

VI.—*The Crinoidea of the Lower Niagara Limestone at
Lockport, N. Y., with New Species.*

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That the lower portion of the Niagara Limestone represents a period favorable to the existence of great multitudes of the echinodermata, the profusion of their fragmentary remains gives abundant proof; especially during the time indicated by the band known as the Lockport Encrinal Marble, which is almost entirely made up in places of disconnected plates, columns, and other portions of their calcareous skeletons.

But conditions conducive to their preservation entire were not present; the deposit being too gradual, giving time for the decay of the organic connective portions, with the subsequent separation of the more indestructible parts; so that while many species, and quite a number of genera are known to have flourished, by the remaining evidence of their plates, but few present enough material to base species upon.

Among the genera may be noted *Caryocrinus*, *Gomphocystites*, *Heterocystites*, *Glyptaster*, *Ichthyocrinus*, *Calceocrinus*, *Periechocrinus*, *Lyriocrinus*, *Dimerocrinus*, *Lecanocrinus*, *Catillocrinus*, *Eucalyptocrinus*, *Macrostylocrinus*, and some others, the last four of which are known to be represented by two or more species, but few of these, after years of careful search, have yielded enough connected evidence to prove identity or to warrant description.

In many instances in which the calyx or the entire individual remains intact, the fossil has so nearly the same consistence as the matrix, and the union between the two is so intimate, that it is almost an impossibility to separate or clean them satisfactorily, and only in a small portion of the layers are the components favorable to successful weathering.

While not enough is presented in most cases for specific determi-

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nation, enough can be made out to show that the larger proportion are specifically distinct from those found in the underlying shales.

Among the species determined are *Caryocrinus ornatus*, Say; *Eucalyptocrinus inconspicuous*, Ringueberg; *Heterocyatites armatus*, Hall; *Lecanocrinus macropetalus*, Hall; *Periechocrinus speciosus*, Hall; *Dimerocrinus immaturus*, Hall; *Calceocrinus contractus*, Ringueberg; and the five new species described below.

***Calliocrinus acanthinus* n. sp.** Pl. III, fig. 1.—Calyx sub-angulate, low, ornamented with spines, nodes, and radiating ridges. Ten of the spines are long and slender and spring in a circle from the middle of the calyx, being directed outwards and upwards, their apices reaching to a point about as high as the top of the calyx. Base nearly as broad as the rest of the calyx; deeply excavated by a wide pentagonal depression, which slopes upwards and inwards from the narrow rim of the excavation to about one-third of the height of the sides, its angles are directed radially and present at about the middle of the first radials. Basal plates small, and of the usual form. First radials bent abruptly outwards and upwards near the middle, their outer upper sides being curved inwards so as to conform to the pentagonal base and meet the margins of the adjoining first radials without the formation of an angle at the sutures; they have six ridges, usually strong, radiating from their center, a median one directed inwards towards the columnar facet, lying in the angle of the basal excavation; two laterally and slightly inwards meeting the corresponding ones from the opposite plates and forming the rim of the base, they also represent the point of the upward curvature of the plates; the next two are directed outwards and upwards towards the sides upon which rest the large inter-radial plates, these are the least prominent of any at the point of radiation, but become rapidly more prominent and strong at the margin of the plate; the remaining ridge is projected outwards on a plane with the base, as far as, and on a line with, the sides of the calyx where it is abruptly truncated by a rectangular turn upwards, thus forming a subacute node or spine. The second radial is broader than high and has a strong median ridge extending from one lateral margin to the other. Third radial gradually elevated from the lower and outer sides forming the sloping base of one of the long spines which it bears, and at times has slight ridges meeting those from the adjoining large inter-radials which are similarly elevated and spiniferous. The apices of the plates, and consequently the bases of the spines being on the same plane, in the third radials and the large inter-radials. The spines of the third radials are flattened antero-posteriorly and those of the inter-radials laterally. The rest of the plates forming the calyx all have their ventral portion elevated into nodes or ridges and are of moderate size. Inter-maxillary plates, arms, column, etc., unknown.

This remarkable crinoid has been known to me for quite a number of years past from disconnected plates, but it was not till somewhat over a year ago that a specimen was found which preserved a

little over half of the calyx. I was at first inclined to publish it as a *Eucalyptocrinus*, but upon mentioning it to Chas. Wachsmuth, Esq., of Burlington, Iowa, to whom a diagram of the species was sent, he called my attention to its being a *Callicrinus*. I quote from a letter of his to myself, dated March 21, 1888.

"The specimen of which you send the diagram is in my opinion a *Callicrinus* (Angelin) and not *Eucalyptocrinus*. The genus *Callicrinus* has not heretofore been recognized from America, but I judge from some excellent specimens which I examined lately from Wisconsin, that not only your new species but also Hall's *Eucalyptocrinus cornutus* should be referred to it, and probably Roemer's *Eucalyptocrinus ramifer*."

From the Lower Limestone of the Niagara Group, Lockport, N. Y.

NOTE.—All the plates and their relative proportions as figured in the restoration can be observed in the type specimen, which shows the interior of the calyx and a small portion of the exterior, with four nearly perfect spines.

I also wish to express my indebtedness to Chas. R. Keyes, Esq., who at the request of Mr. Wachsmuth sent me a tracing of *C. murichsonianus*, from *Iconographia Crinaceorum in stratis Sueciae siluricus fossilium*, page 16, Tab. xxviii, fig. 14, which will be found reproduced on the same plate (Pl. III, fig. 2) with *C. acanthinus* for comparison, and on account of its being of interest in exhibiting parts of the calyx not shown by the specimen from the Niagara, as this is the first publication to my knowledge of this genus here, although as before stated the credit of the generic identification is due to Mr. Wachsmuth.

***Dendrocrinus? nodibrachiatulus* n. sp.** Pl. III, fig. 6.—Calyx small, campanulate; sides incurved, evenly tapering to base, which is of the same size as the upper end of the column; rim spreading. Ventral tube long and in its (apparently) compressed condition, about one-half as wide as the diameter of the top of the calyx. Arms ten, long, not tapering till the end, with nodose joints; pinnulate? Column round, composed of unequally arranged joints, having wide and narrow median rims. Under basals five, as wide as high, pentagonal. Basals hexagonal, with the exception of the posterior, which supports the anal upon its truncate top. Third or radial ring composed of seven plates—five radials, an azygous, and a large anal. Radials broad, pentagonal, except the right posterior, which is quadrangular and elevated above the plane of the rest by the underlying large azygous, which is pentagonal and of nearly the same size as the rest of the radials, and rises to the same level, lifting the radial above it to the same position as is occupied by the first brachial plates in the other series. Anal plate large, subhexagonal, extending up as high as the right posterior radial; but one other plate belonging to the anal area can be made out in the type specimen—this is slightly smaller than the first, and rests upon its upper face. Brachials 3 X 5; of the same character as the arm joints; on each third brachial a bifurcation

takes place. Arm joints nodose, gradually decreasing in size near the distal extremity, without further bifurcation some 28 joints can be counted in one of the arms. Column round, joints unequal in width by reason of the difference in extent of the central elevations or rims; between the wider ones there are from one to three narrower. It increases somewhat in size after leaving the calyx as far as observed, i. e., about 2 cm.

Another specimen, preserving some of the arms and the ventral tube, shows what seem to have been pinnules; but their exact nature cannot be made out on account of the imperfection of the specimen. The ventral tube is long and rather wide in its compressed state, and is exposed up to about one-half of the height of the arms above which point it is covered by them. Five rows of plates can be seen on the posterior side; the median of which are smooth, hexagonal, and depressed below the level of the others; the two adjoining rows interlock with the median, and are of the same height and about the same width, but are pentagonal and alternate with the adjoining outer rows, having a straight suture line between these rows. The plates of each of the adjoining rows are of the same pentagonal character with their truncate sides presenting at the straight longitudinal suture line, and have the suture lines between the successive plates depressed, and at their termination opposite the middle of the opposite plate, there commences a groove which extends half-way across the plate. This arrangement gives a zigzag ornamentation on each side of the tube.

From the Lower Niagara Limestone, Lockport, N. Y.

I have been somewhat at a loss as to the exact generic relations of this crinoid, on account of what seem to be pinnules, but these may turn out to be lateral armlets.

Glyptaster (Eucrius) lockportensis n. sp. Pl. III, fig. 4.—Calyx pentagonal below; angles marked by moderately elevated radial ridges, which arise from the underlying basals and meet in the first radials. This ridge grows stronger and more sharply defined after its bifurcation with the second and third series of radials. Surface ornamented by sharply defined and prominent large granules and ridges, arranged in a radiating manner on the larger plates. Under basals small, projecting but little beyond the column. Basals large, pentagonal, posterior one heptagonal. Primary radials 3×5 , secondary 2×10 , and of the tertiary series three can be made out in the only portion so far observed, i. e., the posterior side. In the posterior side the anal area contains upwards of twenty plates, of which the first anal rests upon the truncate top of the posterior basal; it is the largest plate in the area; immediately above this are three somewhat smaller plates, and the succeeding rows of plates decrease regularly in size towards the top.

This species is readily distinguished by its coarse granules or nodes which coalesce and form ridges or striæ towards the margins of the larger plates to meet corresponding ones from the plates adjoining; and the strong radial ridges being comparatively smooth above the primary series. In the primary radials the granulations and rugæ extend somewhat upon them.

From the Lower Niagara Limestone, Lockport, N. Y.

Quite a number of bases and parts of the sides have been found, but no entire calyx as yet. Subgen. *Eucrinus* differs from *Glyptaster* only in the possession of a tertiary series of radials. Wachsmuth and Springer give no American species in their list, and no other publication of one has fallen under my observation.

***Ichthyocrinus conoideus* n. sp.** Pl. III, fig. 6.—Calyx inverted conical, evenly tapering by straight sides to the broad base; almost circular in section, there being just the faintest suggestion of angularity radially. Arms, column, etc., unknown. Sub-basals three, entirely hidden by column. Basals five, with just the outer angles presenting beyond the base. The lower angle of the radial opposite the smaller sub-basal extending upon the base.

Three series of primary radials can be observed in the type specimen; they are of the usual form, with a smooth or minutely granulose surface; two of the series contain three successive radials, while the other has four; above each primary series the first primary radials are preserved. In another specimen there are four secondary series of three each.

This species is readily distinguished from *I. laevis*, of the shales, by its elongate calyx with straight sides and its proportionately broader base.

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***Eucalyptocrinus muralis* n. sp.** Pl. III, fig. 3.—Calyx inverted conical; sides nearly straight, but slightly curved outwards; base well defined, about twice as wide as the excavation for the reception of the column. Surface covered with coarse, closely arranged, and at times coalescing, granules with spreading bases, and which are but slightly raised above the general surface of the plates, and seem to be without any definite arrangement into radiating lines, as is usually the case in this genus. Column and arms unknown. Basal plates hidden from view by the retention of a joint of the column. First radial plates large and evenly rounded in at the base to the excavated portion, where they are abruptly bent upwards forming its perpendicular walls. The rest of the plates are of average size and construction, and have the outer face convex, evenly rounded up from the sharply defined suture lines.

The types of the species are all in my collection.

Fig. 1. *Callicrinus acanthinus* n. sp. a, Lateral view of calyx (restored).
b, Base of calyx restored.

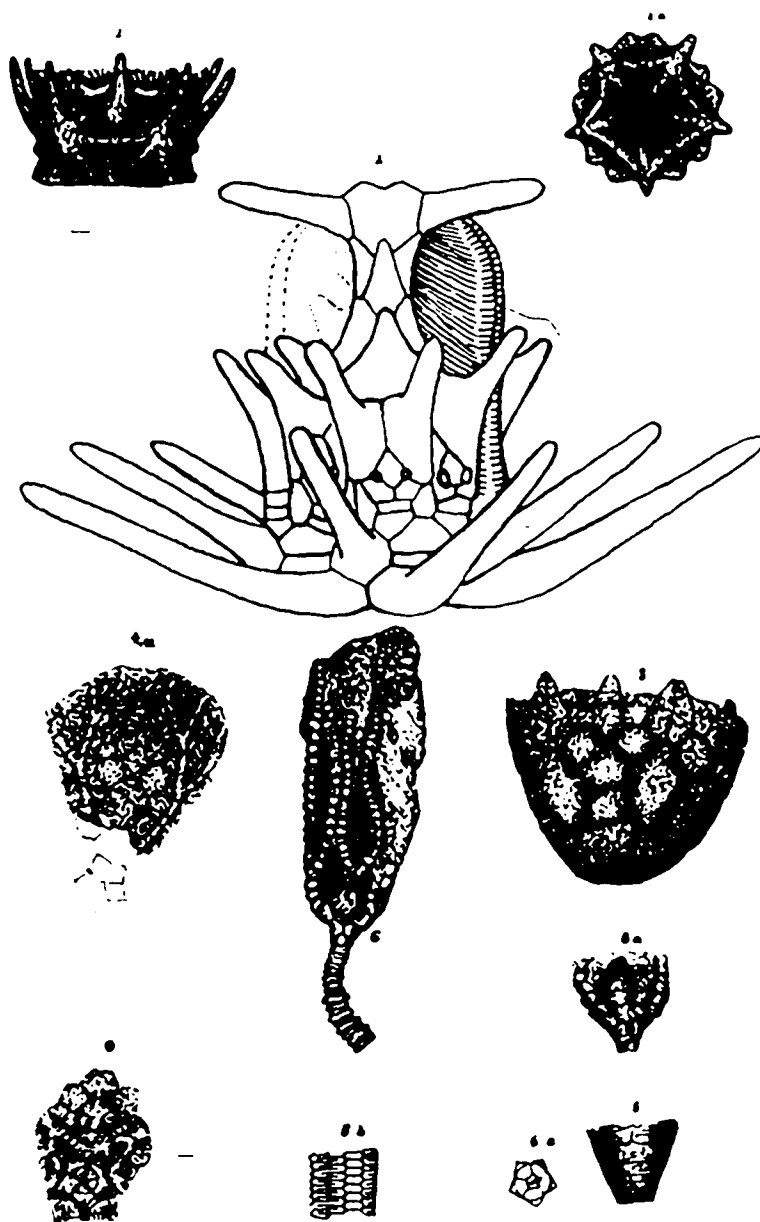
Fig. 2. *Callicrinus murchisonianus* Angelin (after Angelin). Upper Silurian
Gothland, Sweden. For comparison with the above.

Fig. 3. *Eucalyptocrinus muralis* n. sp.

Fig. 4. *Glyptaster (Eucrinus) lockportensis* n. sp. Portion of an individual
preserving the base and first few plates of the posterior side.
a, Another specimen showing the posterior inter-radial area, except
the basal plates.

Fig. 5. *Ichthyocrinus conoides* n. sp. Side view of type. a, Diagram of base
of same.

Fig. 6. *Dendrocrinus nodibrachiatus* n. sp. Anterior side of type. a, Posterior
side of calyx of same specimen. b, Portion of the ventral tube of
another specimen.



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