

DESCRIPTIONS OF NEW SPECIES OF CARBONIFEROUS INVERTEBRATE FOSSILS.

By C. A. WHITE.

The fossils herein described are among the collections of the National Museum. The coral was obtained by Prof. O. St. John in the Black-foot Range of mountains, southward from the Yellowstone National Park, in the summer of 1877, while prosecuting his work as geologist of one of the parties of the survey then in charge of Dr. F. V. Hayden. The spines of *Archæocidaris* are a part of a small collection of Upper Coal Measure fossils sent by Mr. Frank M. Dininny from Tecumseh, Nebraska. The four species of crinoids, here described as new, constitute part of a collection which has been for several years in the cases of the Museum, the donor of which collection is unfortunately unknown. The only label accompanying the fossils contained only the following inscription: "From thirty miles west of Humboldt, Kansas." The place thus indicated, as determined by a Land-Office map, is in the valley of one of the upper branches of Verdigris River, a tributary of Arkansas River. Besides the four new species just mentioned, those enumerated with them in the following list constitute this interesting collection:

1. *Platyceras nebrascensis*, Meek.
2. *Piua peracuta*, Shumard?
3. *Terebratula millipunctata*, Hall.
4. *Spirifer cameratus*, Morton.
5. *Spirifer (Martinia) lineatus*, Martin.
6. *Spirifer (Martinia) planoconvexus*, Shumard.
7. *Spiriferina kentuckensis*, Shumard.
8. *Spirigera subtilita*, Hall.
9. *Retzia mormonii*, Marcou.
10. *Hemipronites crassus*, Meek and Hayden.
11. *Meckella striatocostata*, Cox.
12. *Productus semireticulatus*, Martin.
13. *Productus punctatus*, Martin.
14. *Productus longispinus*, Sowerby.
15. *Productus nebrascensis*, Owen.
16. *Cyathaxonia distorta*, Worthen.
17. *Fistulipora nodulifera*, Meek.
18. *Rhombipora lepidodendroides*, Meek.
19. *Glaucanome* ——?
20. *Lecythiocrinus olliculaformis*, sp. nov.
21. *Cyathocrinus stillativus*, sp. nov.
22. *Erisocrinus typus*, Meek and Worthen.
23. *Erisocrinus planus*, sp. nov.
24. *Rhodocrinus vesperalis*, sp. nov.

Besides these there were fragments of three other species of crinoids

belonging to the *Cyathocrinida*. Although all, or nearly all, the crinoids hitherto published from the Upper Coal Measures of the United States, belong to the *Cyathocrinida*, the species No. 21 of the foregoing list is the first one known from that formation which presents exactly the calyicular formula of true *Cyathocrinus*. Besides this two of the other new species of crinoids belong to genera that have hitherto been unknown in North American strata above the Subcarboniferous, one of them, indeed, being never before known to exist. Such facts demanded rigid inquiry as to whether these strange forms might not have been derived from some older formation, and become accidentally mixed with those from the Upper Coal Measures, especially as the package was not, when first examined by me, securely closed, and the record was defective as before indicated. All the specimens were therefore subjected to careful examination under the lens, which disclosed the fact that some one or more of these new forms had adhering to its surface a greater or less number of minute fragments of Polyzoans, which were not only recognized as Upper Coal Measure species, but fragments of the same were found adhering to many of the well-known Upper Coal Measure brachiopods associated with them in the collection. In addition to this, the character and aspect of the imbedding matrix, so far as it remained with the fossils, were found to be essentially the same upon both the new and well-known forms. There appears, therefore, to be no room for reasonable doubt that these new forms, as well as the others which are associated with them in the collection, came from Upper Coal Measure strata at the locality indicated by the label as before mentioned; and that they are all from substantially the same local horizon. The loss of the record of the donor's name is to be regretted, but it was no doubt occasioned by the confusion into which a part of the collections of the Museum fell at the time of the fire which a few years ago damaged the building of the Smithsonian Institution.

The discovery of these new crinoidal forms is not only interesting in itself, but it is important as showing a persistence of certain paleozoic crinoidal types up to almost the closing epoch of Paleozoic time as it is represented by North American strata. The intimate relationship of at least the brachiopodal fauna of the Subcarboniferous series of the Mississippi Valley (especially that of the Chester limestone member of that series) with that of the Upper Coal Measure limestone and shales is well known. Indeed, quite a number of the brachiopods of these two formations we must consider as specifically identical. The case is different, however, with the crinoidal faunæ of the two formations as regards specific identity, for they afford no exception to the rule that fossil crinoids have a narrowly limited vertical range. But in the case of these fossils there is shown by this collection to be a recurrence of formerly existing types, or, more properly speaking, these newly discovered types indicate the continuation through preceding epochs of

certain generic and family types, that have heretofore been discovered only in the strata representing the earlier of those epochs. Thus *Rhodoerinus vesperalis* and *Cyathocrinus stillatirus* have their nearest known representatives in the Burlington limestone of the Subcarboniferous series. This is interesting because the crinoidal fauna of the Upper Coal Measures had hitherto presented a good degree of contrast with corresponding faunæ of the different divisions of the Subcarboniferous group as well as with that of the group as a whole. For example, as has been already mentioned, there is a great preponderance of the *Cyathocrinidae* in the Upper Coal Measure strata. These are mostly of peculiar types, and their bodies are mostly also composed of massive pieces. *Erisocrinus* is peculiar to this latest of the Carboniferous epochs, as represented by the strata of the great Mississippi Valley, and it is interesting to note that the new genus *Lecythocrinus* agrees with it in excluding the whole of the anal series of its pieces from participating in the structure of the calyx.

The other species of crinoids which are named in the list as associated with these new forms belong to types, either generic or intergeneric, which have been hitherto found only in Upper Coal Measure strata.

The spines of the species here described as *Archæocidaris dininuii* give a very inadequate idea of the characteristics of the whole animal, and such a description has very little value in zoölogical classification; but for the convenience of geological study it is thought best to give systematic names even to such zoölogically imperfect objects as these, that they may be used in the classification of all the recognizable fossils which characterize different formations respectively. The species represented by these spines has quite a wide geological range in the Upper Coal Measures of the valleys of the Lower Missouri and Upper Mississippi Rivers, and their characteristics are such that the species may be readily recognized.

The full Carboniferous series of the great Rocky Mountain region is several thousand feet in thickness; and the horizon within this limit, from which the coral herein described as *Acerularia adjumetiva* comes, is not accurately known. This discrepancy, however, is apparently of less importance than it otherwise would be, from the fact that not only is the great Carboniferous series of that region not marked off into epochal groups in the same manner that it is in the Mississippi Valley, but it is there everywhere difficult to find any recognizable planes, either paleontological or stratigraphical, for the separation of the series into any well-defined groups.

## ACTINOZOA.

## Genus ACERVULARIA, Schweigger.

*Acervularia adjunctiva* (sp. nov.). Plate 1, figs. 1, 2, and 3.

Corallum massive or subdiscoidal, composed of compactly united corallites of somewhat unequal size; corallites approximately straight, irregularly polygonal, averaging about five millimeters in diameter, their outer surfaces faintly marked by vertical lines which indicate the places of the septa within, but they are not sufficiently distinct to give a crenulated border to the calyx; these surfaces also present more or less distinct irregular transverse wrinkles or undulations; outer wall of the corallites distinct but not thick; inner wall well developed; diameter of the space inclosed by the inner wall equal to about one-half the full diameter of the corallite; the transverse tabulæ of this central space well developed, distinctly separate from each other, their number being about ten to each centimeter of length of the corallite. The space between the outer and inner walls is occupied by numerous more or less complete shallow infundibuliform plates, which are not quite so numerous as the central tabulæ. These plates spring from the inner wall, which they successively help to form, and arch upward and outward to the outer wall; being the successively abandoned floors of the outer portion of the calyces. They appear to have been not always complete, either as regards their extension to the outer wall or their construction of a symmetrical cup, but they are apparently no more imperfect in these respects than the calyces of such corals often are.

The condition of the only specimens discovered is not such as to show any of the calyces in their natural condition, and the structure of the corallites has therefore been determined by the examination of polished sections, both longitudinal and transverse. While the parts already described are thus distinctly shown, the rays are discovered with difficulty, and they were evidently only slightly developed; their number, as near as it can be ascertained, is about 16 or 17.

The genus *Acervularia* has been regarded as peculiarly a Devonian form, but as related corals are common to both Devonian and Carboniferous strata, there appears no good reason why *Acervularia* may not exist in the latter. This form seems to differ from the typical species of that genus, at least to such an extent as might be naturally expected of it, when found in strata of so much later date than those which contain the typical forms. This is an interesting form, not only as regards its structure, but also in consequence of the marked difference which it presents from any Actinozoan yet described from American Carboniferous strata.

*Position and locality.*—Carboniferous strata, Blackfoot Range, south of the Yellowstone National Park, where it was discovered by Prof. O. St. John.

## ECHINODERMATA.

Genus *LECYTHIOCRINUS* (gen. nov.).

Etym. *Ληκίθιον*, a small oil flask.

*Generic formula*.—Basal pieces, 3; subradial pieces, 5; first radial pieces, 5; anal and interradial pieces, 0.

*Generic diagnosis*.—The basal, subradial, and first radial pieces are all well developed, none of them being minute. The dome is not known, but it was very small in comparison with the size of the body. The facet for the attachment of the column is small and round, but the column is not known. The facets for the attachment of the arms are small; the arms are not known, but they were five in number, and evidently small and delicate. The character, shapes, and arrangement of the three basal pieces are precisely as in *Platyerinus*, and the arrangement of the five subradial pieces upon them is the same as that of the first radials upon the basals in *Platyerinus*. The arrangement of the first radial pieces upon the subradials is essentially the same as that of *Erisoerinus*; that is, they alternate regularly with each other and have no anal or interradial pieces intervening. The body, which is the only portion of the animal yet known, is therefore composed of thirteen pieces, the arrangement of which is essentially that of five first radials, all in close contact with each other, superimposed upon the calyx-structure of *Platyerinus*. Or, if it be assumed that the basal cycle of pieces in the body of every true crinoid contains the elements of five pieces, and that in case there are only three apparent in the adult state, as in *Actinoerinus* and many species of *Platyerinus*, there has been an early ankylosis of two adjacent pieces in two cases, we may regard *Lecythioerinus* as a Cyathocrinid thus modified. I am disposed to adopt this view, and I therefore refer the new genus to the *Cyathocrinida*. It is thought to be not improbable that if other species of this genus should be discovered the base may be found to be composed of five separate pieces instead of three, but no trace of a fourth and fifth suture can be discovered in the base of the form here described. In case other examples should prove to possess a base composed of five pieces, the other characteristics which it possesses are still sufficient to hold it as a new generic form among the Crinoidea.

Only one example of this interesting crinoid, consisting of the body alone, has been discovered. It is small and delicate in structure, the delicacy of the pieces composing it being similar to that of certain species of *Platyerinus* and *Dichoerinus* found in the Burlington limestone. In this respect it differs from all the hitherto known crinoids of the Upper Coal Measures, the pieces composing the bodies of which are

thick and often massive. This delicacy of structure is probably a generic characteristic.

*Lecythiocrinus olliculæformis* (sp. nov.). Plate 1, figs. 4 and 5.

Body small, subovoid or pot-shaped, higher than broad, broadest a little below the middle, composed of thin pieces; base convex; basal pieces rather small but not minute; subradial pieces larger than any of the others, higher than wide, their height equal to a little more than half the full height of the body, not materially varying in size or shape; first radial pieces smaller than the subradials but larger than the basals, broader below than above, height and greatest breadth about equal; at top, on both sides of the small prominent arm-facet, the border of each first radial is bent inward, constricting the already narrow interbrachial space at the top of the body, which space was probably covered by a dome of minute pieces. Sutures not impressed or otherwise specially marked. Surface, to ordinary vision, apparently smooth, but a good lens shows it to be very finely granular.

Height, 9 millimeters; breadth,  $7\frac{1}{2}$  millimeters.

*Position and locality*.—Upper Coal Measure strata, thirty miles west of Humboldt, Kansas. See introductory remarks.

#### Genus ERISOCRINUS, Meek and Worthen.

*Erisocrinus planus* (sp. nov.). Plate 1, figs. 6 and 7.

Body rather small, subcircular or obscurely pentahedral as viewed from above or below, shallow convex-basin-shaped from the top of the first radials downward; base somewhat deeply impressed at the center, the depression gradually rounding outward to the sides; basal pieces very small, occupying the bottom of the depression of the base and almost covered by the first joint of the column; subradial pieces moderately large, their inner ends bent inwardly by the depression of the base to meet the small basal pieces there, their outer ends extending outward and upward so as to be more or less plainly visible by side view of the body; first radial pieces comparatively large, convex vertically, their upper edges rounded inward to the suture between them and the second radials, their lower angles extending downward almost to the lowest portion of the body visible by side view. The other characters are those common to the genus. One minute piece remains attached to the upper border of the calyx of one of the specimens, at the junction of two of the first radial pieces. This is no doubt an anal piece, its outer surface being in the plane of the outer surface of the calyx, but it does not in any degree enter between the two first radials upon which it rests.

Transverse diameter of the calyx, 14 millimeters; height of the same, 5 millimeters.



This species differs from *E. typus* in having a shallower and more rounded basin-shaped calyx, proportionally smaller basal, and larger subradial pieces, and a more deeply impressed base. It very closely resembles the *Poteriocrinus hemisphericus* of Shumard, examples of which are associated with it in the collection. Indeed, so far as the characteristics of the calyx alone are concerned, there appears to be no essential difference except in the relative position of the small anal piece. In *Erisocrinus* no anal piece is recognized as entering into the structure of the calyx, at least none that is visible upon the outer surface, as a greater or less number of such pieces do in *Cyathocrinus* and *Poteriocrinus*, but I am not without suspicion that this form which I have, according to the recognized usage in the limitation of genera, here described as new, really belongs to the same species with *P. hemisphericus*, Shumard, and that the displacement of the small anal piece from the rim of the calyx is an individual variation only. If this should prove to be the case it is clear that a revision of the generic formula of *Erisocrinus* will be necessary; and it will doubtless also be necessary to assign the type of this proposed species to *P. hemisphericus*, Shumard. It is clear that the last-named species does not strictly belong to either *Poteriocrinus* or *Cyathocrinus*, but it is not my purpose to discuss the generic relations of these forms at this time. Figure 8, plate 1, represents an example of the *P. hemisphericus* of Shumard, which is introduced for comparison with those of *E. planus*.

*Position and locality.*—Upper Coal Measures, thirty miles west of Humboldt, Kansas. See introductory remarks.

#### Genus CYATHOCRINUS, Miller.

*Cyathocrinus stillativus* (sp. nov.). Plate 1, figs. 9 and 10.

Body below the upper border of the first radial pieces shallow basin-shaped, much wider than high, having a narrow, moderately deep, abrupt, five-sided depression at the center of the base, at the bottom of which is the facet for the attachment of the column; composed of eighteen moderately thick and strong pieces, all of which, except the basals, are more or less tumid in their middle portion, some of them presenting an irregular, uneven surface, which, with the impressed sutures and the still more deeply impressed corners of the pieces, gives the surface of the body a decidedly rugose aspect; basal pieces very small, occupying the bottom of the depression at the base, the greater part of each being covered by the first joint of the column; subradial pieces having their height and width about equal, four of them pentagonal, and one, that which is next below the first anal piece, hexagonal, there being no appreciable angle upon that side of any of them which adjoins the basal pieces; first radial pieces much larger than the subradial, wider than their full height including the arm facet; the two

which are adjacent to the anal series being very little if any narrower than the others; arm facets large, about one-third wider than high, their plane being nearly vertical, notched at the upper border and marked transversely by the double ridge or raised lines which are common to the arm facets of many of the *Cyathocrinidae*; anal pieces three known, nearly equal in size, or the first a little larger than the two second, each with a prominent tubercle at the center; first anal piece five-sided, abutting against one subradial, two first radials and two second anal pieces; the two second anal pieces abut against the first anal, against each other, and each abuts against a first radial.

Diameter of calyx, 14 millimeters; height of the same, 6 millimeters.

This is the first and only species of true *Cyathocrinus* that has to my knowledge yet been discovered in Upper Coal Measure strata; *C. inflexus*, Geinitz, and *C. hemisphericus*, Shumard, sp., not being regarded as typical species of that genus. It belongs to a type that is more characteristic of the Burlington limestone division of the Subcarboniferous than of any other division of the great Carboniferous series, and together with the next described form it shows the crinoidal fauna of the Upper Coal Measures to be more intimately related to that of the Subcarboniferous than it has before been known to be.

*Position and locality*.—Upper Coal Measure strata, thirty miles west of Humboldt, Kansas. See introductory remarks.

### Genus RHODOCRINUS, Miller.

*Rhodocrinus vesperalis* (sp. nov.). Plate 1, figs. 11 and 12.

Body subglobose, the sides and outer portion of the base continuously convex; the base having a deep, sharply defined, five-sided pit which contains the whole of the five basal pieces, and also the sharply inflexed inner ends of the five subradial pieces; the latter pieces moderately large, but not much larger than some of the radials and interradials; first radial pieces varying a little in size in the different rays, the larger ones nearly or quite as large as the subradial; second radials much smaller than the first, and the third radials still much smaller than the second, the difference in size being greater in their vertical than in their transverse diameter. The third radial in each ray, which is very narrow vertically, supports two brachial pieces, and they in turn each support another brachial piece, beyond which the structure is unknown; interradian pieces up to a line with the center of the arm bases, three for four of the interradian spaces, and four for that of the anal side; the first or lower interradian pieces are of about equal size in each of the spaces, and a little larger than the two next above; dome moderately convex, prominent opposite the arms and somewhat depressed between them, composed of numerous small pieces; proboscis subcentral, its length unknown. All the pieces of the body, except those of the



base, are slightly tumid, their surfaces being rugose or wrinkled, and in some if not all cases marked by obscure lines which radiate from the center of each piece in groups of threes, and become continuous with similar lines on adjoining pieces.

Height from the base of the body to the base of the proboscis, 12 millimeters; breadth of the same, 16 millimeters.

Although this species serves as a very suggestive link between the erinoidal fauna of the Upper Coal Measures and that of the Subcarboniferous, especially that of the Burlington limestone division of that series, it differs too much specifically from any described form embraced by that genus to need detailed comparisons.

*Position and locality.*—Upper Coal Measure, thirty miles west of Humboldt, Kansas. See introductory remarks.

### Genus ARCHÆOCIDARIS, McCoy.

*Archæocidaris dininnii.* Plate 1, figs. 13, 14, and 15.

Principal spines fusiform, moderately strong, 50 or 60 millimeters long, the greatest diameter being about the middle, which is there about 5 millimeters. The diameter of the basal ring of such a specimen is about  $3\frac{1}{2}$  millimeters, and the short neck or plain space above it is scarcely  $2\frac{1}{2}$  millimeters in thickness. Above the short plain neck the whole spine is studded with irregularly disposed spinules, 1 to 2 millimeters in length, which stand out at nearly right angles with the axis of the spine, except near its point, where they are directed upward. The spinules are usually more numerous and stronger upon the lower portion of the spine than elsewhere, and upon the middle portion of the large spines they are sometimes obsolete, apparently from some other cause than accidental removal. The smaller spines are often not so thickly studded with spinules as the larger ones, and they are usually more slender or less fusiform than the larger; and some of them seem to have been without a basal ring.

A marked peculiarity of this species is the abundance of spinules upon the spine, especially its lower portion, and the general position of most of them at nearly right angles to its axis.

*Position and locality.*—Upper Coal Measures, near Tecumseh, Nebraska, whence it was sent with other Upper Coal Measure fossils by Mr. Frank M. Diniiny, in whose honor the specific name is given. This species has also been recognized by me in rocks of that formation in other portions of Nebraska and also in Western Iowa.

WASHINGTON, November 8, 1879.



## EXPLANATION OF PLATE 1.

### ACERVULARIA ADJUNCTIVA.

Fig. 1, a small cluster of corallites, natural size. Fig. 2, transverse section of the same. Fig. 3, vertical section of a single corallite.

### LECYTHOCRINUS OLLICULEFORMIS.

Fig. 4, side view of body enlarged to  $1\frac{1}{2}$  diameters. Fig. 5, diagram of the same, in the same proportions.

### ERISOCRINUS PLANUS.

Fig. 6, basal view of body, natural size. Fig. 7, view of oval side of the same. Fig. 8, similar view of the *Poteriocrinus hemisphericus* Shumard, for comparison.

### CYATHOCRINUS STILLATIVUS.

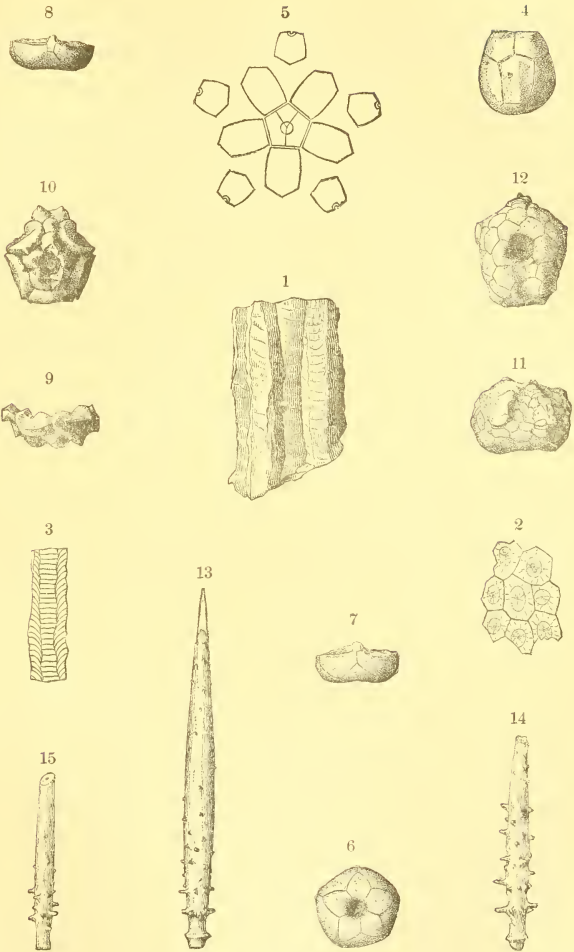
Fig. 9, side view of calyx, natural size. Fig. 10, basal view of the same.

### RHODOCRINUS VESPERALIS.

Fig. 11, side view of the body, natural size. Fig. 12, basal view of the same.

### ARCILEOCIDARIS DININII.

Figs. 13, 14, and 15, views of different spines.



1, 2, and 3.—ACERVULARIA ADJUNCTIVA.  
 4 and 5.—LECYTHOCRINUS OLLICULEFORMIS.  
 6 and 7.—ERISOCRINUS PLANUS.  
 8.—POTERIOCRINUS HEMISPHERICUS.  
 9 and 10.—CYATHOCRINUS STILLATIVUS.  
 11 and 12.—RHODOCRINUS VESPERALIS.  
 13, 14, and 15.—ARCHÆOCIDARIS DINIXII.

