distinctly tubercular, and in the greater number and more crowded arrangement of its arms, which were evidently, at their bases, directed outwards, instead of being, from their origin, directed obliquely upwards.

From our *A. pistilliformis*, with which it agrees more nearly in some respects, it differs, not only in having three more arms, but in the less abruptly contracted form of its body immediately below the arms, as well as in having from four to six interradial pieces to each space, instead of only two or three. There were doubtless other more important differences that would be apparent on comparing perfect specimens of each, judging from the different geological positions of these two forms.

Locality and position.—Burlington limestone, of subcarboniferous series, Burlington, Iowa.

Subgenus SPHÆROCRINUS, M. & W.

Actinocrinus (Sphærocrinus) concavus, M. & W.

Actinocrinus (*Amphoracrinus*) *concavus*, M. & W. Proceed. Acad. Nat. Sci., Phila., June, 1861, p. 132.

This curious little species may be regarded as the type of a section of the group *Actinocrinus*, as usually understood, for which we would propose the name *Sphærocrinus*. Its peculiarities consist in the deep convexity of the base, and the tumid and curved character of its first radial and first anal pieces. These characters are so marked, that when placed with the under side down, it rests directly upon a broad base formed of the first radial and first anal pieces, which curve under to connect with the sunken basal pieces, and upwards to form a part of the vertical walls of the cup. In the lateral position of its anal and oral opening, it agrees with *Agarricocrinus* and *Amphoracrinus;* but it differs from the first, with which it also agrees in being concave below, in the tumid and curved character of its first radial and anal pieces, as well as in having the succeeding radials, anals, and interradials forming a vertical wall, instead of extending out on a horizontal plane, while its arms are very much weaker, and rise from around the summit, instead of from the horizon of the lower part of the body. Its interradial and second range of anal pieces are also much shorter.

From *Amphoracrinus*, it not only differs in the concavity of its base and the curved character of its first radial and first anal pieces, but in all the other peculiarities of form, and the weakness and position of its arms.

From *Dolatocrinus*, Lyon, (*Cacabocrinus*, Troost?) with which it agrees in form, the number of basal pieces, and the sunken condition of its base, as well as in the incurved character of its first radials, it differs in having its first anal piece down on the same range with the first radials, and connecting with the base as in the typical forms of *Actinocrinus*, instead of being up on a range with the first interradials. It also differs in its lateral anal and oral opening, as well as in not having protuberant arm bases.

MOLLUSCA.

CEPHALOPODA.

Goniatites compactus.

Shell subdiscoid; umbilicus wide, or about twice the dorso-ventral diameter of the last turn near the aperture, moderately deep, and showing about half of each inner turn. Volutions four, near twice as wide as their diameter in the direction of the plane of the shell, broadly rounded externally, and each provided with a broad moderately deep concavity on the inner side, for the reception of the next whorl within; sides rather narrowly rounded near the umbilicus, and rounding off more gradually to the periphery, the most

prominent part being within the middle. Aperture (as inferred from sections of the whorls) transversely subreniform. Septa with a single pointed lobe on each side; dorsal lobe infundibuliform, the narrow portion being lanceolate; dorsal saddle broadly and very obtusely rounded; superior lateral lobe from one-fourth to one-third larger than the dorsal, and having much the same shape, excepting that it is proportionally wider; inferior lateral lobe consisting merely of a broad rounded sinuosity. (Surface unknown.)

Should Montfort's name *Aganides* be retained for this genus, the name of this species would become *Aganides compactus*.

Greatest diameter 2·50 inches; convexity (or breadth of aperture) 1·33 inch; breadth of umbilicus, about 1·12 inch.

Locality and position.—Coal Measures. Macoupin Co., Ill.

Note in regard to the name "CINCINNATI GROUP," *used in the foregoing paper.*

As it is now acknowledged that the rocks along the Hudson river valley, to which the name Hudson River Group had been applied, belong, as long maintained by Dr. Emmons, to a different horizon from the so-called Hudson River rocks of western New York, and the states farther westward, it seems to be an awkward misnomer to continue to apply the name Hudson River Group to these western deposits. Hence it is certainly desirable that this group should receive some appropriate and generally applicable name. Its subdivisions, it is true, have already received various lithological names, such as "Utica Slate," "Frankfort Slate," "Lorraine Shale," &c.; but as each of these names will probably be always directly associated, in the minds of geologists, with the particular subdivision to which it was originally applied, while neither of them is applicable to the lithological characters of the whole series, we cannot, without creating confusion, so extend its signification. It has recently been proposed to designate this series as the "Green and Blue Shales and Limestones;" this, however, is not a name, but descriptive phrase, and has the disadvantage of being based upon lithological characters not everywhere characteristic of these beds.

In view of all the facts, we have concluded to propose the name Cincinnati Group—(which will be adopted in the forthcoming reports of the Illinois Geological Survey)—for this series. This name possesses the advantage of being equally applicable to rocks of any color or composition, while it carries the mind to a well-known locality, where the formation referred to is extensively developed, and its fossils so abundant that they have been thence widely distributed, both in this country and Europe. Consequently, geologists will everywhere at once understand to what particular horizon of the Lower Silurian this name refers.

Descriptions of New Crinoidea, &c., from the Carboniferous Rocks of Illinois and some of the adjoining States.

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

Genus POTERIOCRINUS, Miller, 1821.

POTERIOCRINUS INDIANENSIS, M. & W.

Body rather deeply cup-shaped or truncato-obconic. Base basin-shaped, comparatively rather broadly truncated below by the columnar facet. Basal pieces well developed, pentagonal, about one-third wider than high. Subradials large, three pentagonal, and two on the anal side hexagonal, there being no defined angle at the middle of the under side of any of these plates. First radial pieces about half as large as the subradials, wider than long, rounded on the outside, and nearly pentagonal, or with one or both of the superior