XVII. *On three new Species of* Metacrinus. *By* P. Herbert Carpenter, *D.Sc., Assistant-Master at Eton College. With a Note on a new* Myzostoma, *by* Prof. L. von Graff, *Ph.D.* (*Communicated by* Dr. W. B. Carpenter, *F.R.S., F.L.S.*)

(Plates L.–LII.)

Read 5th June, 1884.

THE dredgings of the 'Challenger' at four stations in the Western Pacific and the Malay Archipelago yielded ten species of a remarkable new Crinoid allied to *Pentacrinus*. Most of these were drawn for the Report on the Stalked Crinoids, under the superintendence of the late Sir Wyville Thomson; and when the collection came into my hands after his death, I found the name *Metacrinus* in his handwriting upon a proof copy of one of the plates. This name is consequently employed throughout the 'Challenger' Reports, in which the peculiarities of the genus are fully described. I have elsewhere noticed the one which is most obvious at first sight as specially distinguishing it from *Pentacrinus* *, viz. the presence of four, or even of six radials, instead of three only.

The other special marks of the genus are:—1. The large size and somewhat cuboidal form of the basal joints of the lower pinnules; 2. The derivation of the ambulacra of the lowest pinnules, borne on the outer radials, either directly from the peristome or from the five primary ambulacra proceeding from it; 3. The modification of the supranodal stem-joints, as well as in most cases of the infranodal joints. All these characters are well shown in the three species described in the following pages.

The fine species for which the name *Metacrinus rotundus* is proposed (Pl. L. fig. 1) was dredged at a depth of 70 fathoms in Sagami Bay, Japan, by Dr. L. Döderlein, the Conservator of the Natural History Museum at Strassburg, in the year 1881 †. He has been kind enough to intrust it to me for description, together with a considerable variety of *Comatulæ* (both *Antedon* and *Actinometra*), which he found to be extremely plentiful in the same locality. These will be considered later; but I would here record my indebtedness to Dr. Döderlein, and beg him to accept my cordial thanks for his kindness.

A fine *Myzostoma*, which I found attached to the *Metacrinus*, is figured and described by my friend Prof. L. von Graff, of Graz. I could find none of these parasites upon the *Comatulæ*, nor were there any loose in the spirit in which they were preserved.

The two other species of *Metacrinus* have been for some years in the collection of my friend Mr. Charles Stewart, F.L.S. He obtained them from the officers of the Eastern Telegraph Company at Singapore, where they were brought up in the process of picking up a cable for repair. They were sent home in spirit; but, by some unfortunate blunder on the part of an ignorant clerk, were taken out and dried upon their arrival in this country. The natural result was, in the case of *Metacrinus superbus*, that a considerable

* Bull. Mus. Comp. Zool. vol. x. 1882, p. 167.

† "Faunistische Studien in Japan, Enoshima und die Sagami-Bai," Archiv für Naturgesch. 49 Jahrg. p. 119.

number of the arms broke at one of the lower syzygies, and the great beauty of a large and perfect Crinoid was irretrievably ruined.

The third species herein described, *Metacrinus Stewarti*, is unfortunately only represented by a stem fragment; but its characters are so different from those of the stem in any species of *Metacrinus* yet known to me, that I have no hesitation in regarding it as belonging to a new specific type.

Although Mr. Stewart had long since commenced to write an account of the fine specimen in his hands, and had also made a few drawings of it, his usual unselfish kindness has led him more than once to offer it to me for description; and when I received Dr. Döderlein's specimen, it seemed to me to be a good opportunity to avail myself of Mr. Stewart's generous offer, and to describe the two species together.

1. *Metacrinus rotundus*, sp. nov. (Pl. L.; Pl. LII. figs. 1–7.)

Dimensions.

Length of stem to twenty-ninth node	44	centimetres.
Diameter „	5	millimetres.
Longest cirrus, 45 joints	47	„
Diameter of disk	18	„
Length of arm after palmar axillary, 130 joints	125	„
„ radial pinnule, 20 joints	20	„
„ distichal pinnule, 20 joints	20	„
„ first pinnule after palmar axillary, 14 joints	9	„

Stem robust, with a rounded pentagonal outline. Usually eleven or twelve, but sometimes as many as eighteen internodal joints. They have fairly well crenulated edges, and their sides bear faint, more or less interrupted ridges, which sometimes become slightly tubercular at the angles. These interradial tubercles are more marked on the nodal joints, but vary considerably in size. The nodal joints increase in size from above downwards as far as the lower edges of the wide cirrus-sockets, and then diminish again. The sockets extend upwards above the articular surface on to the supranodal joints, which are thus somewhat incised; but each socket terminates below by a well defined lip, which is distinctly above the lower edge of the nodal joint. The infranodals are not incised to receive the cirrus-bases, so that the apposed syzygial surfaces are almost perfectly circular. The cirri consist of 40–45 very uniform squarish joints, the lowest of which are but little wider than their successors. The cirri at the twelfth and next following nodes are larger than those lower down. The interarticular pores disappear between the eleventh and twelfth nodes.

Basals pentagonal, rounded, and prominent. Radials usually five, with a syzygy in the second, and occasionally another in the fourth or axillary.

The rays divide three, or sometimes four times, giving 40–50 arms, which consist of about 130 joints beyond the palmar axillary. They are tolerably smooth and but little serrate in the mediodorsal line, except near the ends.

Primary arms of 7–10, usually eight, distichal joints; secondary arms of 10–18, usually twelve or fourteen, palmar joints. There is occasionally another axillary after twenty or twenty-two joints more. There is usually a syzygy in the third joint after each axillary. The next is somewhere between the twelfth and thirtieth brachial, and others follow at very irregular intervals.

The three radial pinnules, on the second, third, and fourth radials, are large and prominent, reaching 20 millims. in length, and consisting of 18–20 joints. The three lower ones are massive and cuboidal; the next few flattened laterally, but still stout, and projecting beyond the bases of their successors. This is most marked in the smaller terminal joints, so that the end of the pinnule has a very serrate appearance. The first distichal pinnule is much like those on the radials; but the following ones are smaller and less serrate. The two lower joints are flattened, and much wider than their successors; but this inequality is much less marked after the palmar axillary, and disappears altogether in the later pinnules, which are comparatively small.

The disk is covered by an irregular pavement of small plates, set moderately close, and the ambulacra are well protected by plates; but the perisome at the sides of the disk, between the rays, is almost bare.

Neither are the muscular bundles between the arm-joints covered by plates, which are limited to the ambulacra. They form a fairly regular row on each side, and become differentiated at the bases of the pinnules into more or less pointed side-plates and rounded covering-plates. Colour, a very light yellowish brown, which has scarcely altered in spirit.

Hab. Sagami Bay, Japan; 70 fathoms.

Remarks.—Several well defined characters distinguish this fine species from the various types of *Metacrinus* which were dredged by the 'Challenger.'

In the first place, like *M. Moseleyi*, it occupies an intermediate position between the two groups into which most species of the genus very naturally fall:—1. Those with four radials, of which the second is a syzygy; and 2. Those with six radials, of which both the second and fourth are syzygies. Variations from these numbers occasionally present themselves in single rays of individual specimens; but, as a general rule, the presence of four or six joints in a ray is a very constant character.

This is not the case, however, in *M. Moseleyi*, two individuals of which were dredged by the 'Challenger.' The following variations occur among their ten rays:—

1	ray of	three	joints,	with the	second	and the axillary a syzygy.
1	,,	four	,,	,,	,,	,, ,, ,,
3	rays of	five	,,	,,	,,	a syzygy.
2	,,	,,	,,	,,	,,	and the fourth a syzygy.
1	ray of	six	,,	,,	,,	a syzygy.
2	rays	,,	,,	,,	,,	and the fourth a syzygy.

In the single specimen of *M. rotundus* the construction of the five rays is as follows:—

1 ray of six joints, without a syzygy.
2 rays of five joints, with the second a syzygy.
1 ray of five joints, with syzygies in the second and fourth.
1 ray of five joints, with syzygies in the second and axillary.

In three of the rays, therefore, there were six primitive joints, of which the second and third became ultimately united by syzygy in two cases, but remained separate in a third; while in the other two rays there were primitively seven joints.

The type, therefore, is intermediate between those more regular species, such as *M. angulatus* from the Arafura Sea, with five primitive radials, two of which eventually unite by syzygy, and the other group typified by *M. interruptus* from among the Philippine Islands, which have eight primitive radials that form two syzygial pairs.

It is to the species last mentioned that *M. rotundus* presents, on the whole, the most resemblance. There is about the same number of joints in the primary and secondary arms, and the external characters of the stem are very similar in the two types. The number of internodal joints is almost the same; but the horizontal ridges on their surface are much less marked in *M. rotundus* than in *M. interruptus*, while their outline is more rounded and less sharply pentagonal (Pl. LII. figs. 7, 5).

But it is in the characters of the nodal and infranodal joints that *M. rotundus* differs from *M. interruptus*, and still more so from all other species of the genus.

In most Pentacrinidæ the cirrus-facet is limited to the nodal joint, but lies at the broad end of a pear-shaped socket, the narrower part of which is continued downwards on to the infranodal joint, and receives the base of the cirrus. The upper part of this socket in *Pentacrinus* is confined to the nodal joint, not extending above the edge of the cirrus-facet, which is often considerably lower than the vertical height of the nodal joint; while the cirri are mostly directed downwards, and the infranodals are more or less grooved to receive their bases, as described above. In *Metacrinus*, however, the normal direction of the cirri seems to be upward rather than downward (Pls. L., LI., LII. fig. 13); and the cirrus-sockets, therefore, encroach somewhat upon the supranodal, which is thus slightly incised, as may be seen by comparing figs. 1 and 4 on Pl. LII. The former represents a normal internodal joint, and the latter that immediately above the node. The share of the supranodal joint in forming the cirrus-socket is likewise seen in the side-view of the stem (Pl. LII. figs. 5, 12, 18). In most species of *Metacrinus* the infranodal is also slightly grooved to receive the cirrus-bases, and its upper (syzygial) surface is, therefore, more or less stellate, in correspondence with that of the nodal joint above it. This is least marked in *M. interruptus*, the nodal joints of which differ but little in outline from those in other parts of the stem. The cirrus-facet ends below in a well defined rim, which is distinctly above the lower edge of the joint. The syzygial surface, therefore, has almost exactly the same pentagonal form as the ordinary sculptured face of an internodal joint. That of the infranodal is similar to it, and has no reentering angles as is usually the case.

Now in *M. rotundus* there is the same well-marked termination of the cirrus-facet above the lower edge of the nodal joint (Pl. LII. fig. 5), and neither it nor the infranodal is in any way grooved to receive the cirrus-bases (Pl. LII. fig. 3). Their apposed surfaces, however, are not pentagonal, as in *M. interruptus*, but they are almost circular (Pl. LII. fig. 3); and this character distinguishes the stem of *M. rotundus* from that of all the other species of the genus.

The type which approaches it most nearly in this respect is also a Japanese form, viz.

that dredged by the 'Vega' in 1879, at a depth of 65 fathoms, in the Bay of Yeddo. Prof. Lovén has been kind enough to send me some fragments of the stem, and also to permit my friend Mr. W. Percy Sladen, F.L.S., to make an investigation of the type during his recent visit to Stockholm for the purpose of examining the collection of Starfishes in the Museum. I am greatly indebted to Mr. Sladen for the trouble which he took, and for the careful and detailed description of the 'Vega' specimen with which he has furnished me. It has nearly the same number of internodal stem-joints as *M. interruptus* and *M. rotundus*, and the length of the primary and secondary arms is very much the same as in these types. In the number of radials (six, with syzygies in the second and fourth) it agrees with *M. interruptus* and differs from *M. rotundus*; but it approaches the latter form more nearly in the characters of the stem.

Although the diameter of the stem-joints is less than in *M. interruptus*, and still more so than in *M. rotundus*, they are not only relatively but absolutely higher than in these species. They resemble the latter rather than the former in the slight amount of sculpture on their sides, and in their more rounded pentagonal form. As in both these types, the cirrus-sockets end well above the lower edge of the nodal joint; but the syzygial surface, though much less sharply pentagonal than in *M. interruptus*, is far from being as regularly circular as in *M. rotundus* (Pl. LII. fig. 3).

In the robustness and other characters of its stem, therefore, *M. rotundus* is distinguished from the two species which seem to resemble it most, just as it is by the irregularity in the number of radials. The plates of the cup and arms are altogether larger than in most species of the genus, the only ones which approach it in size being *M. angulatus*, *M. cingulatus*, and *M. nobilis*, all from near the Ke Islands (Station 192).

The pinnules borne by the radials and lowest distichals have especially stout joints; and the serrate appearance of their outer extremities, produced by the elevation of the distal edge of each joint, is extremely well marked, so as to recall the distinctive features of *Pentacrinus asterius*.

The disk of *M. rotundus* is excellently preserved, and shows very well one of the special characters of the genus, viz. the origin of the ambulacra of the large lower pinnules either directly from the peristome, or from the five primary groove-trunks before they bifurcate (Pl. L. fig. 2). The interpalmar areas of the disk are paved with small plates, which are pierced by the water-pores, but are not quite so closely set as they are in some of the Pentacrinidæ and Comatulæ; while there are few or no plates in the perisome at the sides of the disk between the rays. The disk-ambulacra, however, are protected by several irregular rows of plates, which in some places meet so closely over the middle line of the groove that it is converted into a tunnel. This was the case, not only on the arms, but also in the calyx-ambulacra of the Palæocrinoids, whether the latter were external, as in *Cyathocrinus*, or still further covered by a solid vault, as in *Actinocrinus*.

The arms have no anambulacral plates overlying the muscular bundles, as is so often the case; but the ambulacra are well protected by a double row of somewhat irregular plates, in which there is more or less distinct evidence of bifurcation. This becomes specially marked at the bases of the pinnules, where the proximal limb of the fork remains as the side-plate, with a squarish base and pointed top; while the distal limb of the fork becomes the rounded covering-plate (Pl. LII. figs. 6, 7). As in all the Pentacrinidæ, the two series end some little way before the extremity of the pinnule, the ventral groove of which is thus left entirely unprotected. It is rare to find any individuals of *Metacrinus* some part of which does not exhibit irregularities of growth; and *M. rotundus* is no exception to the rule, the seat of the irregularity in this case being the basal ring. One of the basals is much wider than its fellows, and looks as if it were divided into two unequal parts, one of which slightly overlaps the other. This may be due either to an anomalous mode of growth from the beginning, or else to fracture and subsequent reparation. The point is not one of very great importance, but is only of interest from the frequent occurrence of similar irregularities in *Metacrinus* and their comparative absence in *Pentacrinus*, which seems, as it were, to be somewhat more crystallized in the regularity of its characters.

The fine specimen of *Myzostoma cirripedium* (Pl. LII. fig. 19), which is described further on by Prof. von Graff, was attached to this individual; while its cirri afforded anchorage to those of a small *Antedon*.

Dr. Döderlein informs me that it was attached to the tangles, and had the arms closed in over the disk when it was first removed from the water, but that they opened out after a time. Most of them eventually broke off at the syzygy in the third distichal after the specimen had been put into spirit. Its colour, however, has altered but little in consequence.

2. *Metacrinus superbus*, sp. nov. (Pl. LI.; Pl. LII. figs. 8–12.)

Dimensions.

Length of stem to twenty-sixth node	30	centimetres.
Diameter	7·75	millimetres.
Longest cirrus, 68 joints	80·00	,,
Diameter of disk	30·00	,,
Length of broken arm after suprapalmar axillary, 100 joints	105·00	,,
Length of first palmar pinnule, 27 joints	36·00	,,
,, ,, pinnule after suprapalmar axillary, 22 joints	18·00	,,

Stem very robust, with a rounded pentangular outline and smooth flat sides. 9–11 internodal joints, with moderately crenulated edges. The angles of the nodal joints scarcely project at all, and the wide cirrus-sockets between them extend well up on to the supranodals, though but very slightly on to the infranodals. The cirri increase in size down to the seventeenth node, and then remain tolerably uniform. They consist of about 65 stout, but short and wide joints. The interarticular pores disappear at the eighteenth node.

Basals prominent, and widely pentagonal, with downward extensions over the upper stem-joints. Radials wide, usually four in number, with a syzygy in the second.

The rays divide four times, and the outermost of each pair of the arms which are borne by the suprapalmar axillary divides again, so that the number of arms must exceed

100. There are over 100 joints above the suprapalmar axillary, all of them with raised distal edges. This character is not specially prominent on the later joints, but is very well marked on the outermost radials and on the lowest arm divisions.

Primary arms usually of 4–6, but in one case of 10 distichal joints. 7–10 palmars in the secondary arms. Tertiary arms usually of 14–16 (rarely 12 or 18) joints, with another axillary after 16 or 18 (rarely 12, 20, or 22) joints on the outermost of each pair of quaternary arms. The third joint after each axillary is a syzygy; and the second syzygy in the free arms may be anywhere between the thirtieth and sixtieth brachial. Others follow at intervals of 8–20 joints.

The radial, distichal, and palmar pinnules are all large and styliform, especially the two latter. That on the second radial has two large and cuboidal basal joints; but the following ones become rapidly smaller and much flatter.

The first distichal pinnules are much longer again, and consist of nearly 30 joints, of which the basal ones, including even the first two, are much flattened laterally, though of considerable depth. The following ones are of about the same length, but have wider and more massive basal joints. After the first palmar pinnule the size gradually diminishes, rapidly at first, and then more slowly, while the pinnules become more flattened, though the enlargement of the basal joints is visible for some distance out into the arms.

The disk is paved by small irregular plates, which are not very closely set; but the ambulacra are well protected by plates. The brachial ambulacra are limited to the centre of the arm-furrow, and more or less differentiated on the pinnules into side- and covering-plates. Colour in the dry state, a light purplish grey, with a greenish tinge on the tips of the pinnules.

Hab. Singapore.

This magnificent specimen is the largest *Metacrinus*, and, in fact, the largest recent Pentacrinite that I have yet seen. Few species have a stem exceeding 5 millims. in diameter. It reaches 7 millims. in *Pentacrinus asterius* and *Metacrinus nobilis*; but the stem of *M. superbus* is considerably wider than that of either of these two types. The former is the only one which at all approaches it in the number and stoutness of the cirrus-joints, as also in the frequency of the ray-divisions.

The number and very regular grouping of the free arms in *Metacrinus superbus* is a somewhat striking character. Palmars appear to be universally present, so that there are 40 tertiary arms; and, with one exception, all of them which are preserved, either wholly or partially, divide in the same way. Each of them has a suprapalmar axillary; and of the two arms which this bears, the outer, except in one case, divides again; so that each palmar axillary bears 6 arms: 2, 1, 1, 2. If this arrangement extended all round the disk, there would have been 4×6 or 24 arms on each ray, making a total of 120.

It is exactly the same arrangement as often occurs on the distichal axillary of *Pentacrinus asterius,* which has 12 arms to the ray; and also on the radial axillary of *P. Mülleri, P. Maclearanus,* and *P. Wyville-Thomsoni.* It is of some interest, as affording a clue to the mode of development of the armlets of the Jurassic *Extracrinus,* as I have explained in the 'Challenger' Report.

Metacrinus superbus is somewhat closely allied both to *M. Murrayi* and to *M. nobilis*, having, like them, a smooth flat stem and normally only four radials, and also about the same number of joints in the primary and secondary arms. It has slightly shorter internodes than both these types; and the joints composing them are less sharply pentagonal than in *M. nobilis*, though the sides are not quite so much incurved as in *M. Murrayi*. Both the supra- and the infranodal stem-joints are about as much incised as in the latter species, and somewhat less so than in *M. nobilis*. In neither of these species are there more than about 50 cirrus-joints, and the interarticular pores end at about the tenth or twelfth node; whereas in *M. superbus* there are some 65 cirrus-joints, and the interarticular pores extend down to the eighteenth node—a most unusual distance from the calyx.

Both these types, again, differ altogether from the larger *M. superbus* in the smoothness of the dorsal surface of the skeleton as far as the middle of the free arms; while the terminal portions of their arms are distinctly more serrate than in the corresponding parts of *M. superbus*.

Two of the radial series are slightly irregular in the specimen now under consideration. The type consists of five primitive joints, the second and third of which have united to form a syzygy; so that the ultimate number of radials is four, with the second a syzygy. On two rays, however, there were six primitive joints. In the one case the second and third united as in the type, while the rest remained free; so that there are two joints between the syzygy and the axillary, as shown in Pl. LI. fig. 1. In the next ray, however, the axillary became united by syzygy to the joint beneath it, and the proximal and distal edges of the hypozygal are raised and thickened, as in the other parts of the ray, but only for rather more than half their width. This is also the case with the proximal edge of the axillary or epizygal, the smaller half of which appears as a simple syzygial line, while the remainder is raised and thickened.

The disk, though mutilated in parts, is very well preserved for a dry specimen, and presents one or two points worth notice. The peristome is large, but has no visible oral opening, and a large number of food-grooves converge upon it, some of which proceed direct from the large lower pinnules, as is always the case in this genus. There is, therefore, a great number of small interambulacral areas, which are paved by small plates that are pierced by numerous water-pores, but not so closely set as to form a continuous pavement. These perforated plates extend over on to the dorsal side between the ray-divisions, just as they do in *Pentacrinus asterius*; though Müller denied their existence in this position *. The skeleton of the pinnule-ambulacra varies somewhat in appearance, according to the size of the pinnule which bears it (Pl. LII. figs. 10, 11). The side-plates are usually low and rounded, and very different in appearance from the sharply pointed plates which correspond to them in *M. rotundus*. The gradual development of the pinnule-ambulacra from that of the arm is well shown in Pl. LI. fig. 2. In this, as in all species of the genus, the ambulacra do not reach the distal ends of the pinnules, but terminate some little way short of them; and in like manner the terminal portions

* "Ueber den Bau des *Pentacrinus Caput-Medusæ*," Abhandl. d. Berlin. Akad. 1843, p. 49.

of the arms are not only entirely devoid of any ambulacral skeleton, but they bear quite small and rudimentary pinnules, which consist of only two or three minute joints, and appear to remain permanently in this aborted condition (Pl. LI. fig. 4).

Some of the arms, however, have been broken at a syzygy and subsequently repaired, so as to be still in a state of growth, as is shown in Pl. LI. fig. 5. The manner in which their terminal portions, and those of the growing pinnules, are coiled up, as it were, is very singular, and forcibly recalls the characters of the arms and pinnules in *Holopus*.

3. *Metacrinus Stewarti*, sp. nov. (Pl. LII. figs. 13–18.)

Stem robust and pentagonal, the internodes consisting of 11 joints, with moderately crenulated edges. The joints are 6 millims. in diameter, and have slight horizontal ridges on their sides, which are continuous round the angles, so that these are slightly produced. The nodal joints increase in size from above downwards as far as the lower edges of the wide cirrus-sockets, and then diminish again. The infranodal joints are not grooved at all to receive the cirrus-bases; while the supranodals are markedly incised, and contribute to form the upper portions of the cirrus-sockets proper. The cirri are 50 millims. long, and consist of 50 stout joints, the basal ones being much wider than their successors, which are all uniformly cuboidal.

Remarks.—The characters of this stem-fragment are so well defined that I have no hesitation in regarding it as belonging to a species of *Metacrinus* distinct from any yet known; and I am glad to have the opportunity of associating it with the name of my friend Mr. Charles Stewart, F.L.S., to whom I am indebted for the opportunity of describing it.

In the length of the internodes and in the peculiarities of the nodal joints it resembles the stems of *Metacrinus rotundus*, *M. interruptus*, and the 'Vega' specimen. It is larger, however, than all of these, especially the two last, and the joints have much more distinct horizontal ridges. These give it a certain amount of resemblance to the stems of *M. Wyvillii* and *M. cingulatus*, though it differs altogether from these two in the characters of the nodes.

Owing to the headless condition of the fragment, I was at first sight somewhat doubtful as to which way up it should be placed. The line of union of the supranodal and the nodal joints is rather less crenulated than usual, and looks almost like a syzygial line between nodal and infranodal joints (Pl. LII. figs. 13, 18).

The nodal joints (Pl. LII. figs. 14, 18) are enlarged, and increase in size from both ends towards the cirrus-socket, which extends on to what I now know to be the supranodal; but it seemed possible at first sight that this might really be the infranodal, and the stem belong to a *Pentacrinus* with the cirri directed downwards, instead of a *Metacrinus* with upward turned cirri, as is really the case. In fact, the nodal joints have no little resemblance to those of *Pentacrinus Wyville-Thomsoni*, widening downwards to the lower edge of the cirrus-sockets, and then falling away again (Pl. LII. fig. 18). This is also the case in *Metacrinus rotundus*, though to a somewhat less extent (Pl. LII. fig. 5), and the upward extension of the sockets on to the supranodal is somewhat more marked than in the Japanese species. The supranodal is not merely grooved to receive the cirrus-bases, as in many species of the genus; but it actually contributes to form the curved upper edge of the socket itself, which is thus not entirely limited to the nodal joint.

Traces of this arrangement appear in *Metacrinus rotundus* (Pl. LII. figs. 4, 5), though they are far less marked than in *M. Stewarti.*

In consequence of the upward direction of the cirri, and the termination of the cirrus-sockets well above the lower edges of the nodal joints, the infranodals are not grooved at all to receive the cirrus-bases (Pl. LII. fig. 16); so that there are no re-entering angles in their regular pentagonal outline, which is quite different from the circular syzygial surface in *Metacrinus rotundus* (Pl. LII. fig. 3), and resembles that of *M. interruptus.* The syzygial surface of the nodal joint, however, is somewhat lobate, as in the 'Vega' specimen. This lobate shape is partly the result of the increase in the width of the nodal joint from above downwards, and its diminution again below the level of the cirrus-socket by the downward slope of its outer surface, which thus becomes visible in a view of the joint from beneath, as shown in Pl. LII. fig. 15. This is especially marked in the lower side of the figure, and produces a corresponding incision of the infranodal joint, which must not be mistaken for that produced by the downward extension of the socket to receive the base of a cirrus. This, in fact, really does occur in some abnormal sockets, as shown in the lower part of Pl. LII. fig. 16.

When all these peculiarities are considered together, it will be seen that the stem of *Metacrinus Stewarti* has a distinct character of its own. What its calyx may have been is as yet unknown. That of *M. interruptus*, and also that of the 'Vega' specimen, has six radials, while *M. rotundus* has five (Pl. LII. fig. 1); and it is therefore uncertain in which group *M. Stewarti* should be placed, while it might possibly even belong to the group which includes *M. superbus* (Pl. LI. fig. 1), with only four radials.

A large part of one side of the specimen, including many of the cirri, is wrapped up in a dense mass of what appears to be the remains of a horny sponge, in which are imbedded Foraminifera, broken fragments of shells, and a quantity of earthy and mineral matter. Some of the cirri afford an attachment to sessile Cirripedes (*Verruca*?), as shown on the left-hand side of Pl. LII. fig. 13.

Description of a new Species of Myzostoma. *By* Prof. L. VON GRAFF, *Ph.D.*

MYZOSTOMA CIRRIPEDIUM, sp. nov. (Pl. LII. fig. 19.)

A single well-preserved individual was found by Dr. P. H. Carpenter attached to the specimen of *Metacrinus rotundus* which is described by him in the preceding pages.

Its external form resembles that of *Myzostoma Wyville-Thomsoni*, mihi *, which infests *Metacrinus costatus*, P. H. C., and *M. angulatus*, P. H. C., and has been described by myself in the 'Challenger' Report.

* Zoology of the 'Challenger' Expedition, part xxvii. pp. 45–46, pl. vi. figs. 1, 2.

The very delicate body is in the form of an oval plate, 4·6 millims. long and 3 millims. wide. Its thickness is very slight, hardly as much as in the European *Myzostoma cirriferum*; and it is therefore fairly transparent, not only in the clear yellow marginal portion, but also in the somewhat thicker and darker central part within the ring of parapodia. The edge of the body is so much folded over towards the ventral side that the animal appears convex when viewed from above, and concave as seen from beneath.

The unusually extensive ramifications of the digestive canal * almost reach the edge (Pl. LII. fig. 19); and the marginal portion, which is free from them, is not sharply marked off from the rest of the disk.

There are 20 cirri (*c.*), disposed at tolerably regular intervals from one another, except that the ninth and tenth cirri on each side, and also the two of the tenth pair, are somewhat more widely separated. As regards the length of the cirri, the last pair, with a length of 0·77 millim., and the first pair, 0·6 millim., are the best developed. The lateral cirri vary in length from 0·14 millim. to 0·46 millim. The ventral longitudinal furrow is well defined in most of them.

The body-wall bends slightly outwards between every two cirri, as is especially evident in those parts which are not folded over; and the cirri, which are really marginal, thus come to lie in little bays within the edge.

The circlet of relatively weak parapodia (*p.*) is situated about halfway between the centre and the edge of the disk, though the fifth pair is much farther from the hinder end than the first pair from the front end. The parapodia reach 0·77 millim. in length, when extended; but there is nothing special either about their form or about the hooklets which they enclose. On the other hand, there is a peculiarity of structure, hitherto observed in no other *Myzostoma*, in the finger-shaped process (*p.c.*) which each parapodium bears at its base on the side turned towards the middle line of the body. This process is markedly distinguished from the marginal cirri by the want of a glutinous cell-groove ("Klebzelle"). It is therefore best designated as a parapodial cirrus; and its function is probably that of a tactile organ, as with the similarly shaped structure in the Chætopods. The 8 suckers (*s.*) occupy a line situated about halfway between the bases of the parapodia and the edge of the disk. They are very flat, and but slightly prominent, having a somewhat elongated shape, and reaching 0·23 millim. in length and 0·1 millim. in width.

Almost at the same level with the suckers is the ventral mouth-opening (*m.*), situated 0·35 millim. from the anterior end of the body. It leads into a considerably retracted pharynx, the bulbus musculosus of which (*ph.*) reaches the unusual length of 1·23 millims. I could not make out the origin of the individual intestinal diverticula from the central stomach (*st.*); but the rectum (*r.*) is easily distinguished, together with the oviduct (*od.*), which lies above it, and is filled with ova. The cloacal opening (*cl.*) is placed terminally in a slight incision at the hinder end of the body. The two openings of the male genital organs (♂) are simple insignificant clefts close to the outer side of the bases of the third pair of parapodia.

* These are indicated in a semidiagrammatic manner on the left side of the figure only.

DESCRIPTION OF THE PLATES.

Plate L.

Metacrinus rotundus, sp. n.

Fig. 1. The head and upper part of the stem. Natural size.

Fig. 2. The disk, from above. × 3.

Plate LI.

Metacrinus superbus, sp. n.

Fig. 1. The head and upper part of the stem. Natural size.

Fig. 2. Portion of an arm, rather below its middle, from the right side. × 2.

Fig. 3. Terminal portion of an arm undergoing regeneration, showing the growing points of its two divisions. × 2.

Fig. 4. Terminal portion of a full-grown arm, with imperfectly developed pinnules. × 2.

Fig. 5. The ambulacral groove, with its branches on to the pinnules, viewed from above. × 5.

Plate LII.

Figs. 1–7. *Metacrinus rotundus*, sp. n.

Figs. 1–4. Stem-joints. × 6. Fig. 1. Ordinary internodal joint. Fig. 2. Nodal joint; lower or syzygial face. Fig. 3. Nodal joint; upper face. Fig. 4. Supranodal joint; lower face.

Fig. 5. Fragment of stem, showing the cirrus-sockets on the nodal joint. × 2.

Figs. 6 & 7. Side views of pinnule-ambulacra. × 25.

Figs. 8–12. *Metacrinus superbus*, sp. n.

Fig. 8. Nodal stem-joint; upper face. × 4.

Fig. 9. Ordinary internodal joint. × 4.

Figs. 10 & 11. Side views of pinnule-ambulacra. × 25.

Fig. 12. Fragment of stem, showing the cirrus-sockets on the nodal joint. × 2.

Figs. 13–18. *Metacrinus Stewarti*, sp. n.

Fig. 13. The stem-fragment. Natural size.

Figs. 14–17. Stem-joints. × 6. Fig. 14. Nodal joint; upper face. Fig. 15. Nodal joint; lower or syzygial face. Fig. 16. Infranodal joint; upper or syzygial face. Fig. 17. Ordinary internodal joint.

Fig. 18. Fragment of stem, showing the cirrus-sockets on the nodal joint.

Fig. 19. *Myzostoma cirripedium*, sp. n., seen from the ventral side. × 28. *t.* Marginal cirri; *cl.* Cloacal opening; *i.* Intestinal ramifications (indicated only on the left side of the figure); *m.* Mouth; *od.* Oviduct; *p.* Parapodia; *pc.* Parapodial cirri; *ph.* Bulbus musculosus of the Pharynx; *s.* Suckers; *st.* Stomach; ♂. Male genital openings.

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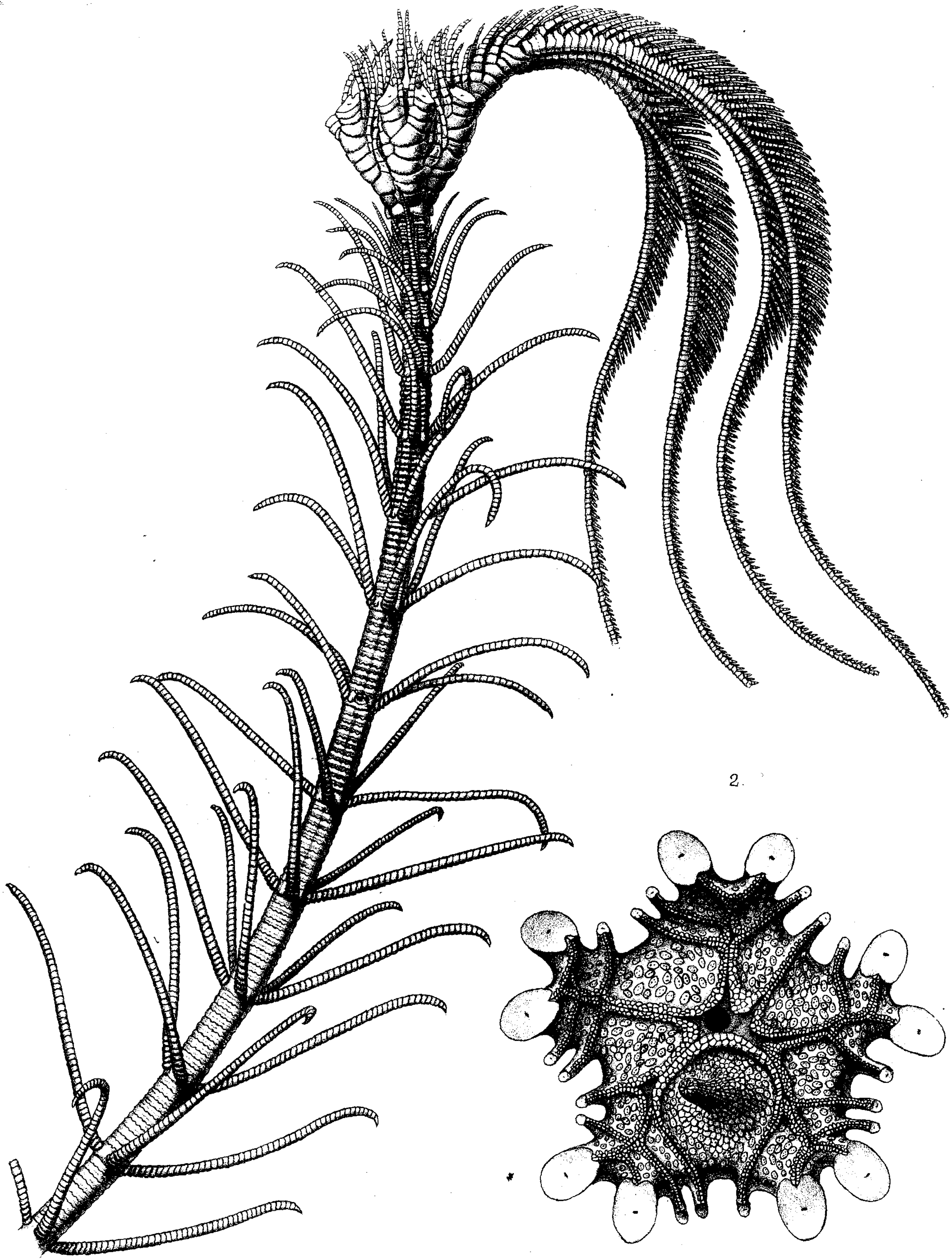

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METACRINUS ROTUNDUS, Sp. n.

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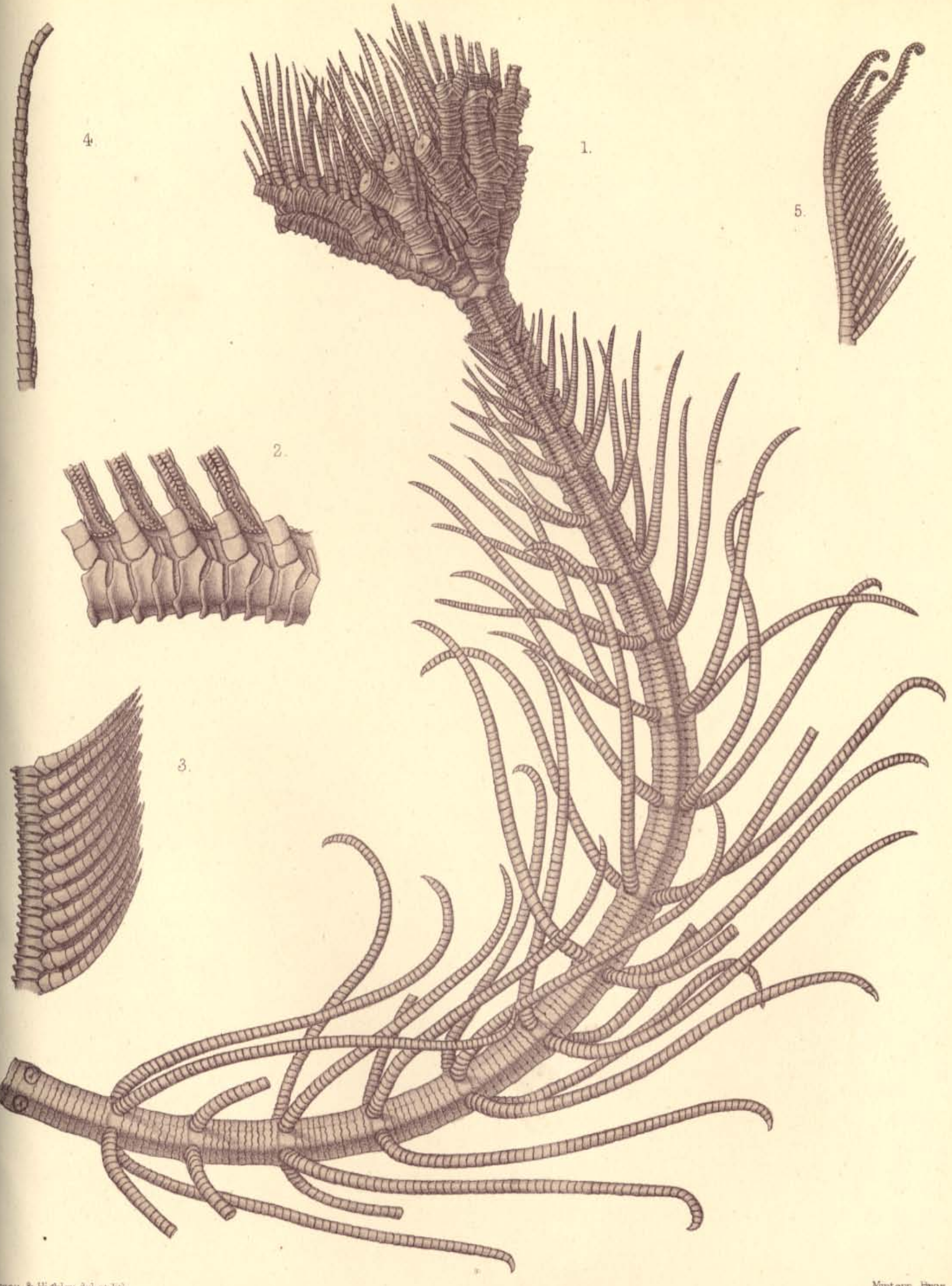

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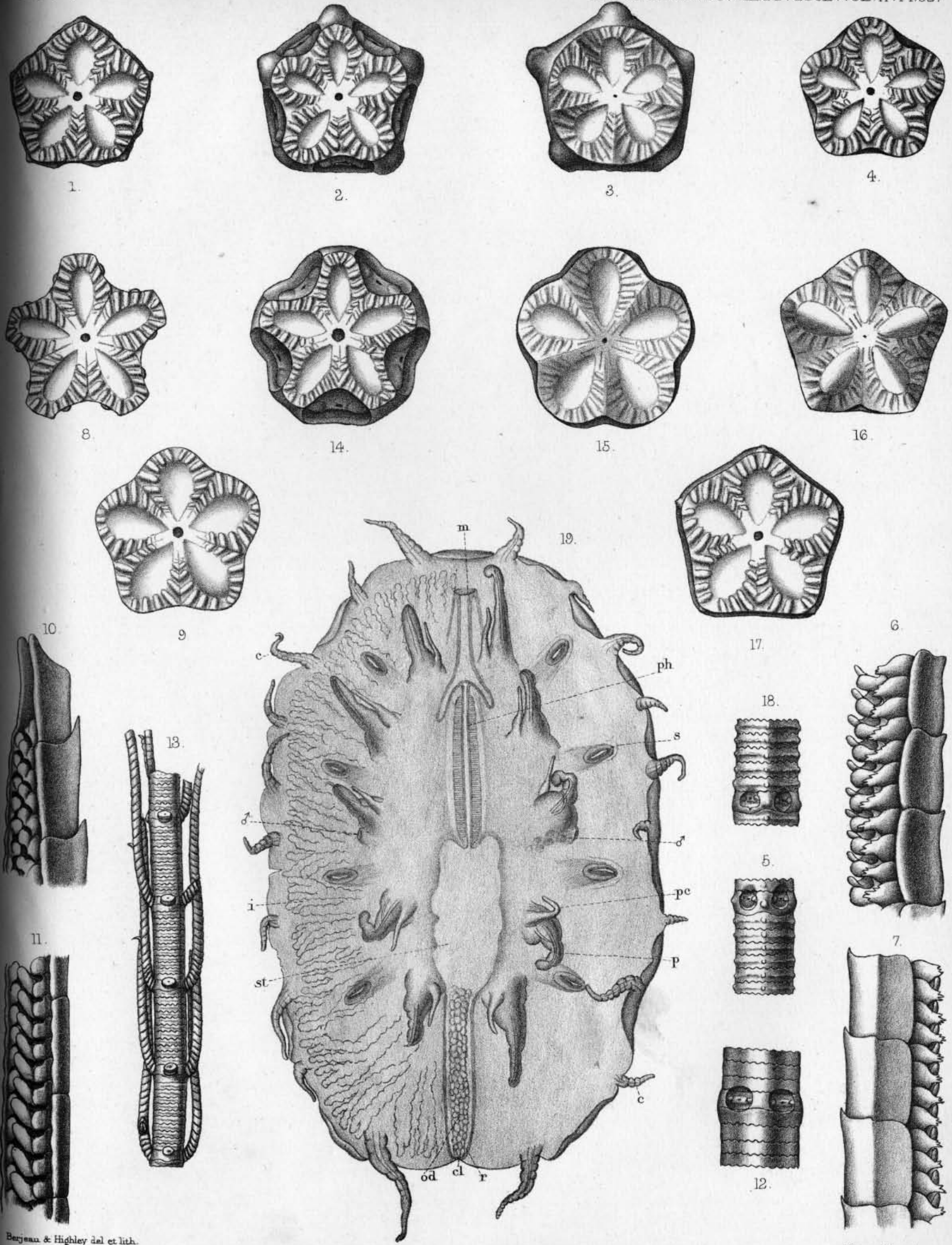
METACRINUS SUPERBUS, Sp. n.



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1–7. METACRINUS ROTUNDUS. 8–12. M. SUPERBUS. 13–18. M. STEWARTI.
19. MYZOSTOMA CIRRIPEDIUM.