
Upper Devonian and Niagara Crinoids

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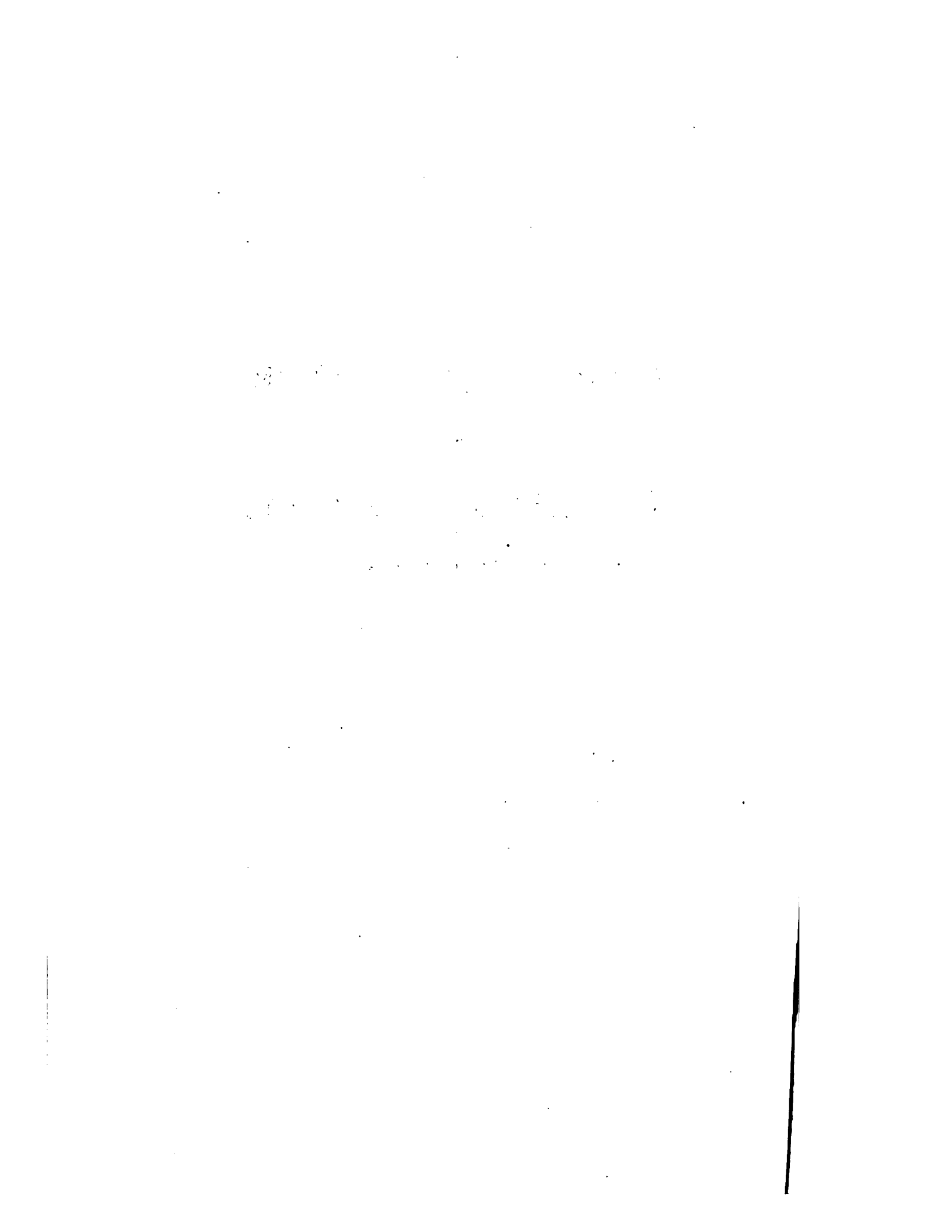
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SUBKINGDOM ECHINODERMATA.

CLASS CRINOIDEA.

ORDER PALÆOCRINOIDEA.

FAMILY MELOCRINIDÆ.

DOLATOCRINUS MAGNIFICUS, n. sp.

Plate 1, Fig. 1, basal view of the calyx, injured in the middle part; Fig. 2, view of the vault, part of which is broken away and the sutures between the plates only partly preserved; Fig. 3, lateral view, with the six-armed ray in front and showing height of vault.

Calyx very large sub-hemispheroidal, broadly lobed in the radial fields and slightly concave below. The radial field opposite the azygous side is much larger, more prominent and more broadly lobed than either of the others. The diameter of the specimen illustrated is two and six-tenths inches and height one and two-tenths inches. The dome is only moderately convex, the radial areas being raised and the interradial areas depressed. Surface of the plates of the calyx sculptured, the larger ones bearing a central node. The radiating ridges do not connect from one plate to another, as is usual in the ornamentation of crinoids, but a radiating ridge may be directed toward the suture between two adjoining plates, instead of joining an end to that of a similar ridge on a contiguous plate; and there are shorter and longer ridges and nodes on the plates. The plates of a kind, however, are ornamented alike and on the whole the ornamentation is very pleasing. The column, in our specimen, is broken off by an irregular fracture and part of the radial plates are injured. Enough is preserved, however, to show that the column is very large and conceals the basal plates that are deeply sunken in the interior of the calyx. The columnar canal is slightly pentalobate.

Basal plates concealed in the calyx. First primary radials probably as long as wide, including the projection up into the calyx to reach the basal plates, but one-half wider than high as exposed around the columnar cavity. The superior side of each is quite concave, and the inferior end is abruptly sunk in the basal cavity, so as to form a funnel around the upper end of the column, as we have seen in specimens of *D. marshi* and other species in this genus, but the depth of the funnel we have not observed in this species.

Second primary radials quadrangular, one-third wider than high, both the inferior and superior sides somewhat convex, and each bears a rather large central tubercle. The superior sides of these plates curve slightly upward and the inferior sides bend a little toward the basal depression, so that the calyx may be made to rest on the central tubercles of these plates.

Third primary radials, in four of the rays, pentagonal, larger than the second radials and about one-fourth wider than long. We will follow these four rays to the arms and afterward recur to the other ray. On each of the upper sloping sides of these four third primary radials there is a single, large, hexagonal, secondary radial, which supports on each of its superior sides two tertiary radials, the last of which supports the free arms. This gives us four arms to each of these four radial series.

In the other or fifth ray, which is opposite the azygous area, the third primary radial is broadly truncated above, hexagonal, twice as wide as high, and supports, upon its upper face, a series of three intersecondary and intertertiary plates, and upon each of its superior lateral sides a single large secondary radial, one of which is hexagonal and the other heptagonal. Each secondary radial bears upon its inner superior sloping side a series of three tertiary radials, the last one of which bears a free arm, and upon its outer superior sloping side a single, large, tertiary radial, which, in turn, supports upon each of its two upper sloping sides two radials of the fourth or quarterternary series, the last of which support free arms. This structure gives to this ray six arms. The first intersecondary radial in this series is a large, quadrangular plate, having nearly equal sides; it is followed by an hexagonal plate abutting its two undersloping sides upon the secondary radials and two upper sloping sides upon the tertiary radials and supporting upon the upper truncated face a somewhat smaller pentag-

onal plate, that abuts its superior sloping sides against the adjacent tertiary radials, that support the free arms. The six plates that support the six free arms in this radial series abut against each other without any intervening plates.

There are, as shown above, twenty-two arms, in this species, which are more than have been found in any species heretofore described. If, however, the ray containing six arms and three interradial plates is abnormal the species would have twenty arms and still be so different from any species heretofore described that no comparison with any of them would serve any purpose in distinguishing it. There is nothing to indicate that this six-armed radial series may be abnormal and we believe it is in the normal condition of the species.

The first interradials are the larger plates of the calyx as exposed on the surface, and larger, in fact, than any of the other plates, unless the first primary radials, including that part which forms the funnel in the columnar cavity should prove to have as great or greater size. The one opposite the six-armed series or first azygous interradial is the larger one and has eleven sides; an approximate one is the smaller and has nine sides; the other three have ten sides each. The first interradial is followed by a single plate that extends nearly to the top of the calyx, and which, in turn, is followed by one or two small plates that separate the arms and connect with the plates of the vault, except in the azygous area, where three plates separate the arms and connect with the plates of the vault. The sutures between the plates in the upper part of some of the interradial areas are not distinct in our specimen, and for that reason are not shown in the illustration.

The dome or vault, as may be seen in the illustration, has part of the plates broken away on the azygous side and some of the sutures are ankylosed or obscure. It is, however, covered with large, polygonal plates of very unequal size. It is most convex toward the six-armed series opposite the azygous side and most sinuate or depressed at the azygous interradius. No pores or passages through the vault between the arms have been found in our specimen.

The specimen from which the foregoing description is drawn is the largest known *Dolatocrinus*. It was found in the Hamilton Group, at the Falls of the Ohio, and is now in the collection of Wm. F. E. Gurley.

DOLATOCREINUS SPINOSUS n. sp.

Plate I. Fig. 4, basal view of the calyx, without the surface markings of the plates; Fig. 5, lateral view, showing some of the spines on the plates of the vault.

Calyx large, subhemispheroidal, broadly lobed in the radial fields, and depressed concave on the lower side. Apparently no azygous interradialia. The diameter of the specimen illustrated is two and two-tenths inches, and height three-fourths of an inch, though we have seen specimens only about two-thirds as large. Vault moderately convex and slightly depressed in the interradial areas. A strong ridge crosses the primary radials. Column round and deeply inserted in the calyx. Surface ornamentation not preserved in any of our specimens.

Basal plates sunk deep within the calyx and extending internally as high as the arm openings. First primary radials twice as wide as high externally, but near the middle of the plates they are abruptly bent, almost at right angles, into the basal cavity, where they form a funnel to the basal plates, into which the column is inserted, so that, in fact, their length is fully equal to their greatest width. The superior face is slightly concave.

Second primary radials quadrangular and more than one-half wider than high. Third primary radials slightly larger than the second, pentagonal, a little wider than high, and supporting upon each upper sloping side a single secondary radial.

Secondary radials nearly as large as the third primary radials pentagonal, and supporting upon each upper sloping side a series of three tertiary radials, the last one of which bears the free arms. The first tertiary radials are larger than the second or third. The species bears twenty arms.

The first interradialia, in each area, are elongated eleven sided plates and larger than any of the other plates in the body. Each one is followed by an hexagonal plate that is as long or longer than wide and supports three narrow, elongated plates in the third range that reach as high as the base of the arms. These are followed, in the fourth range, by three plates that separate the arms, and unite with the plates of the vault. One or two intersecondary plates (apparently a pair of them) are inserted at the base of the arms in the intersecondary areas, but it is not clear, in our

specimens, that they unite with the plates of the vault. Probably they do not, but as the sutures are destroyed this cannot be determined.

The limestone matrix covers the greater part of the vault, in our best specimen, so that but little can be said of it beyond what is shown by the illustration. It is characterized, however, by a plate over each double radial series which bears a very long, strong spine. The broken ends of spines belonging to other plates are preserved in the matrix, but there is no evidence of a proboscis. The summit of the vault is apparently below the top of the matrix shown in the illustration, and not as high as the top of the spines over the radial series.

There have been described, heretofore, only two species bearing twenty arms—*D. lamellosus* and *D. troosti*—and this species is so far removed from them that comparison is unnecessary.

Found in the Hamilton Group, at Charleston, Indiana, and now in the collection of Wm. F. E. Gurley.

DOLATOCRINUS LACUS, Lyon.

Plate I, Fig. 6, side view; Fig. 7, basal view.

Lyon described the body as "subglobose, truncated below, columnar pit broad and deep; summit somewhat conical, prolonged by a proboscis: column round, columnar perforation rather large and pentalobate." He said; "The body is adorned by a most beautiful network of raised triangular figures; the points of the principal triangular figures rise from, and terminate at the center of the first interradial pieces; a subordinate set of figures terminate at the center of all the pieces below the arms. In some specimens the lines are continuous, in others, interrupted. The summit pieces are sometimes adorned by a single prominent granule; in other specimens, many of the pieces are ornamented by a number of granules, arranged in lines across some of the pieces in nearly parallel rows, or in a circular band around a more prominent central one."

Our specimens agree with the above description and in comparison with other species we would note the high calyx, with a slight constriction below the arm bases, the flattened or truncated base, and pentagonal, funnel shaped, columnar pit, bounded externally

by a raised ridge running from a central tubercle on each first radial to another, so as to bound the columnar cavity with a raised pentagonal figure. We have illustrated a basal view to show this pentagonal outline, because Lyon's figure does not show its pentagonal character.

The basal plates are deeply sunken. First primary radials including the extension into the columnar cavity longer than wide; ornamented with sculptured ridges, which terminate at a central node, at each angle of the columnar depression. Second radials quadrangular, wider than high, and bearing a central node. Third radials pentagonal, wider than high, and bearing a central node. First secondary radials as large or larger than the third primary radials. Second secondary radials much smaller and of irregular form and size. Third secondary radials still smaller and of irregular form and size. Arms, ten, composed of ovoid flat pieces of equal thickness.

First interradials the larger plates of the calyx, nine-sided, subovate, angularly pointed below and resting between the upper sloping sides of the first primary radials, the upper sloping sides separate the first secondary radials and the superior side is truncated for a single plate in the second range. Second interradials subquadrate, four pentagonal and one quadrangular and followed by two small plates in the third range (in some areas there are three) and these by three smaller, elongated plates (sometimes there are only two) that separate the arms and unite with the plates of the vault. Intersecondary plates, two, similar to the last three in the interradial areas, and separating the arm bases and uniting with the plates of the vault. Above the summit of the three intersecondary plates and also above the summit of the last two or three interradials, two elongated pores or passages penetrate the vault horizontally. In some interradial areas there are four of these pores, especially where there are three plates in the third range. These pores are conspicuous, in our specimens, but they seem to have been entirely overlooked by Lyon, for they are not shown in his illustration or mentioned in his text. We have given a side view of a specimen for the purpose of showing the interradials and intersecondary plates and the pores, because Lyon's illustration is very erroneous and defective, in all these respects.

Found in the Upper Helderberg Group, at the Falls of the Ohio, and in Clark County, Indiana.

DOLATOCRINUS MARSHI, Lyon.

Plate 1, Fig. 8, showing the abrupt bending of the first radials into a pentagonal funnel shaped cavity.

This species was described and illustrated, by Lyon, in 1869, in the Transactions of the American Philosophical Society, vol. XIII, p. 461, pl. XXVII, Figs. *n*, *n1* and *n2*. His description and illustrations are very good, and for the purpose of identifying the species none other are necessary, but that publication is rare and but few western people ever have an opportunity to see it, and, for that reason alone, we are justified in redescribing it. But our principal object, in calling attention to it, is for the purpose of redescribing and showing a basal view, as we have a specimen hollow on the inside and showing both the exterior and interior of all the plates.

Lyon described the calyx as "discoïd, with five broad, sharp carina, which rise perpendicularly from the margin of the basal pit, and extend outward, equally elevated to the center of the third radials, the carina rising gradually from the margins of the radials, then more rapidly to the center of the pieces. At the center of the third radials the carina sends out branches, not quite so bold as the main stem, but strong, involving all the pieces of the superradials up to the arm bases. Arm bases prominent, in groups of two to each ray, producing a lobed, pentagonal figure of that section of the body. The dome is subconical; twice as high as the body below the arms; surmounted by a thick, strong, subcentral proboscis. The interradial fields unite to the dome-covering between the arms."

The characters above described, to which special attention may be directed, are the low calyx, high vault, subcentral proboscis and carina. Instead of ordinary radial ridges occupying the central part of the radial plates, the whole plates are involved in forming a high central ridge, in each series, which Lyon calls the "carina." And they "rise perpendicularly from the margin of the basal point," which is a striking peculiarity, much more noticeable in a specimen than it is in his illustration or in ours, though the attention of the artist was called specially to it, and our figure is accurate except in giving a full idea of the height of the "carina"

at the "basal pit." The surface of the plates is covered with fine ridges, disposed in groups, radiating from the center of the plates.

The basal plates form a cone, the top of which is on a level with the top of the calyx. The internal position which they occupied, probably caused them to become anchylosed, at all events, one cannot see any possible flexibility they could give the animal, in that situation, if they were not anchylosed. The summit of these anchylosed plates is perforated with a large pentalobate or cinque-foil columnar canal. There is a rim, formed by a thickening of the plates, within the apical part of the cone to which the end of the column was attached, and it appears that the column filled the interior of the cone and the plates were more or less attached to it.

The first primary radials form a pentagonal funnel that extends to the base of the cone formed by the basal plates. The length of the funnel, without including the height of the carina, is equal to the greatest width of the radials. In other words, the length of the first radials is more than their greatest width, but the plates are abruptly bent, and four-fifths of the length is within the funnel shaped basal cavity, and only one-fifth without, which is very little more than the thickness of a plate. It seems quite impossible to show the true depth of the funnel, by pen drawing, but the artist has indicated it as well as he could, in the illustration, which is a character not attempted to be shown, in Lyon's figure of the base of the calyx of this species. In the inside of the calyx, neither the pentagonal form of the funnel nor the external carina are indicated, but a round cone is formed by the extension into the interior of the first radials and basal plates.

Second primary radials quadrangular one-half wider than long. Third primary radials wider than the second and wider than long, pentagonal, and support on each upper sloping side three or four secondary radials, the last of which supports the free arms. The radial series are of variable length within the calyx, as mentioned by Lyon, which somewhat destroys the symmetry of the calyx. There are ten arms.

There are from seven to nine interradials in each area. The first is large, subovoid and has nine sides, it supports a hexagonal plate as large as a primary radial, and it is followed by three plates, in the third range, except in one area, where there