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ZOOLOGISCHEN STAATSSAMMLUNG MÜNCHEN

Crinoids of the Zoological Collection of the Bavarian State

by

AILSA M. CLARK

(With 2 text-figures)

Veröff. Zool. Staatssamml. München

Band 11

S. 151—174

München, 15. Dez. 1967

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The crinoids of the Zoologische Sammlung des Bayerischen Staates sent to me for study by Dr. H. F e c h t e r include a number of specimens from the collections of the Deutschen Tiefsee-Expedition, mainly from west of Sumatra and off the coast of Somalia, though there is also an interesting sample from Bouvet Island in the Southern Ocean besides a few others from north-west and south Africa. In addition there is material from the vicinity of Japan, collected by Doflein, Haberer and Schmidt. Following Gislén's studies (1922 and 1927) on Japanese crinoids and the recent fine paper by Utinomi and Kogo (1965), the Japanese material evokes no special comment and the records are simply listed at the end of this paper. The main part therefore deals with the species taken by the Deutschen Tiefsee-Expedition, which include a new species of *Oceanometra* (Thalassometridae), while the following species are described in detail: —

Stiremetra carinifera; with range extended to Somalia from the Laccadive Sea.

Crotalometra sp. ? *sentifera*.

Thalassometra peripolos.

Fariometra sp., aff. *F. sokotrae* and *sewelli*.

Solanometra antarctica; with range extended to Bouvet Island from Heard Island.

Psathyrometra mira.

Pentametrocrinus semperi; with range extended to Somalia from the Tasman Sea.

Atelecrinus wyvilli; with range extended to west of Sumatra from Borneo and eastwards.

Some numerical details are also given for ten specimens of *Leptometra celtica* from north-west Africa.

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Family THALASSOMETRIDAE

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Members of this family make up the larger part of the collection. Some of the specimens show up certain discrepancies between actuality and the keys devised by Austin H. Clark in his crinoid monograph (part 4c, 1950). For instance, *Crotalometra* is distinguished in his generic key as having the first brachial syzygy at brachials 3+4 on arms following a IIBr series, as opposed to *Koehlermetra* where it is at 2+3. The two specimens which I have identified as simply '*Crotalometra* sp., ? *sentifera*' agree with the Murray Expedition material which Mr. Clark named *Crotalometraentifera* in 1937 in having the first syzygy usually at 1+2. As for the type material of *C.entifera*, from the 'Investigator' collections, this was very badly broken and the figure given by A. H. Clark in 1912 showing the first syzygy at 3+4 is clearly an artistic reconstruction, though it is difficult to say how far the reconstruction goes.

Secondly, the relatively small specimen of *Cosmiometra leilae* from Deutsche Tiefsee-Expedition station 212 has only 16 arms, whereas the genus *Cosmiometra* (together with *Stylometra*) is keyed out as having 20—30 arms, with no allowance for the reduced number found in immature specimens.

The new species of *Oceanometra* described here also raises doubts as to the use of the spiny texture of all the ossicles to distinguish *Oceanometra* together with *Thalassometra* from *Crotalometra* and other genera. The new species as well as *Thalassometra attenuata* has only a very fine scattering of minute rugosities over the dorsal surface of the ossicles, though these may be enlarged laterally.

Cosmiometra leilae A. H. Clark

Cosmiometra leilae A. H. Clark, 1932: 565, pl. 20, figs. 18, 19; 1937: 97; 1950: 43—46, pl. 5, fig. 17, pl. 6, fig. 23.

Material. Deutsche Tiefsee-Expedition station 212, 7° 49' N., 93° 11' E. (near the Nicobar Islands), 302 metres; 1 specimen.

This specimen has 16 arms about 55 mm. long, there being no IIBr series, compared with 23—28 arms 90 mm. or more long in the various specimens described by Austin Clark. However, he has noted two 'small' ones (exact size not given) in which the arms number 15 and 20.

Oceanometra valdiviae sp. nov.

Fig. 1

Material. Deutsche Tiefsee-Expedition station 257, 1° 48' N., 45° 42' E. (off Somalia), 1644 metres; 8 specimens (2 paratypes retained in the British Museum collections).

Diagnosis. Arms 13—21 or 22 in the eight specimen known, usually more than 15; centrodorsal with triangular radial and usually also linear interr radial ridges separating the ten columns of cirrus sockets; cirri XXX-c.L; IBr series with a prominent rounded synarthrial tubercle but no keel; IIBr series normally all of four ossicles; texture of division series and arms very finely rugose.

Description of the holotype. There are 13 arms, the most nearly intact one broken at 60 mm. from the base and regenerated from about 25 mm. The total arm length was probably over 80 mm. The arm breadth at the first syzygy (brachials 3 + 4) following a IBr series is 2.4 mm., or following a IIBr series of four ossicles it is 1.9 mm. However, judging from their paler colour, the three pairs of arms which arise from IIBr series have all fairly recently regenerated from the pre-axillary ossicle, and may be abnormally narrow.

The centrodorsal is massive and rounded conical in shape, 4.0 mm. in vertical height, viewed radially, or 4.8 mm. when viewed interr radially since it

arches up over the base of each post-radial series. The basal diameter is 5.25 mm. There are XLI cirri (or perforated sockets) arranged in ten columns of four or five each, the columns being separated in each interradius by a narrow irregular ridge and radially by a wedge-shaped raised area; there are rugose tubercles on all these elevations, particularly towards their basal ends. The dorsal pole is irregular.

The largest intact cirrus remaining is the middle one of a column of five and measures 35 mm. in length; it has 58 segments and the tenth is a transition segment. In the 45 remaining segments of a cirrus of the second row from the periphery, the total length is 32 mm.; probably at least 10 mm. of the distal part is lost; the eleventh segment is the transition one. An apical cirrus 32 mm. long has 54 segments and the ninth is the transition one.

Close to the peripheral cirrus sockets in each interradius there is usually one or a pair of rugose-tipped tubercles, probably arising from the ends of the basal rays.

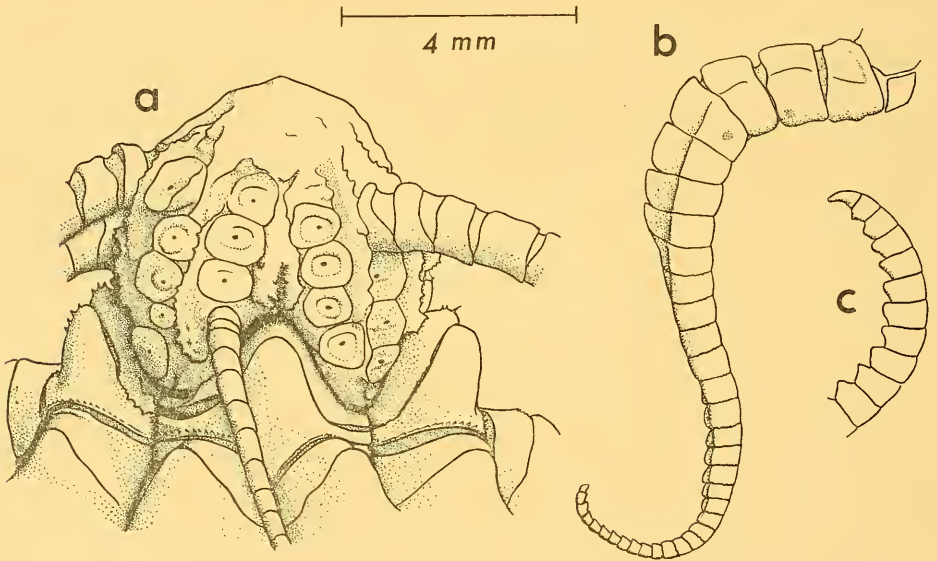


Fig. 1. *Oceanometra valdiviae* sp. nov. Holotype. a) Centrodorsal and IBr series in side view; b) P₁ from an arm following a IBr series only; c) cirrus tip.

The ossicles of the division series are very short. The IBr series have no median dorsal crest but the two ossicles together form a high rounded synarthral tubercle; since the IBr₁ is recessed into the base of the centrodorsal this tubercle does not stand out in profile view of the calyx as it might otherwise do. There is an irregular raised rugose patch at each interradiar extremity of the IBr₁. At the apex of the synarthral tubercle on the IBr₁ are a few very fine thorns and the edges of the two ossicles are very finely thorny; there is also a raised rugose area at the narrow lateral extremity of each IBr₂ (axillary), as well as a scattering of fine rugosities all over the surface of the division series, this texture being also found on the brachials. Of

the three IIBr series, one is of only two ossicles but it follows a parasitic gall on that side of the IBr₂, which may have provoked the irregularity. The two other series are each of four ossicles with syzygy at 3+4. The IIBr₁ and IIBr₂ and the first two brachials of each arm have a similar but less marked synarthrial tubercle to that found on the IBr series, as might be expected. The pair of ossicles following each axillary are fully joined along their inner sides. The first arm syzygy is at 3+4 and the second somewhere between brachials 17 and 22 on most arms, though on one pair there is an additional syzygy at 6+7 on one and 5+6 on the other; also on the arms regenerating from IIBr series the second syzygy is later, at 28+29, 29+30, 30+31 or even 40+41. All the brachials as well as the division series tend to have the general rugosity of the surface exaggerated laterally into rugose projections which help to make the adjacent arms fit closely together proximally.

The basal pinnules are massive with very short segments and a prominent crest, particularly on the basal segments; they are also very prismatic beyond the appressed base. The first pinnule, P_D or more often P₁, is particularly large (fig. 1c). On one arm arising from a IBr series, P₁ has 34 short segments and measures 11.5 mm.; P₂ with 25 segments is 9.5 mm. long, the distal segments slightly longer than those of P₁ and the basal segments relatively more slender; P₃ has 22 segments and is 8.5 mm. long, with the last five or six segments longer than wide; P₄ has 20 segments and is 7.5 mm. long, the last ten segments longer than wide. The next pinnules are similar to P₄ but P₈ is longer again, as are the following pinnules, and measures 8.5 mm., though with only one more segment than the least number.

The disc is studded with thick projecting plates.

Paratypes. These are all more or less broken. The number of arms is 21+ (probably 22), 14, 17, 15+, 15+ (possibly 21), 10+ (all broken at the first syzygy so that there is no way of knowing whether the last ossicle is a IIBr₃ or a Br₃) and 15+ (probably at least 17). In the two specimens where IIBr series occur, they still show signs of regeneration from the IIBr₃.

The cirri number XL, c.XXX, XLIX, c.XLVIII, XL, XXX and c.XL, there being three to five sockets in each of the ten columns. The ridges on the centrodorsal are more tubercular on some specimens than on others and the interrarial ridges may not be well developed. On two specimens the raised radial areas are bifurcated basally, as is suggested in the holotype. In the specimen with XLIX cirri the columns are particularly irregular basally and in one radius there is even a basal mid-radial cirrus.

Few specimens have any complete peripheral cirri. In one, such a cirrus has 60 segments and the sixth or seventh is the transition segment; in another there are 61, 57 and 58 segments in three complete peripheral cirri and the transition segment varies from the seventh to the tenth, more often the latter.

The IIBr series in all the paratypes are never of less than four ossicles. The IBr series always have a more or less well developed synarthrial tubercle but no keel. Only on one specimen is the first brachial syzygy at

1+2 and then only on two arms. All the paratypes are finely rugose, like the holotype.

Affinities. This species proved very difficult to place by means of A. H. Clark's keys to the genera of the family *Thalassometridae*. The non-carinate arms and four ossicles in the IIBr series placed it in section b^2 but the extreme fineness of the rugosities on the arms and division series left me uncertain whether to assign it to d^1 (*Crotalometa*, *Koehlermetra*, *Aglaeometra* and *Stiremetra* with smooth ossicles) or to d^2 (*Oceanometra* and *Thalassometra* with a more or less thick covering of small spines or tubercles). The subsequent further division of these two groups by the number of arms (more than 15 in *Crotalometa*, *Koehlermetra* and *Oceanometra*) or fewer than 15 (in *Aglaeometra*, *Stiremetra* and *Thalassometra*) seems to me artificial, particularly in view of the range of variation shown by the present material and the multiplication of arms which may result from breakage and regeneration at the proximal syzygies.

Although the massive centrodorsal with its radial and interrarial ridges may justify a generic distinction for this new species, the centrodorsal does have much in common with that of *Oceanometra gigantea* (A. H. Clark) from the Hawaiian Islands, which similarly has interrarial ridges and spinose radial areas, though these are evidently not elevated as they are in *O. valdiviae*. Accordingly, despite the development of synarthrial tubercles on the first two ossicles of each division series and the first two brachials, rather than prominent keels, I am referring this species to *Oceanometra*. Apart from the dorsally rounded post-radial series, it differs from the other species of the genus, all of which are from the Pacific, in the more numerous segments of the proximal pinnules and the very fine rugosities on the ossicles.

It has something in common with *Thalassometra attenuata* A. H. Clark, which similarly has very fine rugosities or spinelets on the ossicles, unlike most of the species of *Thalassometra*. In his description of *T. attenuata*, A. H. Clark notes that the radial pairs of columns of cirri are 'usually slightly separated in the midradial line by a shallow furrow or a coarse tubercular ridge' (my italics). In the other species of the family which I have examined, only one or the other of these modifications prevails. I have not seen the six syntypes of *T. attenuata* from south of Karachi but A. H. Clark's figure (1912, fig. 38) shows that the radials are narrowly visible, though his description says that they may also be completely concealed, as they are in *O. valdiviae*. The John Murray Expedition specimen of *T. attenuata* in the British Museum collections has radial hollows between the relatively few cirrus sockets, which number no more than two in each column, as in the types, while the radials form narrow but obvious bands between the centrodorsal and the IBr series. Another specimen in the British Museum collections, from Mozambique, also referred to *T. attenuata* by A. H. Clark, has XXXVIII cirrus sockets (though at least two of the peripheral cirri are immature), that is usually four in each column. This last specimen also has short projecting vertical mid-radial ridges which stop short below the level

of the more nearly apical cirri. The texture of its ossicles with very fine rugosities is similar to that of *O. valdiviae*, though the edges are more spinose, but it differs in having only ten arms and the centrodorsal relatively much smaller, only 2.25 mm. high, radially, the arms being 2.0 mm. wide at the first syzygy. Despite these differences, I think that this specimen from Mozambique may prove to be conspecific with *O. valdiviae* because of its ridged centrodorsal, numerous cirri and concealed radials; certainly it is quite distinct in these characters from the specimens taken in the Maldive area by the John Murray Expedition. All the Indo-Pacific species of *Thalassometra* have relatively few cirri—rarely more than XX—as well as rarely more than ten arms.

Stiremetra carinifera A. H. Clark

Stiremetra carinifera A. H. Clark, 1912: 211; 1950: 130–132.

Material. Deutsche Tiefsee-Expedition station 266, 6° 44' N., 49° 43' E. (off Somalia), 741 metres; 1 specimen.

Since the type specimens of this species were very incomplete, it seems worthwhile to give a full description of this well-preserved specimen.

Description. The arm length was probably about 75 mm. though all are broken at about 60 mm. from the base. The breadth at the first syzygy (brachials 3+4) is 1.0 mm.

The centrodorsal is about 1.4 mm. high; the basal diameter is rather more than this but it is difficult to measure accurately because of the large number of cirri remaining to obscure it. The dorsal pole bears about eight truncated conical papillae, higher than wide. XVIII cirri are crowded around the sides in ten columns of one or two each, leaving only triangular, slightly hollowed, radial spaces between the columns, which are barely wider than one of the basal sockets. Several of the cirri included in the count of XVIII are immature peripheral ones (and as such would probably have been left out by A. H. Clark), leaving only c.XV functional cirri.

The largest peripheral cirri have up to 52 segments, the fifth being usually the transition segment and therefore the longest, having length:median breadth 1.3:0.5 mm.; the following segments become shorter and flared dorsally at the distal end so that there is a prominent sharp, distally inclined, dorsal spine on each, appearing nose-like in profile with the distal end of the segment forming the 'upper lip', the analogy being heightened on the distal segments of the larger cirri by the development of a drip-like small tubercle on the distal side of the dorsal spine. The terminal claw is sharp and curved and the opposing spine well-developed.

The radials are short and each has a median tubercle with a finely rugose tip facing the similarly finely rugose crest which runs the whole length of the short IBr₁, rising abruptly from its smooth surface. There is also a pair of slightly rugose tubercles, one on each side, near the distal edge. The IBr₂ (axillary) bears a continuation of the crest but only on its proximal half; its distal edges are not at all produced or spinose but laterally the proximal edge is slightly flared and rugose for a short length.

The arms are very slender, the breadth at the first syzygy (brachials 3+4) being only 1.0 mm. The second syzygy is at 16+17; thereafter syzygies follow with intervals of usually two or three, sometimes only one, muscular joints. The first two brachials of each arm are slightly carinate but to nothing like the extent of the division series. From about the fortieth brachial (i.e. in the distal half of the arm) the middle of the distal edge of each brachial is produced dorsally and distally and develops several fine thorns; however, the apex is still rounded though narrow and the arm does not really appear carinate in its outer half. In profile it is quite serrated.

P_1 is massive with 15 segments; it is 5.8 mm. long. The first three segments are equally high but it tapers from the fourth to a fairly slender tip. P_2 is much smaller, its tip level with the tip of P_1 ; it has 11 segments and is only 3.4 mm. long. P_3 is almost identical with P_2 but the following pinnules increase progressively in length so that P_7 is 4.2 mm. long and P_{10} 5.25 mm., though both still have only 11 segments. The other pinnules are somewhat larger and all are strongly prismatic in shape with large side and covering plates along their lengths.

Remarks. The holotype and a smaller specimen, which may be designated as a paratype, were taken by the 'Investigator' in the Laccadive Sea in 786 metres. The holotype was very incomplete, broken between the two ossicles of each IBr series, although the smaller specimen retained some axillaries as well as parts of some arms. The latter has a similar tapering, somewhat conical, centrodorsal like this Somalian specimen, though the holotype has a low columnal centrodorsal; the paratype also agrees in possessing lateral tubercles on the IBr_1 as well as crests on both ossicles of the division series. The dorsal spines of the cirri of the holotype are more aquiline in profile than these, with a proximal angle, but this may be correlated with its larger size.

Crotalometra sp., ? *sentifera* A. H. Clark

Crotalometraentifera A. H. Clark, 1909: 147 (?); 1937: 92; 1950: 91—92 (part), pl. 32, figs. 100, 103 (? figs. 101, 102).

Thalassometraentifera: A. H. Clark, 1912: 201—203, fig. 37 (?).

Material. Deutsche Tiefsee-Expedition station 250, $1^{\circ}47'S.$, $41^{\circ}48'E.$ (off Kenya, E. Africa), 693 metres; 1 specimen.

Station 251, $1^{\circ}40'S.$, $41^{\circ}47'E.$ (off Kenya), 693 metres; 1 specimen.

Affinities. These two specimens are certainly conspecific with the two from the Maldive area taken by the John Murray Expedition and identified as *C.entifera* by A. H. Clark. However, they show some differences from the two briefly described syntypes, which were from the Laccadive area and are now in the Indian Museum and the U. S. National Museum. The most notable difference is in the position of the first brachial syzygy on arms following a IBr series of four ossicles. In the figure of one of the syntypes given in 1912, the first syzygy is shown as occurring at brachials 3+4, whereas in the two East African specimens there are syzygies at brachials 1+2 and 3+4 on nearly every arm; also in one of the two Maldive

specimens there is a syzygy at 1+2 on ten out of 16 remaining arms arising from IIBr series and on seven out of ten arms in the other specimen, most of the arms without a syzygy at 1+2 having regenerated, usually from the third ossicle of the IIBr series. However, it is possible that the 1912 figure is not accurate in this respect since it also shows three cirrus sockets in each of the two columns drawn on the centrodorsal, whereas in the description the number of cirri is given as only XX, or two in each of the ten columns. Another difference from the types is that they have only 12–16 arms, whereas the present specimens both have 19 and the Maldive specimens have respectively 18+ (probably 19) and 15+ (possibly up to 20) arms. There may also be a third difference, namely in the modification of the mid-dorsal part of the brachials beyond the basal third of the arms. In his key to the three species of *Crotalometra* (1950:91), A. H. Clark writes that in *sentifera* the distal edge of these brachials is 'produced into long overlapping spines which are more or less flattened dorsoventrally and rounded or truncate at the tip', as opposed to 'somewhat produced and spinous' for *C. rustica* from the Pacific and the eastern half of the Indian Ocean, or 'unmodified, or at least not conspicuously modified' for the South African *C. magnicirra*. I should describe these brachials in both the Murray and Deutschen Tiefsee specimens as somewhat produced and spinose (as in *rustica*) but they differ from at least the Madras specimens of *C. rustica* (mentioned in the crinoid monograph) in having relatively smaller cirri. This last difference also distinguishes them from *C. magnicirra*, which has the cirri as much as half as long as the arms.

The specimen from station 250 is particularly well preserved and merits a full description. It has more numerous cirri with more segments than the Maldive specimens or the types of *sentifera* but the second specimen has fewer of both.

Description. The arm length is 95+ mm., probably c.130 mm. when complete. There are 19 arms only one arising directly from a IBr series.

The centrodorsal is 5.25 mm. high (viewed interradially) or 4.75 mm. (viewed radially) with a basal diameter of about 4.0 mm. (the bases of the cirri preventing a clear view). It tapers slightly towards the apex but cannot be called conical since the top is broadly rounded. The cirrus sockets are arranged in ten vertical columns of three or four each, the columns arranged in interradiial pairs with slightly hollowed bare radial areas, about as wide at the base as a socket and tapering apically, separating them. The convex dorsal pole of the centrodorsal bears some coarse low bumps but no papillae.

The cirri number about XXXV and the longer mature ones in the two more nearly basal positions in each column have 67–72 segments and measure 46–55 mm. in length. The first four segments are broader than long, the fifth has length = breadth and the seventh is the longest, 1.6 mm. long by 0.85 mm. broad. It is the transition segment on all six mature cirri observed, its distal third, together with the following segments, being abruptly shinier and paler than the proximal part. The following segments are pro-

gressively shorter so that the sixth one from the tip of the cirrus has the length: minimum breadth ratio 0.55:0.65 mm.; the minimum breadth is at the proximal end of the segment. From about the twelfth segment, the distal edge begins to be flared on the dorsal side modifying to a well-developed dorsal spine on the segments of the distal half of the cirrus, so that the maximum width of the sixth from last is 0.80 mm., including the dorsal spine. The terminal claw is curved, indeed the whole distal part of the cirrus is preserved in a more or less curved attitude.

The radials are very short but usually have a midradial short thorny-tipped tubercle, sometimes also one or two others.

The IBr ossicles are also short with a vertical thorny-edged frill near the proximal and distal borders and a similar frill along the low median longitudinal keel; on some division series the frill is broken up into isolated narrow tubercles or thorns, especially on the IBr₂.

The IIBr series are all of four ossicles with a syzygy at 3+4. There is a slight median keel on the first two ossicles and small thorns or a slight frill at the edges of all four.

The dorsal surface of the ossicles of the division series is quite smooth, apart from the marginal frills or thorns. The IBr₁ and ₂ and the IIBr₁ and ₂ on the interrarial side have slight ventro-lateral flanges leading to the P_D on the IIBr₃; otherwise the sides of the division series are straight; all are in close apposition laterally.

The arm breadth at the first syzygy (brachials 3+4) is 1.6 mm. and the length from the proximal edge of the IBr₁ to 3+4 (including a IIBr series) is about 8.5 mm.

The first syzygy is at 1+2 on 17 arms. On the single one arising from a IBr series direct it is at 3+4. The nineteenth arm has the first syzygy at 2+3. On 12 (possibly 13) of the arms with the first syzygy at 1+2, the second is at 3+4; then the third syzygy is between brachials 23 and 35. The distal intersyzygial interval is usually five or six muscular joints.

The proximal brachials appear quite smooth but from about the thirtieth one the middle of the distal edge begins to project upwards and by the fiftieth forms a distinct triangular crest at the distal edge of the segment, though the proximal end is still rounded dorsally. As a result of this, the arm appears markedly serrated in profile beyond the basal third of its length.

P_D is massive, strongly prismatic, keeled from about the third segment and tapering from about the fourth; only the distalmost six or so of the 18 segments are longer than broad; the total length is c.8.5 mm. P₁ with 12—14 segments is only 4.5—4.75 mm. long but is about the same shape as P_D. P₂ with 10 segments is 3.4—3.9 mm. long and the next three pinnules are similar though with progressively slightly longer segments, so that P₇ with 9 segments is 3.7 mm. long and P₉ with 11 segments is 4.85 mm. long. P₈ begins to develop a slight expansion of the third and following segments, which is carried further on the larger more distal pinnules, these

being distinctly prismatic. P_{20} has 16 segments and is 7.5 mm. long with a sharp crest beyond the first two segments.

The disc is heavily plated.

Two parasitically-induced galls are present. The larger is between two IIBr series, apparently fused to both but leaving a space between the IBr series. It is sausage-shaped with a hole at the proximal end and the distal part is curved over the disc; the length is c.10.5 mm. The smaller gall runs down the side of another IIBr series distal to the P_D . The P_1 which immediately follows it is unusually large, 6.3 mm. long with 16 segments, while P_2 is 4.0 mm. long with 11 segments.

The specimen from station 251 similarly has 19 arms about equal in basal breadth to the first specimen but it has only XVIII cirri plus two immature ones; the longest cirri have only 56 segments. There is a much higher bare dorsal pole to the centrodorsal, since some cirrus columns have only one mature socket or cirrus. There are tubercles only on the radials, the marginal frills on the division series being fairly smooth and continuous. The distal brachials have a similar median eversion to those found on the first specimen.

Generic position. In A. H. Clark's diagnosis of the genus *Crotalometra*, the position of the first syzygy is given as at brachials 3+4, as it is normally in *C. magnicirra* and in *C. rustica*—the type-species.

As noted by A. H. Clark (1950), one of the many syntypes of *C. magnicirra* in the British Museum collections has a brachial syzygy at 1+2 as well as at 3+4 on all the remaining 14 arms that arise from IIBr series. In fact a second, similarly slender, syntyple of *magnicirra* shares this high frequency of double basal syzygies, having six out of the possible eight arms also with syzygies at 1+2 and 3+4, the two remaining arms having a muscular joint at 1—2. The thirteen other syntypes of *magnicirra* which have more than ten arms (i.e. that have some arms arising from IIBr series) are all considerably stouter than these two and none of them has a syzygy between the first two brachials. It should be mentioned that a specimen of *Glyptometra sclateri*, of the related family Charitometridae, which species often has syzygies at 1+2, was collected together with the types of *Crotalometra magnicirra*; the two are easily distinguished by the shorter cirri with no transition segments and uniform surface texture in *Glyptometra*. Although one of the two aberrant syntypes of *C. magnicirra* has no cirri left, there are a few in the other and these do show transition segments, so there is no doubt that it belongs to the Thalassometridae. Gislén (1938) has noted another specimen of *C. magnicirra* which likewise has syzygies at 1+2 on arms following IIBr division series.

Thalassometra peripolos A. H. Clark

Thalassometra peripolos A. H. Clark, 1929: 651, pl. 40, figs. 3, 4; 1950: 178—180, pl. 18, figs. 56, 57.

Material. Deutsche Tiefsee-Expedition station 210, 6° 53' N., 93° 33' E. (N.W. of Sumatra), 753 metres; 1 specimen.

The specimen is well-preserved and is worth describing since it is only half the size of the two previously-known examples of *T. peripolos*, also from the vicinity of the Nicobar Islands, the holotype having arm length 80 mm. and the breadth at the first syzygy (brachials 3+4) 2.0 mm., whereas in this one the arm length is 45 mm. (some of the arms are complete) and the breadth is 0.95 mm.

Description. The centrodorsal is very low with c.XXV cirri (though three or four of these are immature peripheral ones) arranged irregularly, usually one in the middle of each radius and two, one above the other, on each side of it in the same radial area, so that there are 15 cirri around the periphery of the centrodorsal. The longest peripheral ones measure c.16 mm. in length and have 31—33 segments, the fifth usually the transition segment and even this is fairly short, with length:median breadth 0.95:0.60 mm.; the shorter distal segments each have a prominent nose-like dorsal spine.

The division series and brachials are very finely but densely spinose. They are much more rounded laterally and spaced basally than those of the type but I believe that this is attributable to the much smaller size. There are eleven arms, the single IIBr series numbering four ossicles.

P₁ has 13 segments and is 3.4 mm. long, tapering from a wide base; P₂ with 9 segments is 2.5 mm. long; P₃ is very slightly shorter but by P₈ the length has increased again to 3.2 mm., though there is only one more segment than in P₂.

Family ANTEDONIDAE

Genus *Fariometra* A. H. Clark

Fariometra A. H. Clark, 1917: 128, 130; A. H. Clark & A. M. Clark, 1967: 723.

This genus of the subfamily Bathymetrinae of the Antedonidae is characterized by the conical centrodorsal with XXX or more cirrus sockets having some tendency to arrangement in vertical columns; the peripheral cirri with more than 20 segments, the longest of which are more than twice as long as their constricted median widths, while even the shorter distal segments are usually still slightly longer than broad; the brachials with spinose distal ends and the proximal pinnules with short basal segments but very attenuated distal ones.

The genus is dealt with fully in the final part of A. H. Clark's crinoid monograph. Two of the included species, *Fariometra obscura* from the Laccadive Sea and *F. scutifera* from the Celebes Sea, are only known from specimens lacking the arms (with the pinnules) beyond the first syzygy as well as lacking the cirri. Several of the other species are known only from one or a few broken specimens, so until more is known about the extent of variation of the included species I do not think it wise to add to the number of nominal species referable to *Fariometra*, although the two specimens collected by the Deutschen Tiefsee-Expedition in the Munich Museum's collections do not match the diagnoses of any of those already described. Nor am I cer-

tain that they are conspecific with each other, since there appears to be a significant difference in their proximal pinnules. However, they are well-preserved and worth describing in full for the sake of comparison.

Fariometra sp. A

Material. Deutsche Tiefsee-Expedition station 265, 6° 24' N., 49° 32' E. (off Somalia), 628 metres; 1 specimen.

Description. The arms are almost complete and measure 70—75 mm. in length. The breadth at the first syzygy (brachials 3+4) is 1.2 mm. and the length from the proximal edge of the IBr₁ to the second syzygy (at 9+10) is 8.4 mm.

The centrodorsal is conical with c.LX cirrus sockets ranging well up the sides, most of them irregularly arranged but some tending to form vertical columns; the dorsal pole is papillose. The vertical height of the centrodorsal is 2.1 mm. in radial view or 2.4 mm. in interradian view; the basal diameter is 2.4 mm.

Only a single cirrus remains intact and this is an apical one. It has 26 segments and measures 13 mm. in length. In one of the syntypes of *Fariometra sokotrae* (John), transferred by me in the crinoid monograph from the genus *Thaumatometra*, which specimen has identical arm breadth at 3+4 to this one, the apical-most cirri have c.25 segments while the peripheral ones have 35 or 36. The second cirrus segment in the Somalian specimen is already as long as broad and the fifth, which is one of the longest, is 0.85 mm. long and 0.25 mm. in median breadth; even the distal cirrus segments are slightly longer than their median breadths. All the segments are markedly flared at their distal ends and the longer ones (but to a lesser extent) also at their proximal ends. The distal segments are flared only on the dorsal side. The stumps of one or two peripheral cirri show that they were much stouter than the apical ones.

The radials and ossicles of the division series have prominent spinose frills at their distal edges; the IBr₁ are not contracted distally so that the space between adjacent division series does not form a rhombic 'pore'. There is a spinose tuft at each lateral extremity of the IBr₂ (axillaries). The proximal brachials to about the fifteenth have a raised spinose area at their distal ends but this becomes less prominent and the distal brachials are only very slightly spinose. The proximal syzygies are at brachials 3+4, 9+10 and 14+15.

No P₁ remains intact; the longest has 17 segments together measuring 8.4 mm.; when complete it probably had at least 20 segments and was about 9.5 mm. long. P₂ is much smaller, 4.5—5.0 mm. long, with 11 or 12 segments. P₃, P₄ and P₅ all have about 12 segments but their length increases from 6.0 to 7.35 mm. These proximal pinnules have very attenuated distal ends with extremely long segments about six times as long as wide, but up to six basal segments of P₁ and four of P₂ are not longer than wide. Segments two to six of P₁ have a tall spinose process dorsally

and the following segments have a similar but smaller process at their distal ends. In P_2 fewer of the basal segments have such a large process. P_5 is usually the first genital pinnule (sometimes P_4), the gonad extending from the sixth to the eighth segments.

Affinities. The very last character mentioned—the late appearance of the first genital pinnule—distinguishes this specimen from the one taken at station 266 as well as from *Fariometra sokotrae* and *F. sewelli*, from the vicinities of Sokotra and the Maldives respectively. The types of both of these have P_2 the first genital pinnule. *F. sewelli* (known from only a single specimen) differs in having a relatively lower centrodorsal, little more than half as high as broad and the IBr_1 taper distally to form a rhombic pore between the division series; it agrees with the Somalian specimen in having spinose projections on the proximal ossicles, whereas the five syntypes of *F. sokotrae* are comparatively smooth. Geographically the latter species is certainly the closest and it certainly has a comparably high centrodorsal; probably the cirri too are similar and the IBr_1 are straight-sided. It remains to be seen whether the difference in the development of the genital pinnules and in the texture of the proximal ossicles is sufficiently constant to merit the establishment of a separate nominal species for the specimen described here.

Fariometra sp. B

Material. Deutsche Tiefsee-Expedition station 266, $6^{\circ} 44' N.$, $49^{\circ} 43' E.$ (off Somalia), 741 metres; 1 specimen.

Description. Two of the arms are almost complete and measure c.45 mm. in length. The breadth at the first syzygy (brachials 3+4) is 1.2 mm. and the length from the proximal edge of the IBr_1 to the second syzygy (at 9+10) is 8.2 mm.

The centrodorsal is conical with c.LXX cirrus sockets ranging well up the sides, most of them showing a tendency for arrangement in vertical columns, four or five corresponding to each radius; the dorsal pole is papillose. The height is 2.1 mm. in radial view or 2.35 mm. viewed interradially; the basal diameter is 2.65 mm.

All the cirri are lost, the longest stump remaining consists of three segments of an apical one, the third of which is three and a half times as long as its very constricted median width.

The radials and division series are similar to those in the specimen from station 265, having spinose frills at their distal edges. The first twenty or so brachials also have spinose raised distal ends but the following brachials are smoother.

The first three pinnules are very similar to each other. On one arm P_1 has 15 segments and is 8 mm. long; P_2 with 14 segments is 7 mm. long and bears a gonad, while P_3 has 16 segments and is 8 mm. long. On another arm P_1 with 14 segments is only 6 mm. long but P_2 is again 7 mm. though with no distinct gonad. The first four segments of P_1 are not longer than wide and have a spinose dorsal process similar to those found in the speci-

men from station 265; the following segments become very elongated and flared only at their distal ends.

Affinities. This specimen has much in common with specimen A but the similarity between the first three pinnules and the fact that P_2 is usually the first genital pinnule rather than P_5 (or P_4) makes some doubt that they are conspecific. The proximal position of the first genital pinnule is shared by *Fariometra sokotrae*, *sewelli* and *io* (the last-named transferred by me from *Nepiometra* in the last part of the crinoid monograph). The type-locality of *F. io* and known range is restricted to the East Indies; like the types of *F. sokotrae* it differs in having much smoother ossicles than this specimen from Somalia. Should this character prove to be variable, then this specimen, and probably also the one from station 265, will be referable to *F. sokotrae*.

Solanometra antarctica (P. H. Carpenter)

Antedon antarctica P. H. Carpenter, 1880: 198, pl. 12, fig. 29; 1888: 144, pl. 1, figs. 6, 7, pl. 25.

Antedon australis P. H. Carpenter, 1888: 146, pl. 26, figs. 4, 5, pl. 27, figs. 14—20.

Solanometra antarctica: A. H. Clark, 1913: 61; A. H. Clark & A. M. Clark, 1967: 420—428, fig. 18 (pt.) [? Non *S. antarctica*: A. H. Clark, 1937 a: 9—10, which is probably *Florometra mawsoni*.]

Material. Deutsche Tiefsee-Expedition station 127, 54° 29' S., 3° 43' E. (Bouvet Island), 567 metres; 16 specimens.

The two smallest specimens have the arm breadth at the first syzygy (brachials 3+4) c.0.6 mm. and are extraordinarily spinose, with relatively longer cirrus segments and probably also pinnule segments, as might be expected at this small size. (In the type-material of *S. antarctica* the breadth at the first syzygy is up to 3.4 mm.). The larger specimens are much smoother, the only conspicuous spinose frill being at the distal end of the IBr_1 . The largest and best-preserved specimen has the arm breadth 2.2 mm. and the length from the IBr_1 to the second syzygy 13.5 mm. It has c.LXXV crowded cirri with up to 30 segments, though all the peripheral ones are broken. Another specimen of almost equal size has up to 34 cirrus segments; the longer proximal ones are about twice as long as broad and the distal segments particularly are all prominently flared on the dorsal side towards their distal ends; there is also a well-developed opposing spine. The cirri therefore agree in form with those of both *S. antarctica* and *Florometra mawsoni*, which I suspect may be better considered as congeneric. However, this form contrasts with the markedly straight-sided cirrus segments of *Florometra goughi* John, the Heliometrin species closest in its geographical range to Bouvet Island, from which no member of the subfamily has previously been recorded. Besides Gough Island in 40° S., 10° W., *F. goughi* has also been taken on the Discovery Bank near the Greenwich meridian but at c.42° S. Both Gough Island and the Discovery Bank are well to the north of the Antarctic Convergence, whereas *Solanometra antarctica* has only reliably been recorded from the vicinity of Heard Islands in 73° E. but

on about the same latitude as Bouvet and south of the Convergence. The types of *S. antarctica* are all larger than the present specimens, with a proximal arm breadth of over 3 mm., but the largest syntype of *Antedon australis*, which A. H. Clark considers to be synonymous with *antarctica*, is comparable in size, having the arm breadth 2.0 mm. Its ratio of arm breadth to the length of the division series together with the first nine brachials is exactly the same as in the largest of the Bouvet Island specimens, namely 6.1 : 1, though in the three types of *S. antarctica* in the British Museum collections the ratio is 4.5, 4.8 and 5.0 : 1, the arms evidently becoming relatively stouter with increased size. The seven largest Bouvet specimens have the arm breadth ranging from 1.75 to 2.2 mm. and the ratio from 6.1 to 7.0 : 1.

The relative arm breadth was one of the few characters I could find to distinguish between *Solanometra antarctica* and *Florometra mawsoni* when completing the crinoid monograph; even this may to some extent be correlated with the absolute size. Possibly it is supported by a slightly larger size of the centrodorsal coupled with an increased number of cirri in *S. antarctica*. Thus a specimen of *S. antarctica* from Heard Island (actually the largest syntype of *Antedon australis*) with the arm breadth 2.0 mm. and the length from the IBr_1 to the second syzygy 12.5 mm., has the centrodorsal 4.3 mm. in diameter and 2.5 mm. high with LXXV cirri, whereas one of *F. mawsoni* from off Antarctica, with the same length of proximal brachials and division series and the same arm breadth, has the centrodorsal 3.6 mm. broad and 3.0 mm. high and the cirri numbering only LX.

More material of *Solanometra antarctica* from the type-locality as well as more large specimens of *F. mawsoni* from Antarctica are needed before a true idea of the extent of variation in these characters can be obtained. However, the conclusion I have reached after further consideration is that *mawsoni* must be more closely related to *Solanometra antarctica* than it is to *Florometra magellanica* (Bell), the type-species of *Florometra*, which has the third arm syzygy consistently at brachials 16 + 17, rather than 14 + 15 as in *mawsoni*, and also has more slender and elongated distal pinnule segments, as well as more slender arms and cirri. The very short segments of the distal pinnules are a conspicuous feature of *S. antarctica* and *F. mawsoni*, which I consider are congeneric. This move tends to throw doubt on the position of the other species currently included in *Florometra* which, like *mawsoni*, have the third syzygy in the proximal position at 14 + 15, namely the southern species *F. goughi* John and *F. austini* from the vicinity of New Zealand described by me in the crinoid monograph, together with the north Pacific *F. asperrima* (A. H. Clark). Since yet another species, *F. mariae*, has the third syzygy variable in position, this distinguishing character may not have generic weight and it is possible that *Florometra* should be referred to the synonymy of *Solanometra*.

Psathyrometra mira A. H. Clark

Psathyrometra mira A. H. Clark, 1909 a: 648; 1912: 235, fig. 43; 1918: 227; 1937: 94—95;
A. H. Clark & A. M. Clark, 1967: 519—526.

Material. Deutsche Tiefsee-Expedition station 194, 0° 15' N., 98° 8' E. (S.W. of Sumatra), 614 metres; 1 specimen.

This specimen is quite well-preserved with one complete cirrus and a description of it may be worthwhile.

Description. The longest arm remaining is broken at about 120 mm. from the base and was probably at least 20 mm. longer when intact. The breadth at the first syzygy (brachials 3 + 4) is 2.1 mm.

The centrodorsal is blunt conical, 3.7 mm. in height (viewed radially) and 4.8 mm. in basal diameter. The cirrus sockets number XXXVI, with usually seven in each radial area, two columns of three each approximating apically with an odd midradial socket between their bases; the adjacent sockets tend to alternate in level. Interradially there are slightly hollowed vertical bands without cirri marking off the radial groups, each band being a little narrower than the width of the sockets at the same height on the centrodorsal.

A peripheral cirrus is intact to the thirty-second segment and probably lacks at least five more segments; it is 70 mm. in length, whereas an intact middle cirrus of 37 segments is 60 mm. long and an apical one with 32 plus 1 or 2 is 55 mm. long. All the cirrus segments are longer than wide after the first two. In the peripheral cirrus the third segment has length : median breadth 1.5 : 1, the fifth 3.0 : 1 and the tenth (one of the longest) is 2.73 mm. long and 0.68 mm. broad or 4 : 1. In the intact middle cirrus, the twentieth segment has the ratio 2.5 : 1, the relatively greater width being due to the ventral flange that runs along the distal part of the cirrus exaggerating its vertical width. The last few segments are much more slender, tapering to the small, almost conical, and hardly curved, terminal claw, which is less than half as long as the penultimate segment. All the remaining cirri are almost straight and appear very long and whip-like. The expansion at the joints is very slight.

The radials are well-developed and project out from the base of the centrodorsal. The division series are relatively long and narrow, rounded laterally and well-separated from each other; the surface of the ossicles is perfectly smooth. The axillaries are widest near their distal ends, the maximum width being 3.7 mm. while the median length is 2.9 mm.; the lateral angles are not prolonged.

The first syzygy is at brachials 3 + 4 and the second at 9 + 10. The length from the proximal edge of the IBr₁ to 9 + 10 is 17 mm.

P₁ is large, projecting laterally at the base due to a sideways extension of the second brachial; on one arm it has 22 + segments, possibly c.25, the basal six or seven being short, about as long as broad, though the distal segments increase in relative length to become more than twice as long as wide; the length is 12.5 mm., possibly 13 mm. P₂ on the same arm has 22 plus 2 or

3 segments and is more slender as well as shorter than P_1 , the length being 11.8 mm. P_3 has 22 plus 1 or 2 segments and is 11 mm. long. The following pinnules are smaller but then the length increases again owing to greater elongation of the segments.

On another arm the pinnules are more nearly complete: P_1 has 25 segments and is 15 mm. long; it is webbed to the disc for most of its length. P_2 has 22 plus 1 or 2 segments and is 12 mm. long. P_3 has 19 plus 1 or 2 segments and measures 10 mm., while P_4 with 17 plus 1 or 2 is 8 mm. long. On other arms the complete P_3 has 20 or 23 segments and is up to 10.5 mm. long. A distal pinnule has 26+ very slender segments and is 14 mm. long. There are a few gaps in the pinnule series; on one arm P_2 is missing and on another P_6 . The gonads are undeveloped.

Affinities. With the moderately high centrodorsal and the arrangement of the cirrus sockets in two approximating columns in each radius with an odd midradial socket between their bases, this specimen runs down to *P. mira* within the genus *Psathyrometra*, with which it also agrees in the shape of the axillaries. *P. mira* has been recorded from off Zanzibar to south-west of India, the Philippines, New Guinea and south-west Japan. It is very variable in respect to certain characters such as the shape of the centrodorsal and the arrangement of the cirrus sockets, though to some extent this is probably correlated with the size; consequently it has been recorded under a number of specific names, including *P. major*, *inuitata* and *wireni*, all of which are relegated to the synonymy of *P. mira* by A. H. Clark in the last part of his crinoid monograph. Another species, *P. gracillima* A. H. Clark, has been recorded from off the Arrakan coast, Burma; it differs from this specimen in having a lower but more sharply conical centrodorsal with much wider interradian spaces between the groups of cirrus sockets. *P. anomala* and *minima* differ in having prolonged lateral angles on the axillaries and the former also has a lower centrodorsal.

Leptometra celtica (M'Andrew & Barrett)

Comatula Woodwardii Barrett, 1857: 33, pl. vii, fig. 1 [Non *C. Woodwardii* Forbes, 1852.]

Comatula celtica M'Andrew & Barrett, 1857: 44 (nom. nov.)

Leptometra celtica: A. H. Clark, 1908: 130; Koehler, 1921: 198—199, fig. 153 b; Mortensen, 1927: 34—35, fig. 20; A. H. Clark & A. M. Clark, 1967: 564—572, fig. 32 (pt.).

Material. Deutsche Tiefsee-Expedition station 28, 26° 17' N., 14° 43' W. (off Cape Bojador, north-west Africa); 741 metres; c.200 specimens.

Since some of these specimens are reasonably intact it may be worthwhile to give a short table showing some measurements and segment counts; all the measurements are in mm.

Centrodorsal		Arm br	Length	Cirri			P ₁		P ₂	
Ht.	Br.	at 3+4	to 9+10	No.	Segs.	Length	Segs	Length	Segs	Length
1.68	1.73	0.95	7.0	XXV	—	—	23	7.4	c22	7.6+
2.21	2.00	1.00	6.5	XXX	39	32	—	—	—	—
2.10	2.05	1.05	7.0	XXXIII	34	27	c24	8.5	c24	9.7+
2.10	2.00	1.05	7.0	XXVI	—	—	25	8.9	25+	8.4+
1.73	2.00	1.05	7.0	XXVIII	35	35	25+	10.0+	30+	12.6+
2.36	1.89	1.10	7.0	XXXII	34, 40	35	—	—	—	—
2.63	2.10	1.10	6.5	XXX	35	30	c24	7.9+	c24	6.8+
2.36	2.63	1.21	7.5	XXXV	—	—	c33	13.1+	—	—
2.31	2.36	1.31	7.5	XXXI	35	35	28	10.5	28	12.1
2.73	2.10	1.31	8.0	XXXIII	33	26	25+	10.0+	25+	10.0+

The ratio of height to breadth of the centrodorsal in these ten specimens ranges from 0.86 to 1.30 : 1, with a mean of 1.07 : 1.

In the fifth specimen in the table, the arm length is very close to 65 mm. and P₃ with 17 segments is 6.1 mm. long. P₃ is similarly much shorter than P₂ in all the other specimens except the largest (last) one, in which it is equally long and has about the same number of segments. Only the peripheral cirri were measured.

Family PENTAMETROCRINIDAE

Pentametrocrinus semperi (P. H. Carpenter)

Eudiocrinus semperi P.H. Carpenter, 1882: 497; 1888: 82, pl. 3, fig. 7, pl. 6, figs. 1—3.

Endiocrinus (sic) sp. nov. Döderlein in Chun, 1900: 488.

Pentametrocrinus semperi: A. H. Clark, 1913: 67; Gislén, 1928: 12; A. H. Clark & A. M. Clark, 1967: 802—804, fig. 51.

Material. Deutsche Tiefsee-Expedition station 259, 2° 58' N., 47° 5' E. (off Somalia), 1289 metres; 1 specimen.

Description. The five arms are all broken within 65 mm. of the base; when complete they were probably at least 80 mm. long. The arm breadth at the first syzygy (brachials 4+5) is 1.4 mm. and the length to the second syzygy (when this is at brachials 9+10) is 8.4 mm.

The centrodorsal is low rounded conical, 1.6 mm. high and c.2.3 mm. in basal diameter. The dorsal pole is papillose. There are XXIII cirri but five of them are very immature peripheral ones and only XVIII were probably functional. They are arranged in two rows with some tendency to form vertical columns of two in each.

The longest peripheral cirrus is broken at the end of the twenty-first segment, probably lacking only two or three segments; it measures 33 mm. An intact peripheral cirrus slightly shorter has 21 segments, while two intact apical cirri have 19 and 17 segments and are much more slender as well as shorter, the smaller of the two being only 16 mm. long. In the largest (incomplete) cirrus the first two segments are short, the ratio of length : median breadth in the third is 1.25 : 1, in the fourth it is 4 : 1 and in the sixth and longest 5.4 : 1 (the length being 2.4 mm. and the breadth 0.45 mm.); the

twenty-first segment, though less than half as long as the sixth, is much more slender so that length: breadth is 6.6:1. In those cirri which retain the terminal claw, this is very short and conical in shape. All the cirrus segments are somewhat expanded at the joints, the sixth segment in the one measured being 0.65 mm. wide at its distal end but only 0.45 mm. in the middle.

The arms are very long and only taper slowly. Apart from a constriction at the joint between brachials one and two, the brachials have almost parallel sides, the joints not being much expanded. Although the first syzygy has somewhat oblique ends, the following joints to the second syzygy at 9+10 or 10+11 are almost tangential though for the rest of the arm they are more oblique, the brachials themselves being relatively long after the second syzygy. The first syzygy is at 4+5 on all the arms but the second is at 9+10 only on two, two other arms having it at 10+11 and the fifth at 11+12; the third syzygy is once at 15+16, twice at 16+17 and twice at 17+18.

The first pinnule present is P_2 on Br_5 , arising on the right side in each case. P_b follows on the left side of Br_6 . All the proximal pinnules are badly broken. One P_b has 8 segments remaining, the basal ones short but the last few up to three times as long as wide. A P_c is much larger with 10 segments left which measure 5.25 mm. and was probably at least half as long again. A P_3 has 13 segments left, measuring 5.8 mm. The outermost remaining segments of all these pinnules are several times longer than broad, but the lost terminal segments may have been shorter again, as they are in *P. japonicus*, of which intact proximal pinnules are known.

The disc is closely plated.

Remarks. Although it is far removed geographically from the type and only known specimens of *P. semperi*, which were taken at two 'Challenger' stations south-east of Australia and north-east of New Zealand, I can find no significant difference between them. The position of the first pinnule, the very elongated distal cirrus segments with small conical terminal claws, the relatively small number of cirri, the fairly straight-sided proximal brachials and the variable position of the second syzygy all agree. The two syntypes of *P. semperi* remaining in the British Museum collections have only XV or XVI functional cirri and a relatively small centrodorsal to match, whereas the related *P. japonicus* (which extends from Japan to the East Indian area) has a much larger centrodorsal and more cirri. Four specimens of *japonicus* with the arm breadth at the first syzygy 1.5–1.7 mm. have XXXIII to XL cirri and the centrodorsal 2.1–2.5 mm. high and 3.1–3.5 mm. wide, whereas the syntypes of *semperi* with arm breadth 1.4 and 1.8 mm. have the centrodorsal only 1.5 or 1.8 mm. high and 2.2 or 2.7 mm. wide.

In Chun's narrative of the Deutschen Tiefsee-Expedition this specimen was mentioned as a new species of *Eudiocrinus* (misspelled) as determined by Döderlein. The colour in life was evidently sulphur yellow.

The only species of *Pentametrocrinus* which has been recorded from the

Indian Ocean is *P. varians* (P. H. Carpenter), known from the Maldivé Islands to Japan. It is distinguished from *P. semperi* by the presence of P_1 and P_a , being the only species of the genus known to possess these basal pinnules.

Family ATELECRINIDAE

Atelecrinus wyvilli P. H. Carpenter

Fig. 2

Atelecrinus wyvilli P. H. Carpenter, 1882: 492; A. H. Clark & A. M. Clark, 1967: 820—823, fig. 52.

Atelecrinus wyvillii: P. H. Carpenter, 1888: 72, pl. 6, figs. 4, 5.

Atelecrinus sulcatus A. H. Clark, 1912 a: 152; 1918: 267—268, fig. 16, pl. 26, fig. 94.

Material. Deutsche Tiefsee-Expedition station 210, $6^{\circ} 53' N.$, $93^{\circ} 33' E.$ (N.W. of Sumatra), 753 metres; 2 specimens.

Since one of these two still retains some entire cirri and these have never been described for this species it seems worthwhile to give a full description here.

Description. The arms remain intact for up to 70 mm. and at this distance from the base they are extremely attenuated and cease to bear pinnules. The breadth at the first syzygy (brachials 3+4) is 0.85 mm. and the length from the proximal edge of the IBr_1 to the second syzygy at 6+7 is 5.25 mm.

The centrodorsal is tall conical, 2.1 mm. high and 1.75 mm. in basal width. Its apex is constricted between five interrarial narrow vertical flanges, which extend between the apicalmost cirrus sockets though each flange has one or more steps level with the apical edges of these sockets. The basal half of each interrarial area is almost flat. The cirri number c.XXV, there being only two or three in each of the ten columns. The two columns in each radial area are very close together with the sockets alternating in level but quite distinct from each other, not at all confluent. The base of the centrodorsal adjacent to the ring of basal is almost bare and smooth, the lowest sockets being spaced from the edge and with less marked paired elevations than the majority of sockets.

The longest cirri are 30 mm. long and have 29—31 segments, the first two very short, but all those following the third one much longer than broad (fig. 2). In the distal part the cirrus has a ventral flange so that in side view it remains wide for much of its length. The cirrus that arises nearest the apex is much more slender and only 12 mm. long with 20 segments. The terminal claws are barely curved and there are no opposing spines.

The basals form a complete ring around the base of the centrodorsal leaving no spaces between. The radials are relatively long, about two-thirds as long as the IBr_1 , which are separated right from the base laterally

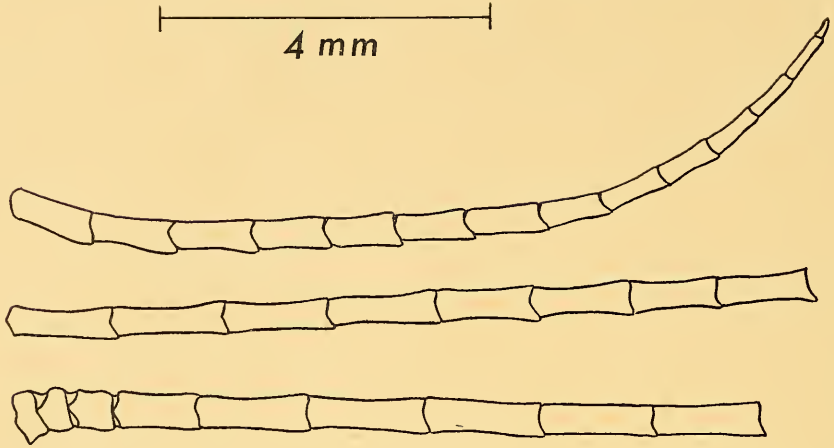


Fig. 2. *Atelecrinus wyvilli* (P. H. Carpenter). Longest cirrus (drawn in three parts).

and have rounded sides with only a small triangular projection at the distal end on each side. This matches the small lateral flange each side of the axillaries, which are otherwise relatively long and smooth.

The arms are cylindrical with the brachials becoming progressively more attenuated, so that the distalmost ones remaining resemble the cirrus segments, though the consecutive ones are variable in length since some of them are syzygial pairs. The proximal syzygies are 3+4, 6+7, 9+10 and 12+13 or 13+14 as a rule and the distal ones are separated usually by only two or three muscular joints.

The first pinnule does not occur until Br_{15} or Br_{16} and may be reduced in size, only 2 mm. long with but 8 segments, or slightly longer with 10 or 11 segments, considerably elongated beyond the first one or two. When it occurs on the outer side of the arm this pinnule is usually equivalent to a P_7 . P_8 has 10 or 11 segments and is over 3 mm. long. The following pinnules become somewhat longer and their segments are very attenuated and slightly swollen at the joints. The distalmost pinnule is on about the eighth brachial beyond which there are 17 further brachials in the most nearly intact arm.

The second specimen has lost most of the cirri completely. It is slightly larger, the centrodorsal 2.35 mm. high and 1.85 mm. wide basally. It is coarser apically with irregular projections rather than the thin interradiar flanges of the smaller specimen. The cirri number c.XLIII, there being four, sometimes five, in each column, but a few of the peripheral ones were probably immature. The arm breadth at the first syzygy is 1.1 mm. The first pinnule may arise on the fifteenth brachial; a complete one has 13 segments and measures 3.7 mm. in length.

Remarks. This record extends the known range of the species into the eastern part of the Indian Ocean. It was hitherto recorded from Fiji to the Moluccas and Borneo.

ADDITIONAL RECORDS

South Africa:

Comanthus wahlbergi (J. Müller)

Deutsche Tiefsee-Expedition station 100, 35° 3' S., 24° 59' E. (near Port Elizabeth), 100 metres; 3 specimens.

Embryometra mortenseni Gislén

Station 100 (as above); 2 specimens.

Japan and Formosa:

Comanthus parvicirra (J. Müller)

Nagasaki; Schmidt, 1901; 2 specimens.

Dichrometra doederleini (de Loriol)

Misaki; Schmidt; 1 specimen.

Comantheria intermedia A. H. Clark

Fukuura, Sagami Bay, 5/II/1904; Haberer; 1 specimen.

Neometra multicolor (A. H. Clark)

Sagami Bay station 7, Okinose Bank, 250 metres; Doflein, no. 673; 2 specimens.

Amphimetra tessellata discoidea (A. H. Clark)

Takao, South Formosa, June 1903; Haberer; 2 specimens.

Cyllometra manca (P. H. Carpenter)

Sagami Bay station 7, Okinose Bank, 250 metres, Doflein, no. 671; 1 specimen.

Sagami Bay; Haberer; 1 specimen.

Yagoshima, 150 metres, 31/X/1904; Doflein, no. 586; 1 specimen.

Colobometrid sp. [Between *Cyllometra* and *Oligometra*]

Dzushi, 120 metres, 2/XI/1904; Doflein, no. 619; 1 specimen.

North Formosa, May 1903; Haberer; 1 specimen.

Antedoninae sp., juvenile

Sagami Bay, Misaki, 50—80 metres; Doflein, no. 613, 20/X/1904; 1 specimen.

Florometra mariae (A. H. Clark)

Entrance to Tokio Bay, 600 metres, 27/X/1904; Doflein, no. 330; 1 specimen.

Florometra asperrima (A. H. Clark)

No. 57, 1900; Schmidt [Must be from Japan Sea.]; 1 specimen.

Mediterranean:

Antedon mediterranea (Lamarck)

Villafranca (Villefranche), S. France; 1 specimen.

Secca Grande, July, 1910; 1 specimen.

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Address of the Author:

Ailsa M. Clark, British Museum (Nat. Hist.), Department of Zoology,
Cromwell Road, London, S.W. 7.

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