

H.L. Clark, 1915: Zoological Journal of the Linnaean Society, 35(234):229-251.

Some Echinoderms from West Australia. By HUBERT LYMAN CLARK,  
Museum of Comparative Zoology, Cambridge, Mass., U.S.A. (Com-  
municated by Prof. W. J. DAKIN, F.L.S.)

[Percy Sladen Trust Expedition to the Abrolhos Islands under the  
leadership of Prof. W. J. DAKIN.]

(PLATE 13.)

[Read 1st February, 1923.]

THE collection of echinoderms placed in my hands by Professor Dakin\* prove to be of great interest even though the number of species represented is small. The specimens were taken off the coast of West Australia, chiefly among Houtman's Abrolhos Islands, but a considerable number were dredged near Fremantle, while one interesting specimen comes from Broome. Many of the species are represented by but one or two specimens, and on this account it is not possible to determine the relative abundance of the different forms.

The 143 specimens represent 46 species, of which two (*Ophiactis savignyi*, *cordatum*) are practical cosmopolitan. Of the others, 27 are tropical species, most of which are common in the East Indies; their occurrence at the Abrolhos is notable because these islands are so far south of the usual range of the species; few, if any, extend their range nearly so far southward on the eastern side of the continent.

There are, in the present collection, 8 species which occur on the southern or south-eastern coasts of Australia between Sydney and Perth, though most of them are known from only a few widely separated stations. These, which may be called the typical Australian species, are:—

- Astropecten preissii* Müller & Troschel.
- Luidia maculata australasiae* Döderlein.
- sterina gunnii* Gray.
- Coscinasterius calamaria* (Gray).
- Ophiothrix spongicola* Stimpson.
- Amblypneustes pallidus* (Lamarck).
- Heliocidaris erythrogramma* (Valenciennes).
- Bryonia australasiae* (Leach).

\* I beg to express here my sincere thanks to Professor Dakin for the opportunity of studying this valuable collection. I would also thank my friend Mr. Austin H. Clark for every important assistance in connection with bibliographical data, which were not available to me.

There are 9 species which seem to be endemic; at least they are not yet known from anywhere but the coast of West Australia:—

- Pentagonaster stibarus* H. L. Clark.  
*Anthenea australis* Döderlein.  
*Anthenea globigera* Döderlein.  
*Nectria macrobrachia*, sp. nov.  
*Petricia obesa*, sp. nov.  
*Parasterina crassa* (Gray).  
*Uniophora dyscrita*, sp. nov.  
*Ophiothrix michaelsoni* Koehler.  
*Centrostephanus tenuispinus* H. L. Clark.

The following species were taken only off Fremantle:—

- Luidia maculata australis* Döderlein.  
*Astropecten preissii* Müller & Treschel.  
*Asterina gunnii* Gray.  
*Parasterina crassa* (Gray).  
*Ophiothrix michaelsoni* Koehler.  
*Echinocardium cordatum* (Pennant).

Three species were found both at Fremantle and at the Abrolhos:—

- Anthenea australis* Döderlein.  
*Ophiothrix spongicola* Stimpson.  
*Ophiothrix stelligera* Lyman.

From Broome alone, comes a specimen of

- Euryale aspera* Lamarck.

Although Gray described several sea-stars from "Swan River" and "Western Australia" as far back as 1840 (Ann. Mag. Nat. Hist. vol. vi. Dec. 1840, p. 281) and 1847 (Proc. Zool. Soc. London, pp. 75-83), almost nothing else was published dealing with the echinoderms of that region until after the close of the nineteenth century. In 1907, Koehler reported on the collection of ophiurans made by Michaelson and Hartmeyer between Cape Naturaliste and Sharks Bay in 1905. (See their 'Die Fauna Südwest-Australiens,' Bd. i. Lief. 4.) There were 28 species in this collection, of which only three were new, and most of the others were well-known Indo-Pacific species. In 1911, A. H. Clark published his invaluable report on the "Recent Crinoids of Australia" (Mem. Austral. Mus. vol. iv. pp. 703-804) and also a report on the collections made by Michaelson and Hartmeyer (Fauna Südwest-Australiens, Bd. iii. Lief. 13), the two papers giving a complete list of Western Australian Crinoids. In 1914, Döderlein reported on the echini brought back by Michaelson and Hartmeyer (Fauna Südwest-

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Austral. Bd. iv. Lief. 12), which included 16 species of which three were new. The same year, Mr. B. Alexander published (1914, Rec. West Aust. Mus. vol. i. pt. iii. pp. 108-112) a list of the echinoderms of Western Australia found in the Western Australian Museum at Perth. This list was based on papers by A. H. Clark and myself published in the same part of the "Records," dealing with the crinoids and the other echinoderms respectively. In his list Alexander records 86 species, of which half a dozen are holothurians. As there are no holothurians in the collection sent me by Professor Dakin I shall ignore that class, and the present remarks deal only with the actinogonidiate echinoderms\*. Alexander includes only ten of the 28 ophiurans of Koehler's 1907 list and only five or six of Döderlein's list of echini, there being some question about certain identifications in this group.

In 1918, Mortensen (Kungl. Svenska Vet.-Akad. Handl., Bd. 58. no. 9) published a report on echini collected by Mjöberg at Cape Jaubert and Broome, a region from which almost nothing was previously known. This collection contained 14 species, of which only four are found in Döderlein's list from the south-western coast. In 1919 appeared Gislén's (Kungl. Svenska Vet.-Akad. Handl., Bd. 59. no. 4) admirable report on the crinoids collected by Mjöberg, in which is given a careful and very valuable account of seven species, one of which had not previously been reported from Western Australia.

Up to the present time therefore, 125 species of echinoderms, not including holothurians, have been reliably reported from Western Australia, and there are perhaps 10 or 11 species which could be added to this list on the strength of old records which may not properly be ignored. This gives us a total of at least 135 species occurring in the region, already reported, but as the Dakin collection contains no fewer than a dozen species not hitherto recorded, it is evident that the total number of echinoderms occurring on the western side of the Australian continent certainly exceeds 150, and it is probably in excess of 200.

It is interesting to examine separately the list of species occurring at the Abrolhos, as those islands are said to contain the southernmost coral reefs in the world. Including the species here recorded, the list of forms known from the Abrolhos is as follows:—

CRINOIDS:—

<i>Comatella nigra</i> (P. H. Carp.).	<i>Comanthus parvicirra</i> (J. Müll.).
<i>C. stelligera</i> (P. H. Carp.).	<i>C. polycnemis</i> A. H. Clark.
<i>Comatula solaris</i> (Lam.).	<i>Amphimetra jacquinoti</i> (J. Müll.).
<i>C. pectinata</i> (L.).	<i>Lanprometra gyges</i> (Bell).
<i>Comanthus annulata</i> (Bell).	<i>Oligometra serripinna</i> (P. H. Carp.).

\* [The Holothurians from West Australia are in the hands of Dr. Jos. Pearson, Colombo Museum.—W. J. D.]

## ASTEROIDS :—

*Nectria macrobrachia*, sp. nov.  
*Pentagonaster stibarus* H. L. Clark.  
*Stellaster incei* Gray.  
*Anthenea australiæ* Död.  
*Anthenea globigera* Död.

*Fromia andamanensis* Koeh.  
*F. elegans* H. L. Clark.  
*Bunaster lithodes* Fisher.  
*Petricia obesa*, sp. nov.  
*Asterina burtonii* Gray.

## OPHIUROIDS :—

*Ophiactis savignyi* (M. & T.),  
*Ophiothrix longipeda* (Lam.),  
*O. michaelseni* Koeh.  
*O. spongicola* Stimpson.

*Ophiothrix stelligera* Lym.  
*Ophionereis porrecta* Lym.  
*Ophiocoma brevipes* Peters.  
*Ophioplocus imbricatus* (M. & T.).

## ECHINOIDS :—

*Prionocidaris baculosa* var. *annulifera*  
 (Lam.).  
*P. bispinosa* var. *chinensis* (Död.).  
*Centrechinus savignyi* (Mich.).  
*C. setosus* (Leske).  
*Centrostephanus tenuispinus* H. L. Clark.  
*Amblymeustes pallidus* (Lam.).

*Salmacis virgulata* Ag. & Des.  
*Pseudoboletia indiana* (Mich.).  
*Tripeustes gratilla* (L.).  
*Heliocidaris erythrogramma* (Val.).  
*Echinometra mathaei* Bl.  
*Breytia australasia* (Leach).

Of these 40 species, now known from the Abrolhos Islands, three-fourths may be reckoned as tropical species, for 1 is tropicopolitan, 25 occur in the East Indies, and 4 others occur along the coast of northern or at least north-eastern Australia. Of the remaining 10, 7 are endemic and 3 are South Australian forms. Of the endemic species, 3 (*Nectria macrobrachia*, *Petricia obesa*, and *Centrostephanus tenuispinus*) are most nearly allied to species from the southern coasts of Australia. It is evident, therefore, that the Abrolhos have received their echinoderm fauna chiefly from the north, and that only a very small number of characteristically Australian forms have as yet found a footing among those islands.

## CRINOIDEA.

## COMATELLA NIGRA.

*Actinometra nigra* P. H. Carpenter, 1888, 'Challenger' Comat. p. 304.  
*Comatella nigra* A. H. Clark, 1908; Smithson. Misc. Coll. lii. p. 207.

A single well-marked specimen dredged off Long Island, Abrolhos. It is nearly black, has 40 arms about 110 mm. long, and the very powerful cirri are XXII, 25-28. The disk is about 32 mm. across, orally. This species has not been recorded hitherto from western Australia, though it is known from the Aru Islands and I found it at the Murray Islands in 1913.

## COMATELLA STELLIGERA.

*Actinometra stelligera* P. H. Carpenter, 1888, 'Challenger' Comat. p. 308.  
*Comatella stelligera* A. H. Clark, 1908; Smithson. Misc. Coll. lii. p. 207.

A single specimen of this northern species was taken on the shores of Wooded Isle. It is bright yellow-brown, in its preserved condition, is

25 mm. across the disk, and has 25 arms: 90 mm. long more or less. Cirri XXX, 19-22. There is only one record of *C. stelligera* from a point anywhere nearly so far south as Wooded Isle, and that is the isolated and dubious record from Port Jackson. The species ranges from Ceylon to Samoa and is very common at the Murray Islands, east of Torres Strait, but is not known from the coast of Queensland.

#### COMATULA SOLARIS.

Lamarck, 1816, Anim. s. Vert. ii. p. 533.

A specimen with the 10 arms, 125 mm.  $\pm$  long and about 7 mm. wide, near base, was taken at East Wallaby Island. It is almost black, but has a longitudinal light stripe on the dorsal side of each of the arms, which are remarkably stout. A second specimen not quite so large, taken in the dredge off Long Island, has no trace of the light stripe on the dorsal side of the arms. It has the cirri XIII, 18.

#### COMATULA PECTINATA.

*Asterias pectinata* Linné, 1758, Syst. Nat. ed. x. p. 663.

*Comatula pectinata* A. H. Clark, 1908, Proc. U.S. Nat. Mus. xxxiii. p. 685.

This comatulid seems to be rather common at the Abrolhos, as there are 13 specimens in the present collection: 9 dredged off Long Island and 4 dredged near First Island. All are brown, pale brown, or yellow-brown in colour. They are small, only two or three having arms 100 mm. long. The cirri range from I-XIV, with segments 10-14, but in no case are they arranged in pairs at the corners of the centrodorsal as they are in *C. purpurea*. Otherwise these specimens would, because of their small size, be more naturally assigned to that species, which Mr. A. H. Clark has recorded from "between Fremantle and Geraldton." Several of the specimens examined by Mr. Clark were not typical *C. purpurea*, and intergrade evidently with *C. pectinata*. Gislén (1919) has found so much intergradation between *C. pectinata* and *C. purpurea* that he retains the latter name as varietal only, and I am inclined to agree with him that it is certainly not specific. Just what the relation between *C. purpurea* and *C. pectinata* really is requires still further study.

#### COMANTHUS ANNULATA.

*Actinometra annulata* Bell, 1882, Proc. Zool. Soc. London, p. 535.

*Comanthus (Vania) annulata* A. H. Clark, 1911, Mem. Austral. Mus. iv. p. 757.

The seven specimens of this handsome species were all taken on the shores of Wooded Isle. The number of arms ranges from 36 to 47 and their length from 100 to 125 mm.; in the specimen with 36 arms every Br series is 4 (3 + 4), but in the one with 47 there are four II Br series, 2 and one IV Br series, 2. Cirri very weak, V-VIII, 12. The uniformity of these specimens in coloration is their most notable feature, and in this they agree

with seven of the specimens A. H. Clark (1914, Rec. W. Austral. Mus. i. p. 120) records from between Fremantle and Geraldton, except that they apparently have a darker ground-colour. But they are all spotted with uniformly small, circular greenish-yellow dots, generally quite distinct, but obscured in some of the darkest specimens. In view of the extraordinary diversity of colour of this comatulid, at the Murray Islands, it is remarkable that no diversity at all is shown at the Abrolhos. Possibly this western form may be worthy of a varietal name, but further field observations are necessary before a decision can be reached.

#### COMANTHUS PARVICIRRA.

*Alecto parvicirra* J. Müller, 1841, Arch. f. Naturg. vii. p. 145.

*Comanthus parvicirra* A. H. Clark, 1908, Smithson. Misc. Coll. lii. p. 203.

There are seven comatulids from Wooded Isle which seem to represent this species, though the colour is the yellow-brown characteristic of *C. luteofusca*. They range in size from those with arms 35-40 mm. long up to those whose arms exceed 100 mm. The disk is 7-12 mm. across. The arms range from 12 to 23 in number. The cirri are few and weak, and have the characteristic form and proportions.

#### AMPHIMETRA JACQUINOTI.

*Comatula jacquinoti* J. Müller, 1846, Monatsb. d. k. preuss. Akad. Wiss. p. 178.

*Amphimetra jacquinoti* A. H. Clark, 1914, Rec. W. Austral. Mus. i. p. 124.

There are five specimens of this fine comatulid, but all are more or less badly broken; two were "dredged outside Wallaby Group," while the other three were "dredged off Long Island." They are each about 12 mm. across the disk, and the arms were apparently about 100 mm. long. The cirri are XXI-XXVI, 26-32, 33-39, 36-41, with the segments *all* much wider than long and the dorsal teeth beginning at the 12th-15th segment. The calyx and arms in each specimen are a dirty cream-colour, while the cirri are of that shade only at the base, becoming purple distally.

#### LAMPROMETRA GYGES.

*Antedon gyges* Bell, 1884, 'Alert' Rep. p. 160.

*Lamprometra gyges* A. H. Clark, 1913, Proc. Biol. Soc. Wash. xxvi. p. 144.

There are two light-brown specimens of this species collected along the shore at Wooded Isle. The arms are about 100 mm. long, and their segments proximally are so closely opposed to each other that the basal part of the arm is noticeably smooth and regular. The cirri are XXX-XXXII, 25-30; one specimen shows twenty-three additional cirrus-sockets. The cirri are less brown, more grey than the calyx. In one specimen there can be distinguished along the dorsal side of each fully-developed arm an inconspicuous longitudinal whitish line.

## OLIGOMETRA SERRIPINNA.

*Antedon serripinna* P. H. Carpenter, 1881, Notes from the Leyden Museum, vol. iii. pp. 175, 182.

*Oligometra serripinna* A. H. Clark, 1908, Proc. Biol. Soc. Washington, vol. xxi. p. 126.

At Long Island a single small specimen of this comatulid was taken, but it is not typical. The ridge across the segments of the cirri is very inconspicuous, and none of the pinnule segments have conspicuous projections. There are ten arms about 35 mm. long, and the cirri are XII, 17.  $P_1$  has 10 segments,  $P_2$  has the same number but is conspicuously bigger, while  $P_3$  also has 10 segments and is about equal to  $P_1$ . In colour the general impression is olive-cream and purple, the former being the ground-colour. There is a distinct wide purple line up each side of  $Br_1$  and  $B_2$  basally, but this soon breaks up into spots, and disappears in the joints or in lines across the segments at their margins. There is no regularity of arrangement.

The occurrence of *serripinna* at the Abrolhos is unexpected, as it has not been hitherto recorded from Australia, but Mr. A. H. Clark considers this specimen undoubtedly Carpenter's species and not *O. carpenteri* Bell, which has been recorded from northern Australia several times. (A. J. D.)

## ASTEROIDEA.

## ASTROPECTEN PREISSII.

Müller & Troschel, 1843, Arch. f. Naturg., jhrg. ix. 1, p. 119.

There are three *Astropectens*, dredged off Fremantle, which seem to be undoubtedly this species. They have lost all indication of their original colour and are now dingy light-brown. The smallest has  $R = 30$ ,  $r = 6$ , and  $br = 6.5$  mm.; thus  $R = 5r$ . Superomarginal plates all unarmed. Inferomarginals with a single wide, flat, pointed marginal spine, below which are two very much smaller and more slender spines, of which the adoral is smaller; about four somewhat smaller spines form a longitudinal, well-spaced series on the ventral surface of the plate. A second specimen has  $R = 70$ ,  $r = 10$ , and  $br = 13$  mm.; hence  $R = 7r$ . On one arm three of the distal superomarginals bear small but distinct spinelets. The armature of the inferomarginals is essentially as in the young individual, but the marginal spines and those below are markedly heavier. The third specimen has  $R = 120$ ,  $r = 15$ , and  $br = 17$  mm.; hence  $R = 8r$ . There are no superomarginal spinelets, and the inferomarginal armature is also quite typical.

## LUIDIA MACULATA AUSTRALÆ.

*Luidia australiæ* Döderlein, 1920, 'Siboga' Ast. pt. ii. Luidia, p. 266.

An adult specimen, taken near Fremantle, has the usual seven rays, and the measurements are  $R = 225$ ,  $r = 29$ , and  $br = 31$  mm. The distal paxillæ are characteristically large, and there are some pedicellariæ on the

lateral paxillæ near the arm-bases. The arms are rather wide near the tip, not tapering so much as in some Chinese specimens. Although I have not seen any really intermediate specimens, I think the Australian form is more probably a local subspecies than a distinct species. Döderlein himself suggests that it should perhaps be considered "nur als eine Lokalform." Material from the northern coast of Australia and the southern East Indies is essential for a proper solution of the problem.

*NECTRIA MACROBRACHIA* \*, sp. nov. (Pl. 13. figs. 5, 6.)

*Diagnosis* : Disk small ; arms relatively long and cylindrical. Granulation of abactinal plates, near tips of rays, coarse, crowded, and prismatic ; actinal granulation noticeably prismatic. Abactinal plates of disk and arm-bases less paxilliform and more crowded than in the other members of the genus.

*Description of holotype* : Rays 5.  $R=60$  mm. ;  $r=17$  mm. ;  $R=3.5$  r.  $Br=16$  mm.  $Br$  at middle of ray = 10 mm. ; at tip, 6 mm. Disk relatively small, only a little elevated ; arms relatively narrow, for the genus, somewhat flattened basally, but nearly cylindrical or terate for the distal half. Abactinal plates on disk and on basal two-thirds or more of rays, large, low, flat, more or less irregularly hexagonal with rounded corners, well spaced but not widely separated, of dissimilar size ; they are connected with each other by heavy radiating ossicles, in the spaces between which arise papulæ in groups of 4-14. Each plate is covered by a coat of low, more or less convex, polygonal granules ; there are about 40-50 on a plate 2-2.5 mm. in diameter, besides a marginal series of about 25 distinctly larger granules. The marginal series of adjacent plates are in close contact even on disk, except here and there at the angles. Distal part of rays covered by similar but coarser granules, quite closely crowded and without indication of marginal series. Madreporite small, about 2 mm. across, situated half-way between centre and margin of disk.

Superomarginal plates about 25, very similar to the abactinal plates in covering and appearance ; interradianal ones much higher than long ; distally and especially close to tip of ray, the superomarginals are so closely crowded against each other, the abactinal plates, and the inferomarginals that they can be distinguished only imperfectly. Inferomarginals about 27, but distal ones very difficult to make out. The whole distal end of the ray is so closely covered with coarse unequal granules that plate limits cannot be distinguished. Intermarginal, and even inframarginal, papillæ are evident near base of ray.

\*  $\mu\alpha\kappa\rho\acute{o}s$  = long +  $\beta\rho\alpha\chi\acute{\iota}\omega\nu$  = arm, in reference to the characteristically long and relatively slender arms.

Actinolateral areas small; along the mid-interradial lines there are about six series of actinolateral plates, but the outermost consists of only one or two plates, the next two are little longer, the next is perhaps 10 mm. long, the second series does not quite reach the middle of the ray and the first extends far out, almost to the tip of the ray; all these plates are covered by coarse prismatic granules, much coarser than those of the abactinal surface; the largest and most prismatic granules are nearest the oral plates.

Adambulacral plates more than 50, the distalmost hard to distinguish; they form a slight undulating margin to the furrow; each plate carries 3 furrow spines (distally only 2), which are subequal, not notably prismatic, blunt, and slightly thicker at tip than at base; distally, as a rule, the adoral is the smaller of the two; near the base of the arm the spinelets are about 2 mm. long, and 50-70  $\mu$ m. thick at tip. On the surface of each adambulacral plate are 3-5 very short, thick, and prismatic spines; the two largest of these adjoin the furrow spines, while the remaining 1-3 are near and resemble the prismatic granules on the first series of actinolaterals. Oral plates not conspicuous or peculiar; even the oral spines are no larger than those on the adjoining adambulacrals. No pedicellariæ were seen anywhere.

Colour light yellowish-grey.

There are two specimens of this interesting new *Nectria*, collected along the shore in the "Pelsart group"; one label says "Pelsart Island." The interbranchial septa are calcified, and the general appearance is so much like *Nectria* that there can be little question of the generic position. And yet the abactinal plates are much less paxilliform, and are much more crowded on the disk and arm-bases than in the other members of the genus. The disk is also very distinctly smaller, and the arms are narrower at base, wider at tip, and more nearly cylindrical than in either *N. ocellata* or *N. ocellifera*. The granulation of the actinal plates, especially at the base of the arms, is noticeably prismatic in *N. macrobrachia*, and that of the abactinal plates at the tips of the rays is coarse, crowded, and prismatic; these differences in granulation, which seem trivial when put into words, are very conspicuous when specimens are compared.

The paratype of *N. macrobrachia* is a badly injured individual, much smaller than the one described. There are but three rays; two, side by side, seem to have been bitten off very close to the disk, apparently at different times, as they show different degrees of healing. The rays present are strongly curved and contracted, but apparently  $R=42$  mm. and  $r=11$ , so that  $R$  is almost 4  $r$ . The granulation and colour are exactly the same as in the holotype. The armature of the adambulacral plates is also similar, but the number of furrow spines is not reduced to two until almost the very tip of the arm is reached.

## PENTAGONASTER STIBARUS.

H. L. Clark, 1914, Rec. Austral. Mus. i. p. 136.

Two little pentagonal sea-stars from Pelsart Island appear to be the young of this species. The smaller is 17 mm. across,  $R=9$  mm., and has 73 flat abactinal plates besides the madreporite, 4 superomarginals on each side, and a terminal plate on each ray, 99 plates altogether abactinally. The distal marginal plate on each side of each ray is the larger, but is not conspicuously enlarged. Orally there are 4 inferomarginals on each side, and the distal ones on each ray are noticeably larger than the proximal. There are 12 (on 2) or 13 (on 3) plates on each of the interradial areas, and there are 17 adambulacral plates on each furrow margin. The other specimen is a trifle larger (18.5 mm. across), but has only 55 flat abactinal plates besides the 20 marginals, 5 terminals, and madreporite, 81 plates altogether on the dorsal side. On the ventral surface there are 14 (in one area 15) plates in each interradial area. A few pedicellariæ occur on the abactinal surface of each specimen, but there are none on the oral surface.

That these little sea-stars are really the young of *stibarus* seems clear as a result of comparing them with the young of *P. dübeni*. The latter have the abactinal plates swollen, the rays longer and narrower, and, at least in some cases, actinal pedicellariæ are present.

At Wooded Island a larger specimen of *P. stibarus* was taken, 27 mm. across,  $R=15$  mm. There are only 4 marginal plates still in each series, on each side of the distinctly pentagonal sea-star; the distal plate is distinctly the larger in every case. In a specimen of *P. dübeni* of the same size there are 40 superomarginals and 50 inferomarginals, 8 and 10 respectively on each side of the animal, which is not, however, at all pentagonal, since  $R$  is 15 mm. and  $r$  only 8 mm.

## STELLASTER INCEL.

Gray, 1847, Proc. Zool. Soc. London, pt. xv. p. 76.

Two specimens of this well-known sea-star were dredged off Long Island. The larger specimen has  $R=90$  mm. and the smaller 80 mm. There are 2-4 low, blunt spine-like tubercles on the carinal line, on the disk at the base of each arm. The number and arrangement of the inferomarginal spines show great diversity; whereas the number of inferomarginal plates is about 17 in each series, the number of spines ranges from 3 to 11. The present specimens have lost all colour.

## ANTHENEAE AUSTRALIÆ.

Döderlein, 1915, Jahrb. Nassau. Ver. f. Naturk. Wiesbaden, lxxviii. p. 52.

Two Antheneas may well be referred to this species. The genus is a perplexing one, and Döderlein's revision of it is a very admirable piece of

work. His recognition of this species seems to be amply justified. The smaller of the two specimens at hand has  $R=33$  mm. and  $r=15$ , while the larger has the measurements 65 and 30 mm. respectively. Even the latter is only three-fourths as large as Döderlein's type. According to the label the smaller specimen was "dredged between Rat and Pelsart Group." It differs from the larger in the paucity of granules and pedicellariæ on the abactinal surface, which is nearly smooth. Even the superomarginal plates have very small groups of granules, especially near the interradius. At the base of each arm, on the carinal line, 7 mm. from centre of disk, is a low but conspicuous tubercle. There are two smaller tubercles near the anus. Similar tubercles can be seen in the larger specimen, but as they have not increased in size with the growth of the sea-star, they are no longer conspicuous among the numerous granules and pedicellariæ with which the abactinal surface is covered. This larger specimen was dredged off Fremantle. Its colour (dry) is brown-olive, with granules, tubercles, and pedicellariæ nearly white or at least very light brownish and the madreporite chocolate-brown; on the oral surface the granules and pedicellariæ are so numerous and crowded that the general effect is much lighter than dorsally. The smaller specimen is grey-brown above and light yellowish-brown below. The larger specimen is very similar to specimens of *A. pentagonula* of the same size, but it is evidently still immature.

#### ANTHENEAE GLOBIGERA.

Döderlein, 1915, Jahrb. Nassau. Ver. f. Naturk. Wiesbaden, lxxviii. p. 50.

A very fine *Anthenea*, taken by "shore-collecting, Wallaby Group," is undoubtedly to be referred to this well-marked species. It is larger than Döderlein's type, in which  $R=59$  and  $r=30$  mm., for  $R=70$  and  $r=34$  mm. The radial series of tubercles is nearly wanting, though the 5 primary ones are evident. Large dorsal pedicellariæ are numerous and conspicuous. The tubercles on the marginal plates are smaller than in Döderlein's type. The dorsal surface is dark purple-brown, with tubercles, pedicellariæ, and madreporite conspicuously light-coloured in contrast; the oral surface is wood-brown, the tubercles, spinelets, and pedicellariæ much lighter.

#### FROMIA ANDAMANENSIS.

Koehler, 1900, 'Investigator' Ast. p. 105.

Six specimens of a *Fromia* have been a source of great perplexity in the study of the Abrolhos sea-stars, but I have failed to find any satisfactory reason for not referring them to *andamanensis*. The unique holotype of that species is from the Andaman Islands, without more definite locality, and while it is recorded as from "238-290 fathoms," I think there is undoubtedly a mistake about the depth. Certainly the specimens from the

Abrolhos are typical littoral sea-stars. None is exactly like Koehler's figure of *F. andamanensis*, but the one most like it is only a trifle larger and has the rays just a little bit more slender. The abactinal plating is very much as Koehler shows it, but the rays are not so flattened. This specimen was taken at Pelsart Island, and no two of the rays are the same length. The longest has  $R = 32$  mm., the shortest only 17. The colour is very light, almost a dirty whitish (dry). A specimen of about the same size from "Wallaby Group. Shore" is brown in colour, and the abactinal plates are no more numerous than in the Pelsart specimen. At the base of the ray one can count six or perhaps seven longitudinal series of these plates. A larger specimen from the Wallaby station has  $R = 35$  mm., and there are nine or ten series of abactinal plates, which are noticeably smaller and of more uniform size than in the other specimen. In this larger specimen the rays are nearly equal, only one being noticeably shorter than the others, and they are distinctly terete and not flattened, the height at the base being 9 mm. and the width 11. The colour is brown as in the smaller specimen. Shore-collecting at Long Island yielded an individual very much like those from the Wallaby Group with  $R = 35$  mm., but having the rays a trifle more flattened ( $11.5 \times 8.5$  mm.). Dredging off Long Island yielded a slightly larger specimen, in which the longest  $R = 40$  mm., but  $br = 10$  mm. and height of arm at base about 8 mm. This specimen is also much lighter coloured, nearly white. Finally, from the reef-flat at Pelsart Isle is a much larger *Fromia*, with  $R = 54$  mm.,  $br = 12$ , and height of arm at base only 7 mm., of a pale brown colour and having 10 or 11 longitudinal series of abactinal plates. The disconcerting feature of this specimen is that many of the adambulacral plates on the basal half of the rays have three furrow spines. Thus the flatness of the rays and the adambulacral armature approach closely to *F. milleporella*. On the other hand, the large number of series of abactinal plates and the more slender rays give this large *Fromia* a different facies from ordinary *F. milleporella*, and taken in connection with the presence of only two furrow spines on most of the plates, warrant us in considering *F. andamanensis* as a distinct species. Information regarding the colour in life would perhaps be decisive, but the labels with the present specimens are blank on that point.

#### FROMIA ELEGANS.

H. L. Clark, 1921, Echinoderm Fauna of Torres Strait, p. 43.

There are two *Fromias* in the collection which are labelled "Colour—Brown dark. Locality—1st Island. Dredge." The smaller has all the rays broken; it resembles the small specimen of *F. andamanensis* from Pelsart Isle, but the abactinal plates are noticeably larger. The other specimen is perfect and has  $R = 40$  mm.,  $r$  and  $br = 10$  mm. The disk and rays are quite flat, the height of the arms at base being only about 6–7 mm.

I cannot find a single reliable character by which to separate this specimen from *F. elegans*, yet the abactinal plates are not so large or well defined as in that species. The coloration is now pale brownish, but in life it must have been very similar to that of *F. elegans*, if we may trust the label. On the whole it seems better to refer these two specimens from "1st Island" to *F. elegans* than to include them under the name *F. andamanensis*.

#### BUNASTER LITHODES.

W. K. Fisher, 1917, Proc. Biol. Soc. Wash. xxx. p. 91.

There are four little ophiasterids in the collections, two from Pelsart Island and two from Wooded Island, which undoubtedly belong to the genus *Bunaster*. They are certainly not *B. ritteri*, for pedicellariæ are present and there are no "ball and socket" plates, and they are not *B. uniserialis*, as comparison with the holotype of that species shows. After very prolonged study it seems best to consider them as young *B. lithodes*, in the holotype of which species  $R = 22$  mm. In none of the Abrolhos specimens does  $R$  exceed 10 mm. The most noticeable resemblance between these specimens and *B. lithodes* is seen in the finely shagreen-like covering (aside from the abactinal plates) of the upper half of the animal; in *B. uniserialis* the space between the abactinal plates is occupied by a coarse granulation, as it is in *B. ritteri* also. In two points the Abrolhos specimens are unlike *B. lithodes*; the subambulacral spines are very little longer than broad, and it is hard to see more than a single row of actino-lateral plates even at the base of the arm. These two points may be dependent, however, upon maturity, and the characters are certainly liable to growth-changes. In view, then, of the obvious immaturity of these little Bunasters, I think they may well be referred to *B. lithodes*.

The two specimens from Pelsart Island have  $R = 8$  or 9 mm. They are shell-pink, faintly variegated with whitish and decidedly lighter below than above. One of the Wooded Island specimens has  $R = 9$  mm., and the rays are distinctly more slender than in the others. Its colour is also a very much darker pink. The fourth specimen has  $R = 10$  mm.; the rays are stout and the pink colour has been entirely bleached.

#### PETRICIA OBESA\*, sp. nov. (Pl. 13. figs. 1, 2.)

*Diagnosis*: Rays wide, rounded at tip. Abactinal skeleton concealed by the very thick skin with which it is covered. No tubercles, spinelets, or even granules on distal marginal plates.

*Description of holotype*: Rays 5.  $R = 65$  mm.;  $r = 30$  mm.;  $R = 2.17r$ .  $Br = 32$  mm.  $Br$  at middle of ray = 24 mm.; at 5 mm. from tip, 15 mm. Disk large, only slightly elevated; arms wide, slightly arched, very blunt

\* *Obesus* = fat, in reference to the wide, blunt rays and the thick skin.

and rounded at tip. Abactinal skeleton almost completely hidden, even in the thoroughly dry specimens, by the very thick skin which covers the whole animal. Papulae numerous, in large irregularly-defined and more or less coalescent groups, absent only from the terminal fifth of the rays. Anus well marked by the fine calcareous papillae which surround it, nearly central in position. Madreporite 10 mm. from anus, small (2 mm. across) but distinct. Interradial pedicellariae huge and very conspicuous, the valves 4-5 mm. long. No other pedicellariae are present.

Marginal plates almost completely concealed by the thick skin; the infero-marginals appear to be larger than those of the upper series, and are larger distally than interradially; there are about a dozen in each series. They bear no spinelets, nor is the surface at all rough or shagreen-like. Interradial areas covered by thick, smooth skin, through which one can distinguish some actinolateral plates, of which the series adjoining the furrow reaches to about the middle of the arm. Adambulacral plates about 50 on each side of the furrow; each plate carries two (rarely three and even more rarely only one) spines, 2-2.5 mm. long, shaped like a bowling-pin, blunt, and even a little capitate at the tip. These spines are connected clear to their tips by a fleshy fold of skin. Outside this fold is the series of subambulacral spines, which are stouter than the furrow spines and are buried nearly to their tips in skin, though in the distal part of the ray they are more free. On some plates at the base of the arms there are two subambulacral spines, but as a rule there is a single one on each plate. Oral plates are not distinguishable, but they carry five, rarely six, spines on each side of the jaw, the most proximal largest, about 3 mm. long. On the surface of the jaw are four short, thick spinelets, two on each side, one proximal, one distal, buried in skin, and very similar to the subambulacral spines. Colour (dry) dull chocolate, of somewhat varied hues, the darker with a purplish cast; adambulacral spines and jaws of interradial pedicellariae, nearly white.

There are two specimens of this remarkable sea-star from Pelsart Island, but they differ so much from each other in colour that it is hard to believe they are of the same species. Unfortunately the labels say nothing as to the colour in life, so we do not know how much of the present difference may be artificial. The paratype is dull greenish-yellow; everywhere the outer surface layer of skin has cracked, permitting the deeper layer, which is nearly white, to show through. This is particularly marked on the actinal interradial areas. The interradial pedicellariae are smaller and much less conspicuous in the paratype, but there are no other differences worth noting. The size is essentially the same.

The occurrence of *Petricia* on the western side of the continent is very interesting, but the Abrolhos species is very different from *P. vermicina*, the species which occurs at Port Jackson and along the southern coast. The

chief points of distinction are the wider and terminally rounded rays, the thick skin which conceals the skeletal plates and is not at all smooth and shiny when dry (the feature from which *P. vernicina* gets its appropriate name), and the absence of tubercles, spinelets, or even granules on the distal marginal plates, in *P. obesa*. The West Australian species seems to be somewhat larger than the one from the east coast, the largest specimens of which have  $R=50-60$  mm.

#### ASTERINA BURTONII.

Gray, 1840, Ann. Mag. Nat. Hist. vi. p. 289.

There are half a dozen very typical specimens of this little sea-star, one dredged off Long Island and the other from Wooded Island. The largest has  $R=26$  mm. None of the specimens has retained any of its natural colour. The discovery of this species at the Abrolhos extends its known range very far to the south on the Australian coast.

#### ASTERINA GUNNII.

Gray, 1840, Ann. Mag. Nat. Hist. vi. p. 289.

There is a badly damaged small specimen ( $R=27$  mm.) of this southern species in the collection, but it is not from the Abrolhos. It was dredged off Garden Island near Fremantle, which is probably about the northern limit of the species on the western coast.

#### PARASTERINA CRASSA Fisher. (Pl. 13. figs. 3, 4.)

*Patiria* (?) *crassa* Gray, 1847, Proc. Zool. Soc. London, p. 83.

*Parasterina crassa* Fisher, 1908, Smithsonian Misc. Coll. lli. p. 90.

A sea-star dredged off Fremantle is apparently to be referred to this species, as it answers well to Perrier's (1875, Arch. Zool. Exp. v. p. 142) rather detailed description except for its much larger size. Gray makes no reference to the size of his specimen, but Perrier says " $d=10$  mm." From the context one would infer that  $d$  meant the distance from tip to tip of alternate rays—that is, the diameter of the entire animal; but in that case the specimens in the British Museum are tiny indeed, and it seems incredible that the description given could apply to so small an individual. If  $d$  refers to the diameter of the disk, then Perrier's specimen was only about half as large as the one in hand. Possibly the 10 is a misprint for 100, but in that case the present specimen is much smaller than those in the British Museum. Perrier refers several times to resemblances to *Pentanogaster*. These led me for a time to feel sure that my specimen could not be *P. crassa*, as I see nothing in which it is the least like *Pentagonaster*, save possibly the ambulacral armature, where a slight resemblance might be imagined.

The present specimen has  $R=36$  mm. and  $r=9$ , and  $R$  is therefore equal to  $4r$ ; Perrier says  $R=3\frac{2}{3}r$ , a difference easily understood if his specimen had  $r$  only 5 mm. Perrier says that the large ossicles in the dorsal skeleton

are more numerous than the small ones, and then says the papulæ are surrounded by the small ones, which certainly implies a considerable number of the latter. In the present specimen, near the base of the arm there are about five small plates to each one of the large ones. At the tips of the rays, however, the large plates become more numerous. All plates, both on the dorsal and oral surfaces of the sea-star, are closely covered with cylindrical spinelets like those occurring in *Asterina*. Dorsally the spinelets end in 2-4, usually 3, glassy points of which one is larger than the other; ventrally there are more glassy points on each spinelet, and they are subequal. Even on the ventral plates, I cannot see that these crowded spinelets resemble a "granulation" as Perrier says. Gray says the colour of his dry specimen was pale yellow, and the one before me might be called dirty yellow. Perrier says that some of those in the British Museum were "encore variés de jaune et de blanc," but immediately states that the spines on the large ossicles were "bleus"; probably either "blanc" or "bleus" is a typographical error.

*COSCINASTERIAS CALAMARIA.*

*Asterias calamaria* Gray, 1840, Ann. Mag. Nat. Hist. vi. p. 179.

*Coscinasterias calamaria* Perrier, 1894, 'Travailleur' et 'Talisman' Stell. p. 106.

A sea-star dredged near Fremantle is the only representative in the collection of this characteristic species of southern Australia. It is a small specimen in poor condition, only three arms remaining attached to the disk, which is but 10 mm. across. The rays are about 55 mm. long, and there evidently were eleven of them originally.

*UNIOPHORA DYSCRITA* \*, sp. nov.

*Diagnosis*: Disk moderate, little elevated; arms short, wide, and little arched. Inferomarginal, actinal, and adambulacral spines flattened, chisel-like at tip. No intermarginal plates. No shagreen-like areas on superomarginal plates. Abactinal spinelets of two kinds, blunt cylindrical and capitate conical.

*Description of holotype*: Rays 5. R=55 mm.; r=13 mm.; R=4r+. Br=15 mm. Br at middle of ray, 13 mm.; at 5 mm. from tip, 7 mm. Disk moderate, little elevated; arms wide and little arched. The specimen is dry and flattened, and it is hard to tell how much elevated and arched the upper surface may have been in life. Abactinal skeleton of rather heavy plates forming an irregular and very open network, the meshes of which are four distinct series only at the base of the arm; at the middle of the arm the lateral series are still evident, but the median series are quite replaced by irregularly-arranged meshes 3-5 mm. across, more or less occupied, at least at centre, by papulæ. Basally there are 4-12 papulæ in the mesh-areas.

\* *δύσκριτος*=hard to determine, in reference to the difficulty of distinguishing the species of *Uniophora*.

Marginal plates very distinct, the upper series forming a very evident boundary to the abactinal surface of the arm. Intermarginal papulae numerous. At the base of each arm a carinal series of plates is evident and one lateral series on each side, but on most of the abactinal surface of each arm, as well as on the disk, there is no definite arrangement of the plates evident. Most of the abactinal and superomarginal plates carry spinelets and minute pedicellariae. The latter are scattered and not very numerous. The spinelets are of two sorts: nearly cylindrical very blunt ones about .50-.75 mm. long and the diameter one-third to one-half as much; and stout, markedly conically capitate spinelets 1-1.5 mm. long and about one millimetre in diameter; on the marginal plates these heavy spinelets are conical rather than capitate. There is never more than one of the stout spinelets on a plate, but one finds on each side of it, usually, 1-3 of the more slender little spinelets; occasionally the stout spinelet is solitary. On the more conspicuous abactinal plates the spinelets form transverse series, sometimes without any large one at the middle. Madreporite 2 or 3 mm. from the disk margin, small, scarcely 2 mm. in diameter, elevated and surrounded by a circle of 15-20 small spinelets.

Inferomarginal plates about 28, each with a stout spine, rarely accompanied by a single much smaller one; distally the spines are low, blunt, conically, but proximally they are flattened and the tips are chisel-like, or deeply channelled on the upper side, or divided into 2 or 3 very short branches. These proximal spines are about 2 mm. long with the tip a millimetre or more wide. Actinolateral spines in two series continuing nearly to tip of ray; at base of arm there seem to be two series of actinolateral plates, but it is hard to determine how far out on the arm they are continued; the spines are similar to those on the inferomarginal plates, but are smaller; there is seldom more than one to a plate. Adambulacral spines about 2 mm. long, flat, blunt, and rounded, or a little widened at tip, in two regular crowded series; the spines of the outer series are only a little, if any, larger than those next the furrow. Oral plates, each with three spines of which the distal is smallest and most like the adambulacral spines, while the most proximal is 3 mm. or more long and very flat and chisel-like. Tube-feet crowded, in four series. Pedicellariae are very few on the actinal surface; here and there are scattered minute forcipiform pedicellariae, and near the base of the ray careful search reveals a few small forcipiform pedicellariae, with short, erect jaws and no stalk; they are about as wide as long.

Colour, of dry specimen, dull yellowish-grey.

One specimen dredged at Garden Island, near Fremantle.

In view of the confusion already existing in the genus *Uniophora*, it may seem of doubtful utility to describe a new species based on a single specimen, but after examining a considerable number of *Uniophoras* from South Australia, representing at least two species and perhaps more, I am satisfied that this West Australian form is at least distinct from any of those hitherto

described. It is particularly characterised by very flat chisel-like infero-marginal, actinal, and adumbulacral spines, but another feature in which it differs from South Australian specimens is the absence of shagreen-like "pebbled" areas on the lower part of the superomarginal plates. These are quite conspicuous in most of the specimens from South Australia, but can barely be distinguished on one or two plates of the specimen from Garden Island. It should also be mentioned that the present specimen does not seem to have any intermarginal plates, such as occur in some Uniophoræ. None of the South Australian specimens have the grey colour of *U. dyscrita*, but, owing to the poor condition of the type, this may be of no significance at all.

#### OPHIUROIDEA.

##### EURYALE ASPERA.

Lamarck, 1816, Anim. s. Vert. ii. p. 538.

A single specimen of this "basket-fish," 20 mm. across the disk, is labelled as having been brought from Broome. It is very light-coloured, possibly somewhat bleached, but is otherwise in good condition. The species was previously known from north-western Australia only from two young specimens taken by the 'Gazelle.'

##### OPHIACTIS SAVIGNYI.

*Ophiolepis savignyi* Müller & Troschel, 1842, Syst. Ast. p. 95.

*Ophiactis savignyi* Ljungman, 1867, Öfv. Kong. Vet.-Akad. Förh. xxiii. p. 323.

A single specimen of this tropicopolitan species is in the collection from Wooded Island. It has six arms and the disk is 3 mm. across.

##### OPHIOTHRIX MICHAELSENI.

Koehler, 1907, Fauna Südwest-Australiens: Ophiuroidea, i. p. 250.

While I do not feel at all sure of the validity of this species, since the section of the genus to which it belongs is in very great confusion, there is a specimen of *Ophiothrix* at hand, taken at Garden Island near Fremantle, which is almost certainly identical with Koehler's specimens and may well bear their name until the group is revised. It is 13 mm. across the disk, and although the arms are all broken, enough is left (65-115 mm.) to show that they are very long. The disk is grey, the arm-spines pale brown, and the upper side of the arms is indistinctly banded with dark and light slate-colour; there is a narrow, more or less interrupted, light line along the middle of the upper-arm surface.

##### OPHIOTHRIX SPONGICOLA.

Stimpson, 1855, Proc. Acad. Nat. Sci. Philad. vii. p. 385.

This is one of the few characteristic species of the southern coasts of Australia which occur at the Abrolhos. In the present collection there are

three specimens from "Garden Island, near Fremantle; dredged," one from "off Fremantle," one from "Wooded Isle," and four from "Long Island." None of the specimens is large, the disk diameters ranging from 4 to 8 mm.

OPHIOTHRIX STELLIGERA.

Lyman, 1874, Bull. M. C. Z. iii. p. 237.

A single small specimen, from Garden Island, near Fremantle, has the disk only 3 mm. across and the arms about 20 mm. long. Seven larger specimens, from "off Long Island," have the disk  $3\frac{1}{2}$ –7 mm. across. Of these Abrolhos specimens, four show spinelets among the thorny stumps on the disk. All the specimens are much alike in their indistinctive, light greyish- or reddish-brown coloration, and show the white stripe on the upper surface of the arms. In the largest specimen a curious anomaly occurs in that on the proximal part of the arm the white stripe is black. Distally there is a white stripe delimited by a black line on each side, but as this passes towards the base of the arm, the black encroaches more and more on the white, and finally obliterates it altogether, the two black lines coalescing. Were the arms broken off near the base, it would be hard to believe that the brittle-star was really an example of *stelligera*.

OPHIONEREIS PORRECTA.

Lyman, 1860, Proc. Boston Soc. Nat. Hist. vii. p. 260.

The occurrence of this species in the Abrolhos is most interesting, as it does not seem to be common anywhere in the East Indies and is not yet known from the mainland coast of Australia, although it is not rare at the Murray Islands, in the Torres Strait region. There are five specimens at hand from Wooded Island and two from Pelsart. One of the latter is only 4 mm. across the disk and has the arms about 20 mm. long. The disk is nearly pure white, save for the dark brown distal tips of the radial shields. The other half dozen specimens are 8–12 mm. across the disk.

OPHIOCOMA BREVIPES var. VARIEGATA.

*Ophiocoma variegata* E. A. Smith, 1876, Ann. Mag. Nat. Hist. (4) xviii. p. 39.

*Ophiocoma brevipes* var. *variegata* H. L. Clark, 1921, Echinoderms of Torres Strait, p. 130.

It is rather remarkable that this widespread and variable *Ophiocoma* should be the only representative of the family taken at the Abrolhos. It was found both at Wooded Island (8 specimens) and at Long Island, Pelsart Group (4 specimens). The specimens range in disk-diameter from 12 to 29 mm. All are evidently to be referred to the variety *variegata*, but two have the black-spotted disk of the form that has been called *O. döderleini* and two have the reticulated disk of the so-called *O. dentata*. None is like *O. insularia* or the typical *O. brevipes*.

## OPHIOPLOCUS IMBRICATUS.

*Ophiolepis imbricata* Müller & Troschel, 1842, Syst. Ast. p. 93.

*Ophioplocus imbricatus* Lyman, 1861, Proc. Boston Soc. Nat. Hist. viii. p. 73, footnote.

There are two adults, light-coloured specimens of this species in the collection, taken on the reef at Long Island, Pelsart Group.

## ECHINOIDEA.

## PRIONOCIDARIS BACULOSA VAR. ANNULIFERA.

*Cidarites annulifera* Lamarek, 1816, Anim. s. Vert. iii. p. 57.

*Prionocidaritis baculosa* var. *annulifera* Mortensen, 1918, Kungl. Svenska Vetensk. Handl. lviii. no. 9, p. 8.

A very fine specimen of this handsome sea-urchin was dredged among the islands of the Wallaby Group. It is 49 mm. in horizontal diameter, and the largest primary spines, which are all more or less conspicuously banded with reddish-purple and greenish-yellow, are about 57 mm. long and 5 mm. in diameter near the base. The number and arrangement of the conspicuous red-purple spots on the collar of the primaries show great diversity.

## PRIONOCIDARIS BISPINOSA VAR. CHINENSIS.

Döderlein, 1903, Jena Deuksehr. viii. p. 697.

A small cidarid dredged off Long Island resembles so closely Döderlein's description and figure that I refer it to this variety with little hesitation, even though the type-locality is so far distant from the Abrolhos. The specimen is 35 mm. in diameter. Most of the primary spines are broken or missing, but the unspotted red-brown collar is characteristic, and the distinctive thorns are well-developed on the upper spines. The longest ones, 33 mm. long, 2 mm. in diameter at the collar, cylindrical, and without thorns, are at the mid-zone. The secondary spines are brownish-red, those on the ambulacra being slightly darker than those on the interambulacra and with a purplish tinge.

## CENTRECHINUS SAVIGNYI.

*Diadema savignyi* Michelin, 1845, Rev. Mag. Zool. p. 15.

*Centrechinus savignyi* H. L. Clark, 1921, Echinoderm Fauna of Torres Strait, p. 145.

A specimen 85 mm. in diameter was taken in the shore-collecting at Wooded Island.

## CENTRECHINUS SETOSUS.

*Echinometra setosa* Leske, 1778, Add. ad. Klein, p. 36.

*Centrechinus setosus* Jackson, 1912, Phylogeny of Echini, p. 28.

A specimen 80 mm. in diameter was taken during the shore-collecting in the Pelsart Group. The abactinal white spots are large and conspicuous, and easily distinguish the species from the preceding.

## CENTROSTEPHANUS TENUISPINUS.

H. L. Clark, 1914, Rec. W. Austral. Mus. i. p. 162.

There are three half-grown but typical examples of this western species, one of which was taken in the lagoon at Pelsart Isle, while the other two were dredged off Long Island.

## AMBLYPNEUSTES PALLIDUS.

*Echinus pallidus* Lamarck, 1816, Anim. s. Vert. iii. p. 48.

*Amblypneustes pallidus* Valenciennes, 1846, Voy. 'Venus,' Zoophytes, pl. ii. fig. 1.

A small *Amblypneustes* from Wooded Island, about 20 mm. in diameter and nearly 20 mm. high, is best referred to this species, although the diamond-shaped markings on the interambulacra are very faint. The test is faintly pink, the secondary and miliary spines dirty whitish, and the primaries are pale red. There are no spines on the anal system, and the tuberculation of the test is that which is characteristic of *A. pallidus*.

## SALMACIS VIRGULATA ALEXANDRI.

*Salmacis alexandri* Bell, 1884, 'Alert' Rep. p. 118.

*Salmacis virgulata alexandri* Döderlein, 1914, Ech. Südwest. Aust. p. 454.

This urchin has already been recorded from Geraldton and from Sharks Bay, so the occurrence of two large specimens (74 and 79 mm. respectively in horizontal diameter) from the Abrolhos is not surprising. They were dredged off Long Island. One has a low ambitus and flat oval surface, though the test is fairly high, while the other has a lower test and the ambitus much nearer to the mid-zone. In the latter specimen the primary spines are green, though the test is light purple, only the primaries near the peristome being somewhat purple near the base. In the larger specimen the primaries, as well as the test, are purple, but those below the ambitus are much longer and more brightly coloured than those above, and all are tipped with white.

## PSEUDOBOLETIA INDIANA.

*Toxopneustes indianus* Michelin, 1862, Ech. et Stel.: Annexe A, in Maillard's Notes sur Bourbon, p. 5.

*Pseudoboletia indiana* A. Agassiz, 1872, Rev. Ech. pt. 1, p. 153.

The occurrence of a *Pseudoboletia* on the western side of the Australian continent is a discovery of more than ordinary interest, as the genus has not hitherto been reported from Australia or the Torres Strait region. But the present specimen, 50 mm. in diameter, with a dirty white coloration lacking all indication of pink, is unmistakable. It was dredged off Long Island.

## TRIPNEUSTES GRATILLA.

*Echinus gratilla* Linné, 1758, Syst. Nat. ed. x. p. 664.

*Tripneustes gratilla* Lovén, 1887, Ech. Linn. p. 77.

Two specimens, 68 and 86 mm. in diameter, with dark test and white

spines, were taken at Pelsart Island, thus extending the known range of the species on the western side of Australia considerably to the south. On the mainland coast it is known only as far south as Sharks Bay.

#### HELIOCIDARIS ERYTHROGRAMMA.

*Echinus erythrogrammus* Valenciennes, 1846, Voy. 'Venus,' Zoophytes, pl. vii. fig. 1.

*Helicoidaris erythrogramma* Agassiz & Desor, 1846, Ann. Sci. Nat. Zool. (3) vi. p. 371

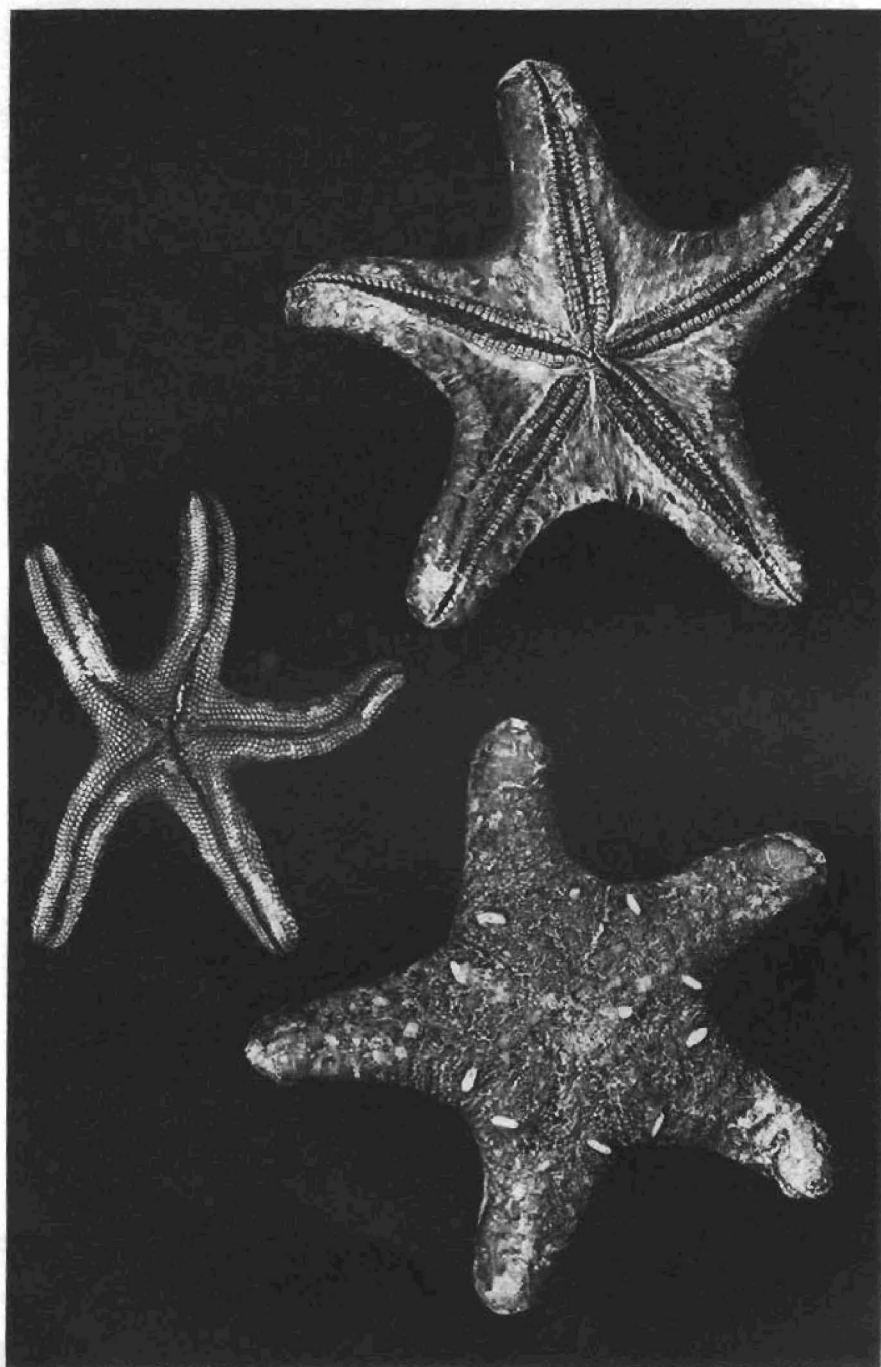
There are half a dozen specimens of this well-known species of the southern Australian coast, but all are young and the specific characters are not well marked. Three from the lagoon, Pelsart Group, 25-30 mm. in diameter and 13-14 mm. high, have purplish tests and bronze-green spines; the largest primaries are 15 mm. long, and not quite a millimetre in diameter at the base. There is little doubt that these are normal *H. erythrogramma*. There is a very similar specimen from East Wallaby Island. Two specimens from Wooded Island have a different appearance, and yet differ more from each other than either one does from the Pelsart specimens. One is about 28 mm. in diameter, scarcely 13 mm. high, and has the tubercles much more conspicuous than in the others. The primary spines are purple, but the secondaries show an evident bronze-green coloration. Most of the primaries are broken, but it is obvious that all were more or less stunted; particularly all the spines above the ambitus are relatively short and thick and blunt. Apparently this specimen lived beneath a rock or among rocks where surf or tidal currents were strong. The other Wooded Island specimen has the test very light-coloured, with a green tinge abactinally, and the spines are green tinged with purple at the tip, at least orally. The largest primaries are 10-12 mm. long, with the diameter at base distinctly more than a millimetre. This individual looks like a different species from the others, and may be a young *H. tuberculata*, but it is highly improbable that that species occurs in the Abrolhos. Probably this little green specimen was collected on an eel-grass bottom in still water, such an environment as favours the green colour and the better-developed spines.

#### ECHINOMETRA MATHAEI.

*Echinus mathaei* de Blainville, 1825, Dict. Sci. Nat. xxxvii. p. 94.

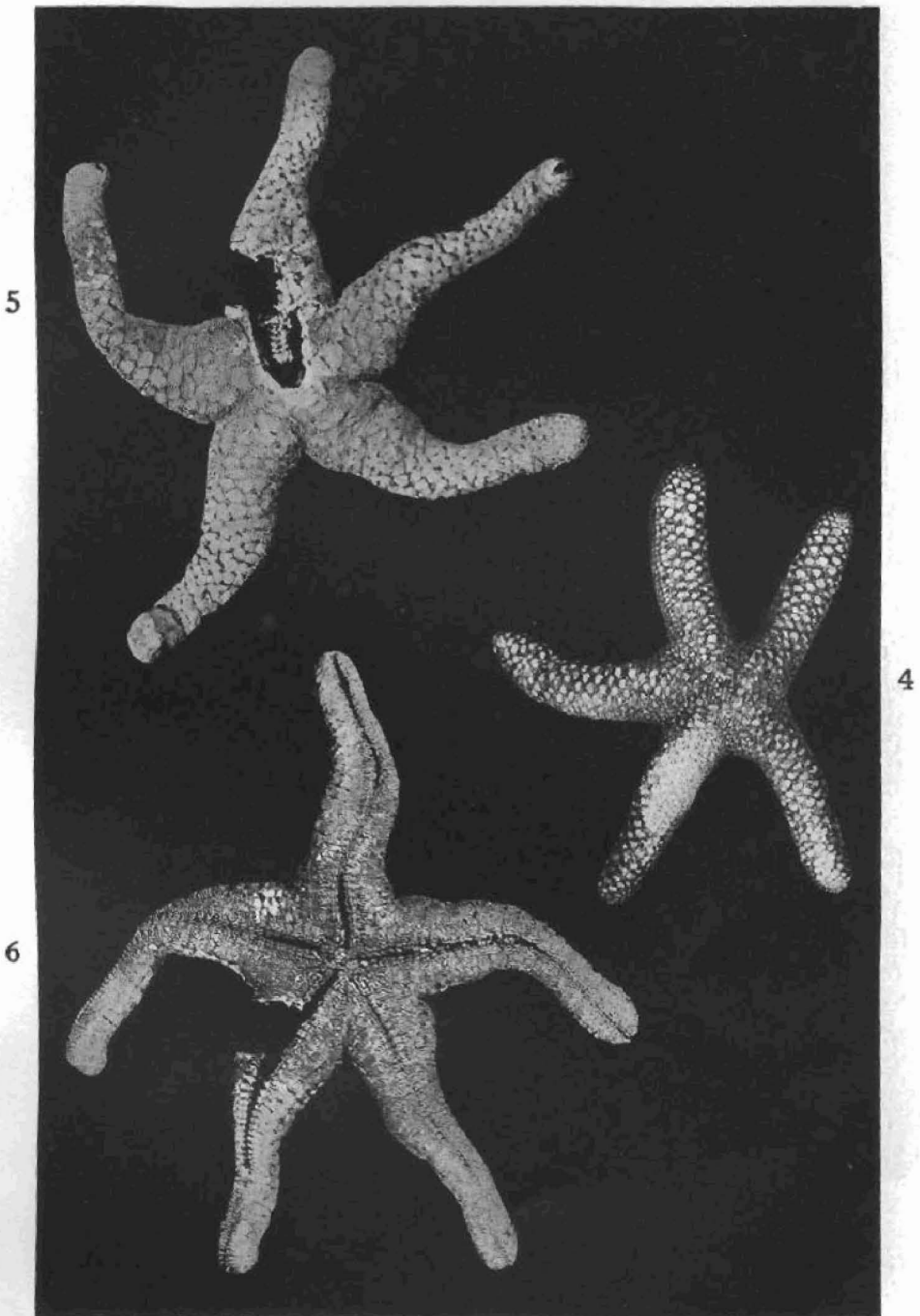
*Echinometra mathaei* de Blainville, 1830, Dict. Sci. Nat. lx. p. 206.

There is a specimen 47 mm. long, 41 mm. wide, and 26 mm. high from North Island, and the label says "Very common everywhere." There are also two small specimens (15-17 mm. long) from "Long Island, shore." The abactinal tube-feet of the large specimen contain large numbers of the triradiate spicules which Döderlein considers typical of his genus *Mortensenia*, but I am not prepared to admit that their presence is even a good *specific* character, and I think these specimens are more properly recorded as *E. mathaei* than as *E. oblonga*. But they are evidently identical with those which Döderlein (1914, Fauna Südwest-Austral. Bd. iv. Lfg. 12, p. 487) identifies as *Mortensenia oblonga*, which were collected in Sharks Bay.



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WEST AUSTRALIA

## BREYNIA AUSTRALASIE.

*Spatangus australasiae* Leach, 1815, Zool. Misc. ii. p. 68.

*Breynia australasiae* Gray, 1855, Cat. Rec. Ech. pt. 1, p. 46.

A single fine specimen from North Island shows that the characteristic species of Australia is not wanting at the Abrolhos.

## ECHINOCARDIUM CORDATUM.

*Echinus cordatus* Pennant, 1777, Brit. Zool. iv. p. 69.

*Echinocardium cordatus* Gray, 1848, Brit. Rad. p. 6.

Two specimens of this cosmopolitan species are in the collection. They were dredged off Garden Island, near Fremantle. The larger is 32 mm. long, 22 mm. wide, and 13 mm. high.

## EXPLANATION OF PLATE 13.

- Fig. 1. *Petricia obesa*, sp. n., aboral view,  $\frac{3}{4}$ rds nat. size.  
 2. " " " oral view, " "  
 3. *Parasternia crassa* (Gray) Fisher, oral view, nat. size.  
 4. " " " aboral view, " "  
 5. *Nectria macrobrachia*, sp. n., aboral view,  $\frac{7}{8}$ ths nat. size.  
 6. " " " oral view, " "