

AUSTRALASIAN ANTARCTIC EXPEDITION

1911-14.

UNDER THE LEADERSHIP OF SIR DOUGLAS MAWSON, O.B.E., B.E., D.Sc., F.R.S.

SCIENTIFIC REPORTS.

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VOL. IX, PART 3.

EDITED BY E. A. BRIGGS, D.Sc.,
UNIVERSITY OF SYDNEY.

ALCYONARIA, MADREPORARIA, AND ANTIPATHARIA.

BY

J. ARTHUR THOMSON, M.A., LL.D.,
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and

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WITH SEVEN PLATES.

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ALCYONARIA, MADREPORARIA, AND ANTIPATHARIA.

By Professor J. ARTHUR THOMSON, M.A., LL.D., University of Aberdeen, and
MISS NITA RENNET, B.Sc., University of Aberdeen.

(Plates VIII-XIV.)

INTRODUCTION.

THIS collection made by the Australasian Antarctic Expedition under the leadership of Sir Douglas Mawson, and entrusted to us for examination by the late Professor W. A. Haswell, D.Sc., F.R.S., includes :—

- 31 species of Alcyonarians, of which 7 are new ;
- 5 species of Madreporaria ; and
- 2 species of Antipatharia.

Very remarkable is the new type *Ainigmaptilon haswelli*, n. g. et sp. Somewhat surprising is a new type of sclerite, chalice-like in form, in the new genus *Ascolepis*.

LIST OF SPECIES.

ALCYONARIA.

ORDER I.—STOLONIFERA *Hickson*.

Family CORNULARIIDÆ.

Clavularia cylindrica Wright and Studer.

Clavularia rosea Studer.

ORDER II.—ALCYONACEA *Verrill (pro parte)*.

Family ALCYONIDÆ.

Alcyonium antarcticum Wright and Studer.

Family NEPHTHYIDÆ.

Eunephthya racemosa Studer.

ORDER III.—PSEUDAXONIA *G. von Koch.**Family* MELITODIDÆ.*Melitodes rugosa* Wright and Studer.ORDER IV.—AXIFERA *G. von Koch.**Family* ISIDÆ.*Primnoisis ambigua* Wright and Studer.*Primnoisis antarctica* (Studer).*Primnoisis armata* Kükenthal.*Primnoisis fragilis* Kükenthal.*Primnoisis sparsa* Wright and Studer.*Ceratoisis (Primnoisis) delicatula* Hickson.*Echinisis armata* (Kükenthal) n. g.*Mopsea tenuis* n. sp.*Family* PRIMNOIDÆ.*Callozostrom horridum* Kükenthal.*Primnoella antarctica* Kükenthal.*Primnoella australasica* Grey.*Primnoella distans* Studer.*Caligorgia ramosa* Kükenthal and Gorzawsky.*Caligorgia ventilabrum* Studer.*Ascolepis spinosa* n. g. et sp.*Ascolepis splendens* n. sp.*Thouarella longispinosa* Kükenthal.*Thouarella striata* Kükenthal.*Thouarella variabilis* Wright and Studer.*Dicholaphis delicatula* n. sp.*Family* MURICEIDÆ.*Astromuricea formosa* n. sp.*Family* GORGONIDÆ.*Leptogorgia sarmentosa* (Koch).

ORDER PENNATULACEA.

Family SCLEROPTILIDÆ.

Scleroptilum grandiflorum Kölliker.

Family UMBELLULIDÆ.

Umbellula carpenteri Kölliker.

Umbellula köllikeri Kükenthal.

Incertae sedis.

Ainigmaptilon haswelli Dean.

ACTINOZOA.

ORDER ACTINIIDEA.

Sub-order MADREPORARIA.

Caryophyllia clavus Sacchi.

Caryophyllia inskipi Duncan.

Caryophyllia vermiformis Duncan.

Flabellum australe Moseley.

Flabellum transversale Moseley.

ORDER ANTIPATHIDEA.

Bathypathes patula Brook.

Euantipathes plana (Cooper).

ALCYONARIA.

ORDER STOLONIFERA.

CLAVULARIA CYLINDRICA *Wright and Studer.*

(For description see Wright and Studer, "Challenger Report, Alcyonaria, 1889," p. 258, 2 figs.)

This identification cannot be regarded as altogether satisfactory, for the specimen is a mere fragment torn from a substratum, and bears only a few polyps. The upper portion is quite retractile into a corrugated calycine portion, with eight spiculose ridges, which stands about 3 mm. high. The retractile portion shows eight narrow triangles of spicules in chevron. When protruded, the upper portion projects about 2 mm. beyond the stiffer calyx. The ribbon-like basis is covered with longitudinally disposed spicules. The spicules are all spindles, straight or slightly bent, mostly with prominent warts, bluntly conical, usually simple. The following measurements were taken:— 0.32×0.03 ; 0.3×0.06 ; 0.2×0.04 mm. A few crosses occur, and there are minute spicules on the tentacles.

Locality.—Commonwealth Bay, Adelie Land; 25 fathoms; 3rd September, 1912.

Distribution.—Previously recorded from off Nightingale Island, Tristan da Cunha, 100–150 fathoms.

CLAVULARIA ROSEA *Studer.*

(For description see Studer, "Sitzber. Akad. Wiss. Berlin, 1878," p. 633, 2 figs.)

Polyps in crowded groups, about 6 mm. high, with a firm calyx wall built up of interlocked spindles so that large pieces can be separated off intact. At the top of the calyx there is a very slight indication of a division into eight bands; all the upper portions of the polyps are retracted. The calyx spicules are mostly thorny spindles with the thorns interlocking. There are also (a) some narrow style-like spindles with slight projections and (b) some small irregular bodies. Some of these look like artefacts, for the interlocking spindles are apt to break. Measurements taken:— 0.3×0.04 ; 0.2×0.05 ; 0.2×0.09 ; 0.1×0.04 ; 0.26×0.12 mm. This species is not far from Hickson's *C. flava*.

Locality.—Macquarie Island, 1912.

Distribution.—Previously recorded from N.W. of Kerguelen Island, 120 fathoms.

ORDER ALCYONACEA.

ALCYONIUM ANTARCTICUM *Wright and Studer.*

(Plate XI, fig. 1.)

(For description see Wright and Studer, "Challenger Report on Alcyonaria, 1889," p. 239, 1 fig.)

Several yellowish colonies with finger-like lobes, covered with numerous polyps, mostly expanded. With one colony a barnacle is associated. The base of the largest is growing round an Isid axis, and the colony rises to a height of 7 cm. It divides into two adjacent main portions, each with numerous finger-like branches extending more or less parallel to one another.

The extended anthocodiæ, 1.5-2 mm. in height, not counting the tentacles, show very distinct, heavily armoured longitudinal ridges of rough spindles, basally somewhat en chevron, but becoming more parallel towards the tentacles on to which they are continued. The cœnenchymal aperture shows eight distinct lobes.

The spicules agree with those described by Wright and Studer, but include (as in the Challenger figure) distinct pseudo-clubs of various sizes, derived from the spindle type, and also numerous simple (young) forms consisting of a rodlet with two whorls of very simple prominences and a simple ending beyond each whorl. The long *narrow* spindles with relatively sparse conical prominences are very characteristic.

Locality.—Station 3, 157 fathoms; 31st December, 1913.

Distribution.—Previously recorded from off Heard Island, 75 fathoms.

ALCYONIUM ANTARCTICUM *Wright and Studer.*

(For description see Wright and Studer "Challenger Report on Alcyonaria, 1889," p. 239, 1 fig.)

Two small much contracted brown colonies, attached to a tube like that of the Polychæt *Chaetopterus*. The height of both is about 2 cm. and they bear short rounded knobs, with completely retracted polyps.

The spicules include :—(a) long narrow spindles with scattered prominent warts; (b) spindles with marked zones of compound warts; (c) reductions of spindles to approximate ovals, thickly beset with zoned warts; (d) irregular double stars, approaching double spheres; (e) small quite irregular forms.

The following measurements were taken of spindles :—0.35 × 0.03; 0.2 × 0.04; 0.15 × 0.05; 0.1 × 0.05 mm. The specules agree on the whole with those figured by Wright and Studer, but there is evidence of the variability that is common in the specules of *Alcyonium*.

Locality.—Commonwealth Bay, Adelie Land, 25 fathoms.

Distribution.—Previously recorded from off Heard Island, 75 fathoms.

EUNEPHTHYA RACEMOSA *Studer.*

(Plate XI, fig. 2.)

(For description see Studer, "Alcyonaires de l'Hirondelle, 1901," p. 33, 2 figs.)

Three colonies growing on a tubular sponge. The absence of supporting bundle, the soft canal walls, the absence of a calyx and other features indicate the genus *Eunephtya*. The polyps are non-retractile, densely spiculate, and arranged in non-umbellate groups, about 4 mm. in height by 2 mm. in diameter, which cover the whole surface of the colony. It seems clear that the specimens should be referred to the group containing *Eunephtya racemosa*, and they differ but slightly from that species. The lower parts of the polyps show longitudinal rows of transversely disposed spicules, and above these a dense chevron arrangement. Most of the spicules are spindles with prominent tubercles either in whorls or irregularly disposed. There are small ones in the cortex which approach the double wheel type. There are also pseudo-clubs and a bifurcate spindle occasionally occurs. The salient feature of the spiculation is the length of the prominences which often interlock. Compared with Studer's figure, our preparations show much more numerous long spindles with irregular prominent warts.

Locality.—Station 11, 358 fathoms; 31st January, 1914.

Distribution.—Previously recorded from North Atlantic.

ORDER PSEUDAXONIA.

MELITODES RUGOSA *Wright, and Studer.*

(For description see Wright and Studer, "Challenger Alcyonaria, 1889," p. 174, 1 fig.)

Fragments of a white colour closely approach this species. Superficially the verrucæ appear to arise bilaterally, but closer examination shows that they come off all round the branches. The spicules agree very well with those described by Wright and Studer, especially in the presence of distinct club-shaped forms with very warty heads. Very notable is the prominence and abruptness of the warts that arise from all the spicules.

Locality.—Off Maria Island, Tasmania, 65–1,300 fathoms.

Distribution.—Previously recorded from off East Monceur Island, Bass Strait, 38–40 fathoms.

ORDER AXIFERA.

PRIMNOISIS AMBIGUA *Wright and Studer*.

(For description see Wright and Studer, "Challenger Alcyonaria, 1889," p. 39, 1 fig.)

The distinctions between some of the species of *Primnoisis* are far from convincing, but the collection includes a colony which seems to come nearest *P. ambigua*. It agrees with that species in the following respects:—

- (1) The branching is prevalently in one plane, though the end of a branch may be almost bushy; (2) The branches are given off from the main stem at acute angles, and show a somewhat marked twisting from side to side; (3) The polyps are arranged rather distantly in spirals, but are closer together towards the ends of the twigs; (4) The calyces are club-shaped and directed obliquely upwards; their height is 0.8–1 mm.; (5) The calcareous internodes are cylindrical and longitudinally fluted; but their length is rather more than that recorded by Wright and Studer (6–8 mm. instead of 2.5–5); (6) The calyx spicules are elongated, slightly curved plates or broadened spindles with much toothed edges and a rough, prickly and warty surface. The median ridge of the calyx, seen from the side, shows a vertical row of 12 sclerites transversely placed. There are also spindles and more oblong platelets and a few crosses. The interlocking-teeth of the calyx-spicules may be compound. In many of the plates the marginal prominences are toothed. As in *P. rigida* the terminal twigs may be without horny nodes and are therefore very brittle.

Localities.—Station 1, 354 fathoms. Station 8, 120 fathoms.

Distribution.—Previously recorded from Kerguelen Island, 10–80 fathoms.

PRIMNOISIS ANTARCTICA (*Studer*).

(For description see Wright and Studer, "Challenger Report on Alcyonaria, 1889," p. 35, 4 figs.)

A much branched colony, broken in two, rising to a height of 25 cm., giving off twigs on all sides, mostly unbranched. The polyps are distant and prominent, very like those of *P. sparsa* in shape. But the sclerites show no trace of ribbing and agree closely with those of *P. antarctica*. The diameter of the axis at its base is 3 mm., and the basal nodes and internodes are respectively 2 mm. and 6 mm. in length. Towards the top of the colony, a common length for an internode is 14 mm. The differences between *P. sparsa* and *P. antarctica* seem to us to be slight.

Locality.—Station 8, 120 fathoms.

Distribution.—Previously recorded from Prince Edward Island, 310 fathoms.

PRIMNOISIS ARMATA *Kükenthal*.

(For description see Kükenthal, "Alcyonaria"; Deutsch. Süd. Pol. Expedition, 1912, Bd. XIII, Zoologie V, pp. 343-5, 4 figs.)

Fragments of a remarkable form which differs from other species of *Primnoisis* in the long spines of the uppermost row of the calyx spicules. They project around the operculum and have somewhat divaricate bases. The calyx walls are covered somewhat loosely by jagged plates. The polyps are very distant.

Locality.—Station 8, 120 fathoms; 27th January, 1914.

Distribution.—Previously recorded from Antarctica.

PRIMNOISIS FRAGILIS *Kükenthal*.

(For description see Kükenthal, "Gorgonaria, Wiss. Ergebn. Deutsch. Tief-see Expedition," vol. XIII, 1919, p. 616. Kükenthal, "Alcyonaria; Deutsch. Süd. Pol. Exp., 1912," Bd. XIII, p. 342-3, 6 figs.)

The least broken specimen has a height of 11 cm. and gives off delicate branches on all sides. There is no indication of flattening in one plane, so far as the specimen goes. Many of the branches from the main stem give off secondary twigs of great delicacy. The internodes may be 10 mm. long, both on the main stem and on the branches. The polyps are in most cases distant, separated by about 1.5 mm. at their bases, and occur in an irregular spiral. On some of the branches of the associated specimens they are very crowded. The height of a polyp is about 1 mm., and the shape is precisely that figured by Kükenthal for *P. fragilis*, namely constricted basally and expanded like a beaker distally. The spiculation agrees thoroughly with Kükenthal's description, but there are a few beautiful slender bows, sometimes with roughnesses at the centre of the bow. A few quadriradiates occur. There is no trace of a longitudinal arrangement of the polyp-sclerites, but a pyramidal framework is formed over the mouth of the polyp above the topmost transversals.

It appears to us that *P. ambigua* W. and S. is very near *P. fragilis* Kükenthal, but we refer our specimen to the latter because the internodes are much longer than in *P. ambigua*, and the cortex of the twigs cannot be called thick, as against the reference to *P. fragilis* it may be noted that there is no flattening of the colony in one plane, but this would also apply against reference to *P. ambigua*. In the descriptions of *P. ambigua* and *P. fragilis* there is no reference to the slender bow-shaped spicules.

Locality.—Station 1, 354 fathoms.

Distribution.—Previously recorded from Antarctica.

PRIMNOISIS SPARSA *Wright and Studer.*

(For description see Wright and Studer, "Challenger Report, 1889," p. 36, 2 figs.)

A portion of a colony rising to a height of 12 cm. and giving off branches on all sides. It bears distant polyps of a brownish colour, 1-2 mm. in height. They are broadest at the apex, about 0.6 mm. across, and about half as much at the base. In some cases the actual insertion of the polyp on the twig is broadened, to which Wright and Studer probably refer when they speak of the base being broad. Some branches show distant calyces, while others not far off have them thickly crowded. There are also other separate portions of this colony or of other colonies. The maximum basal diameter of the bare axis is 2 mm. A very common length for an internode is 8 mm. The nodes are mere discs with a golden sheen. The cortical spicules are mostly flat scales with dentate interlocking margins, and very characteristic is a shape figured in the Challenger Report which shows a median indentation on one side. Triangles also occur and compact crosses. In one specimen the toothed scales and platelets show very markedly what is referred to in the Challenger description,—the presence of sharp ribs running from the marginal teeth towards the centre, but in another, with spicules of the same shape, these ribs are only hinted at,—a warning that too much must not be made of minute features of this sort. A few bent bows occur, approaching those of *P. rigida*.

Localities.—Station 1, 354 fathoms, Station 2, (?) fathoms, label not legible. Station 3, 157 fathoms; 31st December, 1913.

Distribution.—Previously recorded from Prince Edward Island, 85 fathoms.

CERATOISIS (PRIMNOISIS) DELICATULA *Hickson.*

(Pl. VIII, fig. 1.)

(For description, see S. J. Hickson, "National Antarctic Expedition, Natural History," vol. III, 1907, p. 5, 2 figs.)

The specimens agree well with Hickson's description, except in two points. One of the specimens is specially interesting, since it includes part of the main stem, which was quite absent in the Antarctic Expedition specimens. The branches, somewhat tangled, are extremely delicate and brittle, tapering to threads of not more than 0.1 mm. in diameter. The basal part of the stem has a maximum diameter of 2.3 mm., and this substantial part extends for 7 cm. It bears polyps similar to those on the tangles of delicate twigs. A basal node and internode show a length of 1 mm. and 6 mm. respectively. In two specimens from Maria Island, where the base of the axis has a diameter of about 2 mm., a length of three centimetres at the base bears five internodes and seven internodes respectively. An average length of a node is 1 mm.

The ramification is irregular, but is unlike that of Hickson's specimen in this—that most of the branches and branchlets arise at an acute angle.

The coenenchyma is very thin. A common length for a node is 6 mm. A calyx is somewhat trumpet-shaped, narrowed to a crown about 0.3 mm. in diameter, the base being rather under 0.2 mm. It differs from Hickson's specimen in showing only 10–12 horizontal rows of spicules instead of 14 or 15. The calices on the twigs are irregularly scattered and distant, often separated by an interval of 2 mm. A common outside length is 0.6 mm.

Another colony, with a height of 19 cm. in its largest separate piece, differs from the preceding in being distinctly bushy, but it agrees as regards spicules, shape of calyx, and other characters, including, it may be noticed, a terminal crowding of calyces on some of the twigs.

A number of specimens from Station 2 show strong main stems with numerous filamentous branches on all sides. Thus one, with a basal diameter of 3.2 mm., rises in a twisted course to a height of 16 cm., and bears in that length 20 nodes; another, with a basal diameter of 3 mm., has 11 nodes in a length of 8.7 cm., and gives off a strong main branch; a third has 30 nodes on a curved course of 20 cm. In regard to the spicules from these strong specimens, it may be noted that there are more numerous and stronger forms of the irregular oblong disc shape, showing again that the growth-strength of a colony may be associated with a slight change in spiculation. From the same station there are several strong bare axes without filamentous branches, and with much longer internodes, *e.g.*, 2 cm. It is quite likely that these belong to another species, *e.g.*, *Primnoisis sparsa*, but determination is impossible without polyps.

The spicules include the following: (a) Rather broad, flattened spindles, often slightly curved, strongly toothed on each side, and rough all over, 0.3 x 0.07 mm. in average size; (b) more oblong plates derivable from (a), belonging to the coenenchyma of the stem and branches, 0.2 x 0.08 mm. in average size; (c) markedly bow-shaped tuberculate spindles, an extreme form of which may become a distinct horseshoe, 0.3 x 0.03 mm. in average size; (d) some of the plates (b) are broad, like sturgeon's scales, others are triangular like arrow-heads; (e) a few crosses occur.

Localities.—Station 2, 318 fathoms, 28th December, 1913; Station 6, 800 fathoms, 14th January, 1914; Station 12, 110 fathoms; off Maria Island, Tasmania, 65 and 1,300 fathoms; dredgings, Commonwealth Bay, Adelie Land, 21st December, 1913.

Distribution.—Previously recorded from Antarctica, 25–80 fathoms.

ECHINISIS ARMATA (Kükenthal) n.g.

(Plate VIII, fig. 3; Plate XI, fig. 3.)

(See S. J. Hickson (*Ceratoisis spicata*), "National Antarctic Expedition," Natural History, vol. III (1907), p. 7, 3 figs. Kükenthal (*Primnoisis armata*), "Deutsch. Süd-polar Expedition, 1912," p. 343, 4 figs.

This specimen is one of the Isididae, with non-retractile polyps, and without the characteristic needles and rodlets, with transversely disposed sclerites on the polyps, and thus referable to the sub-family Mopseinae, beside the genera *Peltastisis*, *Primnoisis*, and *Mopsea*. As *Peltastisis* is unbranched and has elongated plates and spindles in its cortex; as *Mopsea* is always branched in one plane and has very small polyps with overlapping platelets, the specimen cannot be referred to either of these.

But it seems to us impossible to keep it the genus *Primnoisis* because of the entirely divergent type of spicules, which are not of the close-fitting scale type, but are either very irregular-toothed plates or long-spined forms with divaricate base. We suggest that Hickson's *Ceratoisis spicata* and Kükenthal's *Primnoisis armata* should be referred to a new genus *Echinisis*.

The colony is very irregularly branched, and many of the branches show extraordinary twistings, some going down as well as up. The diameter of the broken end of the main stem is about 2 mm.; most of the secondary branches have an initial diameter of about 1-3 mm.; the terminal twigs are extremely delicate and brittle. A common length of internode on the main stem is 10 mm.; and it may rise to 18 mm.; and on the secondary branches and terminal twigs the length rises from about 8 mm. to 14 mm. The surface of the internodes shows in some places very distinct, fine, longitudinal grooves. The nodes are brownish, up to 1 mm. in length. There is no constancy as regards the angles (acute, obtuse, and right) at which the branches arise from the internodes. The coenenchyma is thin, mostly rubbed off, and in other places obscured by a branching hydroid growth. It is thickly beset with large very irregular branched thorny sclerites.

The polyps arise singly on all sides, without constant arrangement, some at right angles to the branch, some curved inwards. A common height is 2 mm., rather longer than Kükenthal's 1.3 mm. The polyps expand gradually in trumpet-like fashion, from a base of 0.8 mm. to a mouth of 1.2 mm. Kükenthal describes them as constricted in the middle and distally expanded. They bear irregular-toothed sclerites, which form four transverse rows, with about 6 or 7 in each row. Those of the uppermost or distal row (sub-opercular) have transversely expanded divaricate bases, and are prolonged into prominent spines. Those of the next row also show protruding spines, but not so long. In some polyps there were short spines even on a third row, though in nine out of ten cases the long spines were restricted to the uppermost row. This links Hickson's *Ceratoisis spicata* to Kükenthal's *Primnoisis armata*, though we are inclined to retain two species.

A dissection of the opercular region showed a spined sclerite lying flat over each tentacle, and a number of irregular small sclerites transversely disposed on a single row on the dorsal surface of each. The armature of the polyp is very different, it seems to us, from that of any other *Primnoisis*.

The spicules include the following forms:—(a) The long-spined sub-opercular forms, with a long rough-edged spine, 0.8 x 0.05 (base) mm.; (b) the spined forms of the next row, also with a rough-edged spine, 0.5 x 0.35 (base) mm.; (c) the irregular forms of the lower rows of the polyp, corresponding to the bases of (a) and (b); often with numerous minute roughnesses and a suggestion of radiating lines; diameters, 0.3 up to 0.6 mm.; (d) the irregular, roughly-toothed cortical sclerites, 0.2-0.5 mm.; (e) the spined forms of the operculum, as it were small forms of (a) and (b), 0.3 mm. in length; (f) small irregular sclerites on the tentacles, rodlets and small curved forms with slight roughnesses, 0.1 mm. in length; (g) a few irregular cortical crosses and stellate forms, 0.2 x 0.3 mm.

It is plain that (a), (b), (c), (d), and (e) may be arranged in a series according to the degree of spine-development.

Localities.—Station 12, 110 fathoms; 31st January, 1914. Station 8, 120 fathoms; 27th January, 1914.

Distribution.—Previously recorded from Gauss Station, Antarctica.

MOPSEA TENUIS *n. sp.*

(Plate VIII, fig. 2; Plate X, fig. 4; Plate XI, fig. 4.)

Broken pieces of a very delicate white colony, branching on the whole in one plane, and for the most part dichotomously. The longest branch rises to a height of 15 cm.; the axis has a very uniform breadth of 0.8 mm. and approaches that of *Primnoisis delicatula* Hickson in its delicacy and fragility. But the closeness of the polyps points to the genus *Mopsea*.

Among the species of *Mopsea*, this new one comes nearest *M. flabellum* (Thomson and MacKinnon, which Kükenthal rightly renames *M. squamosa*); but it is much more delicate, and the internodes are in proportion much longer. In our specimen, the longitudinally-striated internodes are usually 4 mm. in length, and the light-brown nodes about 0.5 mm. The colony is partly overgrown with a calcareous sponge with triod specules.

The calices are close together, on all sides, never quite opposite, club-shaped, and curved in towards the axis. A common length is about 0.8 mm. In some places they are so close that the apex of one practically touches the base of another. Young calices are interspersed irregularly.

The abaxial rows of the calyx show about a dozen sclerites in each row. These are very like those of *M. squamosa*, and have very dentate margins. They include:— (a) Oblong scales, 0.18×0.1 mm.; (b) irregularly oblong scales with a medium constriction, 0.2×0.1 mm.; (c) very rough, rather broad spindles, straight and curved, 0.2×0.07 mm.; (d) pseudo-clubs derived from the spindle type, 0.16 mm. long; (e) some small slender spindles, less tuberculate, 0.2×0.04 mm.; (f) a few quadriradiates approaching stars, 0.1 mm. in diameter.

Locality.—Off Maria Island, Tasmania, 65–1,300 fathoms; 12th December, 1912.

CALLOZOSTRON HORRIDUM Kükenthal.

(For description see Kükenthal, "Deutsch. Süd-Pol. Expedition, vol. XIII (1912)," pp. 331–4, 7 figs.)

A much-damaged portion of a colony, with no trace of branching, shows a glistening stiff axis, 100 mm. in length and 2 mm. in diameter. The axis bears broken calices in whorls, but there is a bare streak on both surfaces, more marked on one than on the other, as in *C. horridum* Kükenthal. The height of a polyp, from base to operculum, not including the circumopercular spines, is about 3 mm. Very striking is the length of the spines of the four circumopercular sclerites. It may amount to 2 mm. The opercular sclerites are broad triangles. The calyx shows four transverse rows of fish-scale-like sclerites. Many of the sclerites show concentric lines and radiations of minute points, giving a characteristic appearance. It must be noted, however, that the very imperfect state of the specimen makes identification a little uncertain.

Locality.—Station 2, 150 fathoms; 31st December, 1913.

Distribution.—Previously recorded from Antarctica.

PRIMNOELLA ANTARCTICA Kükenthal.

(For description, see Kükenthal, "Wiss. Ergebn. deutsch. Tief-see Expedition," vol. XIII (2), 1919, p. 391, 10 figs.)

An unbranched specimen, with a slight indication of basal attachment, 45 cm. long. The terminal four centimetres are devoid of polyps; then come six centimetres bearing polyps; the remainder is bare. In the fully-developed whorls there are about 12–14 calices in a whorl. In the incipient whorls, which occur in the intervals between the fully-developed whorls, there may be only 2–3 polyps. The maximum distance between 2 whorls is about 2 mm.; but this may be reduced to almost nil by the interpolation of another whorl. The number in a whorl seems to increase by the interpolation of new polyps between the older ones.

The fully-formed calyx shows three or four abaxial rows of scales; each row has about 12 (11-14) scales; there is no hint of a keel; the median adaxial line is naked, but there is a lateral adaxial on each side of the naked groove.

As the specimen is fragmentary, we have but a narrow basis for description, but it agrees well with Kükenthal's *P. antarctica*, and must, we think, be placed within or in the vicinity of that species. Thus the polyps are on the whole cylindrical; there are three or four abaxial rows of sclerites clearly visible; the adaxial median line is naked; there are 12 or more sclerites in an abaxial row; the cortical spicules are precisely the same. But the same cannot be said of the polyp-sclerites, for though many approach a circular form, they do not show an entire rounded margin such as Kükenthal describes and figures.

Locality.—Station 7, 60 fathoms.

Distribution.—Previously recorded from Bouvet Island.

PRIMNOELLA AUSTRALASIÆ Gray.

(For descriptions, see Wright and Studer, "Challenger Report on Alcyonarians, 1889," p. 88, 3 figs.; Versluys, "Siboga Primnoiden," XIIIa, 1906, p. 52, 6 figs.)

A small, unbranched specimen, 7 cm. in height, with about 22 whorls of about six calices in each, with intervals of about one millimetre. The curved calices are 2 mm. in height, and show two pronounced dorsal abaxial rows of sclerites, two less distinct lateral abaxial, and the adaxial almost quite absent, except close to the mouth of the polyp. The specimen therefore belongs to the Carinatae division of the genus, and agrees on the whole with *P. australasiæ*, except that the triangular character of the circum-opercular sclerites, and of the smaller narrower opercular sclerites is more pronounced. The whorls are not so close together as in the previously-described specimens, but this would be natural in a young specimen. Another difference between our specimen and the descriptions of *P. australasiæ* cannot be overlooked—the margin of the sclerites on the body of the calyx and on the axis is always toothed, either finely or coarsely.

Locality.—Station 2, 318 fathoms, 28th December, 1913.

Distribution.—Previously recorded from Port Jackson, Australia, 30-35 fathoms; and off Twofold Bay, Australia, 150 fathoms.

PRIMNOELLA-DISTANS *Studer.*

(For description see Wright and Studer, "Challenger Report on Alcyonarians, 1889," p. 85, 2 figs.)

A portion of a delicate colony, without the root, of a whitish colour. It is 10 cms. long and 1.4 mm. broad at a whorl. The whorls are about 2 mm. apart on an average and in each there are four calices. A calyx is 1.2 mm. high by 0.5 mm. in breadth. The abaxial wall of the calyx is made up of two longitudinal rows of platelike spicules, 6 or 7 in each row. These spicules have a smooth edge for about three-quarters of the margin, and a warty base; the surface is also covered with warts radiating from a small, dense area near the base. A common size is 0.3×0.25 mm. The opercular spindles are triangular, having a warty base and a smooth, pointed or rounded expansion; they vary in their proportions, e.g., 0.4×0.1 mm., or 0.45×0.22 mm. Small warty spindles also occur.

Locality.—Station 2, 318 fathoms; 28th December, 1913.

Distribution.—Previously recorded from off Sombrero, West Indies; off Pernambuco.

CALIGORGIA RAMOSA *Kükenthal and Gorzawsky.*

(Plate VIII, fig. 4.)

(For description see Kükenthal and Gorzawsky, "Abh. Bayer. Akad. Wiss., 1908," 1. Suppl. Bd., 3 Abth, pp. 26–28, 5 figs.)

Two pieces, one with three, the other with two branches, agree well with the description and figures of *C. ramosa* Kükenthal and Gorzawsky. The branching is loose, more dichotomous than pinnate, with a delicate bronze axis, with three whorls to a centimetre, and usually six polyps to a whorl. Each calyx is about 3 mm. in height, and is markedly curved upwards and inwards. The abaxial rows show 8–9 ribbed sclerites; there are a few upper adaxials; the operculum is prominent. Very characteristic is the longitudinal ridging of the polyp sclerites, which are rough all over. The rough cortical spicules are denticulate at their margin. In the specimens described by Kükenthal and Gorzawsky, the colour of the whole colony was reddish-brown; our specimens are greenish-white.

Locality.—Off Maria Island, 1,300 fathoms, 13th December, 1912.

Distribution.—Previously recorded from Tokio Bay, 600 metres.

CALIGORGIA VENTILABRUM Studer.

(For description see Versluys, "Die Gorgoniden der Siboga Expedition," II Primnoidae: 1906, p. 74, 2 figs.)

A fragment, 5 cms. in length, agrees with previous descriptions of this well-known species, and the calyx scales are very similar to those figured by Versluys. There are five or six polyps in a whorl, and five whorls to a centimetre. The two abaxial rows of scales are well developed, and, in most cases, the external-laterals as well. There are 7 or 8 in each row. The abaxial scales have the characteristic heavily toothed outer edge and warty base. The opercular spicules are somewhat broadly triangular, with a short warty base and a leaf-like expansion, with a few longitudinal ridges; these operculars may be either pointed or rounded at the tip. A few small warty spindles also occur.

Locality.—Station 2, 318 fathoms, 28th December, 1913.

Distribution.—Previously recorded from Mediterranean; and north of New Zealand, 90 fathoms.

ASCOLEPIS SPLENDENS n.g. et sp.

(Plate IX, fig. 6,7; Plate X, fig. 1, 2; Plate XI, fig. 6.)

A fine colony of a form closely related to *Caligorgia*, but separated off by the possession of peculiar ascus-like or chalice-like scales. From a common stalk four main stems spread out in one plane; the two outer stems give off a succession of secondary branches all to the inner side, and these dichotomise; the two inner stems dichotomise from the start. The whole forms a very substantial, richly-branched fan, 18 cms. in height, by 15 cms. in breadth.

The surface of the branches is entirely covered with whorls of polyps, with never more than a millimetre of interval. The number of polyps in a whorl varies from six to ten. Each polyp has an average height and breadth of 1.5 mm. and 0.9 mm. respectively. Some rise to 1.8 mm. in height. The base of a branch is 4 mm. across at a whorl; at the tip this is reduced to 2 mm.

The calyx shows two well-developed abaxial and two well-developed external-lateral rows, each with 8-10 sclerites of a peculiar type. On the adaxial surface the sclerites are vestigial. The operculum is distinct but not prominent, and consists of eight broad triangles, each tapering to a point. The base of the triangle is beset with rough warts; the projecting part is marked by longitudinal ridges.

The striking peculiarity is that the main sclerites of the vertical rows have a distinct ascus-like or chalice-like form. That is to say, the basal portion is the substantial very warty support of a delicate cup whose cavity is open to the exterior! The delicate

edges of the cups are weakly notched, sometimes almost entire. The cup of the sclerite is broader than the substantial knobbed support, so that the appearance is somewhat like a short-stalked chalice or fruit-basket.

On the cortex between the whorls there are the following forms: (1) compact cupped chalices with very warty bases; (2) derivatives or antecedents of these in which the cup-portion is absent or only slightly indicated; (3) short spindles with compound warts; (4) derivatives of warty spindles of various shapes, triangular, oval, oblong, club-like, or arcuate, in the last case more developed on one side than the other; (5) peculiar forms, such as triradiates and stars.

The following measurements were taken:—Polyp sclerites: 0.2, 0.23 mm. in height; 0.2, 0.16 mm. in basal breadth; 0.35, 0.26 mm. in cup margin diameter. Opercular scales: 0.35, 0.4 in height, by 0.2, 0.25 mm. in breadth.

Of the cortex forms mentioned above, types (1) and (2) showed heights and maximum breadths of 0.2 × 0.55 mm., 0.2 × 0.3 mm., 0.15 × 0.12 mm.; type (3) showed in height and breadth 0.25 × 0.08 mm.; type (4) were about 0.15 mm. in diameter; type (5) were 0.1 to 0.2 mm. in diameter.

We must emphasise the point that the specimen is on the whole like a *Caligorgia*, but its characteristic hollow ascus-like sclerites are very far from the ctenoid-scale type.

Another specimen, a young colony, branching in one plane to a total height of 7 cms., showed very regular dichotomy and distinctly smaller polyps. It had precisely the same spicules, and also came from Station 2. The chalice-like sclerites are, so far as we know, quite unique, but we may call attention to Kükenthal's figure of the polyp-scale of *Caligorgia antarctica* (Deutsch Südpolar Expedition XIII, 1912, p. 321, fig. 30), which is very suggestive of an external cup. To some extent, this is the case also with the drawing (fig. 28) of the polyp. Unless one happens to focus the scales at different levels the deep depression may easily escape notice. In his large monograph of *Gorgonacea* (Ergebnisse Deutschen Tiefsee Expedition, vol. XIII (2), 1919, p. 382), Kükenthal refers again to the "smooth outer surface" of the polyp-scales, and returns to the suggestion that the specimen of *C. antarctica* may be intermediate between *Caligorgia* and *Primnoella*. Of course, "smooth outer surface" could not apply to a sclerite like a salver, yet the drawing is curiously suggestive of a cup.

A young colony from Station 7 is very instructive in its superficial unlikeness to the full-grown forms. It stands rigidly to a height of 15.5 cm., and is sparsely branched with regular dichotomy, five times repeated along one line. The diameter of the stem, just above the disc of attachment, is about 2.5 mm., and it becomes gradually narrower. Very striking is the distance between the whorls of polyps, the interval being up 4 mm., whereas on the other young specimen there is no interval at all. This shows how unimportant such a character is, for the spiculation is identical. In two

centimetres of the young Station 7 specimen, there are six whorls of polyps; in the same length of a part of the young Station 2 specimen there are eleven. The polyps in the young Station 7 specimen have a length of about 1.4 mm.; those of the young Station 2 specimen have a length of 1.5; those of the full-grown specimen rise to 1.8 mm. Another unimportant character is the number of polyps in a whorl, for in the young colony there are 4-6, and in the large specimen 6-10. Yet the spicules are *indistinguishable*. Cases like this warn us against the ultra-minutiose descriptions which have sometimes been given of Alcyonarian and also Antipatharian species, for specific distinctions have sometimes been based on differences which are not more than individual, which is absurd.

Three very luxuriant colonies from another Station (7) with a strong *Caligorgia* appearance, showed the ascus-like spicules in great abundance. The dimensions were:—(1) 31 cm. in height by 25 cm. in maximum breadth; (2) 24 cm. in height by 20 cm. in maximum breadth; and (3) 22 cm. in height by 20 cm. in maximum breadth.

Localities.—Station 2, 28th December, 1913, 318 fathoms; Station 7, 21st January, 1914, 60 fathoms; Commonwealth Bay, Adelie Land, 3rd September, 1912, 25 fathoms; two small pieces from Station 8, 27th January, 1914, 120 fathoms.

ASCOLEPIS SPINOSA *n.sp.*

(Plate VIII, figs. 5, 6; Plate XI, fig. 5.)

A portion of a colony, dichotomously branched in one plane, with a total height of 4.5 cm. The longest separate twig is 3 cm., and that includes 16 whorls, mostly with four polyps. In some cases one of the members of a whorl is smaller than the others, and occasionally not on a level with them. The average height of a calyx is 1.4 mm.; there are six sclerites in an abaxial median row and the long-spined operculars form a prominent erect pyramid; the adaxial side is weakly armoured. The abaxial sclerites of a row alternate with those of adjacent rows. The circumoperculars have a very distinct spine, but shorter than that of the operculars, and there is a triangular prominence corresponding to a spine on the sclerites of at least three rows below the circumoperculars. This prominence tends to become compound, gradually dwindling towards the base of the calyx.

The abaxial sclerites show the unique *Ascolepis* or chalice type. Each has an upper concave chalice or ascus with compound warts in its depression. To the inside the rim of the chalice is extended into the spine or prominence, and to the outside it forms an outward projecting ridge; the part corresponding to the stalk of the chalice is covered with compound warts. Again the shape recalls a silvery fruit-basket with a bossed base.

The opercular spicules are like narrow isosceles triangles, with a spine winged on each side and marginally toothed, the points of the teeth directed upwards. The base is densely covered with compound warts. The only trace of a chalice in this type of sclerite is a slight projecting shelf.

If we consider the three parts together—spine, chalice, and base, the strongest development is in the circum-operculars. In this type the chalice or ascus is very clear.

Most of the cortical sclerites covering the axis are roundish plates, toothed but smooth marginally, and bearing within this narrow rim a dense crowd of compound warts. In some cases there is a radiation of ribs.

The following measurements were taken:—Operculars, 0.4 x 0.2 mm.; sub-operculars, 0.5 x 0.3 mm.; Polyp sclerites, 0.25–0.4 mm. in height x 0.3 mm. in breadth; Cortical sclerites, 0.1–0.3 mm. in diameter; small irregular spindles up to 0.2 mm.

This species differs markedly from *A. splendens* in the presence of a strong internal spine above the ascus in the sclerites of the polyps, and in having a much more delicate growth. The opercular spicules of *A. splendens* are longitudinally ridged triangles tapering to a point, but they have not the marked spine of *A. spinosa*. The sub-operculars of *A. splendens* are not highly specialised as in *A. spinosa*. The lower sclerites of the calyx of *A. splendens* bear spines which are only hinted at in *A. spinosa*. Another specimen, a larger portion of a colony on the whole dichotomously branched, has a height of 16 cm., and an apical spread of 12 cm.

Another specimen from Station 7, 60 fathoms, is more spinose than any of the others and more loosely branched. The bare terminal parts of the axis of the twigs are exceedingly delicate. It is noteworthy that on the same colony there are whorls of 3, 4, and 5; by far the commonest number is 4. But this shows that it is quite futile to attach taxonomic importance to the number of polyps in a whorl. The specimen bears a *Halicystus*, and the depth (60 fathoms) may be noted in this connection.

Localities.—Station 8, 120 fathoms; 27th January, 1914, and 27th January, 1913; Station 12, 110 fathoms; Station 7, 60 fathoms.

An intermediate form.

An interesting specimen from Station 7, 60 fathoms, 21st January, 1914, is in certain respects intermediate between *A. spinosa* and *A. splendens*. It differs from *A. spinosa* in the absence of spines on the ordinary calyx sclerites, in having only a short spine on the sub-operculars, and in having operculars of the triangular type, *i.e.*, with the spine portion less differentiated. But the sub-operculars show a distinct chalice, which is not developed in these sclerites of a typical *A. splendens*. The

branching is much denser than in *A. spinosa* and several strata of branches overlap. The number of polyps in a whorl rises to eight. The axis is much more substantial. In short, this is a good example of an intermediate form between two species. It has a height of 22 cm., a maximum spread of 14 cm., and the basal diameter of the axis is 3 mm. A transitional form like this, certainly not worthy of a specific title, is what should be expected if evolution is going on. It is possible, however, that its peculiarities are not constitutional, but modificational—that is to say, impressed by some extrinsic influences (environmental, nutritional, or habitudinal).

THOUARELLA LONGISPINOSA *Kükenthal*.

(? *STENELLA ACANTHINA* *Wright and Studer*.)

(Pl. IX, fig. 1, 2, 3; Pl. XII, fig. 1.)

(For description see *Kükenthal*: "Alcyonaria; Deutsch Südpolar-Expedition, 1912." Bd. XIII, Zoologie V, p. 299, 4 figs.)

Several specimens of an interesting form which stands apart from most other species of *Thouarella*, e.g. in having only four sclerites in an abaxial row, and also does something to unite the genera *Thouarella* and *Stenella*, e.g. in the oblique incurved disposition of the calices.

A striking feature is the occurrence of two distinct types of branching, which we have illustrated in figures. (A) Resembling *Kükenthal*'s figure of a colony of *Thouarella longispinosa*, there is a loosely branched form, with short branches of unequal length all round the axis and without secondary twigs. The total height is 12 cms.; an average length for a branch is 3 cm.; the basal diameter of the axis is 2 mm.; on many of the branches about 5 whorls occur on a centimetre; there are usually 3-4 polyps in a whorl. Belonging to this type is a complete colony (Station 2) with attaching disc; it rises to a height of 10 cms. and bears about 70 short branches without secondary twigs, arising at acute angles in every direction. The number of polyps in a whorl is 2-3.

(B) A second type of branching is illustrated by a piece of a substantial colony from Station 12. While the branches actually arise on all sides of the axis, there has been a compression, so that a bilateral colony has resulted. In consequence there is a superficial differentiation of what might be called, as in Pennatulids, the dorsal and ventral surfaces; and another consequence is that the branches come to lie in two or three parallel planes. There are no secondary twigs. The total height of the piece is 9.5 cms.; the lateral spread is 7 cm., an average length of a branch is 4 cm.; the diameter of the axis is 1.5 mm. On many of the branches 5 whorls occur on a centimetre; there are often 4-6 polyps in a whorl.

It must be noticed that elongated bottle-brush types which we are compelled to refer to *Th. variabilis* occur at Station 2 along with type A. of *Th. longispinosa*, and were obtained on the same day. The differences between the two species are indicated in the following table:—

<i>Thouarella variabilis</i> (Parathouarella section).	<i>Thouarella longispinosa</i> (Euthouarella section).
The polyps arise singly.	The polyps are in whorls.
The side branches often bear secondary twigs.	The side branches do not bear secondary twigs.
The sub-operculars are drawn out into spines but not extremely.	The sub-operculars are drawn out into extremely long spines.
The calyx sclerites below the sub-operculars show well-marked short triangular prominences, somewhat abruptly defined off. There are no basal tuberculations of the <i>Th. longispinosa</i> type.	The calyx sclerites below the sub-operculars have rounded outer margins, and the bases are characteristically roughened with tubercles that suggest suturing.
The operculars are very narrow triangles.	The operculars are well-developed isosceles triangles drawn out into spines.
The sclerites do not show parallel ridging.	Many sclerites show a characteristic appearance of concentric ridges, like lines of growth on an oyster shell.

The most striking features of *Thouarella longispinosa* are the following:—(a) the polyps usually occur in whorls (3-4 in each, according to Kükenthal), rarely in pairs; (b) they are somewhat trumpet-shaped and are adaxially incurved; (c) the branches arise all round the axis and have no secondary twigs; (d) in the abaxial rows there are four sclerites, including the sub-operculars; (e) the sub-operculars, which appear to be in process of numerical reduction, bear exceedingly long spines, which overtop the operculars, and project at various angles; they are often four or five in number instead of the normal eight; (f) the operculars are of the narrow isosceles triangle type, tapering into a spine; (g) the calyx scales resemble the more concave valves of oyster shells, the projecting margin being rounded and almost entire, the lower margin bearing tuberculate prominences which probably interosculate with other sclerites; (h) the cortical sclerites are in many cases approximately circular, and, besides being superficially warted, show the interlocking tuberculate prominences already referred to; (i) very characteristic of the sub-operculars, and of some of the other calyx sclerites, and of some of the cortical sclerites, is a marked zoning due to superficial ridges.

Of these characters the most striking is the great length of the sub-opercular spines, up to 1.2 mm. out of a total sclerite length of 1.6 mm. They are prominent enough to recall those of *Callozostron carlottæ* Kükenthal. The diversity of their pose suggests that they are quite movable. The reduction of long spines to a total of 3-5 is

also noteworthy, and so is the basal zoning. Another very important peculiarity is the small number (4) of abaxial sclerites. This suggests affinity with *Thouarella variabilis*, in which the same number occurs.

Our specimens of the Antarctic *Thouarella longispinosa* agree closely with the description and figures given by Wright and Studer for *Stenella acanthina*, from off Rio de la Plata, and we share Kükenthal's doubt whether the two are not the same species.

As to the resemblances, it may be noted that *St. acanthina* has (a) "three large acutely spined spicules in the pre-opercular layer"; (b) polyps in whorls of three or four, and of the same dimensions and shape as in *Th. longispinosa*; (c) four sclerites in an abaxial row, including the sub-operculars or pre-operculars; (d) densely packed "oval disc-like spicules" in the coenenchyma, which show basal interlocking tuberosities; (e) short branches arising on all sides of the axis; (f) polyps with an oblique pose; (g) a reduction in the number of sub-operculars. It seems to us extremely probable that *Stenella acanthina* is the same as *Thouarella longispinosa*.

This raises the final question why our specimens should be referred to the genus *Thouarella* instead of to *Stenella*, a question the more urgent since the occurrence of as many as six polyps in a whorl has not been recorded, so far as we know, in any other well-established species of *Thouarella*.

We refer our specimens to *Thouarella*, not to *Stenella*, for the following reasons:—(1) The polyps arise obliquely, not perpendicularly; (2) the polyps are incurved adaxially, not stiffly erect; (3) the sub-operculars are certainly not immovable, and there is no evidence of particular rigidity in the polyps.

While we cannot pronounce on a specimen that we have not seen, and can therefore only suggest, with Kükenthal, the identity of *Thouarella longispinosa* and *Stenella acanthina*, it is certain that the existence of these two types, or of this type, serves to bind the two genera more closely together.

Two very fine specimens from Station 12 show a dense ostrich-feather like branching, with a suggestion of "dorsal" and "ventral" surfaces. One of these rises to a height of 26 cm. with a maximum spread of 7 cm. The axis has a basal diameter of 4 mm. The colour of both colonies is umbre-brown in contrast to the brownish white or white (probably bleached) of the others.

Spicule measurements of height and maximum breadth:—Sub-operculars = 1.7 mm. x 0.5 mm. (maximum size); operculars = 0.6 mm. x 0.3 mm.; other Calyx sclerites = 0.5 mm. x 0.55 mm., and 0.6 mm. x 0.55 mm.; Cortical sclerites = 0.3 and 0.4 mm. in diameter.

Localities.—Station 2, 318 fathoms, 28th December, 1913; Station 12, 110 fathoms, 31st January, 1914; Station 12.

Distribution.—Previously recorded from Gauss Station, 385 m.

THOUARELLA (PARATHOUARELLA) STRIATA *Kükenthal*.

(For description see Kükenthal, "Wiss. Ergebn. Deutsch. Tief-see Expedition, 1919," XIII, part 2, p. 426, 6 figs.)

A bushy branch of a colony, light brown in colour, with a height of 9 cm. and a maximum breadth of 2.7 cm. The twigs arise on all sides and most of them bear secondary twigs.

It belongs to the Parathouarella sub-genus since the polyps arise singly, never in whorls. They are crowded, however, towards the tip of a branch. There are 4-5 scales in an abaxial row, and the larger cortical sclerites have very marked radiate lines of warts. There are also non-striated warty discs. The sub-operculars are broad at the base and taper into winged spines with finely toothed margins; the operculars are broad triangles with parallel ribs. The salient feature of this well-marked species (*not* including Nutting's *Thouarella striata*) is the prominence of the radiating ridges. Several large specimens, 45-55 cm. in height, have an umbre-brown colour, but unfortunately much damaged polyps.

Locality.—Station 3, 157 fathoms; 31st December, 1913.

Distribution.—Previously recorded from East Coast of Bouvet Island.

THOUARELLA (PARATHOUARELLA) VARIABILIS *W. & S.*

(Plate IX, figs. 4, 5; Plate XII, fig. 3.)

(For description see Kükenthal, Gorgonacea; Deutsch. Tief-see Expedition, 1919, p. 428; Kükenthal, Deutsch. Süd. Polar Expedition, XIII, 1912, p. 305; Wright and Studer, Challenger Report, Alcyonaria, vol. XXXI, 1889, p. 68.)

According to Kükenthal's diagnostic tables the forms with polyps arising singly, as in this case, should be referred to a sub-genus Parathouarella, and the only species within this sub-genus which these specimens resemble is *Th. variabilis*. The cortical sclerites are not striated, as in *Th. striata*; the polyps are not crowded in terminal clubs as in *Th. antarctica* and *Th. clavata*; the sclerites in a vertical row are 3-4 in number, which excludes *Th. verschuyssi*. Six circum-operculars are distinctly spinose; those of the operculum are drawn out into rough tapering triangles sometimes longitudinally ridged as in the figure given by Wright and Studer, Pl. XXI, fig. 1.

Locality.—Station 2, 318 fathoms; 28th December, 1913.

Several bottle-brush specimens from Station 7, perhaps branches of a larger colony. Twigs arise on all sides and sometimes branch. The maximum height is 18 cm.; the average breadth of the colony is 4 cm.; the basal diameter of the axis is 1.3 mm.

The polyps come off singly; they have an average height of 1.2 mm.; very characteristic are the five or so circum-opercular spines which project prominently to a maximum of 0.6 mm. beyond the broad rough base of the sclerite. Also diagnostic is the small number (3-4) of sclerites in an abaxial row. The adaxial spiculation appears to be very irregular.

Locality.—Station 7, 60 fathoms; 21st January, 1914.

A fine colony of the densely branched bottle-brush type, white in colour, rises to a height of 34 cm. and shows an attaching base. We were at first inclined to refer it to a new species in the Parathouarella group on account of the rarity of secondary twigs, and the crowded occurrence of polyps which arise in a dense spiral and leave practically no gaps on the branches. Closer examination showed, however, that the architecture and spiculation of the polyps was precisely that of *Th. variabilis*. Thus there are four sclerites on the abaxial rows of the calyx; the sub-operculars are drawn out into keeled winged spines; the operculars are inconspicuous narrow triangles; the calyx-sclerites below the sub-operculars are each drawn out into a short abrupt spine. This colony showed a large broken secondary branch, not a twig, arising from the base of the main stem.

Locality.—Dredgings, Commonwealth Bay, Adelie Land, 45-50 fathoms; 14th December, 1913.

A fine specimen like a grandiose bottle-brush, but with two strong branches given off from the main stem near its base. The total height is 30 cm., and an average length of twig is 3 cm. Numerous twigs arise on all sides and some of these divide twice or thrice. About half way up there is a secondary branch with many twigs all round like the beginning of the two strong branches seen further down. There is actually more than one fusion of twigs belonging respectively to the main and to the largest branch.

The polyps are densely crowded leaving practically no gaps. The narrow triangular opercular scales have a median keel with a hint of a spine. The circum-operculars have strong triangular points with delicate wings dentate on the margin, and a strong spine the base of which, passing into a median ridge, is also toothed. There may be short spines on the sclerites below the sub-operculars.

Localities.—Commonwealth Bay, Adelie Land, 55-60 fathoms; 21st December, 1913. Station 9, 240 fathoms; 28th January, 1914. Station 10, 325 fathoms; 29th January, 1914.

Distribution.—Previously recorded from off the Crozets, 550 fathoms.

About a dozen specimens which show the architecture and spicules of *Thouarella variabilis* are instructive in showing at the same time much variety (*a*) in the branching (thus one bears two strong secondary branches from the main stem, another is almost pinnate (!), most are bottle-brush-like); (*b*) in the density of the polyps, which in some are almost touching, while in others they are separated by very distinct gaps; and (*c*) in the length of the sub-opercular spines. It is possible to distinguish two main sets, (1) those with close-set polyps and looser more irregular branching, without division of the twigs arising from the main stem, and (2) those with more distant polyps, regular bottle-brush appearance, and frequent branching of the twigs. Yet all of these come from one station, viz., Station 8, 120 fathoms; 21st January, 1914. We are warned then that the mode of branching, the density of the polyps, and, within limits, the length of the calycine spines are unimportant as specific characters. In particular it seems a useful caution that a centimetre on one colony may bear ten polyps, and on another twenty. The sparse and distant polyps are often much smaller than those that are crowded, *e.g.*, 1 mm. in length and 0.5 in breadth as compared with 1.5 in length and 1 mm. in breadth.

In some cases the length of the sub-opercular spines varies markedly on the same colony; on the other hand, five specimens of the bottle-brush type from Station 12, 110 fathoms; 31st January, 1914; all show relatively long spines. One of the colonies, standing 17.5 cm. in height, bears from the main stem, at heights of 10 and 11 cm. two branches 8 cm. in length, all of course with the usual short twigs, many of which give off a tertiary twig near the base.

Other localities.—Station 1, 354 fathoms; 22nd December, 1913. Station 8, 120 fathoms; 27th January, 1914.

A young complete colony, fastened to a stone by an expanded base, shows only simple twigs, and the polyps are more than usually distant. The architecture of the calyx is identical with the specimens of *Th. variabilis*. In its delicacy of build it resembles *Th. variabilis* var. *gracilis*, W. & S. Challenger Report, vol. XXXI, 1889, p. 70; but it seems to us that the difference between *Th. variabilis* and the variety *gracilis* is only in degree; there are many intermediate forms.

Locality.—Station 7, 60 fathoms; 21st January, 1914.

We have examined so many different specimens of what appear to us to be *Thouarella variabilis* that we venture to re-emphasise the point that around the typical form, numerous varieties occur; so that no great importance can be attached to:—(*a*) the grouping of the polyps, from single and distant, to dense spiral and almost touching, even on one colony; nor to (*b*) the delicacy or substantiality of build; nor to (*c*) the degree of differentiation of the spines of the calyx sclerites below the level of the sub-operculars.

On the other hand as constant features the following must be emphasised:— (1) in the sub-operculars, the presence of a long keeled spine rising from the expanded triangular warty base; (2) the presence of only four calyx sclerites in an abaxial row, this number including the sub-operculars; (3) the narrow, relatively inconspicuous, operculars, approximating to isosceles triangles; (4) the absence of radial striations on the cortical sclerites; and (5) the typically single disposition of the polyps, which are never in whorls, though they may be densely crowded.

Some of the colonies of *Thouarella variabilis* afford attachment to growths of sponge and shelter to Ophiurids and Nereids.

Distribution.—Previously recorded from Gauss Station, 350–385 m.; off Prince Edward Island, 310 fathoms.

DICHOLAPHIS DELICATULA *n.sp.*

(Plate IX, figs. 8, 9; Plate XII, fig. 4.)

If Kinoshita's genus *Dicholaphis* be recognised, this specimen should be referred to it, on account of (1) its general delicacy, (2) its dichotomous branching in one plane, (3) its very slender axis, (4) its high operculum of 8 sclerites, (5) the polyp constriction and adaxial bending below the oral expansion.

The fragment of colony has a total height of 4 cm.; and a length of 1 cm. bears 4 pairs of polyps, which are on the whole, though not rigidly, in the plane of the branching. The average height of a polyp is 2 mm. The axis is yellowish with a golden sheen. We are unable to include this form in the species *D. delicata*, for the following reasons:—(a) the polyps are much more distant, (b) the colony is still more delicate, (c) the triangular opercular sclerites are less noticeably toothed on their margin, (d) the circum-operculars form a definite "collar" with their projecting tips, which sometimes end in a short spine, (e) the polyps always occur in pairs opposite one another.

The following spicule measurements were taken:—Circum-operculars, 0.7–0.9 mm. in height x 0.3 mm. in breadth; operculars, 0.5 x 0.3 mm.; other scales, 0.1–0.3 mm. in diameter. They are all very delicate and easily broken.

Locality.—Off Macquarie Island, 1,500 fathoms.

ASTROMURICEA FORMOSA *n.sp.*

(Plate IX, fig. 10; Plate X, fig. 3; Plate XII, fig. 2.)

The salient features of the genus *Astromuricea* Germanos are:—the abundance of stellate spicules, far outnumbering the spindles; the low, crowded verrucæ, each surrounded by imbricated spicules with projecting edges or points; the slight crown and eight triangular points of the operculum on the retracted anthocodia.

The present specimens cannot be included in any of the previously described species:—*A. polyklados*, Germanos, *A. theophilasi* Germanos, *A. ramosa* Thomson and Handerson, *A. stellifera* Thomson and Crane.

Several fan-like greyish-brown colonies, with much anastomosis of branches, which present a very uniform thickness of 2 mm., and arise at very obtuse angles before they bend upwards.

The verrucæ cover almost the entire surface and have a diameter of about 0.75 of a millimetre. They are rounded domes with relatively small apertures occupied by the always retracted anthocodiæ. The surface of the verrucæ is rough with the projecting points of irregular imbricating sclerites, which show no suggestion of being in rows. The operculum consists of eight triangular points rising from a slight crown of two or three rows of horizontal spicules. Each point consists of two large curved spindles, with two smaller ones included between their diverging bases.

The axis is dark brown in colour, with a diameter of 1.3 mm. just above the disc of attachment. Two of the colonies had small Avicula shells attached.

The spicules include the following forms:—(a) many-rayed irregular very warty stars, often with a boss rising from the centre of one surface, 0.3 x 0.25 mm.; (b) stellate forms in which one of the processes is becoming a short spine, 0.45 x 0.25 mm.; (c) more delicate stars with more widely separated arms, more starfish-like, 0.2 x 0.2 mm.; (d) irregular forms derivable from (a), with rough foliaceous expansion to one side, and two or three warty stellate arms to the other, 0.4 x 0.2 mm.; (e) more compact forms with arms reduced, derivable from (d), with a compound boss arising in the middle, 0.2 x 0.15 mm.; (f) warty spindles and bows, 0.3 x 0.05 mm.; (g) very broad rough spindles, 0.6 x 0.15 mm.; (h) a few triradiates, derivable from branched spindles, 0.15 x 0.1 x 0.1 mm.; (i) minute capstan-like forms knobbed at each end, 0.07 x 0.05 mm.

Locality.—No label.

LEPTOGORGIA SARMENTOSA (*Koch*).

(For description see Koch, "Fauna und Flora des Golfes von Neapel. 1887," p. 37, 1 fig.)

A good specimen of this well-known species, with a marked colour pattern; the red verrucæ are crowded on the sides of the yellow branches, leaving a bare yellow streak back and front. There is an expanded yellow basal portion.

The spicules are red and yellow spindles, covered with warts, mostly compound. Many are zoned—a feature not noted by Koch in his description of the species. They vary much in size, the longest ones being about 0.23 x 0.04 mm.; the smallest forms with two tiny zones, only 0.03 x 0.01 mm.

Locality.—Station 2.

Distribution.—Previously recorded from the Gulf of Naples.

PENNATULACEA.

SCLEROPTILUM GRANDIFLORUM *Kölliker*.

(For description see Kölliker, "Challenger Report, 1880," p. 30, 2 figs. Kükenthal and Broch, "Pennatulacea, 1911," p. 268, 6 figs.)

This genus includes indistinctly verticillate Pennatulids without distinct calyx, with abundant 3-flanged spicules, with the polyps sharply kneed adaxially, and with a cylindrical axis.

Of our specimens the longest is 24 cm. in length, 6 cm. going to the stalk. The polyps are generally in pairs, one on each side of the axis, as Kölliker describes for *Scleroptilum grandiflorum*, but they are not so crowded as in his figure. On a length of 6 cm. there are altogether 19 polyps. The siphonozooids are very indistinct. The spicules attain to larger dimensions than those recorded by Kölliker or by Kükenthal and Broch, being sometimes 1.2 mm. in length as against 0.74 and 0.36 mm. respectively. In form they agree exactly with the descriptions and figures given by Kükenthal and Broch.

In regard to the position of *Scleroptilum*, it appears to us to be far away from the substantial and bilaterally disposed Kophobelemnonidae, beside which Balss places it. It comes very near the genus *Chunella*, and the only doubt is whether it should be kept in a separate family Scleroptilidae or merged with Chunellidae as Hickson suggests. We incline to the last view. We think that Kölliker's *S. durissimum* should disappear into *S. grandiflorum*. Verrill describes a calicle for *S. gracile*, this appearance is due to the basal portion of the polyp being more heavily armoured than the upper portion.

Locality.—Station 13, 1,800 fathoms, 25th February, 1914.

Distribution.—Previously recorded from North Pacific, East of Japan; Atlantic Ocean; Indian Ocean.

UMBELLULA CARPENTERI *Kölliker*.

(Pl. X, fig. 5.)

(For description see Kölliker, "Challenger Report," vol. 1, 1880, pp. 23-4, 3 figs.)

Two specimens agree on the whole with Kölliker's description of *U. carpenteri*. They belong to the group with few autozooids, having tentacles longer than the bodies, including *U. lindahli* and *U. carpenteri*. The lowest part of the stalk is absent from the larger specimen, and no trace of calcareous corpuscles could be found. The base of the small specimen showed slight effervescence. The stalk is very delicate and the autozooids are large in proportion and seem very top-heavy. The siphonozooids are numerous at the top of the stalk and extend in five areas between the bases of the autozooids, leaving one aspect almost free.

Locality.—Station 9, 230 fathoms, 28th January, 1914.

Distribution.—Previously recorded from South Polar Sea, South-West of Australia, 1,975 fathoms.

UMBELLULA KÖLLIKERI *Kükenthal*.

(For description see Kükenthal, "Pennatulacea 'Valdivia' Tiefsee-Exp. 1911," XIII, pp. 298-9, 2 figs.)

A specimen with five autozooids, one dorsal and two on each side of it, with tentacles shorter than the body of the polyp, with no hint of spicules, with prominent siphonozooids, agrees very closely with Kükenthal's description of *U. köllikeri*.

Locality.—Station 2, 318 fathoms, 28th December, 1913.

Distribution.—Previously recorded from East African coast.

AINIGMAPTILON HASWELLI, *Dean*.

(Pl. XII, fig. 5; Pl. XIII.)

(For description see Proc. Linnean Society: Zoology, vol. XXXVI, 1926, pp. 337-344, 2 pls., 1 fig.)

It differs so much from any other Alcyonarian so far described that one finds it difficult to assign it to any of the five large orders! Most unfortunately the fixative used has not worked well, and the specimen is entirely unsuited for satisfactory histo-

logical study. Thus the evidence on more than one important point of structure is necessarily inconclusive. Unfortunately, also, the specimen is incomplete; both ends are missing! But it remains very remarkable.

That it is an Alcyonarian, in the first place, is shown by (1) the form of the autozooids, (2) the type of spicule, and (3) the internal structure of the stem.

(1) The autozooids have eight pinnate tentacles. (2) The spicules, though unique, have a distinct resemblance to those of some Primnoids, in especial to those of that strange unattached form, *Callozostrom mirabilis* (see Report "Challenger," Exped. 1889, p. 48, pls. X and XX), which, however, has quite different polyps, and an axis, of which there is not a trace in this specimen. (3) The internal structure of the stem is paralleled by that of many Pennatulids—most closely by *Amphiacne*.

As to the order in which this specimen should be placed, one may definitely rule out the Stolonifera, Alcyonacea, Pseudaxonia and Axifera, as it shows none of their most distinguishing features. The only order to which it has any resemblance is that of the Pennatulacea (*Stelechotokea*), but even here we find points such as the grouping of the polyps, the absence of axis and the apparent absence of siphonozooids, which make its classification as a Pennatulid not altogether convincing.

As to its positive Pennatulid features, the following may be emphasized:—
(a) The long narrow stem shows what apparently have been four longitudinal canals running from end to end, and this is certainly a distinctive Pennatulid feature. The wall of the stem shows that exaggeration of the mesogloea which is commonly found in the Pennatulid stem. (b) Secondly, the arrangement of the autozooids, though unique, is not approached in any Alcyonarian outside the Pennatulids, and is there, at any rate superficially, hinted at in some forms such as *Virgularia gustaviana* and *Virgularia halisceptrum*, which, however, have a well-developed axis. What is peculiar in our specimen is that the polyps occur in close tufts at the tips of numerous short branches that come off irregularly on the two sides of the main stem. The rounded branches bearing the autozooids may correspond to the pinnæ of Pennatulids, but, whereas in a Pennatulid the pinna is formed by the fusion of the proximal portions of several autozooids, and the walls of each zooid remain distinct so that each canal in the pinna represents the cavity of a zooid, here we find that the branch is divided into a number of canals, and that each canal is a cavity into which the cœlentera of from three to seven zooids open.

On the other hand, several typical Pennatulid features are conspicuous by their absence. (1) Thus there is no trace of any axis, which is typically, though not universally, developed in Pennatulids. (2) What is also striking is the absence of a central canal at the junction of the four longitudinal septa in the interior of the stem. Vague irregular gaps are seen in the central tissue in the one portion of the stem at one end where the septa have remained untornd, but there is no trace of a definite axial canal. An entire absence of a definite axial canal is reported, it is true, in the genus *Echinoptilum*, which has no axis, but in other forms where the axis is absent, such as *Cavernularia*

elegans and *C. obesa*, a small central canal is present. (3) While the autozooids are comparatively large and with well-preserved structure, there is no convincing proof of the presence of siphonozooids. The only hints of them are small whitish specks, often slightly prominent, which occur in irregular rows on the more exposed side of the main stem. But these are admittedly unsatisfactory, since the sections unfortunately show no trace of any internal structure. They are most probably cavities containing bunches of spicules.

In spite of these difficulties it seems reasonable to give *Ainigmaptilon* a provisional place among the Pennatulacea till further specimens are forthcoming.

The habit of growth presents another problem. Unless one entertains the rather remote possibility that the specimen had originally a fine supporting axis which was torn out or left behind in the process of dredging, the extreme weakness and flexibility of the narrow stem must have made it quite impossible for the colony to grow erect. It is possible that what we have of the specimen is merely a terminal tassel-like rachis which was supported by a strong and much elongated peduncle.

The specimen (Pl. XIII, fig. 2) has a striking appearance, suggestive of an elongated, delicate, flexible inflorescence. It is approximately 18 cm. long and consists of a narrow, very flexible stem, with an average diameter of 2 mm., from which on either side, but on the whole more towards the ventral (metarachidial?) surface, short stout branches arise irregularly at average distances of 2.5 mm. These grow out at right angles to the stem, either horizontally or sloping ventrally. In view of the probable Pennatulid nature of the colony, the barer, more exposed portion of the main stem will be termed here dorsal—that is, prorachidial.

On this dorsal side of the stem are seen irregular rows of small white and yellowish specks, some of which are slightly prominent. These may possibly be regarded as rudimentary siphonozooids, but we do not consider this at all probable. Scattered over the ventral and lateral surfaces there are a few similar specks.

The mode of branching is peculiar. Each short stout branch leads on, in a manner to be presently described, to a dense cluster of small autozooids, and since many of the polyp-clusters of opposite and adjacent branches meet, little of the stem can be seen from the ventral surface. The branches increase slightly in size towards one end of the colony, but we cannot say which end. The base of the main trunk of a branch (Pl. XIII, fig. 5, A) is 2 to 3.2 mm. in diameter, and the total length from base of trunk to top of polyp-cluster is 4 to 8 mm. The main trunk of a branch, rounded and tapering slightly from the base, divides into two to three (more typically two) secondary twigs (Pl. XIII, fig. 5, B), but after this the branching is extremely irregular. Each secondary twig gives rise to small tertiary twigs (Pl. XIII, fig. 5, C), varying in number from three to eight or nine. Some of these are terminal, bearing four to seven or even more polyps. Others divide into two or three further very minute twigs. These also may be terminal, bearing four to seven polyps, or may divide still further into twigs so

minute that it is difficult to distinguish them, except microscopically. Each of these bears three to five minute polyps. This very irregular mode of branching is utterly different from anything seen in the superficially somewhat similar tufts of *Virgularia gustaviana* or *V. halisceptrum*.

A zooid arises from a terminal twig by a narrow neck (Pl. XIII, fig. 1, *Nk*) (or polyp-stalk) which bears the cup-shaped body of the polyp, the mouth and tentacles of which are protected by the long projecting points of five to eight (probably eight) spicules (Pl. XIII, fig. 1, *Pt*). On both neck and polyp-body can be seen eight dark bands, doubtless corresponding to the mesenteries. The average length of a zooid, including neck, is 1 mm. The average breadth of the polyp-body is 0.3 mm. The average breadth of neck is 0.06 mm. The tentacles, which attain a length of 0.3 mm., are in most cases concealed by the rather incurving spicule-points, but they are seen to bear on each side a single row of eight to nine short pinnules.

A minute group of what appear to be rudimentary autozooids was found laterally on one portion of the main stem. At this point an irregular cavity in the stem-wall, which is here more than usually thick, connects by a narrow opening with one of the four longitudinal canals and opens exteriorly into the cavity of a tentacle-like outgrowth in which two septa run obliquely. This outgrowth bears three polyps (Pl. XIII, fig. 6, *Rud-Zo*), each connected with it by a comparatively long neck (Pl. XIII, fig. 6, *Nk*). The coelentera of these open into the cavity of the tentacle-like stalk. In these cup-shaped bodies small rudimentary tentacles are found as lobes round the margin of the mouth; and there can also be seen a gullet and faint traces of mesenteries. The average size of these zooids is 0.26 mm. by 0.15 mm., thus very much smaller than the typical forms. The length from the junction with the main stem to the tip of the stalk is 0.8 mm. Growing beside this compound outgrowth, and with a cavity connected with the central canal by the same passage, is a solitary minute stalk, bearing a very rudimentary polyp. The length of this stalk and polyp together is 0.2 mm. There is thus a hint of dimorphism among autozooids, for the appearance presented is not in the least like the origin of a new branch.

Any idea that these dwarf zooids are siphonozooids reduced to vestigial numerical representation may be ruled out. In the first place, their origin here is compound and not simple as is that of a siphonozooid. In the second place, we must recognise the presence of small tentacles, which are absent in siphonozooids, except in some of the Umbellulidæ and Chunellidæ, which have one tentacle.

Spicules (Pl. XII, fig. 5).—(A) In the wall of the main stem there are oval or irregularly oval scale-like spicules, with (B) one end occasionally prolonged into a short arm. These spicules bear a few minute warts and a central or excentric nucleus, from which radiate several fine striations. The dimensions are 0.1 mm. by 0.05 mm. to 0.3 mm. by 0.15 mm. A few spicules of this type occur in the walls of the branches.

In the polyp-walls there are (C) very small irregularly shaped scale-like spicules, some with minute warts and with finely-toothed edges. The types varied in greatest length from 0.03 mm. to 0.1 mm. There are also (D) flat spicules which are roughly isosceles triangles in shape, with a centrobasal nucleus (sometimes wanting) from which radiate first minute warts and then numerous fine ridges which project slightly beyond the outer margin, thus resulting in markedly toothed edges and a very striking general feathery appearance. The basal edge is the only one that is untoothed. (E) In many spicules of this type the apex is prolonged into a narrow process, which is less than half the width of the basal portion, straight or slightly bent, covered with longitudinal or slightly oblique ridges which again give a rough outline, but with no warts. The length of these slender processes varies from a little more than half the entire length of the spicule to an almost negligible size. (F) In some forms the basal portion is considerably reduced in breadth (*e.g.*, 0.08 mm.) and without ridges. The following measurements were taken:—Total length, 0.25 mm. to 0.52 mm.; breadth of lower portion, 0.12 mm. to 0.15 mm.; breadth of apical process 0.03 mm. to 0.06 mm. There are also (G) numerous almost square plate-like spicules with minute warts. One edge is smooth, and often bears a middle marginal nucleus with fine striations radiating from it. On the opposite edge and occasionally on the lateral edges there are comb-like teeth. A side of this approximately square spicule varies from 0.1 mm. to 0.5 mm. Some are slightly more irregular in form. (H) Some much less numerous spicules were seen which can be described exactly by apposing the smooth edge of the approximately square spicule (type (G)) to the smooth basal margin of the triangular feathery spicule (types (D) or (E)). In some of the spicules a faint crack can be seen at this line of junction, running from what is now a central nucleus either right across the spicule or only a part of the way. In others there is no trace of any crack. It is thus obvious that many of the spicules of types (D), (E), and (G) are really the halves, broken apart, of this last spicule (type (H)). This is confirmed by the fact that there is always one central nucleus in type (H), whereas in types (D), (E), and (G) the marginal nucleus may or may not be present, this depending, one supposes, on whether the break took place above, below, or through the middle of the central nucleus. It is also evident that they would readily break, as a large portion of the upper half projects from the polyp-body and might easily snap off during the process of boiling out the spicules. One cannot be sure, however, whether they are *all* broken halves, or whether some of types (D), (E), and (G), especially the more irregular spicules of (G), may not be really separate spicules. There are also (J) circular scale-like spicules with toothed edges and a central nucleus. In some there are warts radiating outwards from the nucleus, and in many there are a few marginal ridges extending inwards for a short distance. The diameter of these circular spicules varies from 0.14 mm. to 0.18 mm.

Excluding type (C), the micro-spicules, one can trace in these spicules two lines of evolution. I. A series of the smooth spicules can be suggested, the simple oval of type (A) leading on to the isosceles triangle of type (B). II. A series of the feathery

spicules would start from the rounded spicule type (J), with a toothed edge and a few marginal ridges; this would lead to the isosceles triangle shape and the extreme featheriness of types (D) and (H). The end of the series would be reached in types (E) and (F), where the apex of the triangle is drawn out into a long and narrow process. We cannot leave these spicules without again emphasizing their convergent resemblance to those of Primnoidæ.

All the spicules are colourless.

Colour of the specimen in spirit.—The polyyps and branches grey-white to grey-yellow; the stem brownish with grey-yellow and whitish specks.

Internal Structure.

Branch.—At the junction of branch and main stem is a relatively stout wall (0.05 to 0.15 mm. in thickness), similar to the outer wall of the main stem, and penetrated by a few (2 to 4) narrow passages. The base of the branch is formed of mesoglœa, riddled with numerous anastomosing solenia.

From this mesoglœal mass narrow septa arise (Plate XIII, figs. 3, 8, 9, 10, *Sept.*). These vary in number according to the number of ultimate twigs, for, on tracing these septa through serial sections, one finds that each septum terminates at the point of junction of two twigs (Plate XIII, fig. 3 (1, 2, 3, 4)). As has been stated before, every ultimate twig bears from three to seven zooids, so that each canal between two septa is a cavity into which the cœlentera of three to seven zooids open.

Down the centre of each septum runs a narrow intra-septal cavity (Plate XIII, figs. 3, 8, 10, *Int-Sept.*), to which we are unable to attach any significance. There is no trace of a definite epithelial lining.

The canals of ultimate and penultimate twigs are filled with ova, each ovum surrounded by its envelope. Most lie free, but one or two are apparently attached by strands of tissue arising from the wall of the twig. If this is the case they must have been produced in the twig, probably from a delicate continuation of the mesentery. As already explained, it is not possible to determine this, owing to the imperfect preservation of the specimen.

Main Stem.—The mesoglœa of the outer wall of the main stem is considerably thickened; fine fibrils and many small cavities or canals can be distinguished in it which give it a spongy appearance. No trace of the cellular structure of the ectoderm or the endoderm is preserved. The outer portion of the wall is often very spongy in texture, and in portions of the stem the whole wall is riddled with small cavities.

A considerable number of larger cavities, generally oval in shape and often containing spicules, are distributed irregularly in the stem-wall. Many of these open to the exterior by a narrow neck or more directly, and occasionally the cavity lies in a slight projection of the outer wall. It is just possible that some of these cavities are siphonozooids, but others seem to be no more than spicule-filled gaps in the mesogloea.

Along the internal cavity of the stem run four longitudinal septa (Plate XIII, fig. 6, *Long-sept*), the bases of which are attached continuously to the wall. Each is considerably thickened from the base inwards for nearly half its length, but then tapers to a narrow strip. In the thicker half the septal mesogloea is riddled with numerous small cavities; the narrower half contains a smaller number of larger cavities arranged in a string. Except for one small portion of stem from one end of the specimen, these septa lie loose in the central cavity, the free end of each showing a torn edge. In this one portion they all join to form an irregular central mass; but though this mass contains ill-defined cavities there is no sign of a definite axial canal nor, as we have said, any trace of an axis.

The generic name of this remarkable new type is chosen in reference to the present puzzle of its systematic position (*Ainigma*, a riddle; *ptilon*, a feather or wing). The specific name expresses our indebtedness to the late Professor W. A. Haswell, F.R.S., F.L.S., of Sydney.

Summary.

A unique type of Alcyonarian, probably referable to the order of Pennatulids. From a narrow main stem, without an axis, numerous short side-branches are given off which subdivide irregularly into twigs bearing many small autozooids. There is no satisfactory evidence of the presence of siphonozooids; small white specks on the main stem appear to be merely groups of small spicules projecting on the surface. On one portion of the stem is a group of small rudimentary autozooids. The spicules of the colony are strikingly like the Primnoid type (*Axifera*). The most striking Pennatulid feature of the colony is the presence of four longitudinal septa in the main stem. In addition, the side-branches are most nearly comparable to, though not identical in structure with, the pinnae of the Pennatulids *Virgularia gustaviana* and *V. halisceptrum*. Pennatulid features that are missing are—(1) siphonozooids; (2) a definite axial canal; (3) an axis. It is possible, however, that the axis was separated from the colony in the dredging, and, although this is rather a remote possibility, it is borne out by the torn condition of the septa.

Locality.—Station 2, 283–300 fathoms, 21st December, 1913.

ACTINOZOA : MADREPORARIA.

CARYOPHYLLIA CLAVUS *Sacchi*.

(For description see : P. Martin Duncan, "Madreporaria of the 'Porcupine' Expedition." Trans. Zool. Soc. London, vol. viii, 1874 (?))

Three specimens of this common and very variable species. They show a conical corallum, with an almost circular mouth, with a substantial pedicle slightly bent to one side. The costæ are distinct towards the mouth of the calyx; there is a well-developed epitheca reaching almost to the calyx; the septa are slightly exsert. They bear numerous triangular prominences on their surfaces. There are a dozen primary, and between each pair a secondary and two tertiaries. There are about a dozen prominent pali. The height of the calice varies from 16 to 20 mm., and the axes of the mouth are practically equal to each other, varying from 14 to 17 mm.

Locality.—Station 10, 325 fathoms, 28th January, 1914.

Distribution.—Previously recorded from Mediterranean and North Atlantic.

CARYOPHYLLIA INSKIPI *Duncan*.

(Pl. X, fig. 6.)

(For description see : P. Martin Duncan, "Description of Madreporaria of 'Porcupine' Expedition," Trans. Zool. Soc. London, vol. viii, 1874, p. 316.)

Three specimens agreeing well with Martin Duncan's description. Thus the corallum is short and curved, with a small base; the strong costæ extend to the base and the surface of the epitheca is granular; the calyx mouth is sub-circular, shallow externally, deeper above the inconspicuous columella; the septa show lines of granules; the pali are tall and thick. If the identification is correct, as it seems to be, the geographical distribution is remarkable. The height of the largest specimen, considerably greater than that dredged by the "Porcupine," is 2 cm., and the diameter of the sub-circular mouth of the calyx is 2.4 cm.

Locality.—Station 10, 325 fathoms, 28th January, 1914.

Distribution.—Previously recorded from Bay of Biscay, 539 fathoms.

CARYOPHYLLIA VERMIFORMIS *Duncan*.

(For description see : P. Martin Duncan, "Madreporaria of the 'Porcupine' Expedition." Trans. Zool. Soc. London, vol. viii, 1874, p. 316, 4 figs.)

A trumpet-shaped cylindrical colony, 4.5 cm. in height, with a basal diameter of 6 mm. and a calyx diameter of 1 cm. The narrow basal portion, less in diameter than the disc of attachment, extends for about 1.7 cm., and shows a marked knee near the base. The identification cannot be satisfactory since the mouth of the calyx is

broken and the surface of the specimen weathered. But it agrees with *C. vermiformis*, though not in the attaching disc; in the cylindrical curved stem, the distinct costæ near the calyx, the stout wavy septa in three cycles. The surface of the septa is studded with pointed prominences.

Locality.—Off Maria Island, 65 fathoms.

Distribution.—Previously recorded by the "Porcupine," Lat. 39.39 N., Long. 9.39 W. Depth, 740 fathoms.

FLABELLUM AUSTRALE Moseley.

(For description see Moseley, "Challenger Report on Madreporaria," Vol. II, 1881, p. 173, 5 figs.)

The specimen agrees well with Moseley's description and figures of *Flabellum australe*. Thus the lateral view of the compressed calyx is a broad triangle with a distinct short pedicle; the mouth of the calyx is a narrow oval; the septal borders are cut away close to the margin of the calyx; the surface of the septa is covered with fine pointed granules; the summits of the calyx margin across the short axis are higher than those on the long axis. A Polyzoon encrusts one side of the calyx. The dimensions of the specimen are as follows: maximum height, 5 cm.; maximum width along the long axis, 7 cm.; maximum breadth across the short axis, 3 cm. These are almost the same as those of Moseley's largest specimen.

Locality.—Off Maria Island, 65 fathoms.

Distribution.—Previously recorded from off Twofold Bay, New South Wales, 120 fathoms.

FLABELLUM TRANSVERSALE Moseley.

(For description see Moseley, "Challenger Report on Madreporaria," II, 1881, p. 174, 2 figs.)

Several specimens agreeing closely with Moseley's description and figures of *Flabellum transversale*. Thus, the form is elongated, compressed conical, with a short pedicle twisted to one side, and with an oval mouth; the entire surface is covered by deep curved transverse sulci and rounded ridges; the summits of the two axes are nearly on the same level; the stout straight septa have numerous fine-pointed granules on their surface.

The largest specimen has a maximum height of 7.5 cm.; the long diameter of the mouth of the calyx is 3 cm.; the short diameter is 2.3 cm.

Localities.—Station 9, 240 fathoms, 28th January, 1914; Station 10, 325 fathoms, 28th January, 1914.

Distribution.—Previously recorded from Bass Straits, Australia, 38 fathoms.

ANTIPATHARIA.

BATHYPATHES PATULA *Brook*.

(For description see Brook, "Challenger Report Antipatharia, 1889," pp. 151-152, 4 figs.; Cooper, Percy Sladen Trust Exp., Trans. Linn. Soc. Zoology, xii, 1909, pp. 310-311, 5 figs.; Van Pesch, "Siboga Expeditie, Monographie xvii," 1914 pp. 29-37, 5 figs.)

A plume-like colony, with 72 curved branches in two rows, alternating, with no secondary branches. The colony curves first in one direction and then in the other like a mark of interrogation. The stem tapers at the base to a sharp sickle. The agreement with *B. patula*, with which *B. alternata* should be united, is very close. There are 4-5 longitudinal rows of triangular spines visible on the axis.

Locality.—Station 5, 1,700 fathoms, 6th January, 1914.

Distribution.—Previously recorded from Makassar Straits, 450 m., 1,301 m.; Celebes Sea, 1,901 m.; Banda Sea, 1,158 m., 2,796 m.

EUANTIPATHES PLANA (*Cooper*).

(For description see: Cooper, "Percy Sladen Trust Expedition," Trans. Linn. Soc. Zoology, xii, 1909, p. 317, 2 figs.; Van Pesch, "Siboga Expeditie, Monographie xvii," 1914, pp. 48-9.)

In the absence of polyps it is not of much service to discuss this specimen, which is represented by many pieces. But it is characterised by the frequent fusions of branches, resulting in a spreading fan-like or flabellate reticulum. The twigs of adjacent branches are abundantly fused and a twig often unites with a neighbouring branch. This points to *Euantipathes plana*, with which the specimen agrees in the four longitudinal rows of alternating spines on the twigs. Cooper speaks of 8 steep spirals, but this probably refers to a branch not a twig. On the thick branches the spines are densely disposed. The largest piece rises to a height of 9.7 cm., and the axis has a basal diameter of 3 mm. Besides numerous delicate twigs which arise alternately on each side at an angle of about 75°, there are more substantial twigs, of which the strongest is 6.6 cm. in length, and has a diameter of 1.5 mm.

Locality.—Off Macquarie Island about 25 miles, 1,500 fathoms.

Distribution.—Previously recorded from Salomon Atoll (Chagos), 75 fm. Solar Strait, 113 m.

EXPLANATION OF PLATES.

PLATE VIII.

- Fig. 1. *Ceratoisis (Primnoisis) delicatula* Hickson. Natural size.
 2. *Mopsea tenuis* n.sp. $\times 1.5$.
 3. *Echinosis armata* (Kükenthal) n.g. Polyp $\times 20$.
 4. *Caligorgia ramosa* Kükenthal and Gorzawsky. $\times 7$.
 5. *Ascolepis spinosa* n.sp. Natural size.
 6. *Ascolepis spinosa* n.sp. $\times 8$.

PLATE IX.

- Fig. 1. *Thouarella longispinosa* Kükenthal. Natural size. First type of branching (A).
 2. *Thouarella longispinosa* Kükenthal. Natural size. Second type of branching (B).
 3. *Thouarella longispinosa* Kükenthal. $\times 17$.
 4. *Thouarella variabilis* Wright and Studer. $\times 18$.
 5. *Thouarella variabilis* Wright and Studer. Natural size.
 6. *Ascolepis splendens* n.g. et sp. Natural size. St. 2.
 7. *Ascolepis splendens* n.g. et sp. $\times 11$. St. 2.
 8. *Dicholaphis delicatula* n.sp. $\times 2$.
 9. *Dicholaphis delicatula* n.sp. $\times 17$.
 10. *Astromuricea formosa* n.sp. $\times 10$.

PLATE X.

- Fig. 1. *Ascolepis splendens* n.g. et sp. Natural size. St. 7.
 2. *Ascolepis splendens* n.g. et sp. $\times 8.5$. St. 7.
 3. *Astromuricea formosa* n.sp. $\times 1.5$.
 4. *Mopsea tenuis* n.sp. $\times 5$.
 5. *Umbellula carpenteri* Kolliker. Natural size.
 6. *Caryophyllia inskipi* Duncan. $\times 2$.
 7. *Euantipathes plana* (Cooper). Natural size. Axis.

PLATE XI.

- Fig. 1. *Alcyonium antarcticum* Wright and Studer. Spicules.
 2. *Eunephtya racemosa* Studer. Spicules.
 3. *Echinosis armata* (Kükenthal) n.g. Spicules.
 4. *Mopsea tenuis* n.sp. Spicules.
 5. *Ascolepis spinosa* n.sp. Spicules.
 6. *Ascolepis splendens* n.g et sp. Spicules.

PLATE XII.

- Fig. 1. *Thouarella longispinosa* Kükenthal. Spicules.
 2. *Astromuricea formosa* n.sp. Spicules.
 3. *Thouarella variabilis* Wright and Studer. Spicules.
 4. *Dicholaphis delicatula* n.sp. Spicules.
 5. *Ainigmaptilon haswelli* Dean. Spicules.

PLATE XIII.

AINIGMAPTILON HASWELLI *Dean.*

- Fig. 1: Arrangement of spicules in autozoid. Semi-diagrammatic. The tentacles are not figured.
 2. "Dorsal" view of specimen. $\times 1.25$.
 3. Longitudinal section of a portion of a side-branch showing the septa terminating at the junction of the twigs.
 4. Side-branch enlarged.
 5. Diagrammatic representation, as if in one plane, of the mode of branching of a side-branch.
 6. Transverse section of portion of main stem, with rudimentary zooids.
 7. Longitudinal section of an ultimate twig with autozooids opening into it.
 8. Longitudinal section of the base of the side-branch, with a portion of the main stem from which it arises. The mesogloæal mass, perforated with solenia, is seen with the septa of the branch arising from it.
 9. Transverse section of base of side-branch showing mesogloæal mass, and bases of some of the septa.
 10. Transverse section of the "trunk" of a side-branch.

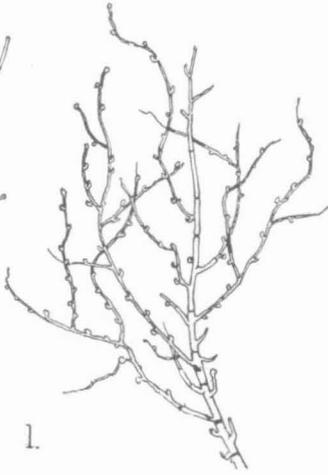
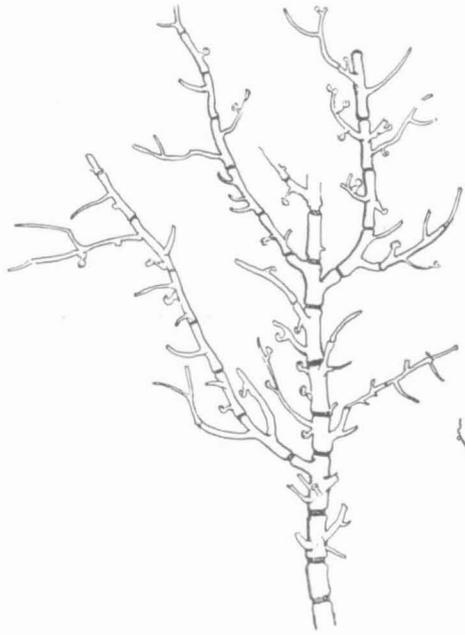
PLATE XIV.

A very deceptive specimen; a Gorgonid axis overgrown by a Hydractinia-like Hydroid.

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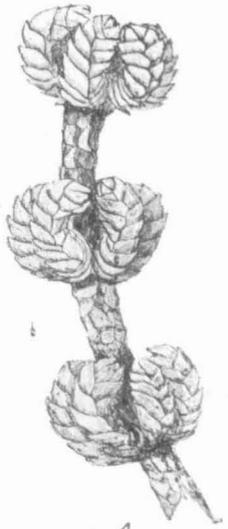
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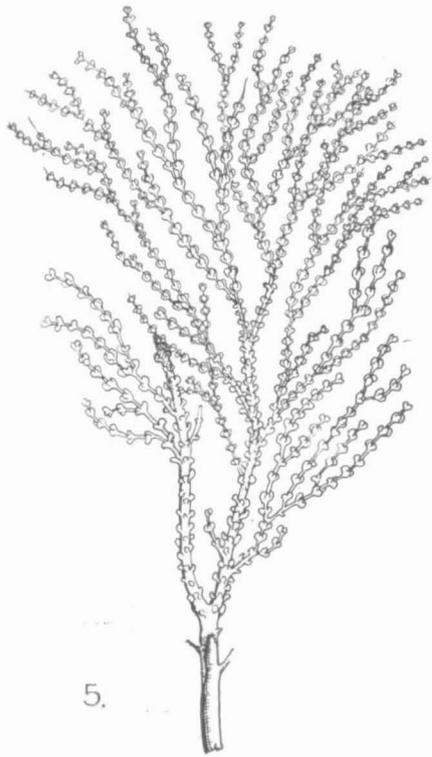
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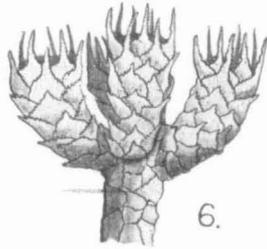
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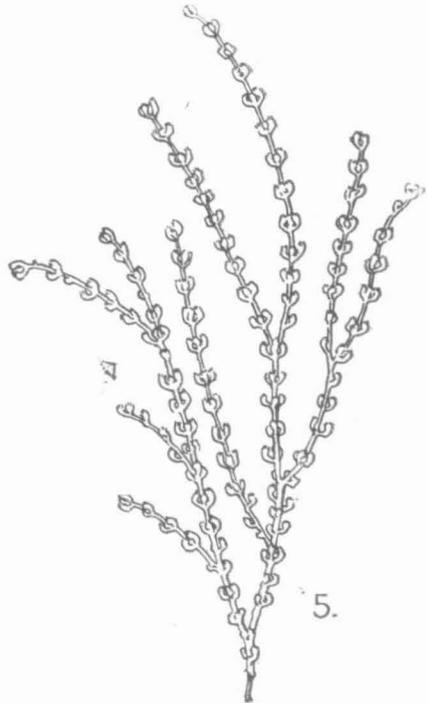
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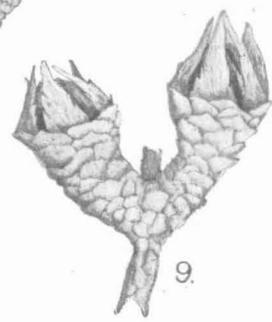
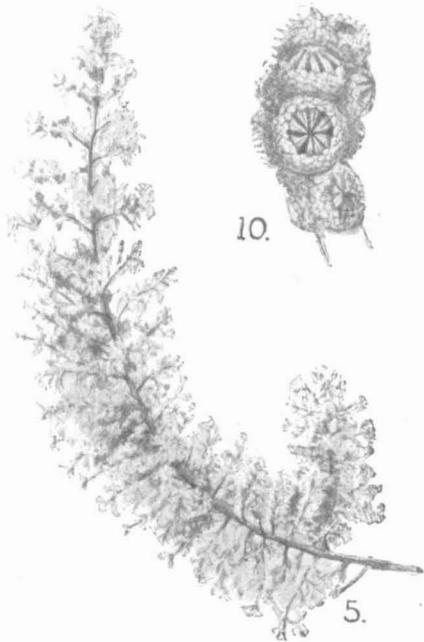
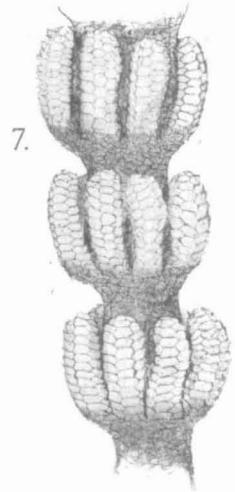
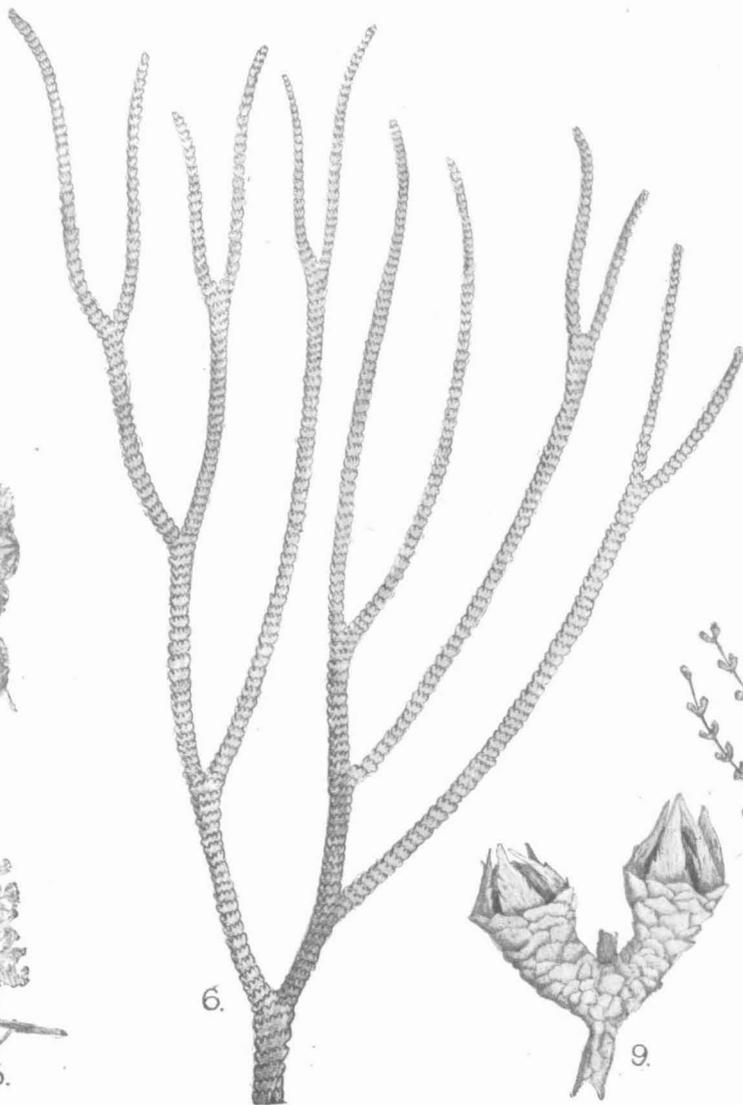
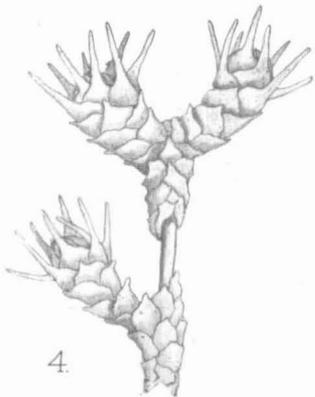
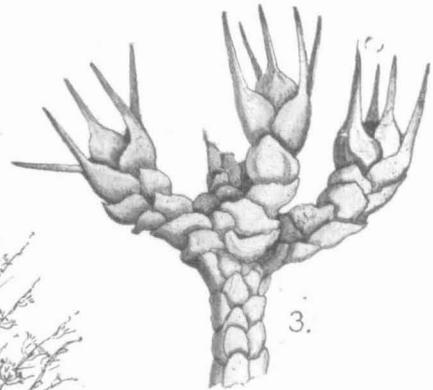
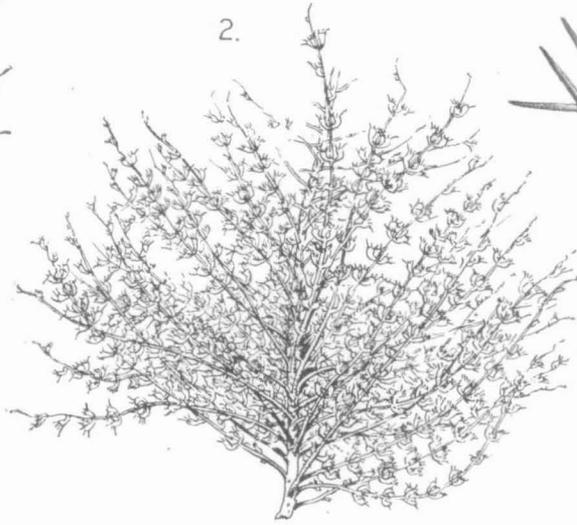
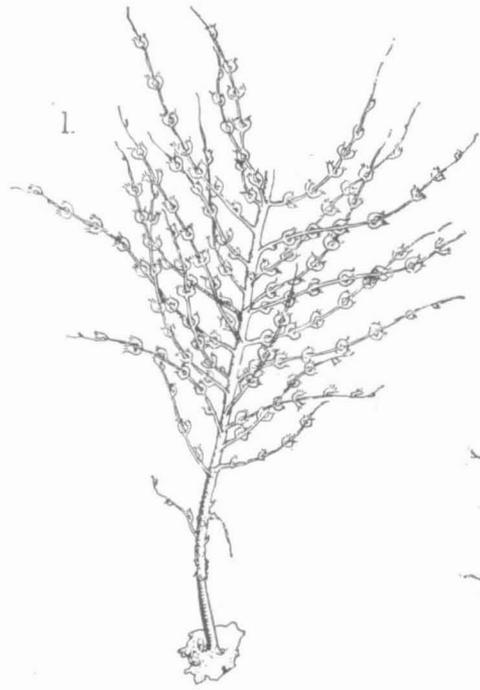
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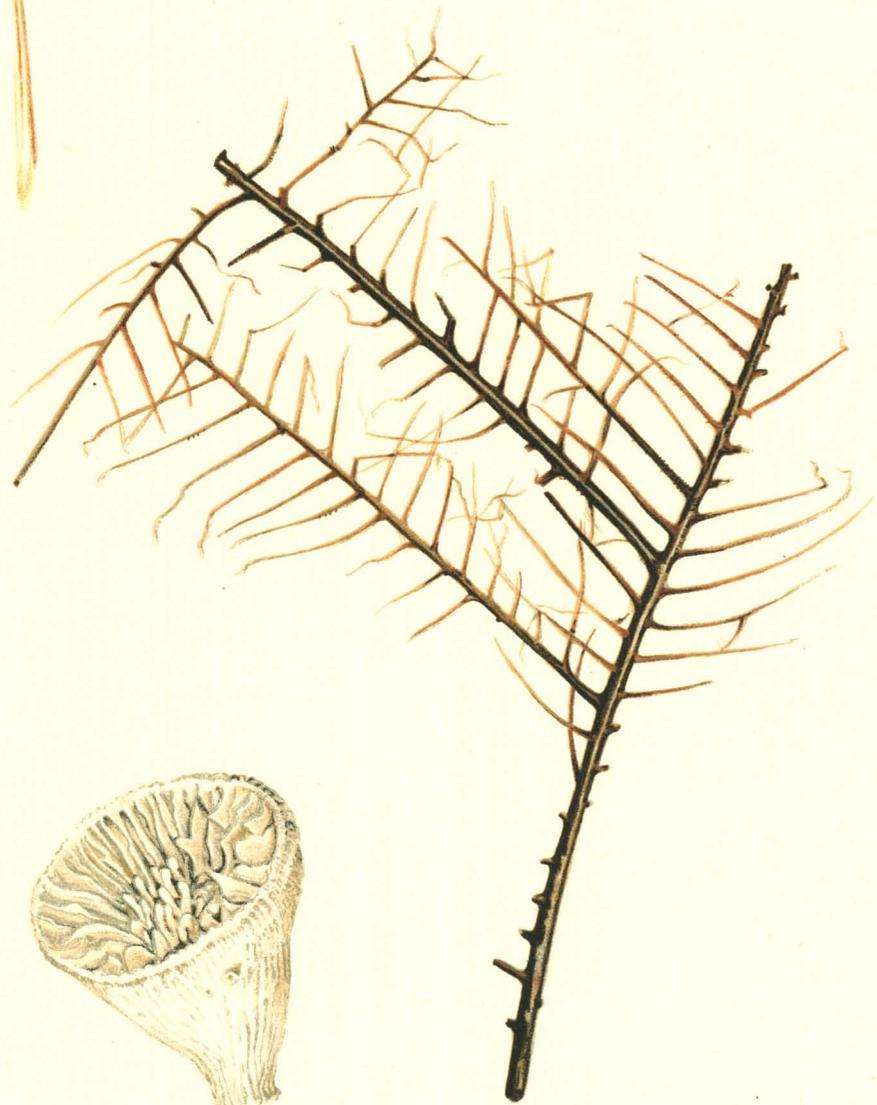


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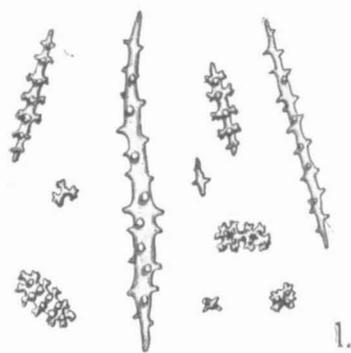
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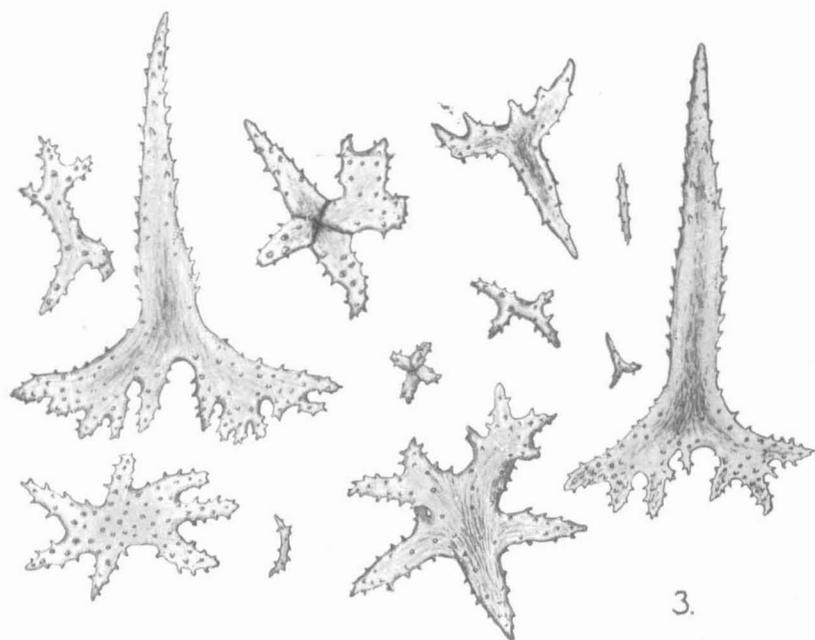
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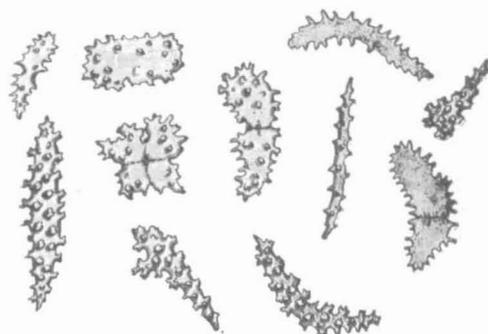
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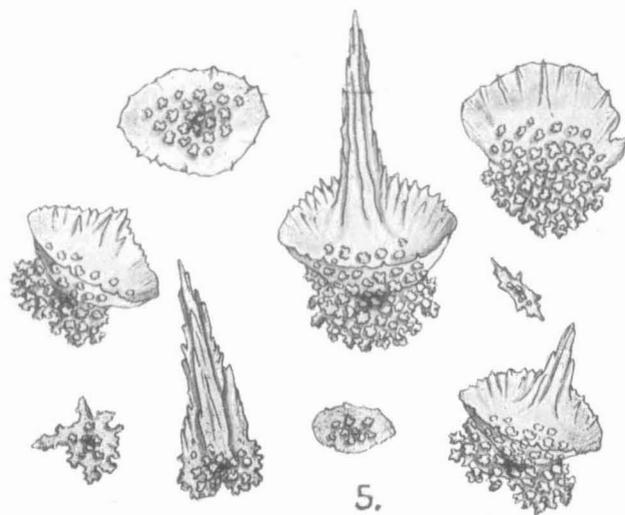
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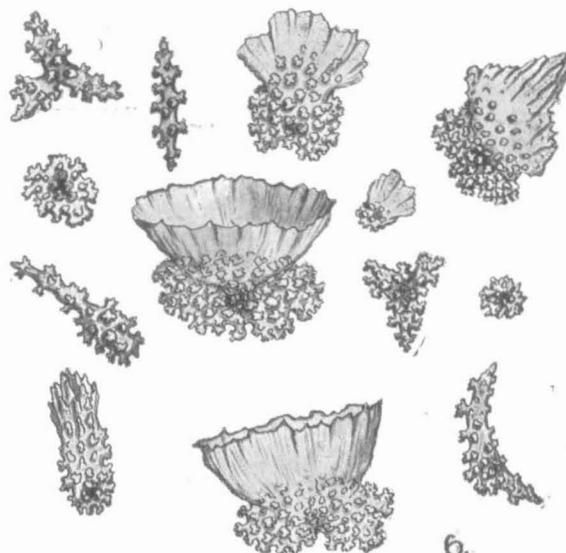
3.



4.



5.



6.

