ART. XXXII.—*Descriptions of two new star-fishes, and a Crinoid, from the Cincinnati group of Ohio and Indiana; by F. B. MEEK.**

PALÆASTER? DYERI Meek.

AMONG the specimens loaned to me for study and description by Mr. Dyer, there is a very imperfect example of one of the largest known Silurian star-fishes. When entire, it must have been from five to five and a half inches in diameter across from end to end of the rays of opposite sides; while its disc, as seen in a flattened condition, measures about two inches in diameter. As near as can be determined from the published description of *Palæaster granulosa* of Hall (which has not yet been figured), this very large specimen would seem to be related to that species, and may possibly be the same. Still, from its much larger size (*P. granulosa* being described as "of medium size"), as well as from the want of exact conformity of some of its details of structure, I am led to believe it distinct. The specimen, however, is unfortunately much obscured by the adhering matrix, and detached and confusedly mingled spines. Like *P. granulosa*, it has the dorsal side composed of numerous small pieces, bearing very small short spines.† These pieces, however, are not, as described in that species, "tuberculose," but merely convex, while the dorsal pores passing through the sutures between them, are apparently so large that the pieces only seem to connect with each other by a few salient points, so as to form a kind of reticulated structure; a feature not mentioned in *P. granulosa*.

Again, while agreeing with that species in having its marginal and adambulacral piece convex, small, tuberculose or coarsely granular, as wide as long, and alternately arranged, it apparently presents the important difference of having very nearly the same number of pieces in each of these ranges, instead of nearly twice as many in the inner as in the outer range. It likewise shows indications of a few disc plates intercalated, on the ventral side, between the marginal range and the inner adambulacral pieces in the only axillary space of that side exposed; which character, if it really exists, would separate it perhaps generically from *P. granulosa*. A comparison of better specimens would probably also show other differences.

Each piece, on the ventral side, shows a small central pit for

* Figures and descriptions of these fossils are to appear in the Ohio Geological Report.

† The spines are articulated, and not merely projecting points of the dorsal pieces themselves.

the articulation of a spine, measuring from 0.16 to 0.23 inch in length, and about 0.04 inch in thickness, and consequently, distinctly larger than those of the dorsal side. On the dorsal side, the so-called madreporiform body can be seen near the margin of the disc, in one of the axils between two of the ranges. It is nearly flat, of a transversely suboval or subtrilobate form, the lobed side being directed inward; while the little divisions are seen radiating and bifurcating inward on the middle lobe, and laterally on the lateral ones, like the nerves of the pinules in some kinds of ferns.

From some of the characters imperfectly seen in the species, it is possible that better specimens may show it to belong to the genus *Petraster*, and render it necessary to write its name *Petraster Dyeri*. The structure of the dorsal side of *Petraster* is, I believe, not certainly known. In the published species of *Palæaster*, the dorsal pieces are illustrated as if close-fitting, or at least without very obvious pores passing between the pieces. Indeed, it was originally supposed that the dorsal pores passed through these pieces, instead of through the sutures between them, and this was mentioned in the generic description as one of its most important characters. I have no typical examples of that genus at hand, showing the dorsal side; but as no such characters are shown in the figures of any of the published species, or alluded to in connection with the genus, in later publications, we may perhaps infer that it would not now be insisted upon as an essential character of the genus.

Locality and position.—Cincinnati group of the lower Silurian; from the horizon of about one hundred feet below the tops of the hills at Cincinnati, Ohio; where it was discovered by Mr. C. B. Dyer, to whom I have dedicated the species.

STENASTER GRANDIS Meek.

Attaining a very large size, with the body or disc comparatively small, or only of the breadth of the united inner ends of the five rays. Rays long, slender, gradually tapering, and very flexible, widest at their immediate connection with the body, where they seem to be more or less depressed, but becoming more nearly terete farther out. Dorsal side of body and arms composed of numerous subtrigonal pieces that rise into pointed tubercles, or sometimes assume almost the character of short spinules, and are arranged in quincunx, so as to form about eight rows near the middle of the rays; those of the outer two rows being a little larger than the others. Dorsal pores apparently rather large, and passing through between the concave sides of contiguous pieces. Ventral side of body unknown. That of the rays composed of the usual single row of transverse adambulacral pieces on each side of the well defined,

rather deep, and moderately wide ambulacral furrows. Adambulacral pieces rather more than twice as long as wide, with their longer diameters at right angles to the ambulacral furrows, and rounding over from end to end so as to be most prominent in the middle; while they do not connect with each other by flat sides, but have little projecting processes, and corresponding sinuses, apparently for the purpose of imparting greater flexibility to the rays.

Breadth of body, 0.63 inch; length of rays, 2.40 inches; breadth of same at their connections with the body, 0.36 inch. Diameter across from the tips of rays on opposite sides, about 5.50 inches.

Not having seen the under side of the body of this species, I am not quite sure that it is exactly congeneric with Mr. Billings's typical species of *Stenaster*. It does not show the peculiar contraction of the inner ends of the rays, seen in his *S. Salteri*, from which it also differs in a marked degree in the much greater length and slenderness of its rays. In these characters, however, it agrees more nearly with his *S. pulchellus* and *S. Huxleyi*; though it differs from the first specifically, in having proportionally larger rays, with more numerous dorsal pieces, and in attaining a much larger size. I had suspected that it might possibly be the *S. Huxleyi*, but on comparing drawings, and the foregoing description, sent to him for that purpose, with his typical specimen of *S. Huxleyi*, Mr. Billings writes that he has no doubt whatever that it is entirely distinct.

The specimen shows a few short spines connected with the adambulacral pieces; but neither their exact mode of attachment, nor their arrangement, can be very clearly made out. They seem, however, to connect with these pieces along their joining edges, instead of springing from their crests.

Adopting the suggestion already made by another, that the name *Stenaster* for this group should be replaced by McCoy's name, *Urastrella*, previously suggested, incidentally, for apparently congeneric forms, the name of the species here described would become *Urastrella grandis*.

Locality and position.—Upper part of the Cincinnati group at Richmond, Indiana. I am under obligations to Mrs. M. P. Haines of Richmond, for the use of the only specimen I have seen of this species, which was discovered by her at that place, some time back. It may not be out of place to state here, that this lady has by her own zeal and industry, stimulated by a taste for scientific studies, succeeded in getting together one of the finest and most valuable private collections of minerals and fossils in the West.

GLYPTOCRINUS BAERI Meek.

Body of about medium size, globose-obconoidal. Sub-basal pieces apparently not developed, or very small.* Basal pieces short and pentagonal. First primary radials of comparatively moderate size, presenting a general pentagonal outline; second a little narrower than the first, but of nearly the same length, with a general heptagonal outline; third a little narrower than the first, but of nearly the same length, with a general pentagonal form. Secondary radials, consisting of about four pieces in succession, on each upper sloping side of each third primary radial; the first two or three of each series only about one-third smaller than the second primary radials, while above these the succeeding pieces soon become much shorter free brachials. Interradial pieces numerous, small, of very unequal size, and without any regularity of arrangement. Anal series unknown, but probably consisting of a mesial series of hexagonal pieces resting one upon another, and a greater number of much smaller pieces irregularly arranged on each side. Axillary spaces each occupied by some six or more very small pieces.

Arms ten, rather long, simple, widest a little above their bases, and thence gradually tapering to their ends; composed of very short pieces, so strongly cuneiform as to appear almost to taper to nothing alternately on opposite sides, while each supports a pinnule at its thicker end, along the inner margins. Pinnules very long, moderately short, nearly in contact, and composed of pieces three to four times as long as wide. Surface of body plates without costæ or striæ; those of the primary and secondary radial series more prominent than the much smaller pieces filling the interradian spaces, and thus forming somewhat flattened ridges, more or less interrupted at the sutures, and abruptly beveled at the sides; interradian and axillary areas roughened by a minute projecting central point on each of the little pieces filling them.

Column of moderate thickness, apparently nearly round, or perhaps sub-pentagonal near the base, and composed of alternately thicker and thinner pieces, the former of which project a little beyond the others.

The body of the only specimens of this species I have seen, are too much distorted by pressure to afford accurate measurements, but it seems to have been about 0.45 inch in height, by

* I prefer to designate the minute pieces sometimes seen at the connection of the body and column, in species of this and some other Silurian types, as sub-basal pieces, rather than as true basals, not only because they are sometimes absent in species of the same genera, but because precisely similar pieces are sometimes intercalated between the segments of the column, in the types in which they occur, for some distance below the body, thus indicating that they belong to the column.

a little less in breadth; while its arms measure 0·07 inch in breadth at the widest part, a little above the top of the body, where about eight arm pieces may be counted in a length of the same extent.

This species will be readily distinguished from all of the described forms of the genus, resembling it in other respects, by having only ten simple arms, and by the large number and small size of its interrarial pieces. In the latter character it resembles *G. Nealli*, of Hall, from which, however, it differs materially in almost every other respect, but more particularly in having only ten instead of twenty arms, which are also stouter. Its interrarial and axillary spaces likewise differ materially in not being distinctly excavated, and in having each of the little pieces by which they are filled provided with a little projecting point.

The specific name is given in honor of Dr. O. P. Baer, of Richmond, Indiana, to whom I am indebted for the use of the specimens from which the description has been prepared.

Locality and position.—Upper part of the Cincinnati group of the Lower Silurian, at Richmond, Indiana.

NOTE ON THE GENUS *lichenocrinus*.

Since the publication of the note on the genus *Lichenocrinus*, issued in the January number of this Journal, Mr. Dyer, at my request, sent on a specimen of this type which I had seen in his collection last summer, that shows the disc separated from the matrix in such a manner as to expose both the upper and the lower sides. In this one alone, of all the numerous specimens that have been found, there is on the flat or under side, a small central opening, that I have supposed to be due to some accident, and radiating from this, are seen numerous regular fine raised lines, with little linear furrows of the same breadth between them. In looking at this specimen alone, without any knowledge of others, one could scarcely entertain a doubt that this opening, situated so exactly at the center of radiation, must be the mouth, and the minute radiating furrows the ambulacral canals. A careful examination under a magnifier, however, shows that the little raised lines between the furrows *bifurcate* regularly several times, so that the little furrows, in part, do not reach the central opening, but end abruptly at the points of bifurcation. Again, as has already been several times stated, specimens that grew attached to the surface of some smooth body, have been separated from the same, so as to show the under surface of the basal layer, or platform, as it may be called, of the disc; and here we find it without any opening whatever, or traces of radiating striæ, on the under surface. But when moistened, and examined under a magnifier, these regular radiating striæ can be seen through its

thin translucent substance within. In numerous other instances where these basal platforms can be seen still firmly attached to their original station, with the plates of the upper side and the internal lamellæ wholly, or in part removed, the inner, or upper side of this platform can be clearly seen to be without a trace of a central or other opening, and marked by numerous slender radiating lines corresponding to the lamellæ of the interior. A portion of these striæ can be distinctly traced to the central point, where, instead of an opening, there is often even a minute elevation. It is also worthy of note, that here, on the inner surfaces of these basal layers, the little raised radiating lines, like the lamellæ within the disc, do not increase by *bifurcation*, but by the *intexcalation* of shorter ones between the longer; so that if we were to place the specimen mentioned above, showing the central opening and striæ of its under side, on one of these basal platforms, the elevated striæ of its under side would conform to the little furrows of the platform in such a manner that these little furrows would all be closed.

If it were not for this fact, and the absence of any indications, so far as yet known, of any minute openings around the base of the periphery of the disc, at their connection with the bodies upon which they grew, I should be half inclined to suspect that there might be a double basal layer sometimes capable of accidental separation, with a central opening to an internal mouth through the upper one, and numerous minute ambulacral canals passing to this opening *between the two layers*. The bifurcating striæ on the flat under side of this specimen showing the opening, can hardly be, as I at one time supposed, the edges of the internal lamellæ exposed by weathering, because their bifurcating character would seem to show that they do not coincide with the lamellæ within, but with the *interstices between them*; while there are no open slits between these striæ, as we would expect if they were the edges of lamellæ, but mere furrows.

As I have already remarked, if these discs are really *bodies*, they must belong to a form constituting the type of a strongly marked family of the *Cystoidea*, if not typical of a more important section.