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# The Swain Reefs Expedition: CRINOIDEA

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(Manuscript received 15th March, 1974)

## SUMMARY

Eighteen species of crinoids collected at the Swain Reefs, 21° 43' S. : 152° 25'E.; N.E. of the Capricorn Channel, are discussed, one of these, the unusual five-armed *Eudiocrinus serripinna* A. H. Clark, representing a genus new to the Australian fauna. The range of two other species, *Oligometra serripinna* (P. H. Carpenter) and *Ptilometra australis* (Witton), are extended into Queensland waters by the expedition's work.

## INTRODUCTION

Some difficulty is involved in the identification of Australian crinoids because of the frequent differences of opinion between the crinoid specialist, Mr A. H. Clark, working on preserved material, and Dr H. L. Clark, whose interests were wider but who had considerable experience of live echinoderms of Australia, though less of crinoids as a group. Being in the same position as A. H. Clark, without knowledge of the species in life, I have tended to follow his dispositions of the species to a greater extent than those of H. L. Clark. Nevertheless I should state that I consider the number of valid species could be reduced further, the distinction between at least four pairs of nominal species being poorly-founded. These are *Comatella nigra* and *stelligera*, *Comatula pectinata* and *purpurea*, *Zygometa microdiscus* and *elegans* and *Lamprometra palmata* and *gyges*. (The last two are treated here as subspecies.) An intensive study of variation, growth changes and ecology is needed to clarify the relationships of these.

The references in the text have been kept to a minimum since full details are given in A. H. Clark's crinoid monograph.

All the crinoids were collected in the vicinity of Gillett Cay; those from station 1 on the reef and sand flats, while stations 5 and 6 are in 27-37 and 64-73 metres respectively.

## COMASTERIDAE

*Comatella nigra* (P. H. Carpenter)

*Actinometra nigra* Carpenter, 1876: 583; 1888: 304.

*Comatella nigra*.—A. H. Clark, 1908b: 208; H. L. Clark, 1921: 12–13.—A. H. Clark, 1931: 92–98; fig. 1–31.—H. L. Clark, 1932: 198; 1946: 25–26.

*Material*

Capre Cay, 1 specimen; station 6, 4 specimens.

*Remarks*

This very ill-founded nominal species could be cited as *C. nigra* (Semper in Carpenter) since Carpenter consistently referred to it only as "Semper MSS" and never gave a formal description. It is debatable whether his brief remark about the internal anatomy of the arms in 1876 is sufficient indication to establish the name but in 1888 he did distinguish it from the three other species of the "stelligera-group" in a short key. It is, therefore, unfortunate that A. H. Clark in 1908 designated *Actinometra nigra* as type-species of *Comatella* rather than the better-known *stelligera*. The type-material of *C. nigra* must be Semper's specimens from Bohol, Philippines, which were deposited in the Dresden and Vienna Museums.

H. L. Clark (1946) gives only three Australian records of *Comatella nigra*, all identified by himself, from the Abrolhos, from Mer, Torres Strait and from Lizard Island, off N. Queensland, collected by the Great Barrier Reef Expedition. All other Australian specimens of *Comatella* he has referred to *C. stelligera*.

A. H. Clark's key to the species of *Comatella* (1931: 91–92) distinguishes *nigra* as having the cirrus segments "usually 26–30; arms usually more than 40" in comparison with *stelligera* with "usually 20–25 cirrus segments; usually 30–40 arms". The five specimens from Swain Reefs have respectively c. 45, 43, c. 40, 40 and 29 arms with up to 26, 27, 31, 25 and 27 cirrus segments, in general approximating more to *C. nigra*. I can see no good reason for distinguishing the last one specifically from the other four; in comparison with a syntype of *C. stelligera* from the Fiji Islands, having 26 arms, it has the division series and arm bases much less stout and widely separated from each other laterally. However, the arm length in the Swain Reefs specimens is only c. 70 mm, whereas in the type of *C. stelligera* it is 60 + (?) c. 30–40 mm. The smaller size of the former probably accounts for the greater smoothness of the division series and arm bases, the larger specimens from Swain Reefs having these ossicles much more rugose; also their more numerous arms leave little room between them laterally. The specimens from the Great Barrier Reef collection are certainly conspecific with those from Swain Reefs and I suspect that comparison of really good samples from the Philippine area (the type-locality of *C. nigra*) and from Australia and the Fiji Islands will show that the range of variation in arm number and cirri is such that two species cannot be differentiated. Unfortunately, I have no Philippine material available for study.

Colour notes for four out of five specimens describe them as deep or dark red with bright green tips to the arms in life.

### Comatula Lamarck

*Comatula* Lamarck, 1816: 530–533.—A. H. Clark, 1931: 302–308.

Type species: *C. solaris* Lamarck, 1816.

A. H. Clark (1931) recognizes no less than six species of the ten-armed *Comatula* sensu stricto (i.e. excluding the subgenus *Validia*), of which four have been recorded from tropical Australia; of these he notes that “undoubtedly *C. cratera* is merely a form of *C. solaris*, related to it in much the same way that *C. purpurea* is to *C. pectinata*”. His key to the species is based solely on the occurrence and development of the cirri, which show considerable individual as well as ontogenetic variation in many comasterids, notably in *Comanthus parvicirrus*. The type-species, *Comatula solaris*, is supposed to be distinguished by the relatively well-developed cirri with 16–25 segments. However, I think it is significant that A. H. Clark includes no mention of any specimens referred to *solaris* with arm length less than 90 mm, whereas for *Comatula pectinata* with not more than 16 cirrus segments both small and large specimens are described. Surely some of these must be immature individuals of what would be called *C. solaris* if more fully grown. Conversely, the relatively small number (15) of *Comatula cratera* recorded by A. H. Clark show more or less extreme reduction of the cirri, ten of them having none at all and the rest only a few probably functionless ones, while the arm length is 175 mm or more. This could represent a parallel to *Comatula (Validia) rotalaria* Lamarck\* in which small specimens possess cirri but these are progressively lost as the size increases. *C. solaris* then results from neotenus individuals which have retained and increased the size of their cirri, possibly in response to life in more active water necessitating better anchorage. Clearly a special study of the variation and growth changes of local populations of *Comatula* is needed to clarify the limits, if any, between the nominal species which have been described.

The 40 specimens of *Comatula* from Swain Reefs are all relatively small, arm length about 45 mm, the largest only about 70 mm. With three exceptions all of these run down to *Comatula purpurea* (J. Müller) in A. H. Clark's key since they have incomplete rings of cirri around the centrodorsal. The three remaining specimens not only have complete rings of cirri as in *C. pectinata* (Linnaeus) but also appear to have the division series and arm bases more nearly cylindrical in cross-section than in any of the former specimens, at the same time lacking the median longitudinal ridge on the arms. However, this last feature is variable and such ridges have been described in several specimens attributed to *pectinata*, including Linnaeus's type-material. The correlation between the dorsally-flattened ossicles of *purpurea* and the incomplete cirrus ring needs further investigation in other large samples. Another character which should be taken into consideration is the form of the comb on the basal pinnules, which Gislén found to be shorter in *C. purpurea*.

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\* The subgenus *Validia* of A. H. Clark is distinguished from *Comatula* sensu stricto by the development of ten additional arms at a relatively late stage in ontogeny. H. L. Clark (1938) raised *Validia* to generic rank but I am not sure that this is justified; certainly the arm structure in the two is very similar.

Gislén (1919) has treated *purpurea* as a variety of *C. pectinata* and this could well be preferable to according its specific rank. However, pending additional study I am following A. H. Clark's usage at present, even though another Australian specimen of *Comatula* (sent for identification simultaneously) collected in the Gulf of Carpentaria, is intermediate between *purpurea* and *pectinata*, having only small gaps in the ring of cirri. H. L. Clark in 1946 synonymized the two, having earlier (1938) retained *purpurea* as a form of *pectinata*.

#### **Comatula purpurea** (J. Müller)

*Alecto purpurea* J. Müller, 1843: 132.

*Comatula pectinata* var. *purpurea*.—Gislén, 1919: 6–9.

*Comatula purpurea*.—A. H. Clark, 1911a: 451.—H. L. Clark, 1921: 14–15.—  
A. H. Clark, 1931: 360–372, figs 108, 109, 111, 114.

*Comatula pectinata* forma *purpurea*.—H. L. Clark, 1938: 19, 20.

*Comatula pectinata* (part).—H. L. Clark, 1946: 31.

#### *Material*

Station 1, 12 specimens; station 6, 25 specimens.

Eighteen of these specimens have notes of the colour in life; for ten of them this is given as dark red, deep red, brown (once) or bright red (once); eight others show a combination of red or brown with cream, yellow or orange. This is probably just a superficial impression of colour and the angle of assessment is not given. Judging from a colour transparency, the soft (ventral) upper parts are predominantly dark red, which may be consistent. The dorsal side (lower most in life) on the specimen photographed is almost pure white with small red dots under magnification and distally there are larger reddish areas, though these may be partly the reflexed soft parts.

#### **Comatula pectinata** (Linnaeus)

*Asterias pectinata* Linnaeus, 1758: 663.

*Comatula pectinata*.—Gislén, 1919: 6.—H. L. Clark, 1921: 14, pl. 1 fig. 3, pl. 3 fig. 2.—A. H. Clark, 1931: 339–360, figs 49, 100–107.—H. L. Clark, 1938: 18–20; 1946: 31.

#### *Material*

Station 6, 3 specimens.

#### **Comanthus** A. H. Clark

*Comanthus* A. H. Clark, 1908a: 220.—H. L. Clark, 1921: 16.—A. H. Clark, 1931: 527–531.

Type-species: *Comanthus intricata* A. H. Clark, 1908, a synonym of *C. parvicirrus* (J. Müller).

A comment on the gender of the name *Comanthus* is needed. H. L. Clark (1921) noted that the greek word anthos is neuter but since, he said, A. H. Clark had used the feminine termination for the specific names he included in the genus in 1908, he himself would henceforth adopt the feminine gender. However, the International Code of Nomenclature, article 30 (3), dealing with genus-group names ending with a greek word, states that if this greek word is latinized with a change of termination (as in this case from os- to -us), it takes the gender appropriate to that termination, in this case masculine. The specific name *samoana* is accordingly modified here to *samoanus*, being an adjective in the nominative. However, *trichoptera*, being a noun in apposition, remains the same. Although *parvicirra* is also a noun in apposition I think it should have taken the masculine ending in the first place since cirrus is masculine, so this too is changed. A. H. Clark made a practice of retaining original terminations and spellings of specific names even when transferring them to genera of other genders, which conflicts with the rules now followed.

The division of the genus *Comanthus* into two subgenera, *Comanthus* and *Cenolia*, by A. H. Clark, the latter subsequently (1946) raised to generic rank by H. L. Clark following remarks of Gislén, seems to me quite untenable in view of the great variation of cirrus development in *Comanthus parvicirrus*. Gislén was prompted to support the division on the basis of differences in the pinnule combs but, these too have been shown to be extremely variable in *C. parvicirrus*. Even A. H. Clark himself (1931: 662) has noted that *Comanthus (Comanthus) parvicirrus* and *C. (Cenolia) samoanus* intergrade and in dealing with Australian crinoids I have had some difficulty in deciding which name to use for some of the specimens of *Comanthus*. Although I cannot trace a published mention of his final conclusion about the distinctness of *C. parvicirrus* and *timorensis*, in a letter to me written in the early 1950's, A. H. Clark admitted that he no longer felt able to distinguish two species on the basis of arm number and the occurrence of functional cirri, these characters being too variable. It seems to me likely that the more restricted range of what has been called *C. timorensis* is attributable to enhanced growth involving multiplication of the arms, correlated with further reduction of the cirri in localities where the optimum conditions obtain; in the more outlying parts of the range, development does not proceed beyond the usual *parvicirrus*-form with about twenty arms and retaining small and more or less functional cirri.

Here again, the tropical Australian species of the genus need further critical study including detailed attempts to correlate the various characters. The geographical and morphological limits between *Comanthus parvicirrus* and *C. samoanus* on the one hand and the temperate *C. trichoptera* on the other should be investigated.

#### ***Comanthus parvicirrus* (J. Müller)**

*Alecto parvicirra* J. Müller, 1841: 185.

*Comanthus parvicirra*.—A. H. Clark, 1911a: 443.—H. L. Clark, 1921: 19, pl. 1, figs 5, 7.—A. H. Clark, 1931: 631–684, figs 88, 184, 200, 209–218, 221.—H. L. Clark, 1938: 26; 1946: 39.

*Alecto timorensis* J. Müller, 1841: 186.

*Actinometra annulata* Bell, 1882: 535, pl. 35.

*Comanthus annulata*.—A. H. Clark, 1911a: 443.—H. L. Clark, 1921: 16, pl. 1 figs 2, 8, pl. 3 fig. 3.

*Comanthus (Vania) annulata*.—A. H. Clark, 1911a: 457–458; 1911b: 757–1918: 53–54.

*Comanthus (Vania) parvicirra*.—A. H. Clark, 1911b: 758–1918: 54–59.

*Comanthus timorensis*.—A. H. Clark, 1931: 603–631, figs 181, 204–207.—H. L. Clark, 1938: 27–28; 1946: 38–39.

#### Material

Station 1, 1 specimen; station 6, 7 specimens; Capre Cay, 1 specimen.

A colour note of the specimen from station 1 states that the arms were dull green at the base gradually lightening to bright green distally. One from station 6 was "green and white".

The specimen from Capre Cay has the cirri fairly well developed, numbering about XX and forming a complete ring around the centrodorsal, though some sockets appear to be becoming obsolete. The cirri are not much compressed laterally, though the larger ones are incurled in their outer part. This condition is also found in the specimen from station 1 and seems to me transitional to *C. samoanus* with its short incurled cirri normally stouter than is usual in *C. parvicirrus*. The specimens from station 6 show much variation, two have all the cirrus sockets more or less obsolete while at the other extreme there are about X laterally compressed cirri in a more or less complete ring, though this condition appears to be correlated here with the relatively smaller size.

#### **Comanthus** sp. **Cotrichoptera** (J. Müller)

*Comatula trichoptera* J. Müller, 1846: 178.

*Comanthus (Bennettia) trichoptera*.—A. H. Clark, 1911a: 456–457; 1911b: 755–156.

*Comanthus trichoptera*.—A. H. Clark, 1938: 28–29.

*Comanthus (Cenolia) trichoptera*.—A. H. Clark, 1931: 579–587, figs 4, 203.

#### Material

Station 1, 1 specimen; station 6, 2 specimens.

All three specimens are relatively small, arm length 30–60 mm, and are distinguishable from *C. parvicirrus* by the more prolonged angles of the axillaries. Their cirrus rings are also complete.

As for colour, one is described as bright yellow and another is shown as yellow in a colour transparency. This agrees with *C. trichoptera* which H. L. Clark notes is generally yellowish though ranging from white to brown. However, H. L. Clark has also noted a yellow form (*xantha*) of *C. timorensis* (i.e. *parvicirrus*) occurring in Torres Strait.

If the identification as *C. trichoptera* is correct, it means an extension of range northwards from Lord Howe Island.

**Comantha perplexa** (H. L. Clark)

*Comanthus perplexum* H. L. Clark, 1916: 14–15, pl. 3 fig. 2.

*Comantheria perplexum*.—A. H. Clark, 1931: 506–507; H. L. Clark, 1938: 25; 1946: 35.

*Material*

Station 6, 1 specimen.

This specimen has 36 arms, c. 80 mm long and with an arm breadth at the first syzygy (on arms following a IIIBr series) of 1.85 mm. Four of the IIBr series are of two ossicles only, the remaining six are of four. Of the fourteen IIIIBr series present, eleven have only two ossicles, as is characteristic of *Comantheria* as opposed to *Comanthus* in which the majority usually have four. There are two IVBr series, one of two ossicles, the other of four.

There are XIV cirri still present plus about v diminutive ones or recently emptied sockets (which A. H. Clark would not have counted). The mature cirri have 20 or 21 segments and are about 13 mm long. After the few basal ones, the segments to about the twelfth are longer than broad; the twelfth to sixteenth show two dorsal processes when viewed in profile, one proximal one distal, but these approximate as the segments shorten and coalesce on the seventeenth segment leaving a single curved transverse ridge with two or sometimes three small spines emphasizing it on the last two segments before the terminal claw.

The ossicles of the division series are not markedly flared although the arm segments do have some tendency this way, becoming slightly spinose along their distal edges.

The colour in life was noted as very dark red with green tips. This does not accord either with the "uniformly pale fawn" of the dorsal side in the holotype, though this was in the dried condition and the colour in life could well have been very different, or with some specimens in the British Museum collections from Mooloolabah in southern Queensland, the subject of pigment studies by Dr Sutherland of the Chemistry Department of the University of Queensland, which were yellow in life. At first I thought this Swain Reefs specimen was referable to *Comanthus parvicirrus* but the high proportion of IIIIBr series of only two ossicles and the double dorsal processes on some of the cirrus segments incline me to refer it to *Comantheria perplexa*. H. L. Clark, (1938) has already recorded the species from the adjacent Capricorn Islands.

Three of the specimens from Mooloolabah have the following counts: arm number 33, 32 + c. 5, 30++; the first has arm length c. 80 mm, and all three have the arm breadth at the first brachial syzygy c. 1.75 mm; the cirrus number is VII + vi, V + vi, and VIII + viii, the larger mature cirri having 20 or 21 segments in all of them and measuring 10–13 mm in length; one of the three has a single IIBr series of only two ossicles and all of them have all the remaining IIIIBr series of only two ossicles. In comparison with the specimen from the Swain Reefs, the division series and arm bases are smoother, while the cirri are slightly stouter and smoother dorsally with low rounded processes, none of the segments showing a distinct proximal process though the penultimate segment has the distal process paired.



## ZYGOMETRIDAE

### *Zygometra elegans* (Bell)

*Antedon elegans* Bell, 1882: 534; 1884: 162, pl. 13 fig. B.

*Zygometra elegans*.—A. H. Clark, 1911a: 458–459; 1911b: 762–763.—H. L. Clark, 1916: 18–19; 1938: 31–32.—A. H. Clark, 1941: 98–110, figs 5, 7–12.

—H. L. Clark, 1946: 40–41.

*Zygometra microdiscus* var. *elegans*.—Gislén, 1919: 19–23.

#### Material

Station 6, 3 specimens.

The colour notes from life are “yellow and cream with purple tips”, “cream and deep purple” and “cream and purple-brown”.

### *Zygometra punctata* A. H. Clark

*Zygometra punctata* A. H. Clark, 1912a: 24–25.—H. L. Clark, 1932: 200–201.  
—A. H. Clark, 1941: 120–123, figs 18–21.—H. L. Clark, 1946: 41.

#### Material

Station 6, 2 specimens

The colour in life is given as “yellow with very narrow brown bands on the arms” for one specimen which in spirit is pale with purple spots, agreeing with the preserved colour of the holotype; a transparency of the second specimen shows it as golden brown with a lighter band across each ossicle, probably along the distal edge.

H. L. Clark (1946) suspects that *Z. punctata* will prove to be indistinguishable from *Z. comata*, known in Australia only from the northwest, the vicinity of Broome. According to A. H. Clark, *Z. punctata* has short, rather stout, incurled cirri with up to 21 segments only, none of them longer than broad and 10–21 arms, compared with less stout cirri having 25–45 segments, several of which are longer than broad and 14–41, usually 25–30, arms in *Z. comata*. The largest specimens of *Z. punctata* described by Mr Clark have an arm length of only 35 mm compared with 40–135 mm for *comata*. However, I think that any ontogenetic change in shape of the cirri is more likely to be from attenuated in small specimens to stouter in larger ones, rather than the reverse.

The larger of the Swain Reefs specimens has the arms 35+ (probably c. 40) mm long and the breadth at the first syzygy (3 + 4) on arms based on IBr series is 1.5 mm. It only has 11 arms, the single IIBr series having four ossicles, though since two of the IBr series are broken at the syzygy, it is possible that two other IIBr series could have been present and the total number of arms 13. The smaller specimen has only 10 arms. The cirri number about XX, the larger specimen having up to 21 segments and the smaller 20, with dorsal spines from the seventh segment onwards. P<sub>2</sub> is always the largest pinnule. In the smaller specimen P<sub>1</sub>, P<sub>2</sub> and P<sub>3</sub> are respectively 5.5 mm, 6.0 mm and 4.2 mm in length with 23, 22 and 16 segments.

A somewhat larger specimen of *Z. punctata* in the British Museum collections from the Low Islands originating with the Great Barrier Reef Expedition and named by H. L. Clark, has all the arms broken within 37 mm of the base but the intact length was probably 50–60 mm. Br at 3 + 4 after the IBr series is 1.75 mm. The arms of two radii are regenerating and simultaneously multiplying by the development of II and even some III Br axillaries. Owing to further breakage on capture, the total number of these arms is uncertain but the number of arms on the two radii was at least eight, making a total of 17 with the two, three and four arms developed on the three more mature radii; without the earlier damage provoking regeneration of supernumerary arms the total would more likely have been about 15. Unfortunately, all the cirri are broken off by the sixth segment but some fragments in the jar indicate that there were about 23 or 24 segments in some of the cirri; in form they are stout and strongly incurled, agreeing completely with *Z. punctata*, the higher number of segments being clearly correlated with the larger size in comparison with previously described specimens. Unfortunately, I do not think that the specimen from the same expedition with arms 80 mm long mentioned by H. L. Clark is a *Zygometa* at all; it has a synarthry in the IBr series and P<sub>3</sub> is similar to, or even slightly larger than P<sub>2</sub>, though the cirri do have about 21 segment and well-developed single dorsal spines like *Z. punctata*.

In contrast to these specimens from off Queensland, a relatively small specimen of *Z. comata* from Holothuria Bank off N.W. Australia has much more slender, almost straight, cirri with more segments (30–34) though its arm length was probably less than 50 mm, br at 3 + 4 after a IBr series being only 1.3 mm. The difference is so marked that I am sure H. L. Clark is wrong and *Z. comata* and *punctata* are specifically distinct.

## EUDIOCRINIDAE

### *Eudiocrinus serripinna* A. H. Clark

*Eudiocrinus serripinna* A. H. Clark, 1908b: 211; 1941: 169–171, fig. 49.—  
A. M. Clark, 1972: 90–91, fig. 4.

#### *Material*

Station 6, 1 specimen.

The discovery of this unusual five-armed crinoid, recorded in 1972, adds another genus to the Australian echinoderm fauna, previous records of *Eudiocrinus* not approaching nearer than the Pacific islands and of *E. serripinna* not nearer than the Kei Islands.

The colour in life was "light and dark brown". In spirit this has changed to light brown and purple; under magnification the entire surface appears dappled with small patches of colour.

The arms are all broken within 45 mm of the base but were probably 10–15 mm longer than this. Br at 3 + 4 (i.e. between the fifth and sixth free ossicles since in this five-armed genus the "division" series do not in fact divide though the first two ossicles are said to be equivalent to a IBr series) is 1.4 mm.

The discoidal centrodorsal is 2.5 mm in total diameter and 1.9 mm across the dorsal pole. There are XXII cirri or large sockets with perforations (more than half being lost), the longest ones with 17 segments and measuring c. 8 mm in length. Most of the segments, especially the longer ones, are constricted in the middle and flared distally; the fifth to seventh at least are distinctly longer than broad.

The arm ossicles are markedly flared at their distal ends and most have a dorsal tubercle which is midradial on the first ten ossicles but then becomes offset alternately to one side or the other. Since the successive tubercles are linked by a slight ridge along the ossicle, this results in a keeled appearance of the arms, at first straight then zig-zagged, especially as the ridges are paler in colour than the rest. In profile the arms appear very serrated.

The first two pinnules, PC on the left side (facing out from the centrodorsal) of the IBr<sub>2</sub> and P<sub>1</sub> (on the right of Br<sub>2</sub> since Br<sub>1</sub> as usual lacks a pinnule) are very similar with 11 strongly prismatic segments, stout to the sixth and then tapering rapidly. The length is c. 3.7 mm.

Pa and P<sub>2</sub> are abruptly different, more rounded in cross-section except that the distal end of each segment is dramatically flared and spinose. The whole pinnule has 11 or 12 segments and measures 4.25–5.25 mm in length.

Pb and P<sub>3</sub> and the following pinnules are only about two-thirds as long as the immediately preceding pinnules and much more slender though the number of segments is still about 12. The distal ends of their segments are flared and spinose, the third segment particularly having a short dorsal crest.

The disc has been lost.

A. H. Clark recognized no less than seven species of *Eudiocrinus* from the Kei Islands or Moluccas alone, distinguishing them primarily on the proportions of the cirrus segments (which vary to some extent with size) and on the form of the pinnules. I suspect that further material will show sufficient variation to account for some of the supposed differences.

## HIMEROMETRIDAE

### *Heterometra nematodon* (Hartlaub)

*Antedon nematodon* Hartlaub, 1890: 185.

*Heterometra nematodon*.—A. H. Clark, 1911b: 768; 1941: 241–245, fig. 117.

#### *Material*

Station 5, 1 specimen.

This specimen has the arm length only c. 65 mm and 17 (possibly 18) arms, several arms arising direct from IBr series. Correlated with this relatively small size there are only c. 34 cirrus segments; also, in the absence of PD, the largest pinnule is P<sub>2</sub>, which has c. 26 segments.

### *Heterometra crenulata* (P. H. Carpenter)

*Antedon crenulata* P. H. Carpenter, 1882: 507–509.

*Amphimetra crenulata*.—A. H. Clark, 1913: 22; H. L. Clark, 1916: 21.

*Heterometra crenulata*.—A. H. Clark, 1918: 79–80.—H. L. Clark, 1932: 201; 1938: 33–34.—A. H. Clark, 1941: 253–275, figs 89–96, 101–103.—H. L. Clark, 1946: 43.

*Material*

Station 6, 3 specimens, 2 of them immature.

The smaller specimens were “reddish brown and white” in life and the larger “white with faint purple tips”.

***Amphimetra tessellata discoidea* (A. H. Clark)**

*Himerometra discoidea* A. H. Clark, 1908b: 215–216.

*Amphimetra discoidea*.—A. H. Clark, 1911a: 459; 1911b: 766–767.

*Amphimetra tessellata discoidea*.—A. H. Clark, 1941: 376–385, figs 178, 182, 188.—H. L. Clark, 1946: 43–44.

*Material*

Station 6, 4 specimens.

The colour notes of three of these from life are “cream, yellow and dark brown”, “cream with purple ribs”, “yellow and purple-brown”. Transparencies presumed to be of one of these specimens show the colour as predominantly white with about a dozen yellow patches on each arm, the patches marked by paired longitudinal purple lines linked across the intervening white areas by small purple spots.

**MARIAMETRIDAE**

***Stephanometra indica protecta* (Lütken)**

*Antedon protectus* Lütken in P. H. Carpenter, 1879: 19.

*Antedon monacantha* Hartlaub, 1890: 179.

*Stephanometra monacantha*.—A. H. Clark, 1909a: 168–169.—H. L. Clark, 1921: 22; 1946: 46.

*Stephanometra indica protectus*.—A. H. Clark, 1941: 443–459, figs 222, 225–232.

*Material*

Station 1, 2 specimens.

One of these had the arms “basally cream, apically (i.e. distally) deep red” in life, the other is patterned with crimson and white in spirit, like some of the specimens of *Lamprometra palmata*, though the spike-like P<sub>2</sub> with only about 12 segments easily distinguishes it.

**Lamprometra palmata** (J. Müller)

*Alecto palmata* J. Müller, 1841: 185.

*Antedon gyges* Bell, 1884: 160–161, pl. 12, fig. B.

*Lamprometra brachypecha* H. L. Clark, 1915: 104; 1921: 22–23, pl. 2 fig. 1, pl. 22, figs 1, 2.

*Lamprometra gyges*.—H. L. Clark, 1921: 23, pl. 1, fig. 4, pl. 21, figs 4, 5, pl. 22, fig. 3; 1932: 201–202; 1938: 35–36; 1946: 47.

*Lamprometra palmata palmata*.—A. H. Clark, 1941: 474–517, figs 243–246, 248–252, 257.

*Lamprometra palmata gyges*.—A. H. Clark, 1941: 517–526, figs 253–255.

*Lamprometra palmata*.—H. L. Clark, 1946: 47.

*Material*

Capre Cay, 2 specimens; station 1, 1 specimen (all three *L. palmata palmata*). Station 6, 3 specimens (*L. palmata gyges*).

Two of the specimens of *L. palmata gyges* have notes of the colour in life; one was dark red, the other yellow, cream and purple-brown.

H. L. Clark (1946) still maintains a specific distinction between *L. palmata* and *gyges* but I doubt whether it is even worthwhile recognizing a subspecific one. Nor am I sure that *L. klunzingeri* (Hartlaub) from the western Indian Ocean can properly be distinguished from *L. palmata*, the form of P<sub>2</sub> (providing the supposed differences) being extremely variable, some specimens of *L. palmata palmata* with P<sub>2</sub> extra stout approximating to *Stephanometra indica* (as suggested by the confused synonymies of *L. palmata* and *S. indica* shown in A. H. Clark's monograph), while conversely those specimens of *L. palmata gyges* with P<sub>2</sub> hardly at all keeled are difficult to distinguish from *L. klunzingeri*.

**COLOBOMETRIDAE*****Iconometra anisa*** (H. L. Clark)

*Oligometra anisa* H. L. Clark, 1915: 105; 1921: 23–24, pl. 1, fig. 10, pl. 4, figs 1, 3, pl. 21, figs 1–3, pl. 36, fig. 1.

*Iconometra anisa*.—H. L. Clark, 1932: 202.—A. H. Clark, 1947: 97–103, figs 45, 46, 57–61.—H. L. Clark, 1946: 49.

*Material*

Station 5, 1 specimen; station 6, 2 specimens.

At first sight this ten-armed species can easily be confused with the Antedoninae, the second syzygy being usually at 9 + 10, while the cirri are more compressed laterally than in most Colobometrids. However, the proximal pinnules are distinctly keeled basally on the side facing the arm tip.

The two specimens from station 6 both have the arm length c. 45 mm and br at the first syzygy (3 + 4) is 1.65 mm. The length from the proximal edge of the IB<sub>r1</sub> to the second syzygy at 9 + 10 is c. 8.5 mm. Both have XIX cirri (or newly vacated sockets) with up to 21 segments in one specimen and 22 in the other, the length being 11.0–11.5 mm; most of the segments are about as long as broad and those beyond the base show the rather small transverse "ridges", two on the dorsal side of each segment, characteristic of the species, giving the dorsal profile a double peak on each segment. P<sub>1</sub> has 11 segments and is 6.6 mm long in one specimen and 7.3 mm in the other; unfortunately, none of the other proximal pinnules are intact in the original state though some have regenerated tips, I estimate that P<sub>2</sub> and P<sub>3</sub> probably had at least 15 segments and were over 10 mm long.

The specimen from station 5, however, has an intact P<sub>1</sub> and P<sub>2</sub> on one arm very similar to each other with 8 or 9 segments and c. 3.5 mm long, though it is possible that this P<sub>2</sub> has regenerated; it is slightly stouter than the P<sub>1</sub>. This specimen has the arm length only c. 37 mm and not more than 16 cirrus segments.

The previously recorded maximum number of cirrus segments was only 19, even in specimens with an arm length as much as 65 mm. Using A. H. Clark's key to the species of *Iconometra* (1947: 90) the two larger specimens therefore, run down to *I. bellona* (with more than 20 cirrus segments) rather than to *I. anisa* (with less). *I. bellona* (A. H. Clark, 1920) is known from only two Philippine specimens with arm length c. 100 mm. Its cirrus segments have only a proximal transverse ridge on the dorsal side, not a pair. In fact the presence of a distal dorsal ridge or process in *I. anisa* causes it to run down to the monotypic *Oligometrides* in A. H. Clark's key to the genera of *Colobometridae* (1947: 8–9), though the proportions of P<sub>1</sub> relative to P<sub>2</sub> are inverted and contradict this, *O. adeonae* having a progressive reduction in size from P<sub>1</sub> to P<sub>3</sub>. That species is also known from tropical Australia and for some time A. H. Clark regarded *anisa* as a synonym of it, although by 1947 he had given way to H. L. Clark's insistence that the proportions of the proximal pinnules serve to distinguish it. I think the relationships between these nominal species would repay further study.

#### ***Oligometra serripinna* (P. H. Carpenter)**

*Antedon serripinna* P. H. Carpenter, 1881: 175, 182.

*Oligometra serripinna*.—A. H. Clark, 1918: 130–131; 1947: 216–217.

(?) *Oligometra serripinna*.—H. L. Clark, 1946: 49–50.

#### *Material*

Station 6, 2 specimens.

H. L. Clark (1946) includes this species in the Australian fauna on the strength of a single rather dubious record from the Abrolhos of which I can trace no mention by A. H. Clark in 1947. Other Australian records of *O. serripinna* have all been referred to other species, especially *O. carpenteri*, and the nearest locality for *O. serripinna* given by A. H. Clark (1947) is New Guinea. The present record therefore adds another species to the echinoderm fauna list for Queensland, if not for Australia. Although *Oligometra* is notoriously variable in the form of the proximal pinnules so that a number of subspecies of *O. serripinna* have been recognized, the present two specimens with their very rugose but

relatively slender pinnules contrast so strongly with the extremely stout sharply prismatic and elaborately-finned pinnules (especially  $P_2$ ) of the other five specimens of *Oligometra* from the same station, which I am calling *O. carpenteri*, that I cannot regard them as conspecific.

One of the two specimens is very small but the other has arm length c. 35 mm and br at the first syzygy (3 + 4) 1.05 mm. It has c. VIII mature cirri plus c. V more or less immature ones, the former having up to 22 segments, none of them longer than wide.  $P_1$ ,  $P_2$  and  $P_3$  have respectively 14, 15 and 12 segments and are 3.1 mm, 4.75 mm and 2.65 mm on one arm studied.

### ***Oligometra carpenteri* (Bell)**

*Antedon carpenteri* Bell, 1884: 157, pl. 10, fig. A.

*Oligometra carpenteri*.—A. H. Clark, 1911b: 775–776.—H. L. Clark, 1932: 202; 1946: 49.

#### *Material*

Station 6, 5 specimens.

Even the largest specimen has the arm length only c. 25 mm and br at the first syzygy (3 + 4) c. 0.75 mm. There are no more than 14 cirrus segments and the relatively huge  $P_2$  has 13 segments.

In the holotype of *O. carpenteri*, which is in the British Museum collections and came from Port Curtis, the arm length was c. 50 mm. Br at the first syzygy is 1.5 mm and there are up to 20 cirrus segments.

Colour notes from life of three of the Swain Reefs specimens are “cream and deep purple”, “ribs deep red remainder cream” and “ribs dark red remainder creamish yellow”.

## **PTILOMETRIDAE**

### ***Ptilometra australis* (Wilton)**

*Encrinus australis* Wilton, 1843: 118–120.

*Ptilometra mülleri* A. H. Clark, 1909b: 41.—H. L. Clark, 1916: 24.

*Ptilometra australis*. H. L. Clark, 1946: 55–56.—A. H. Clark, 1947: 403–415, fig. 207.

#### *Material*

Station 6, 1 badly broken specimen.

This record extends the range of the species northwards from off the mouth of the Clarence River, northern N.S.W., though there is a specimen in the British Museum collections taken near Southport, S. Queensland in 45–50 metres and sent by Dr Sutherland of the University of Queensland.

The cirri of the Swain Reefs specimen number only X, being arranged in a single row around the discoidal centrodorsal. The longer cirri have 46 or 47 segments, all much shorter than broad; there is a tendency for a triple keel to

develop on the dorsal side of the distal segments. There is a syzygy in the IBr series. The IIBr series are usually (perhaps always) of four ossicles; most are broken. The first arm syzygy is at 2 + 3 on arms based on IIBr series. PD has 20 segments and is small compared with the basal pinnules of the arms, which have about 12 segments, these being relatively elongated after the first two.

There are also three specimens in the present collection from 13 miles off the Clarence River mouth in N.S.W., which show various degrees of compromise between the characters given in the keys of H. L. Clark (1946) and A. H. Clark (1947) to *P. macronema* and *australis*. The latter key reads as follows:

*Macronema*:

a<sup>1</sup> Proximal cirrus segments as long as, or longer than, broad; cirrus sockets in more or less definite columns, three to each radial area; middle segments of the proximal pinnules half again to twice as long as broad; distal pinnules with the third and following segments longer than broad.

*Australis*:

a<sup>2</sup> Proximal cirrus segments about twice as broad as long, or at least broader than long; cirrus sockets usually irregularly arranged; middle segments of the proximal pinnules not so long as broad; distal pinnules with the segments broader than long until the distal third.

Although in these three specimens the proximal cirrus segments are distinctly broader than long, agreeing with *australis*, the cirrus sockets are in more or less regular columns, there being four in each radial area in one specimen at least and the middle segments of the pinnules are longer than broad, as in *macronema*. A rather more precise study of variation in *Ptilometra* is needed.

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