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SOME GENERA AND SPECIES OF THE ASTERINIDAE.

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(Plates i-v.)

THIS contribution contains descriptions of seven new species and one new genus, discussions on the grouping of various species within the family, notes on the status of *Habroporina pulchella* H. L. Clark, and opinions on the validity of the sub-family Tremasterinae.

All the specimens referred to herein are housed in the Australian Museum, Sydney, unless stated to the contrary.

***Asterina scobinata* sp. nov.**

(Pl. v, figs 9-12, and 15.)

Description.—Body moderately and evenly elevated. Rays five, tapering evenly from the disc and terminating fairly acutely. $R. = 11 \text{ mm.}$, $r. = 6 \text{ mm.}$; $R. = 1.8 r.$ Interbrachial arcs angular, fairly acute.

The abactinal plates are regularly arranged, crescentic, imbricated, and of more or less even size. Those on each midradial region form a distinct area of three longitudinal rows. These plates are slightly larger than their neighbours, less crescentic, and overlap one another edgewise to a greater degree.

Low down near the margin in the inter-radial region the abactinal plates are nearly circular, not crescentic, and only slightly imbricated. The raised crescentic surface of each abactinal plate does not lie at an angle; it stands straight and upright, and is armed with a large number of delicate minute spinelets, about ten to twenty in number according to the size of the crescentic surface to be covered. These spinelets, being very small and delicate, are easily dislodged when the specimen is handled. In two of the three specimens before me the spinelets have almost disappeared, leaving a somewhat bare abactinal surface.

The madreporite is very small, almost central in position and porous, not striated or channelled.

The terminal plate is relatively small and usually bare.

The papular pores are numerous, well developed and situated in the notched or crescentic upper surface of the abactinal plates. About twelve series of papular pores occur at the base of each ray. Five to six median series extend from the disc towards the terminal plate, but terminate just before that structure is reached. The centre of the disc, which contains few papular pores, is enclosed by a ring formed by a number of large crescentic plates from which radiate five short and non-perforate inter-radial bands. These bands more or less isolate the pores on the disc and rays so as to create five separate areas.

Twenty-five to twenty-seven superomarginal plates occur on each side of a ray. They are regularly arranged, round, with elevated dome-like centres, a little larger than most abactinal plates in the immediate vicinity, and armed with a circular tuft of delicate spinelets similar in character to those occurring on adjacent abactinal plates. The inferomarginal plates about equal the superomarginals in number. They project outward beyond the superomarginals for some

distance, thus making a small though very distinct marginal flange. The infero-marginal plates are flat and wedge-shaped, and placed obliquely so as to overlap one another. Sometimes a distinct space separates individual plates, but the oblique arrangement in such cases remains unaltered.

Each of the five actinal intermediate areas is made up of from seven to eight chevrons of plates. The first and second (counting from the furrow) reach to the tip of the ray, while the third reaches to about the seventh inferomarginal plate. Each plate carries from three to six fairly long, though very slender spinelets. On each side of the second chevron and between the first and second, or third and fourth plate (counting from the angle of the chevron), there is a small uncalcified area in the form of a brownish membrane similar to ones described in species of the genus *Disasterina* hereinafter dealt with. In all five pairs of uncalcified areas are to be seen on the actinal surface near the oral plates. These areas are small, though distinct, and occur in all three specimens before me. Although the presence of uncalcified areas serves to distinguish species of *Disasterina*, as pointed out elsewhere in this contribution, the present species, apart from having paired areas, is so different in most other characters that it cannot be placed in *Disasterina*.

The adambulacral armature is in two series. The inner, or furrow series, is made up of curved combs containing from four to five fairly long, though very slender, spinelets; they are like those seen in *A. cepheus*. The outer series is very similar in character to the furrow series. It is made up of obliquely-placed combs containing from four to five slender spinelets.

Six marginal spinelets occur on each oral plate. These spinelets, like all others on the actinal surface, are noticeably thin and slender. The innermost marginal spinelet is the longest; the remainder grade away only very gradually. On the actinal surface of each oral plate three to four spinelets, arranged in a slight curve, are to be seen.

Locality.—Tasmania (Austr. Museum Reg. No. J. 1241), holotype, R.=11 mm.

Tasmania (Austr. Museum Reg. No. G. 11522), two paratypes, R.=13 mm.

Affinities.—The above species appears to be closely allied to *A. cepheus* M. and Tr. (= *A. burtonii* Gray). After examination of an extensive series of *cephesus* from such localities as Queensland, Western Australia and New Guinea, and comparing the specimens with *scobinata*, the following characters have been found useful as a means of separation. In *scobinata* the rays are acutely pointed, whereas in *cephesus* they are blunt and rounded. The marginal flange caused by projecting marginal plates in *cephesus* is not nearly so prominent in *scobinata*. The abactinal plates in *scobinata* carry more spinelets than in *cephesus*. The entire actinal spinulation in *scobinata* is much finer than that of *cephesus*. Ten small uncalcified patches, a pair in each actinal intermediate area situated near the mouth, occur in *scobinata* and are wanting in *cephesus*.

Asterina scobinata is also allied to *Asterina batheri* Goto. The characters distinguishing the two species are as follows:—In *scobinata* the marginal plates are small, not larger than adjacent actinal and abactinal plates as seen in *batheri*. The furrow spinlets in *batheri* range from six to seven in number, whereas in *scobinata* only four to five occur. The actinal surface of each oral plate in *scobinata* does not carry so many spinelets as in *batheri*. The uncalcified patches which occur in *scobinata* are absent in *batheri*.

Asterina inopinata sp. nov.

(Pl. v, figs. 1-8 and 14.)

"*Palmipes* ? sp." Whitelegge, Journ. Roy. Soc. N.S. Wales, xxiii, 1889, p. 201.

Description.—Body comparatively thin and depressed, particularly noticeable in juvenile examples of the species. Rays five, stout, and of equal length, depressed abactinally. In holotype R. = 13 mm., r. = 10.5 mm., R. = 1.2 r. Each interbranchial arc is in the form of a shallow concavity.

The abactinal plates are imbricated, less so in the inter-radial regions, the free upper crescentic edges facing the centre of the disc. The abactinal plates are almost wholly bare. They are totally devoid of granules of any kind. A few minute glass-like spinelets sometimes border the free crescentic upper edge of abactinal plates on the disc and radial regions, and an occasional central tuft of from one to four similar spinelets occurs on plates of the inter-radial regions. In some specimens almost every plate in the inter-radial regions carries a tuft of minute spinelets. Stress is laid upon the fact that such spinelets are exceedingly small and almost invisible to the unaided eye.

The largest abactinal plates occur on the disc, where they are arranged in the form of a central ring. Arising from this ring are five inter-radial bands of similar large plates which extend outwards for a short distance.

The papular pores are in the form of pits, which lie within the crescentic sinus on the upper surface of the abactinal plates. The pores are confined to the disc and radial areas. One or two rows of pores extend along each side of the median series of radial plates, to end abruptly some distance short of the terminal plate. The median radial series of plates are partially separated by papular pores for about the first two-thirds of their length; the last third continues on uninterruptedly to reach the terminal plate. The inter-radial areas are devoid of papular pores.

The marginal plates are prominent, particularly the inferomarginal series, where each plate is provided with a circular bunch of small crowded spinelets. These spinelets, being dense and closely packed, are responsible for the formation of a somewhat prominent marginal flange.

The actinal intermediate plates are arranged in nine regular chevrons. Only the series lying next to the adambulacral plates reaches to the tip of the ray. The second series extends to the third inferomarginal plate, the third series reaches to the fourth inferomarginal plate, while the fourth series terminates at the sixth inferomarginal plate. Each actinal intermediate plate carries a curved, or sometimes straight single row of from two to four (mostly two to three) stout and sharply pointed spinelets, which are basally webbed for about half their length. The spinelets are fairly stout and well developed basally, and are firmly attached to the plate. In the holotype the actinal intermediate plates are separated from one another by a thin integument, which, owing to shrinkage when drying, has given the plates a raised appearance.

The furrow spines are long and slender, tapering only very slightly. Each comb contains five to six spinelets arranged in a crescent and webbed for almost their entire length; in some cases only the extreme tips of the furrow spinelets are free of the webbing. The spinelets are spaced evenly apart and are fan-like. The spinelet lying nearest the mouth is always conspicuously shorter than any other spinelet in the comb. Behind the furrow series is a second series of two to three well developed spinelets, webbed for most of their length and arranged in a slight curve. Each comb of this second series of adambulacral spinelets is placed at an angle of about forty-five degrees to the furrow.

The oral plates have a marginal series of eight spinelets, increasing gradually in size to the innermost pair, which are of equal length and the largest of the series. These spinelets are webbed for well over three-quarters of their length. On the actinal face of each oral plate there are three webbed spinelets arranged in a slight curve.

A small madreporite is placed just within the circle of large apical plates on the disk.

No pedicellariæ.

Localities.—Under stones between tide marks, Long Reef, Collaroy, near Sydney, N.S. Wales; Holotype and eleven paratypes (Austr. Museum Reg. No. J. 3077).

Inter-tidal zone two miles south of The Entrance, Tuggerah Lakes, New South Wales, 1924; one specimen, Austr. Museum Reg. No. J. 4406).

Shellharbour, N.S. Wales; two specimens (Austr. Museum Reg. Nos. J. 4501, J. 4552).

Tasmania; one specimen (Austr. Mus. Reg. No. G. 11518).

Watson's Bay, Port Jackson, N.S.W.; thirteen specimens (Austr. Museum Reg. Nos. J. 440, J. 442).

Affinities.—This species is allied to *Palmipes sarasini* de Loriol. Before dealing with the points of difference between the two species it seems necessary to point out that *sarasini* would seem to be better placed in *Asterina* than in *Anseropoda*, the genus now accepted in place of *Palmipes*. *Asterina inopinata* can be distinguished from *sarasini* in that it is devoid of an abactinal granulation, and that it does not possess cylindrical points on plates of the disc.

Two specimens of *Asterina nuda* H. L. Clark, collected at the type locality in 1907, have been examined and compared with specimens of *inopinata*. The following differences have been considered worthy of note:—*A. inopinata* differs from *nuda* in the character of the adambulacral armature, the spinulation of the oral plates, and in the character of the marginal spinulation, which, in *nuda*, does not nearly reach the degree of development and the size characteristic of *inopinata*.

Variation and Remarks.—In the youngest example R. = 3 mm.; that is much the same as adult specimens in the shape of the body. The abactinal plates, however, are not so well imbricated as in adults, and the crescentic upper surfaces are either absent or only very faintly defined. Only a few papular pores occur. Five inter-radial slits completely perforating the body are present. The abactinal plates possess from one to three centrally placed spinelets of very small size. Abactinal plates in the inter-radial areas are more conspicuously armed in this manner than any other plates on the abactinal surface.

Occasionally a plate on the disc bears a curved series of from two to four spinelets on its free upper edge as seen in the adult form. The marginal flange of spines in this and slightly larger juveniles is very prominent, and seems to reach a greater stage of development than in adults. In the smallest juvenile the actinal intermediate plates, which are arranged in three chevrons, are armed with a single central spinelet of comparatively large size, and, as in dried adults, the plates themselves are slightly raised and well defined. The furrow spinelets range from two to four in number, three being usually present. The spinelets of the second or outer series are mostly in pairs. Oral plates possess five or six spinelets as a marginal series. A solitary spinelet occurs on the actinal face of each oral plate.

Except that the actinal plates bear two central spinelets instead of one, and the abactinal plates become a little more imbricated and crescentic, the characters set out as above for the smallest juvenile persist in specimens up to $R. = 6.5$ mm., or even a little more. In specimens with $R. = 7.5$ mm. or more, the adult characters as set out in the description of the holotype are to be seen.

The largest specimen, a paratype, has $R. = 16.5$ mm.; it does not exhibit any variable characters.

THE VALIDITY OF THE SUB-FAMILY TREMASTERINAE SLADEN.

This discussion has been included here owing to the subject matter being closely bound up with the variation shown by juvenile examples of *Asterina inopinata*.

Sladen¹ proposed the sub-family name in 1889, and Fisher², with others, accepted it, setting out the characters in key form. The sub-family certainly shows characters which warrant its position in the classification, but in the light of new facts it would seem that its validity is open to question. The fact that *Asterina inopinata* in its juvenile phases can be associated with the sub-family Tremasterinae and with the Asterininae in its adult stages seems sufficient reason for ceasing to recognise the sub-family Tremasterinae. In such an event the genus *Tremaster* could be placed in the sub-family Anseropodinae.

The characters exhibited by juvenile specimen of *Asterina inopinata* which agree with the diagnosis of the sub-family Tremasterinae as set out by Fisher (*loc. cit.*) are as follows. General form of the body like *Anseropoda*. Abactinal plates imbricated, with free margin facing centre of disc. Papulae confined to radial areas, not quite reaching centre of disc. The presence of inter-radial slits completely perforating the body. A series of specimens shows that these slits gradually work out towards the margin and disappear as the adult condition approaches (see Pl. v, figs 1-7).

Disasterina Perrier.

Disasterina Perrier, Rev. Stell. Mus. Hist. Nat. Paris, 1875, p. 289.

Habroporina H. L. Clark, The Echinoderm Fauna of Torres Strait; Dept. Mar. Biol. Carnegie Inst., Washington, x, 1921, p. 34.

A single specimen before me from New Caledonia agrees so well with Perrier's description of *Disasterina abnormalis* that I have no hesitation in associating it with that species, especially as it comes from the type locality. *D. abnormalis* is the genotype, and when the specimen before me is compared with the description and figures of *Habroporina pulchella*, also a genotype, no differentiating characters are to be seen. Therefore, *Habroporina* H. L. Clark must be relegated to the synonymy of *Disasterina* Perrier.

Disasterina abnormalis has not received any material attention since its original description by Perrier, a fact which has, no doubt, been responsible for the misunderstanding of the genus. With nothing beyond Perrier's diagnosis to guide them authors have placed into *Disasterina* species which have no place there, with the result that the characters of the genus have been so widened as to become somewhat misleading. Verrill (1913) furnished an interpretation of the genus, giving characters which have too wide an application, and Döderlein has placed in *Disasterina* a species (*ceylonica*) which, I believe, is not referable to it

¹ Sladen, Zool. Challenger, Asteroidea, xxx, 1889, p. xxxiv.

² Fisher, U.S. Nat. Mus., Bull. 76, 1911, p. 254.

Likewise, owing to the confused condition of the genus, Dr. H. L. Clark named a species *leptacantha* which should have been placed in *Disasterina* rather than *Asterina*. The species *spinosa* which Koehler described in 1910 under *Disasterina* should have no place in that genus; its position is doubtful. The species is unique, it cannot be placed with certainty in any existing genus, and the only course at the moment is to leave the question open until more material is examined. On present indications the erection of a new genus for its reception seems necessary.

After studying the characters exhibited by specimens of *Disasterina abnormalis* from New Caledonia, Murray Island, Torres Strait (type locality of *Habroporina pulchella* H.L.C.) and Michaelmas Cay, off Cairns, Queensland, and taking account of other considerations, I have reached the following conclusions and formed the succeeding diagnosis.

That *Disasterina abnormalis* Perrier is valid.

That *Habroporina* H.L.C. should be relegated to the synonymy of *Disasterina* Perrier.

That *Habroporina pulchella* H.L.C. is a synonym of *Disasterina abnormalis* Perrier.

That *Asterina leptacantha* H.L.C. should be placed in *Disasterina*.

That the position of *Disasterina spinosa* Koehler is doubtful; the species is valid.

That *Disasterina ceylonica* Döderlein is referable to the new genus *Tegulaster* described later in this contribution.

Diagnosis.—Form stellate. Rays well differentiated from disc. Abactinal plates not all in regular order; either completely or partially bare. Abactinal plates slightly or strongly imbricated, in all but one species covered by a moderately thick integument capable of obscuring the plates in living or alcoholic specimens. Inferomarginals produced to form a flange and armed with spines varying in number and form.

Papulae noticeably large, scattered at random on disc and radial regions. Spinelets on actinal surface sacculate, one to each actinal intermediate plate. A comparatively large uncalcified patch of membrane in each actinal intermediate area close to mouth. No pedicellariae.

The genus can be distinguished principally by the sacculate nature of the actinal spinulation, the presence of uncalcified patches on the actinal surface, and by the presence of an integument on the abactinal surface.

The species belonging to the genus *Disasterina* are:—*D. abnormalis* Perrier (genotype), *D. leptacantha* (H. L. Clark), and *D. praesignis* sp. nov. (p. 10).

Remarks.—In recognizing this genus attention must be paid to the nature of the actinal surface; the somewhat sacculate nature of the spinulation, the well armed and well produced inferomarginals, and the five uncalcified patches of membrane. All the species which I believe should be grouped together under *Disasterina* are remarkably constant in the character of the actinal surface.

In some instances the degree of imbrication of the abactinal plates is seen to be a character useless for generic differentiation. Its variation in obviously related species leads to confusion when used as a character in grouping. The species regarded herein as belonging to *Disasterina* illustrate the position. In *abnormalis* the imbrication of abactinal plates is slight and barely discernible in dry specimens. In *leptacantha* the degree of imbrication is intensified and more

clearly seen, while in *praesignis* the imbrication reaches a development comparable to a typical *Asterina*. The presence of an integument covering and obscuring the abactinal plates in living specimens, while helpful in recognizing a species in which it has reached a goodly development, is hardly worthy of generic recognition. Like the abactinal plates which it covers it is variable among the species of the genus and entirely absent in *praesignis*.

***Disasterina abnormalis* (Perrier).**

(Pl. iv, figs. 6-7, 9; pl. v, fig. 13.)

Disasterina abnormalis Perrier, Rev. Stell. Mus. Hist. Nat., Paris, 1875, p. 289.

Habroporina pulchella H. L. Clark, The Echinoderm Fauna of Torres Strait; Dept. Marine Biol. Carnegie Inst., Washington, x, 1921, p. 34, pl. iv, fig. 2; pl. xxiv, figs. 2-3; pl. xxvi, figs. 4-5.

The reasons given above for placing *Habroporina* in the synonymy of *Disasterina* are sufficient to explain why *H. pulchella* has been placed in the synonymy of *D. abnormalis*. It may be well to point out, however, that, when describing *H. pulchella*, Dr. Clark made no reference to the presence of five uncalcified patches of membrane on the actinal surface near the mouth. These can be distinguished on pl. xxvi, fig. 5 in Dr. Clark's work (*loc. cit.*).

Description.—Disc and rays only slightly to moderately elevated. Rays five, well differentiated from the disc. In dry specimens R. = 2 to 2.5 r.

Abactinal surface of body covered by a moderately thick integument, which obscures the abactinal plates in living or alcoholic specimens. In dry specimens the integument shrinks and the abactinal plates can be seen. The abactinal plates, at least on the disc and radial areas, are irregularly placed, of varying size and heights, thus giving the general surface an uneven and rugged appearance. They are only very slightly imbricated, sometimes disjointed, leaving small membranous areas between them. The plates are bare except for minute granule-like bosses which can be seen under a high magnification. Abactinal plates in the inter-radial regions are more or less regularly arranged in rows, smaller and more evenly graded in height than those on the disc and radial regions. In young specimens some inter-radial plates carry a small, single, upright spinelet.

Several large plates on the disc are arranged in the form of a central crown, from which five inter-radial bands of plates arise to proceed towards the margin. These inter-radial bands are conspicuous owing to their large size and also because no papular pores occur to separate and break them up.

The papular pores are isolated, of large size and confined to the disc and radial regions. They are arranged in a more or less serial order. In young specimens four series of pores run from the disc down the top of each ray towards the terminal plate. The inner pair end about half way from the centre of the disc to the terminal plate, while the outer pair continue on for some distance beyond that point. In older specimens six rows or series of papular pores leave the disc to run down the top of each ray towards the terminal plate. The outermost pair ends abruptly shortly after leaving the disc, the innermost pair ends by uniting some distance from the terminal plate, while the intermediate pair proceeds for the greatest distance to end just short of the terminal plate.

The madreporite, which is situated at a point about one-third the distance from the anal aperture to the margin, is embedded in one of the five inter-radial bands of plates described above. Its surface is on a level with the general surface.

The terminal plate is fairly well developed in large specimens and is about one-third the total width of the end of the ray. It is armed with from one to four small sacculate spinelets situated in a transverse row on the distal half.

The superomarginal plates appear to be lost among the plates of the abactinal surface near the margin. They cannot be disassociated or recognized as a definite series.

The inferomarginal series, however, is very prominent. The plates of this series, together with some on the edge of the abactinal surface, are produced to form a conspicuous flange which completely encircles the body. The inferomarginals in juvenile specimens carry three to four webbed and sacculate spinelets. These spinelets are of considerable length, thus making the lateral flange more prominent. In older specimens one to three spinelets, usually two, occur on the outside edge of each inferomarginal. Being long, of a sacculate nature, poorly calcified, and webbed for the greater portion of their length they appear, as Dr. Clark states, like long pedicellariæ.

The actinal surface is invested in a thin transparent membrane, which does not conceal the faintly imbricated nature of the actual intermediate plates. These latter are arranged in regular order, and have been described in detail by Dr. Clark in his description of *Habroporina pulchella*. Many are provided with a single long, sacculate spinelet which is swollen basally. Near the oral plates such spinelets are lacking, their places being occupied by an irregularly shaped uncalcified membrane of fairly large size. In some instances one or two "floating" plates are to be seen in the substance of the membrane.

On the furrow margin of each adambulacral plate is a comb made up of from two to four (usually three or four according to age) long, poorly calcified spinelets united laterally by a thin membrane. Immediately behind, and on the actinal surface of each adambulacral plate, is a single, unusually long sacculate spine with a swollen base. Each adambulacral plate is separated to some extent from its neighbour by a small uncalcified area which is situated at the base of the furrow comb. In young examples four, and in older specimens up to six, webbed marginal spines occur on each oral plate. The innermost is always the longest and the outermost the shortest. On the surface of each oral plate is a long sacculate spine. This is really the last spine of the actinal adambulacral series.

For colour in life see Clark (*loc. cit.*).

Type locality.—New Caledonia (Perrier).

Localities of material examined.—

Noumea, New Caledonia (Austr. Mus. Reg. No. J. 5042) R. = 15 mm.

Murray Island, Torres Strait (Austr. Mus. Reg. No. J. 5619) R. = approx. 10 mm., rays curled).

Michaelmas Cay, off Cairns, Queensland (Austr. Mus. Reg. No. J. 4947)
Two specimens, R. = 20 mm., R. = 17 mm.

Disasterina leptacantha (H. L. Clark).

(Pl. iii, figs. 5-6; pl. iv, figs. 1, 4.)

Asterina leptacantha H. L. Clark, Biol. Results F.I.S. "Endeavour," Sydney, iv, pt. 1, 1916, p. 57, pl. xviii, figs. 3-4.

The holotype of this species, which is housed in the Australian Museum, Sydney, has been used, along with several other specimens, in the preparation of

the following description. There can be absolutely no doubt about the close relationship between this species and *abnormalis*, and grouping them under one generic heading is, I believe, most desirable.

Description.—Rays five. $R. = 2$ to 2.5 r. Disc slightly elevated. The rays are also slightly elevated and each ends in a blunt, somewhat rounded manner. The abactinal plates are not so well imbricated as in species of allied genera and on the whole are more loosely arranged. They are deeply notched on the upper side for the passage of the papulae. In adult examples all abactinal plates are bare except those immediately surrounding the anal pore and madreporite. Plates occupying such a position are armed with numerous, small, needle-like spinelets. In young examples many abactinal plates carry a single, or a row of several, small spinelets. This armed character of the abactinal plates is most noticeable in the inter-radial regions. In young specimens the arrangement of the abactinal plates, particularly on the disc and radial regions, is not regular, but in older examples a somewhat regular, but far from perfect, order exists. In many of the specimens before me some abactinal plates are wholly covered and obscured by a thin integument such as is seen in *abnormalis*. In mature examples ten to twelve irregular series of abactinal plates are to be counted at the base of each ray.

The terminal plate is fairly well developed.

In adults the papular pores are large and conspicuous as seen in *abnormalis*. Five to seven series of pores occur at the base of each ray, but only two or three rows extend beyond half the length of the ray. In young examples the papular pores are not regularly arranged into rows or series.

The superomarginal plates are perfectly bare and very small.

The inferomarginals are very conspicuous and by the aid of their spines form a well defined flange. Each inferomarginal plate in adult examples carries a tuft of delicate needle-like spinelets of considerable length.

These spinelets vary in number but never less than twelve occur on each plate. In young examples the long tuft-like growth of spinelets is absent. Their place is taken by a single row of from four to five short thin spinelets.

Except in the vicinity of the mouth every actinal intermediate plate carries a long, centrally placed, sacculate spinelet exactly similar to those occurring in *abnormalis*. In each actinal intermediate area near the mouth there is a conspicuous patch of uncalcified membrane varying in size within the individual and sometimes bearing a "floating" plate complete with sacculate spinelet.

The adambulacral armature is in two series. The inner or furrow series is made up of combs containing from four to six (usually five, even in small examples) spinelets arranged in a fan-like manner and webbed for nearly their entire length. The outer series is made up of a row of single, long, sacculate spinelets, which are twice as long as those occurring on adjacent actinal intermediate plates. Each adambulacral plate is separated from its neighbour by a small patch of uncalcified integument as seen in *abnormalis*.

The number of spinelets bordering each oral plate ranges from seven to nine. The innermost is the largest and the outermost the smallest. A single, long, sacculate spinelet occurs on the actinal face of each oral plate. When examining the holotype Dr. Clark evidently overlooked several spinelets which are now seen to border the oral plates. This explanation will serve to correct any discrepancy between his published observations and my own.

Type locality.—Masthead Island, Queensland.

Localities of material examined:—

Masthead Island, Capricorn Group, Queensland (Austr. Mus. Reg. No. J. 3082) Holotype, R = 18 mm.

Masthead Island, Capricorn Group, Queensland (Austr. Mus. Reg. No. J. 1697), R. = 11 mm., ray curled.

Norwest Island, Capricorn Group, Queensland (Austr. Mus. Reg. Nos. J. 5506), J. 5179, J. 5604, J. 5600), eight specimens, R. = 12.5 to 18.5 mm.

Heron Island, Capricorn Group, Queensland (Austr. Mus. Reg. No. J. 5172), four specimens, R. = 12 to 24.5 mm.

Remarks.—This species is not very common at any of the above localities. It is usually found under dead coral boulders in pools at low tide.

***Disasterina praesignis* sp. nov.**

(Pl. i, figs. 5, 8; pl. ii, fig. 5.)

Description.—General form of body as in species of *Asterina*. Rays of moderate length, rounded and flattened at their free extremities. R. = 14 mm., r. = 8 mm., R. = 1.7 r. Br. at base of ray 9.5 mm. Disc and rays moderately elevated with a deep suture in each inter-radius. The presence of this latter may be due to the dry condition of the specimen. Abactinal plates strongly imbricated, particularly on the disc and base of rays; nowhere covered by a thickened membrane or integument. The plates are notched on their upper sides for the passage of the papulae. The abactinal plates on the disc are of varying sizes and shapes and not arranged in any definite order. In the inter-radial regions near the interbrachial arcs the abactinal plates are very small and only moderately imbricated. All the abactinal plates are bare and wholly unarmed, except a few surrounding the anal pores and madreporite, which are provided with small granule-like spinelets. The anal pore, which is central in position, is more or less completely surrounded by a ring of very large crescentic plates almost upright in position.

The terminal plate is moderately developed, and occupies about one-third to one-quarter the distance across the tip of the ray.

The papular pores are fairly numerous and on the disc are not regularly arranged. About eight series of papular pores run from the base of each ray towards the tip, but only three or four reach a point beyond half the length of the ray. No papular pores occur between plates near, or at the ends of, the rays.

The superomarginal plates are very large and prominent, not small and hard to detect as in other species of the genus. They are heart-shaped and in size are at least twice as large as adjacent abactinal plates. The superomarginals, together with the inferomarginals and their attached spinelets, form a prominent flange around the body.

The inferomarginal plates are well developed but not as large as the superomarginals. Each inferomarginal plate carries a tuft of from four to six very small and short spinelets which are not webbed.

The actinal intermediate plates are regularly arranged into about nine chevrons. Each plate, except in the vicinity of the oral plates, carries a single, long, sacculate spinelet as in the two other species of the genus.

The adambulacral armature is in two series. The inner or furrow series is made up of combs containing from three to four spinelets, usually four, webbed

for less than half their length. The furrow spinelets, which are placed close together and not arranged fanwise, are relatively long and slender, tapering gradually towards their pointed free extremities. The two inner spinelets of each oomb are the longest and are of equal length. The two outermost spinelets are a little shorter yet equal one another in length. The outer adambulacral series is in the form of a single row of spinelets, one spinelet to each adambulacral plate. These spinelets are of a sacculate nature, long, and tapering to a sharp point, very similar to, but twice as long as, spinelets occurring on the actinal intermediate plates. Each adambulacral plate is conspicuously separated actinally from its neighbour by a rectangular patch of uncalcified membrane, which can be seen between the inner and outer series of adambulacral spines. Certain plates near the mouth in each actinal intermediate area are replaced by a patch of uncalcified membrane of irregular shape and comparatively large size. It can be easily seen with the unaided eye as in other members of the genus. One to three actinal intermediate plates appear to be "floating" in the substance of the membrane, and in some instances these plates carry the usual central, sacculate spinelet.

The oral plates are small and carry from eight to nine marginal spinelets, which are webbed for only a small part of their length. The innermost spine, which is the longest, is strong and robust. The remainder fall away very rapidly in length, the last spine being very small and inconspicuous. A single, long, sacculate spine, slightly shorter than the innermost of the marginal series, occurs on the actinal face of each oral plate.

Locality.—North Channel, off Curtis Island, Port Curtis, Queensland. Dredged in three to four fathoms, July, 1929 (Austr. Museum Reg. No. J. 5059). One specimen, the holotype.

Remarks.—This species is undoubtedly related to the two foregoing species of *Disasterina*, and should be placed in that genus for reasons given earlier in this paper. Its main points of difference lie in the general form of the body, the strongly imbricated character of the abactinal plates and the large size of the superomarginal plates. Evidently the species is not an inhabitant of the intertidal zone like the two other members of the genus. The collectors, Messrs. W. Boardman and M. Ward, have informed me that all their dredging operations off Curtis Island were carried out in fairly deep water and over ground that was always covered at low tide. The nature of the bottom tended to muddiness, with patches of dead and living coral.

Tegulaster gen. nov.

Diagnosis.—Rays five, long, each tapering only very slightly to a well rounded tip. Abactinal surface of each ray keeled longitudinally, the sides sloping away very abruptly so as to make the rays acutely triangular in section. Abactinal plates bare and of varying sizes; imbricated, not all arranged in regular order.

Actinal intermediate plates small, armed with from one to four webbed spinelets arranged in a straight line. Furrow spines five to six. Oral plates small. Pedicellariae present.

Genotype.—*Tegulaster emburyi* sp. nov.

Remarks.—Döderlein's *Disasterina ceylonica* and *Tegulaster emburyi* sp. nov., which is fully described in the following pages, are so closely related and so different from *Disasterina* as intended by Perrier that it seems most desirable to have them associated under one heading. Hence the reason for the creation of

the genus *Tegulaster*. Despite the fact that the Sub-family *Asterininae* contains many genera of uncertain value, which, to-day are in some confusion, I venture to adopt this course. Neither of the two above species can be placed in any existing genus, not even if the diagnoses are accepted in their broadest terms.

The genus *Tegulaster* can be distinguished from other genera within the sub-family *Asterininae* by its long, gradually tapering rays, the conspicuous keeled nature of the mid-radial plates of the rays and the abrupt falling away of the sides of the rays.

***Tegulaster emburyi* sp. nov.³**

(Pl. i, figs. 1, 3; pl. ii, figs. 2-3, 6 and 9.)

Description.—Rays five, R. = 19 mm., r. = 7.5 mm., Br. (at base of ray) 8.5 mm. R. = 2.5 r. and 2.2 br. The rays are sharply separated from the disc, each is strongly keeled longitudinally on the abactinal surface, the sides sloping away very abruptly to give the rays an acutely triangular appearance in section.

The interbrachial arcs are very acute.

The abactinal plates are, for the most part, in regular order, but near the ends of the rays they become irregular and uneven. All are imbricated, those in the median radial areas more strongly so than anywhere else. In addition, the abactinal plates in the median radial areas are considerably larger than any other plates on the abactinal surface. The abactinal plates are bare except for pedicellariae and a few small, centrally placed spinelets on the disc and plates near the margins. Under a good magnification the abactinal plates are seen to be somewhat rugged and covered by a glistening, transparent membrane. The centre of the disc is strongly marked off by a circle of five, large, crescentic plates, which are actually the first plates of the median radial series.

The plates within the enclosed area are much smaller than most plates of the abactinal surface. They are circular in shape, irregularly arranged, of a uniform size, and only very slightly imbricated.

The small madreporite is interradial in position, porous and not striated, slightly sunken below the level of the general surface, and roundly triangular in shape. The two upper angles of this triangular madreporite rest next to the primary plates of two of the median radial series.

The terminal plate is about twice the size of abactinal plates situated nearby. It is bare and rugged in appearance.

The papular pores are not always arranged in regular order. On the middle of the disc, within the circular area formed by the large crescentic primary plates of the median radial series, the pores are scattered and number about fifteen. Seven to eight series, sometimes broken, leave the disc to proceed down each ray. The four innermost series, although broken here and there as the median radial plates become irregularly arranged, reach almost to the terminal plate and are separated from that structure by about three small abactinal plates. The remaining series end at a point a little beyond half the length of the ray, or less as is often seen. One to three papular pores occur at random between interradial plates but never close to the margin. The abactinal plates are only very slightly notched or sinuated for the passage of the papulae.

Pedicellariae are fairly abundant but occur only on the abactinal surface. They are two-bladed, erect and forciform. Almost invariably each occupies a

³ Named for Mr. E. M. Embury, of Manilla, New South Wales, who was responsible for the expedition on which this species was collected.

place on the slightly notched upper surface of abactinal plates. Their close proximity to the papular pores indicates that they probably afford protection to the delicate papulae.

The superomarginals average thirty in number, are clearly defined, small, and circular. They are slightly domed and elevated somewhat beyond the level of the slightly larger abactinal plates nearby.

The inferomarginals also average about thirty in number. They project outward for some little distance beyond the superomarginals and are armed with a row of from three to six very short spinelets.

The actinal intermediate plates are arranged in six chevrons. Counting from the furrow the first series reaches to the tip of the ray. The second series, if uninterrupted by the third, also reaches to the tip of the ray. The third series sometimes reaches to the end of the ray at the expense of the second series. The fourth series terminates at a point a little beyond half the length of the ray while the remaining series proceed for only short distances along the ray. Each actinal intermediate plate carries a straight, centrally placed series of from one to four, usually two, spinelets which are webbed for about half their length. Single spines occur on plates situated near the margin.

The adambulacral armature is in two series. The inner, or furrow series, is made up of combs containing six to seven, usually six, spines arranged fanwise and webbed for nearly their entire length. The outer series, which is situated on the actinal surface, is made up of from two to four spinelets a little longer than those occurring on the actinal intermediate plates. In the distal half of the ray usually only two spinelets occur, but close to the mouth three predominate along with an occasional group of four. When three occur the central spinelet is, in most cases, the longest. When four occur the central pair are the longest.

The oral plates are comparatively small and inconspicuous. Eight to nine marginal spines occur on each oral plate. The innermost pair are very long; the innermost spine is the longest. A pair of long and unusually stout spines are placed well forward on the actinal surface of each oral plate. These are backed by four smaller spines arranged in a row.

Colour in Life.—The life colours of this species are very gaudy. The circular area on the middle of the disc is coloured a bright orange. Some plates in the inter-radial region are similarly coloured. The remainder of the abactinal surface is of a deep cream colour blotched irregularly here and there with large patches of both light and deep magenta. The actinal surface is creamish, with a few small and well-spaced patches of deep magenta.

Although the specimen was placed directly into an alcohol preservative when collected the colours faded only very slightly. Even when dried the specimen retained its brilliant colouration more or less completely. It appears to be obvious that, in this species, the plates themselves are not coloured. They are stained by a supply of pigment which oozes through certain papular pores and spreads over the creamish plates in the immediate vicinity. This process was witnessed as the specimen was drying after a brief sojourn in alcohol.

Locality.—Norwest Island, Capricorn Group, Queensland. Mr. F. A. McNeill who collected the specimen in January, 1932, informs me that the species was found living under a dead coral boulder near the north-eastern reef crest. (Aust. Mus. Regd. No. J. 5605). Holotype.

Affinities.—This species can be separated from *T. ceylonica* (Döderlein) by the slightly more regular arrangement of the abactinal plates, the greater number of spinelets in both series of the adambulacral armature, and by the fact that the actinal plates as a whole, carry more spinelets.

Asterinopsis praetermissa sp. nov.

(Pl. iii, figs. 1-2, pl. iv, figs. 2-3.)

Asterina penicillata (spelling of specific name obviously intended to be *penicillaris*, as it appears in Müller and Troschel's work quoted by Whitelegge), Whitelegge (*non* Lamarck), "Invertebrate Fauna of Port Jackson. . . ." Journ. Roy. Soc. N.S.W., xxiii, 1889, p. 40, species no. 62.

Description.—Rays five. In the holotype $R. = 36$ mm., $r. = 21$ mm., $R = 1.7$ r. In other specimens $R. = 1.4$ r. consistently. The disc and rays are only slightly elevated. The interbrachial arcs are wide and well rounded, not acute as in *A. penicillaris* (Lamarck). The abactinal plates are very small and of two types. Those arranged in a somewhat distinct median radial or carinal band on each ray smallest, round, irregularly disposed and not imbricated; those on sides of rays and in the inter-radial regions slightly larger, somewhat ovate, regularly arranged in longitudinal series (except near the margins), and slightly imbricated. Every abactinal plate is provided with a dome-like eminence or boss from which arises a thick, circular bunch of very fine and delicate spinelets, resembling the setae of certain Polychaet worms. These spines give the surface a peculiar furry appearance. The number of spinelets to each boss varies. On the disc and median radial bands the spinelets range from twenty to forty in number; on the sides of the rays and in the inter-radial regions about twelve to twenty-five are to be seen. In specimens smaller than the holotype the number of spines to each boss is relatively smaller. The abactinal plates are not wholly obscured by these spinelets. Everywhere on the abactinal surface bare patches of plates can be seen between the circular clumps of spines, particularly on the sides of the rays.

The papular pores are fairly numerous and occur singly only on the disc and radial areas. Varying according to the size of the specimen, eight to ten series leave the disc to travel down the rays. The inner six series reach almost to the terminal plate, the remainder end at distances usually less than half the length of the ray. Sometimes, however, one of the outer series may proceed for a short distance beyond half the length of the ray.

The terminal plate is comparatively small and is always covered by a number of small, short spinelets.

The madreporite, which is very small, is situated near the centre of the disc. It is circular and channelled.

The marginal plates are small, yet rendered prominent by their very regular arrangement. The superomarginals in the holotype number about one hundred in the interbrachial arc from terminal plate to terminal plate. They are circular in outline and slightly domed. Each is provided with a small tuft of spinelets similar in character to those found on adjacent abactinal plates. The inferomarginal series approach the superomarginals in number. They project slightly beyond the superomarginals and carry the usual tufts of spinelets. The actinal plates are wholly obscured by a covering membrane, but their whereabouts and arrangement can be gauged by the large circular tufts of slender and delicate spinelets which spring from them. All actinal plates, except those very near the margin, are regularly arranged. The series run outward from the furrow towards the margin, about eighty to ninety series occurring in each actinal intermediate area. Each actinal intermediate plate is armed with a circular tuft of about twenty-five spinelets, which are long and slender and decrease in size, height, and numbers as the margin is approached. These tufts are much more widely spaced than those on the abactinal plates so that the membrane covering the actinal plates is clearly seen.

The adambulacral armature is in two series. The inner or furrow series is made up of combs containing from seven to eight, usually eight, long, faintly tapering spinelets, almost of equal length and webbed for over half their length. The second or outer series, which is situated on the actinal surface, is made up of obliquely placed tufts of spinelets. About twenty-five spinelets, which are longer than similar spinelets occurring on nearby actinal intermediate plates, occur in a tuft.

The oral plates carry ten marginal spines. On the actinal surface of each plate a bunch of large spinelets, similar to those on actinal intermediate plates, are to be seen. Behind, and also on the actinal face of the plate, is a second but much smaller bunch of spinelets.

Localities and material examined.—

- Little Bay, south of Port Jackson, N.S. Wales; under stones in pools between tide marks (Austr. Mus. Reg. No. J. 4793). Holotype, R. = 36 mm.
 Port Jackson, N.S.W. (Austr. Mus. Reg. No. J 1913), one specimen, R. = 18.5 mm.
 Port Jackson, N.S.W. (Austr. Mus. Reg. No. J. 1911), one specimen, R. = 29.5 mm.
 Port Jackson, N.S.W. (Austr. Mus. Reg. No. J. 3196), two specimens, R. = 19 mm. and 13 mm.
 Port Jackson, N.S.W. (Austr. Mus. Reg. No. G. 7644), one specimen, R. = 25 mm.

Remarks.—This is the species referred to by Whitelegge (*loc. cit.*) when he recorded the occurrence of *penicillaris* from Port Jackson, N.S. Wales. *Asterinopsis penicillaris* (Lamarck), I believe, does not occur in Australian waters; likewise I am of the opinion that, when the existing records of the species are checked some will be found to be based on other species. Goto (1914) has already denied its existence in Japanese waters and Clark (1923), throws doubt on the Red Sea records. The meagre description of *penicillaris* in the first place, and the naturally erroneous impressions gained from it later, have largely contributed to the confusion. So far as can be learned no author has given a satisfactory description and figures of the species from which its true characteristics can be gained. Until this is done the species seems destined to be confused with allied species. However, sufficient information can be gained from the old descriptions to convince one that *praetermissa* is distinct.

Asterinopsis praetermissa can be distinguished from *A. penicillaris* principally by its relatively shorter rays, its wide interbranchial arcs and the greater number of furrow spines.

***Asterinopsis grandis* (H. L. Clark).**

(Pl. iii, figs. 3-4, pl. iv, figs. 5, 8.)

Nepanthia grandis H. L. Clark, Rec. South Austr. Museum, iii, No. 4, 1928, p. 393, and figs. 113 a-d in the text.

Asterina sp. Whitelegge, "Invertebrate Fauna of Port Jackson . . ."; Journ. Roy. Soc. N.S.W., 1889, No. 63 on p. 40.

The specimens before me have been compared with the holotype and other specimens examined by Dr. H. L. Clark kindly sent to me on loan by the authorities of the South Australian Museum. The comparison has proved beyond doubt that the Australian Museum specimens are referable to *grandis*.

Whitelegge's "*Asterina* sp." is undoubtedly a synonym of *A. grandis*. That author furnishes a clue to the identity of the species he intended by stating "Allied to the last [*A. penicillaris*—printed as *penicillata* in his work and described in this contribution as a new species, *Asterinopsis praetermissa*] but distinct from it."

The placing of *grandis* in the genus *Asterinopsis* calls for some explanation. In the first place it is considered that *Nepanthia*, as at present understood, is sufficiently distinct to be disregarded in the question. In adopting this belief I have not lost sight of Dr. Clark's able and valued comments (*loc. cit.*), or the fact that *grandis* is not entirely destitute of some slight claim to a position in *Nepanthia*, but in general form of the disc and rays *grandis* is so unlike species of *Nepanthia* that I cannot at present admit the association. Further, although Dr. Clark claims that the skeleton of *grandis* resembles that of a *Nepanthia*, I find that in all but old and fully mature examples no such resemblance can be seen.

The species *grandis* approaches much closer to *Paranepanthia* Fisher than to *Nepanthia*, and, were it not for the fact that *Paranepanthia* is of doubtful value as a genus, being probably a synonym of *Asterinopsis*, I would have no hesitation in referring *grandis* to it. If *Paranepanthia* is to be retained it will be necessary to find some means of disassociating it more clearly from *Asterinopsis*. Fisher⁴ admits that "The gap between *Asterinopsis* and *Paranepanthia* is not great."

Localities and material examined.—Apart from the material obtained on loan from the South Australian Museum the following material has been examined:—

Simpson's Bay, d'Entrecasteaux Channel, Tasmania, dredged (Austr. Mus. Reg. No. J. 5009), five specimens, R. = 31 to 50 mm.

Neilsen Park, Port Jackson, N.S.W., under stones between tide marks (Austr. Mus. Reg. No. J. 4630), one specimen, R. = 40 mm.

Port Jackson, N.S.W. (Austr. Mus. Reg. No. J. 1901), one specimen, R. = 28 mm.

Shellharbour, N.S.W. (Austr. Mus. Reg. No. J. 4939), one specimen, R. = 13 mm.

Watson's Bay, Port Jackson, N.S.W. (Austr. Mus. Reg. Nos. J. 441 and J. 443), two specimens, R. = 11.5 mm. and R. = 12.5 mm.

***Patiriella mimica* sp. nov.**

(Pl. i, figs. 6-7; pl. ii, figs. 8, 10-11.)

Description.—Body large and robust as in *calcar*; disc elevated and dome-like. Rays five; R. = 24 mm., r. = 14 mm., R. = 1.7 r. Interbrachial arcs well rounded, not relatively acute as in *calcar*.

The abactinal plates are distinct, crescentic, well imbricated except near the margins. They carry, along with the secondary abactinal ossicles, a coarse granulation which does not extend down the sloping sides of the plates being confined mostly to the elevated portions. The granulation, although coarse, is noticeably finer than that covering the abactinal plates of *calcar*. The largest abactinal plates are strongly crescentic and occur on the disc where some are arranged to form an irregular circle enclosing an area containing small, circular and well granulated ossicles.

⁴ Fisher, U.S. Nat. Museum Bull. 100, vol. 3, 1919, p. 419.

The papular pores are fairly numerous and lie in groups of from one to four in the crescentic upper surface of the abactinal plates. They are not conspicuous. Radially, the papular pores reach to the terminal plate, while inter-radially they reach to a point about half way from the centre of the disc to the margin.

The superomarginal plates are small and armed with from two to four small spine-like granules. The inferomarginal plates are larger than the superomarginals and project outward some distance to form a small flange. They are unarmed and rounded at their free extremities.

The actinal intermediate plates are arranged into nine to eleven chevrons. They are raised centrally and slightly imbricated. On each raised central portion there is a single, short, conical spine, which, when near the margin, is small, and when near the mouth, larger and better developed. Sometimes two spines, arranged fork-like, occur on plates near the margin.

The adambulacral armature is in two series. The furrow series is composed of paired spines, the innermost of each pair being usually about half to two-thirds the length of its neighbour.

The second or outer series are arranged singly and in line with the furrow. These spines are comparatively long, stout, and bluntly pointed.

The oral plates carry five marginal spines. The two innermost are much longer and thicker than the remaining three. All marginal spines are comparatively short, stout, and bluntly pointed, not long and slender as in *calcar*. A fairly large spine is situated on the actinal face of each oral plate.

Locality.—Newcastle Bight, New South Wales, sixteen to nineteen fathoms (Austr. Museum Reg. No. J. 1696), one specimen, the holotype.

Affinities and Remarks.—*Patiriella mimica* is closely allied to the common intertidal New South Wales species, *P. calcar* (Lamarck), and the specific name *mimica* has been chosen to indicate this fact. Apart from the number of rays, a close examination is necessary before the distinguishing features are fully revealed. *P. mimica* can be separated from *P. calcar* in having five rays instead of from seven to eight (usually eight); in having a finer and denser granulation on plates of the abactinal surface; in having broader rays, and by the fact that the marginal spines of the oral plates are numerically greater, relatively shorter and more dwarfed.

***Patiriella inornata* sp. nov.**

(Pl. i, figs. 2, 4; pl. ii, figs. 1, 4, 7.)

Description.—Rays five; R. = 27 mm., r. = 15 mm., R. = 1.8 r. The body is moderately elevated. The abactinal plates are, for the most part, only very slightly imbricated. Those on the disc are not regularly arranged and show very little sign of being imbricated at all, while those on the tops of the rays are crescentic, more or less regularly arranged, and show clearly their imbricated character. The abactinal plates in the interradial areas are almost round in outline, small, and slightly imbricated. All the abactinal plates are covered by coarse and comparatively widely spaced granules.

The superomarginal plates are roundly rectangular in shape, bare, and although not conspicuous, are almost twice the size of abactinal plates nearby. About forty-five superomarginal plates occur on the side of a ray. The inferomarginal plates project for a short distance outwards beyond the superomarginals. They are bare and less than half the size of the superomarginals.

The papular pores are fairly small and numerous. They occur at random on the disc, and, radially, are arranged into twelve or more somewhat irregular series, about six of which reach to the tip of the ray.

The madreporite is almost central in position. It is finely and intricately channelled and unusually large, being four mm. across its widest part. The terminal plate is small, bare, and inconspicuous.

The actinal intermediate plates are not distinguishable, but their positions are indicated by the spinelets springing from them; they are arranged in from nine to eleven chevrons. Near the mouth the actinal intermediate plates are large, the spinelets springing from them being widely spaced; towards the margins the plates become suddenly smaller and crowded. Each actinal intermediate plate is armed with from one to three (usually one) short conical spinelets. Near the margin the spinelets are single and placed closer together. From two to four series of plates reach to the tip of the ray.

The adambulacral armature is in two series. The furrow series is composed of combs containing two to three very short spinelets of varying lengths. In the case of combs made up of three spinelets the centre one is usually the longest. Stress is laid upon the very short and inconspicuous nature of the furrow series. The outer series is made up of spinelets arranged in groups of from one to three. Sometimes the groups are obliquely placed, but usually they are arranged so as to be parallel to the furrow. Single spines occur mostly near the tips of the rays.

The oral plates, which are of moderate size, are provided with four marginal spines. The innermost is the longest. It is flat, slightly hollowed or channelled longitudinally, and sinuated at its free extremity so as to make it appear forked. Each oral plate carries on its actinal face from two to four spines arranged in a line parallel to the furrow.

Locality.—Western Australia (Austr. Mus. Reg. No. J. 3198), one specimen, the holotype.

Affinities.—This species can be easily separated from its nearest allies, *P. calcar* and *P. mimica*, principally by the lack of an abactinal surface made up of well imbricated and conspicuously crescentic plates; by the character of the adambulacral armature and the unusual nature of the innermost marginal spines of the oral plates

EXPLANATION OF PLATES.

PLATE I.

- Fig. 1.—*Tegulaster emburyi* gen. et. sp. nov. Actinal surface of holotype (Austr. Mus. Reg. No. J. 5605). x 1.5.
- Fig. 2.—*Patiriella inornata* sp. nov. Abactinal surface of holotype (Austr. Mus. Reg. No. J. 3198). Slightly over nat. size.
- Fig. 3.—*Tegulaster emburyi* gen. et. sp. nov. Abactinal surface of holotype (Austr. Mus. Reg. No. J. 5605). x 1.5.
- Fig. 4.—*Patiriella inornata* sp. nov. Actinal surface of holotype (Austr. Mus. Reg. No. J. 3198). x 1.5.
- Fig. 5.—*Disasterina praesignis* sp. nov. Actinal surface of holotype (Austr. Mus. Reg. No. J. 5059). x 1.75.
- Fig. 6.—*Patiriella mimica* sp. nov. Actinal surface of holotype (Austr. Mus. Reg. No. J. 1696). x 1.5.
- Fig. 7.—*Patiriella mimica* sp. nov. Abactinal surface of holotype (Austr. Mus. Reg. No. J. 1696). x 1.5.
- Fig. 8.—*Disasterina praesignis* sp. nov. Abactinal surface of holotype (Austr. Mus. Reg. No. J. 5059). x 1.75.

PLATE II.

- Fig. 1.—*Patiriella inornata* sp. nov. Enlarged view of oral plates and associated marginal spines in the holotype (Austr. Mus. Reg. No. J. 3198). x 4.
- Fig. 2.—*Tegulaster emburyi* gen. et. sp. nov. Enlarged view of portion of ray of holotype showing the slight granulation of the plates, the spinulation of the inferomarginal plates, and the unarmed character of the superomarginals (Austr. Mus. Reg. No. J. 5605). x 6.
- Fig. 3.—*Tegulaster emburyi* gen. et. sp. nov. Oral plates and associated spinelets in holotype (Austr. Mus. Reg. No. J. 5605). x 5.
- Fig. 4.—*Patiriella inornata* sp. nov. Enlarged view of portion of abactinal surface of holotype (Austr. Mus. Reg. No. J. 3198). x 4.
- Fig. 5.—*Disasterina praesignis* sp. nov. Enlarged portion of actinal surface of holotype showing oral plates, actinal intermediate plates with sacculate spinelets, and the uncalcified membrane with unarmed plates "floating" in its substance (Austr. Mus. Reg. No. J. 5059). Approx. x 5.
- Fig. 6.—*Tegulaster emburyi* sp. nov. Portion of abactinal interradial area showing imbricated plates and pedicellariae in the holotype (Austr. Mus. Reg. No. J. 5605). Approx. x 8.
- Fig. 7.—*Patiriella inornata* sp. nov. Portion of adambulacral armature and actinal plates nearby in holotype (Austr. Mus. Reg. No. J. 3198). Approx. x 4.
- Fig. 8.—*Patiriella mimica* sp. nov. Oral plates and associated spinelets in the holotype (Austr. Mus. Reg. No. J. 1696). x 4.
- Fig. 9.—*Tegulaster emburyi* gen. et. sp. nov. Adambulacral armature of holotype (Austr. Mus. Reg. No. J. 5605). Approx. 6.
- Fig. 10.—*Patiriella mimica* sp. nov. Adambulacral armature of holotype (Austr. Mus. Reg. No. J. 1696). Approx. x 6.
- Fig. 11.—*Patiriella mimica* sp. nov. Portion of abactinal surface of holotype (Austr. Mus. Reg. No. J. 1696). x 8.

PLATE III.

- Fig. 1.—*Asterinopsis praetermissa* sp. nov. Abactinal surface of holotype (Austr. Mus. Reg. No. J. 4793). Nat. size.
- Fig. 2.—*Asterinopsis praetermissa* sp. nov. Actinal surface of same specimen as Fig. 1. Nat. size.
- Fig. 3.—*Asterinopsis grandis* (H. L. Clark). Abactinal surface of specimen from Port Jackson, N.S.W. (Austr. Mus. Reg. No. J. 1901). Slightly over nat. size.
- Fig. 4.—*Asterinopsis grandis* (H. L. Clark). Actinal surface of same specimen as Fig. 3. Slightly over nat. size.
- Fig. 5.—*Disasterina leptacantha* (H. L. Clark). Abactinal surface of specimen from Heron Island, Capricorn Group, Queensland (Austr. Mus. Reg. No. J. 5172, part). x 1.5.
- Fig. 6.—*Disasterina leptacantha* (H. L. Clark). Actinal surface of same specimen as Fig. 5. x 1.5.

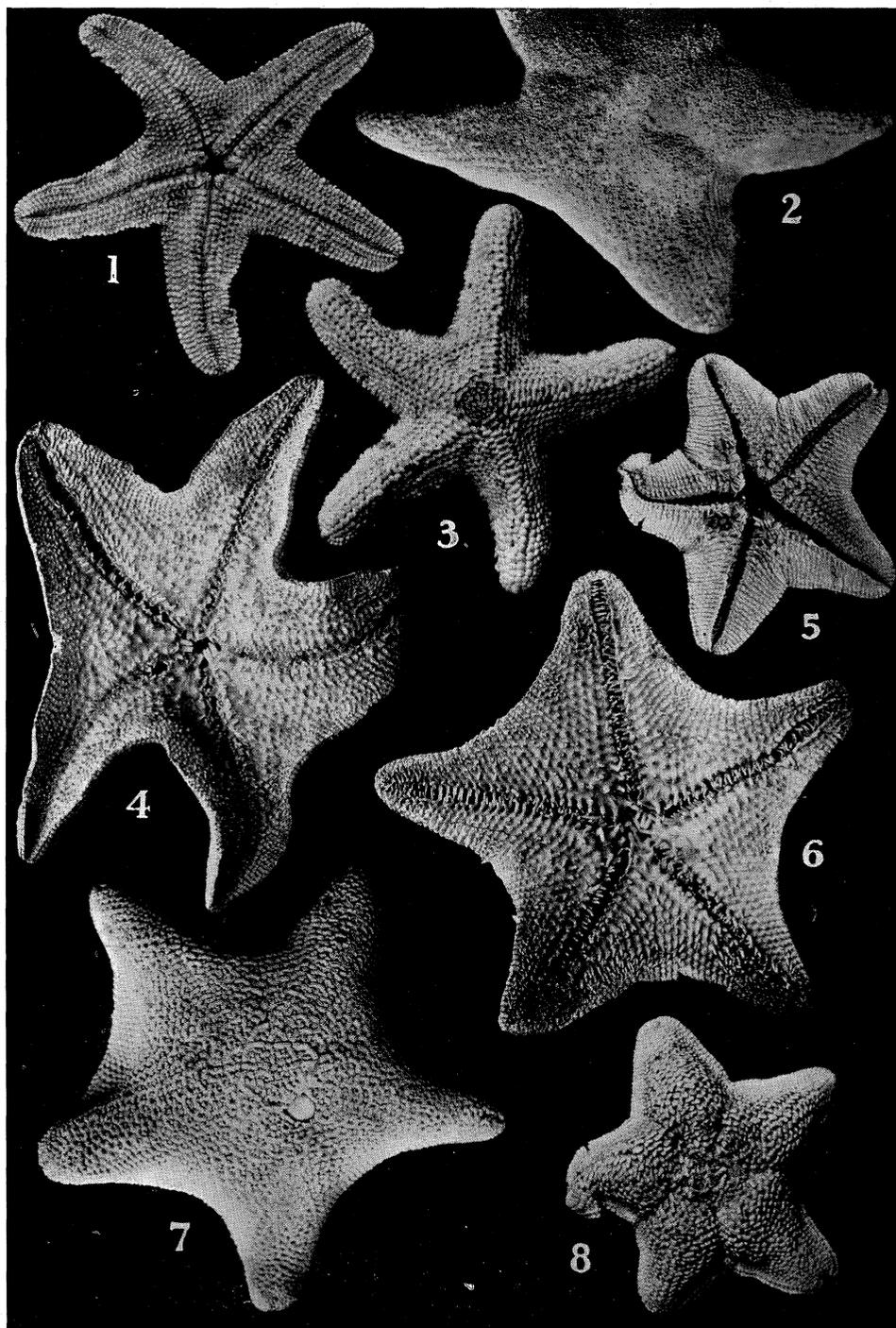
PLATE IV.

- Fig. 1.—*Disasterina leptacantha* (H. L. Clark). Enlarged portion of side of ray showing the well-developed marginal spinulation and the character of the abactinal plates (Austr. Mus. Reg. No. J. 5172, part). x 7.
- Fig. 2.—*Asterinopsis praetermissa* sp. nov. Enlarged section of actinal surface showing character of the oral plates and adambulacral armature (Austr. Mus. Reg. No. J. 4793). Holotype. x 4.
- Fig. 3.—*Asterinopsis praetermissa* sp. nov. Enlarged portion of actinal intermediate area showing character of spinulation on the plates. Same specimen as Fig. 2. Approx. x 6.
- Fig. 4.—*Disasterina leptacantha* (H. L. Clark). Spinulation of oral plates and character of adambulacral armature. The non-calcified patches are situated immediately behind the oral plates. The lower patch carries a "floating" plate. Same specimen as Fig. 1. x 5.

- Fig. 5.—*Asterinopsis grandis* (H. L. Clark). Oral plates and associated spinulation (Austr. Mus. Reg. No. J. 1901). x 5.
- Fig. 6.—*Disasterina abnormalis* Perrier. Actinal surface of specimen from New Caledonia (Austr. Mus. Reg. No. J. 5042). x 1.5.
- Fig. 7.—*Disasterina abnormalis* Perrier. Abactinal surface of same specimen as Fig. 6. x 1.5.
- Fig. 8.—*Asterinopsis grandis* (H. L. Clark). Spinulation of actinal intermediate plates and adambulacral plates. Same specimen as Fig. 5. Approx. x 6.
- Fig. 9.—*Disasterina abnormalis* Perrier. Abactinal surface of adult specimen from Michaelmas Cay, off Cairns, Queensland (Austr. Mus. Reg. No. J. 4947, part). x 1.5.

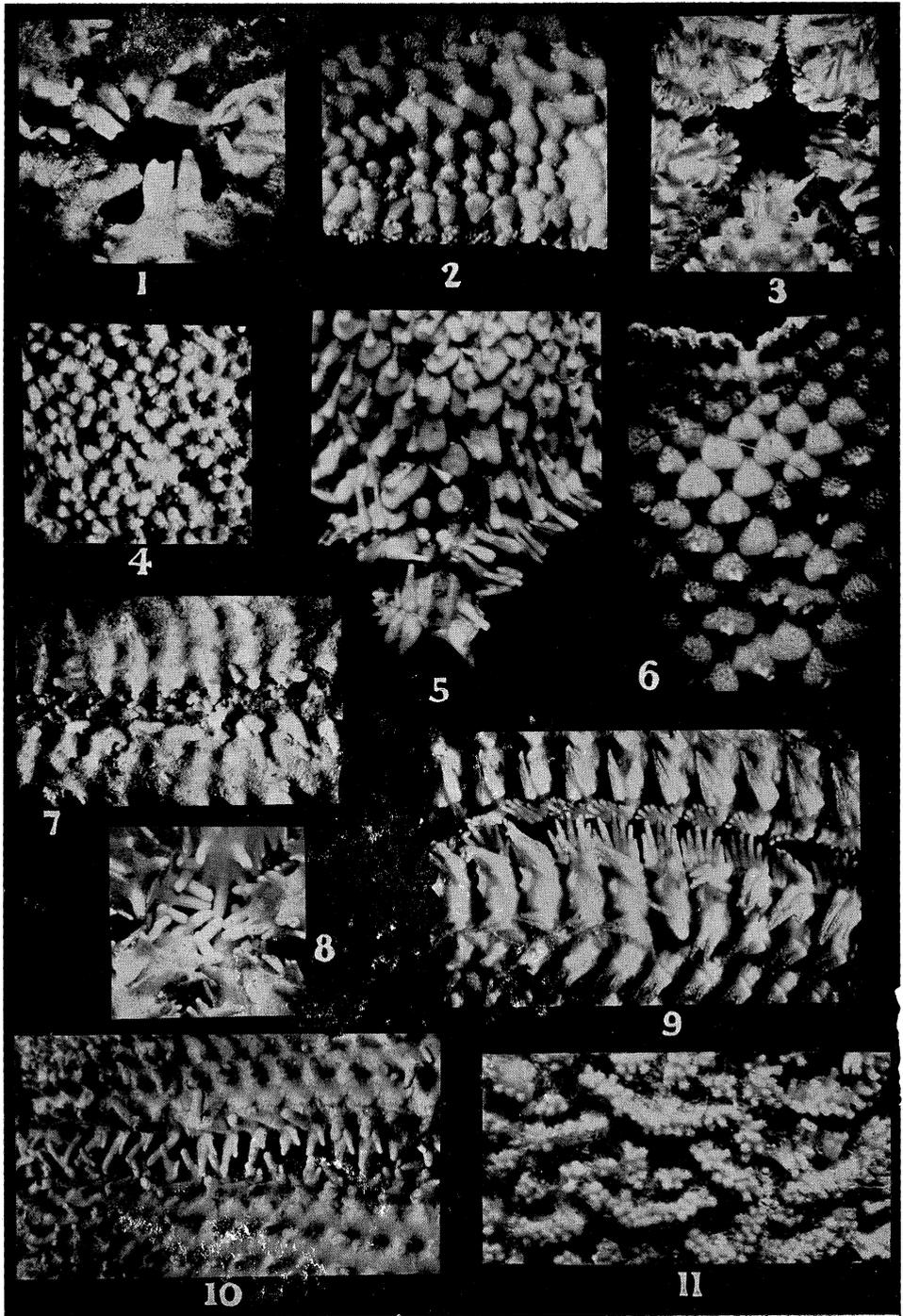
PLATE V.

- Figs. 1-5.—*Asterina inopinata* sp. nov. Juvenile examples showing the gradual movement of the interradial slits towards the margins where they disappear as growth proceeds. The marginal flange of spinelets is seen to be very highly developed in juvenile examples (Austr. Mus. Reg. No. J. 440, part). x 3.5.
- Fig. 6.—*Asterina inopinata* sp. nov. Actinal surface of holotype (Austr. Mus. Reg. No. J. 3077, part). Slightly under x 2.
- Fig. 7.—*Asterina inopinata* sp. nov. Abactinal surface of same specimen as Fig. 6. Slightly under x 2.
- Fig. 8.—*Asterina inopinata* sp. nov. Adambulacral armature of same specimen as Fig. 6. Approx. x 6.
- Fig. 9.—*Asterina scobinata* sp. nov. Actinal view of holotype (Austr. Mus. Reg. No. J. 1241). x 1.75.
- Fig. 10.—*Asterina scobinata* sp. nov. Abactinal surface of same specimen as Fig. 9. x 1.75.
- Fig. 11.—*Asterina scobinata* sp. nov. Oral plates of same specimen as Fig. 9. Approx. x 6.
- Fig. 12.—*Asterina scobinata* sp. nov. Enlarged section of abactinal surface showing plates and spinelets. Same specimen as Fig. 9. Approx. x 6.
- Fig. 13.—*Disasterina abnormalis* Perrier. Oral plates with spinulation and adambulacral armature. The non-calcified areas occur immediately behind the oral plates. The lowermost carries a "floating" plate (Austr. Mus. Reg. No. J. 5042). x 4.
- Fig. 14.—*Asterina inopinata* sp. nov. Oral plates and associated spinulation. Same specimen as Fig. 6. x 8.
- Fig. 15.—*Asterina scobinata* sp. nov. Adambulacral armature of same specimen as Fig. 9. Approx. x 6.
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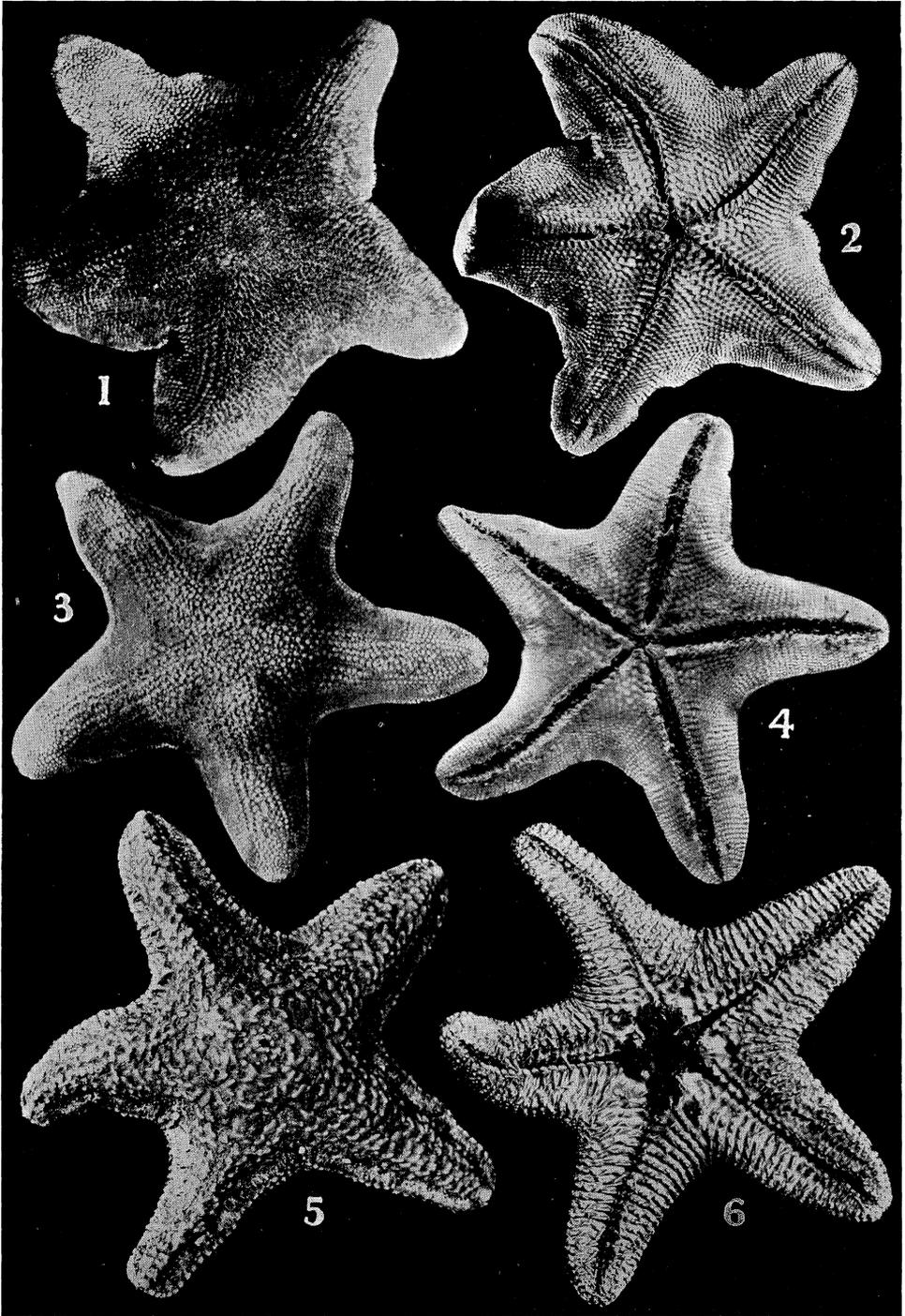


G. C. CLUTTON, photo.

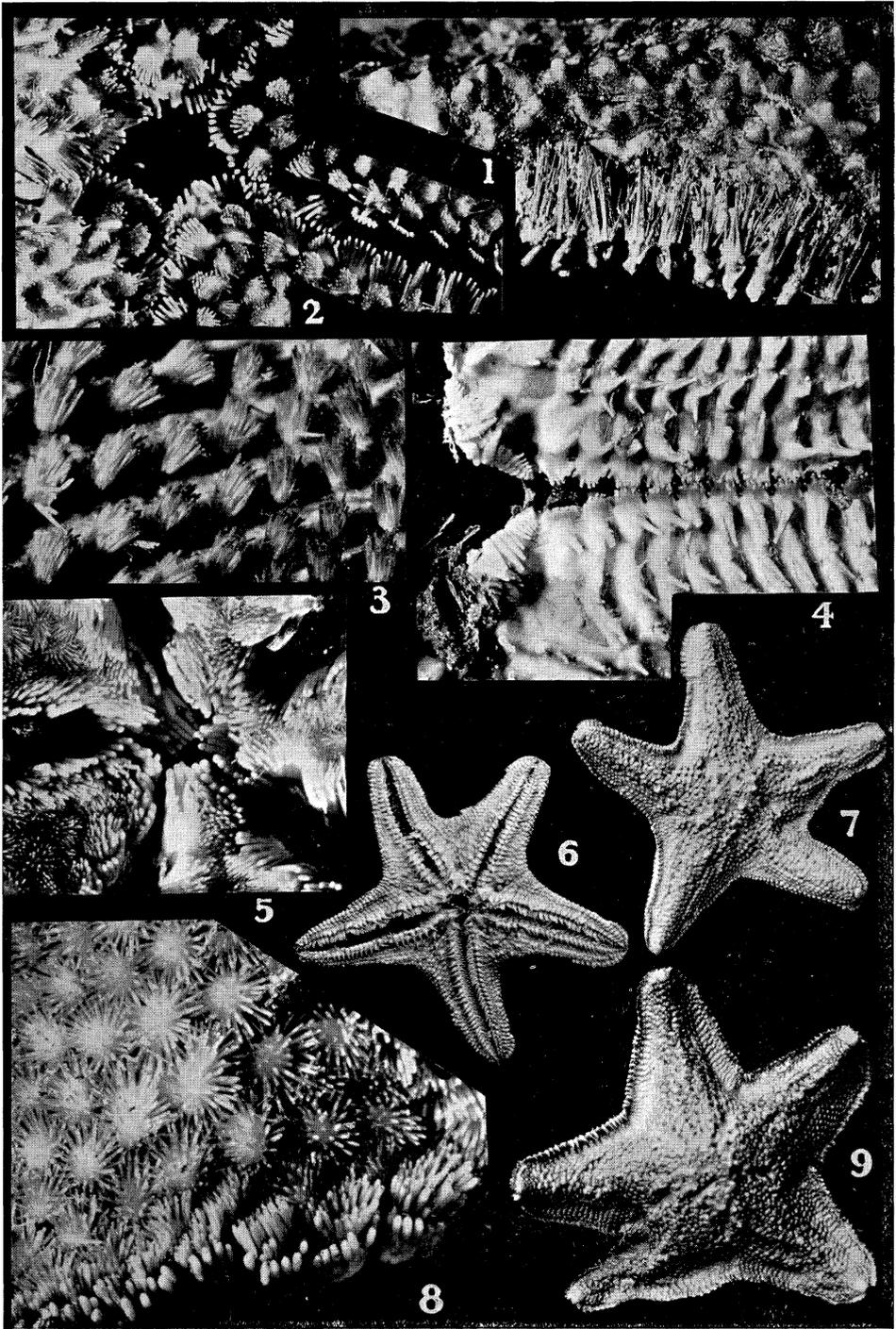
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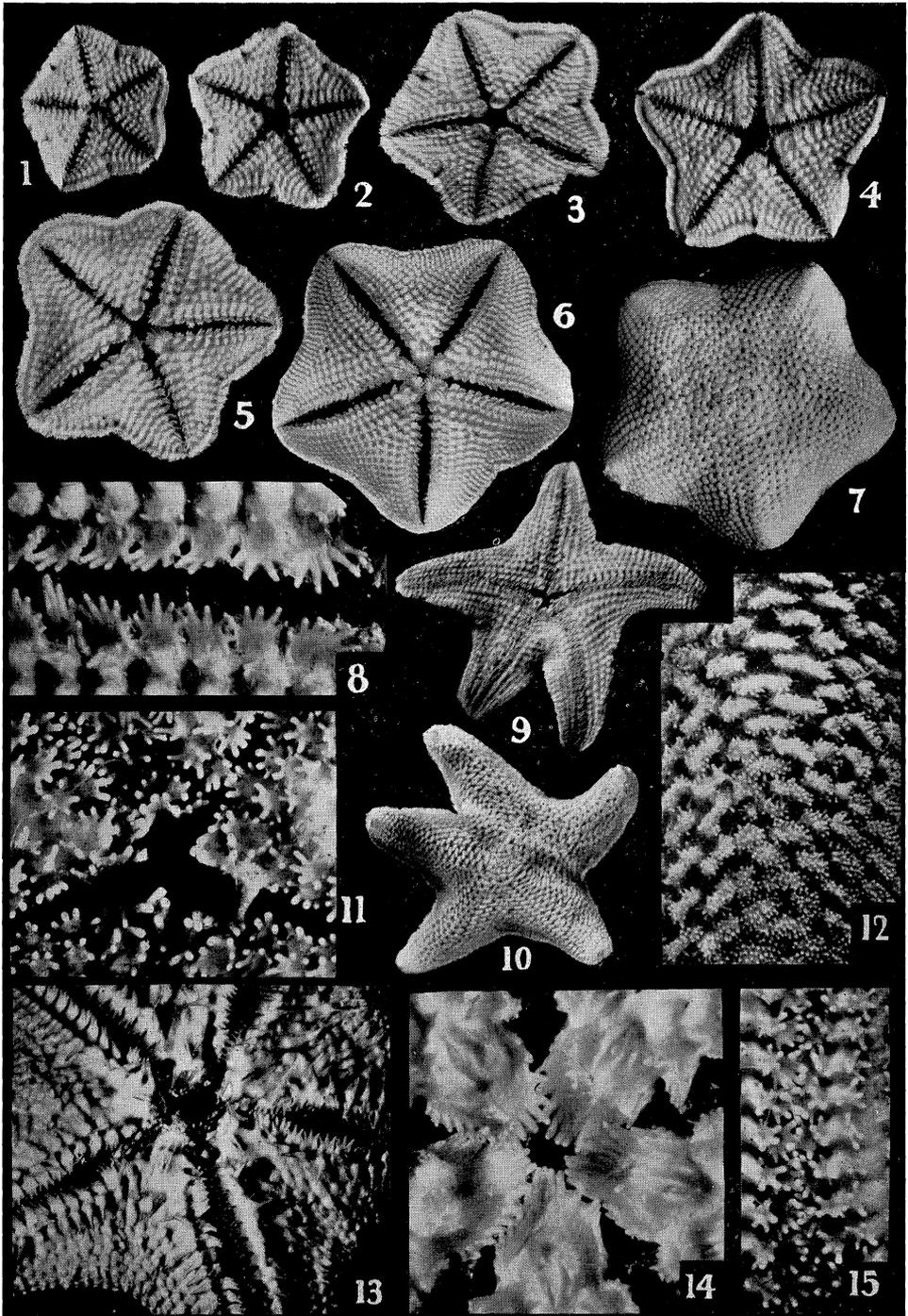
G. C. CLUTTON, photo.



G. C. CLUTTON, photo.



G. C. CLUTTON, photo.



G. C. CLUTTON, photo.