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THE TUNICATA OF THE " THETIS "

EXPEDITION.

BY

PROFESSOR W. A. HERDMAN, D.Sc., F.R.S.

AND

WM. RIDDELL, M.A.

THE TUNICATA OBTAINED DURING THE EXPEDITION OF THE H.M.C.S. "THETIS" ON THE COAST OF NEW SOUTH WALES IN 1898.

By W. A. HERDMAN, D. SC., F.R.S., Professor of Zoology at the University of Liverpool; and WM. RIDDELL, M.A., Fisheries Assistant in the University of Liverpool.

(Plates xc.-xcii.)

The collection of Tunicata obtained during the trawling operations of the "Thetis" comprises twenty-five species, and most of these are familiar Australian forms. Three of the species appear to be new to science, and three are in such poor condition that they cannot be named with certainty. That no representatives of peculiar or exceptional genera were obtained is quite natural when we remember that the expedition was undertaken mainly for fisheries purposes, and that consequently the "Thetis" worked along the coasts of the State, north and south of Port Jackson, always within the 100 fathom line, and never more than thirty miles from shore. When we add that the Australian Tunicate fauna, and especially that of New South Wales, is one of the best known in the world, the small number of novelties found in this collection will cause no surprise. Believing, as we do, that the further elucidation of known forms is quite as important for science as the diagnosis of new species, we have not hesitated to add to this Report particulars ascertained from the "Thetis" specimens in regard to the structure and affinities of species already known to science.

The species of the "Thetis" collection represent Simple and Compound Ascidiæ fairly equally, but there is only a single member of the Thaliacea (or pelagic forms) present, viz., *Salpa costata-tillesii*. The simple Ascidiæ all belong to the great Family Cynthiidae, which is not only the largest family, in species, but is also the one that is most strongly represented in Southern seas. The Ascidiidae which are so abundant in European seas are evidently very rare on the Australian coast.

Amongst the Compound Ascidiæ, although Distomids and Polyclinids are the most abundant, still four in all of the leading families are represented.

The complete list of the species in the collection is as follows:—

ASCIDIACEA.

I.—ASCIDIÆ SIMPLICES.

Family CYNTHIIDÆ.

- Boltenia pachydermatina*, Hrdn.
 „ *tuberculata*, Hrdn.
Microcosmus herdmani, von Drasche.
 „ *julinii*, von Drasche.
Styela whiteleggii, Hrdn.
Polycarpa tinctor (Quoy and Gaimard).
 „ *aurata* (Quoy and Gaimard).
 „ *stephenensis*, Hrdn.
 „ *pilella*, Hrdn. (?)
 (?) *Cynthiid* (imperfect and indeterminable).

II.—ASCIDIÆ COMPOSITÆ.

Family DISTOMIDÆ.

- Distoma*, sp. (?).
Colella tenuicaulis, Hrdn.
 „ *plicata*, Hrdn.
 „ *murrayi*, Hrdn.
 „ *elongata*, Hrdn.

Family POLYCLINIDÆ.

- Amaroucium rotundatum*, Hrdn.
 „ sp. (?).
Psammaphidium rude, Hrdn.
 „ *thetiense*, sp. nov.
 „ *ordinatum*, sp. nov.

Family DIDEMNIDÆ.

- Leptoclinum jugosum*, sp. nov.
 „ *incanum*, Hrdn.

Family BOTRYLLIDÆ.

- Sarcobotrylloides jacksonianum*, Hrdn.
 „ *pannosum*, Hrdn.

THALIACEA.

Family SALPIDÆ.

Salpa costata-tilesii, Q. and G.—Cuv.

For convenience of reference, and because this present paper may be considered as an extension or supplement to the "Descriptive Catalogue of the Tunicata in the Australian Musuem,"¹ published in 1899, we have adhered as far as possible to the nomenclature and arrangement of species made use of in that former work—which will be referred to, when necessary, in the following pages simply as the "Catalogue."

Out of the twenty-five species that follow, thirteen will be found described in the "Catalogue," a few others were previously obtained off the Australian coast during the voyage of the "Challenger," and three species remain—a very fine *Leptoclinum* (*L. jugosum*) and two forms belonging to the difficult genus *Psammopliidium* (*P. thetense* and *P. ordinatum*)—as the new Tunicata made known to science as a result of the "Thetis" Expedition.

ASCIDIACEA.

ASCIDIÆ SIMPLICES.

Family CYNTHIIDÆ.

BOLTENIA PACHYDERMATINA, *Herdman*.

Station 51.

There is one specimen, measuring $5\frac{1}{2} \times 3 \times 2\frac{1}{4}$ cm., with the stalk measuring 23 cm.—a moderate-sized individual compared with some recorded.

The branchial sac has six folds on each side.

The dorsal tubercle is characteristically and closely patterned (see figure in the "Catalogue").

This large-stalked Simple Ascidian is apparently one of the commonest forms in southern seas, as it has frequently been obtained from the coasts of Australia and New Zealand.

Locality.—Station 51, Shoalhaven Bight, 15 fathoms.

¹ Austr. Mus. Cat., xvii. Tunicata, 1899.

BOLTENIA TUBERCULATA, *Herdman*.

Station 55.

The single small specimen of this species was attached to one of the individuals of *Styela whiteleggii* (the same association is noted in the "Catalogue"). It measures 2.5 x 1.5 x 1.3 cm., and was trawled at Station 55.

The tuberculate condition characteristic of the external appearance of this species is well shown.

The test varies in thickness from 1 to 5 mm.

The branchial sac has six folds on each side, and agrees in all details, including the presence of fine spicules, with the description in the "Catalogue."

Locality.—Station 55, off Crookhaven River, 15 fathoms.

MICROCOSMUS HERDMANII, *von Drasche*.

(Plate xc., figs. 1-4).

Station 54.

There are two specimens of this species, measuring respectively 11 x 8½ x 6 cm. and 10 x 8 x 5 cm. Colour, deep brown.

External Appearance.—Apertures are four-lobed and prominent (Pl. xc., fig. 1). The anterior end of the test is partly retracted, forming a rounded pad at the base of the apertures, somewhat as in *Cynthia praeputialis*, Heller. The test is leathery, very hard and stiff. It is smooth at the anterior end as far as the rounded pad, but behind that it is raised to form numerous irregular ridges, or vermiform projections (Pl. xc., figs. 1 and 3), coated with embedded sand. These projections are in places branched so as to form small tufts (Pl. xc., fig. 3) up to 4 or 5 cm. in length. The lower third or more of the test as seen from the outside consists of a matted mass of these sandy processes. The test is white in section, and smooth and glistening on the inner surface.

The branchial sac has its length placed transversely (Pl. xc., fig. 2). There are six wide folds on each side, and one rudimentary (ventral) fold which is not mentioned by von Drasche. There are about ten bars to a fold, and twelve stigmata in a mesh.

The test measures up to 6 mm. in thickness between the siphons, and is even thicker on the posterior tufted, sand-incrusted part.

The mantle is muscular and opaque, and is very powerful at the anterior end. It measures up to 4 mm. in thickness (Pl. xc., fig. 2).

The tentacles number about twenty-two, chiefly large, but with some smaller ones between.

Dorsal tubercle with the horns coiled spirally round two divergent cones (Pl. xc., fig. 4).

Locality.—Station 54, Jervis Bay, 10 to 11 fathoms.

MICROCOSMUS JULINII, *von Drasche*.

One specimen, measuring 6 x 4 x 4 cm.

External Appearance.—Much contracted, test wrinkled, apertures withdrawn and more or less concealed by folds, four-lobed. Colour, brownish to grey. The test is covered with shells, Serpula tubes, and other foreign particles.

Test not very thick. Test lining the branchial siphon unarmed.

Branchial sac with six folds on each side, about twelve bars to a fold, six between and six to eight stigmata to a mesh.

The transverse vessels are alternately broad and narrow.

Tentacles branched, about sixteen in number.

Dorsal lamina a plain membrane.

Dorsal tubercle horse-shoe-shaped, both horns turned in, with the lines indented or undulating.

The branchial sac contains numerous spicules, chiefly curved spindles or crescents; the mantle also is full of spicules of various shapes (including tri-radiate, or even quadri-radiate); the test also contains spicules. The larger of these spicules from the mantle show traces of the minutely serrated edges which are figured by von Drasche for this species.

Externally this "Thetis" specimen agrees closely with the description of *M. julinii*, and the indented opening of the gland also approaches the wavy condition figured in that species by von Drasche. But there are only twelve folds in the branchial sac, not fourteen; and while there is some irregularity in the number of stigmata it does not seem as great as von Drasche describes.

Locality.—Jervis Bay; trawled.

STYELA WHITELEGGII, *Herdman*.

Station 55.

Two specimens, measuring $4 \times 4\frac{1}{2} \times 1\frac{1}{2}$ cm. and $6 \times 3\frac{1}{2} \times 2\frac{1}{4}$ cm.

External Appearance.—There is a broad base for attachment at the posterior end. The apertures are distinct, on more or less prominent siphons. The test is firm, wrinkled, brown in colour, and moderately thick and tough.

The branchial sac is deep brown in colour. There are four folds on each side, eight bars to a fold, six to twelve between, and five to seven stigmata to a mesh.

The tentacles are simple, numerous, of three sizes.

Dorsal tubercle apparently broken up. Alimentary canal a wide loop. Anus with a crenated margin. Gonads not developed.

The above characters, except in unimportant minor details, agree with the description of *S. whiteleggi* in the "Catalogue." The shape, however, may vary greatly in this species.

The second specimen is not so compressed as the first, and it has another Ascidian (*Boltenia tuberculata*) attached to it between the siphons. It is covered in places by a Halisarcoid sponge, as were also the specimens described in the "Catalogue." We have also to note again that same association of this *Styela* with *Boltenia tuberculata* which is referred to in the "Catalogue."

Locality.—Station 55, off Crookhaven River, 15 fathoms.

POLYCARPA STEPHENENSIS, *Herdman*.

(Plate xc., fig. 5).

There are five specimens, the largest measuring $12\frac{1}{2} \times 6\frac{1}{2} \times 2\frac{1}{2}$ cm. Colour, deep brown to grey, some with a reddish tinge.

External Appearance.—Much compressed, apertures four-lobed, prominent. Test much wrinkled, firm and tough, not very thick, more or less flaccid, thickened at the posterior end and sometimes prolonged into a considerable process or stalk.

Mantle firm and moderately muscular, thickened posteriorly.

Branchial sac has four folds on each side; there are six to seven bars to a fold, and four between the folds; ten to fourteen stigmata to a mesh. The transverse vessels are wide, and contain muscle-fibres.

Tentacles numerous, simple, of three sizes.

Dorsal lamina, a plain, narrow membrane.

Dorsal tubercle bicornuate, one horn turned out, the other in.

Gonads.—The polycarps are arranged in distinct areas on the inner surface of the mantle.

This species was previously known from the collection of the Australian Museum, and was described in the "Catalogue" (p. 45). As only one specimen, from Port Stephens, was examined, we have thought it well to give the above notes from the specimens before us to supplement the original description. The chief point of difference is in the external appearance, as several of those from Jervis Bay are attached by large basal thickenings of the test at the posterior end, which may either be a wide matted mass including much foreign material or may be prolonged in the form of a narrow stalk which may extend to about 10 cm. in length and 3 cm. in width. The dorsal tubercle is also a little different, one horn turning out in the "Thetis" specimens (Pl. xc., fig. 5), but we do not attach much importance to that variation.

Locality.—Jervis Bay; trawled.

POLYCARPA TINCTOR, (*Quoy and Gaimard*).

The one specimen, 8 x 2 x 1 cm., of this species is very much elongated in the posterior part. Otherwise it agrees well with the description given in the "Challenger" Report and that in the "Catalogue," from specimens obtained in Port Jackson.

Locality.—Jervis Bay, 10 to 11 fathoms.

POLYCARPA PILELLA, *Herdman* (?).

Some small specimens which almost certainly belong to this little species are found associated with *Psammaplidium rude*.

They are unfortunately in such bad condition inside the test that the internal characters cannot be determined; but they belong to the genus *Polycarpa*, and in size, shape, and other external characters they closely resemble *P. pilella*, which is known from Port Jackson.

Locality.—Coast of New South Wales.

POLYCARPA AURATA, (*Quoy and Gaimard*).

(= *P. sulcata*, *Herdman*).

Station 28.

One specimen was obtained measuring 6 x 4 cm., and covered

with an incrusting layer of the smooth sponge, *Halisarca*. This was also the case with the specimen from Port Jackson described in the "Catalogue."

The species was also obtained by the "Challenger" at Banda, and by Sluiter near Java, in the Malay Archipelago.

Locality.—Station 28, off Manning River, 22 fathoms.

CYNTHIID (?)—PROBABLY POLYCARPA, *sp.* (?).

Station 41.

One imperfect specimen.

Only the test is left of this specimen, the body had been removed.

The test, which measures $3\frac{1}{2} \times 2 \times 2$ cm., is firm but thin pearly grey inside

The branchial and atrial openings are four-lobed.

This test has the appearance of being a *Polycarpa*, but of course it is impossible to determine the genus and species with certainty.

Locality.—Station 41, off Wata Mooli, 52 to 71 fathoms.

ASCIDIÆ COMPOSITÆ.

Family DISTOMIDÆ.

DISTOMA. *sp.* (?).

Station 22.

There is a colony measuring about $5\frac{1}{2} \times 4\frac{1}{2} \times 3\frac{1}{2}$ cm., which is undoubtedly a member of the family Distomidæ, but cannot be determined further with certainty. It is of dark grey colour and of firm gelatinous consistency, but has a number of large cavities in the interior, in a few of which the imperfect remains of large ascidiozooids are found. The test, like that of a *Colella*, contains many bladder cells. The ascidiozooids are about 1.5 cm. in length by 2 mm. wide, and are divided into thorax and abdomen united by a long narrow pedicle containing the œsophagus and rectum. The branchial sac has about a dozen rows of small rounded stigmata, many in a row. The branchial and atrial apertures are both at the anterior end and the branchial at least is six-lobed.

The condition of the test in this colony recalls a *Cystodytes* in which the disc-like calcareous spicules surrounding the ascidiozooids have become dissolved out, leaving large cavities in which the ascidiozooids lie more or less loosely.

Locality.—Station 22, Newcastle Bight, 26 to 40 fathoms.

COLELLA TENUICAULIS, *Herdman*.

Station 54.

This species was described in the "Catalogue" (p. 64) from specimens collected in Port Jackson and Port Stephens. The "Thetis" collection contains thirty-six small specimens. It is probably a common species of *Colella* on the Australian coast in shallow water. The "Thetis" specimens are, on the whole, smaller than those described in the "Catalogue," the largest having a stalk of only 34 x 1.5 mm., and an ascidiarium measuring 18 x 5 mm.

Locality.—Station 54, Jeryis Bay, 10 to 11 fathoms.

COLELLA PLICATA, *Herdman* (?).

(Pl. xc., fig. 6).

Station 51.

A colony from Station 51 is either this common Port Jackson species, or is so closely allied that with the material at our disposal we are unable to separate it. The colony in the preserved condition is opaque and of a deep purple-brown colour, while *C. plicata*, as described in the "Catalogue," is pale yellow; but the single "Thetis" specimen has the appearance of being much contracted, and possibly became discoloured in the process of preservation, or since. We give a figure of an ascidiozooid (Pl. xc., fig. 6) from the "Thetis" specimens to show the short, stout stigmata which differ from those figured for *C. plicata*.

Locality.—Station 51, off Shoalhaven River, 15 fathoms.

COLELLA MURRAYI, *Herdman*.

Station 49.

One large colony in the "Thetis" collection, obtained at Station 49, clearly belongs to this species discovered by the "Challenger" Expedition off the south-east coast of Australia and at Port Jackson. The dimensions of the "Thetis" specimens are as follows:—

Head, 3 cm. x 2.5 cm. x 7 mm.

Peduncle, 3.5 cm. x 1 to 1.5 cm.

Stolon, about 5 cm. x 5 to 10 mm. in diameter.

The other characters agree well with the description in the "Challenger" Report.

Locality.—Station 49, off Port Kembla, 63 to 75 fathoms.

COLELLA ELONGATA, *Herdman*.

(Pl. xc., fig. 7).

Stations 22 and 53.

Four narrow club-shaped colonies of this species, united at a common base, were obtained at Station 53, and another smaller cylindrical colony at Station 22. The size of the largest colony is:—

Asciarium, 4 cm. x $1\frac{1}{2}$ cm. x 5 mm.

Peduncle, 1 cm. x 1 cm. x 5 mm.

The specimens are all in rather poor condition, but in all characters that could be determined they agree well with the description of the "Challenger" specimens. We give a figure (Pl. xc., fig. 7) of the alimentary canal, which is very characteristic, with its well-marked pyloric constriction and sudden widening into the intestine.

The ascidiozooids are densely crowded in all the colonies, and the short fleshy peduncles are filled with their thread-like ectodermal appendages.

Locality.—Station 22, Newcastle Bight, 26 to 40 fathoms; Station 53, off Crookhaven River, 23 fathoms.

Family POLYCLINIDÆ.

AMAROUCIUM ROTUNDATUM, *Herdman*.

Stations 10, 41, and 54.

Station 10 (off Broken Head, 28 fathoms), two specimens, the larger one measuring $5\frac{1}{4}$ x $4\frac{1}{4}$ x $3\frac{1}{2}$ cm. (ascidium) and 3 x $3\frac{1}{4}$ cm. (peduncle); Station 41 (off Wata Mooli, 52 to 71 fathoms), one specimen measuring 6 x 4 x $3\frac{1}{2}$ cm. (ascidium), and 2 x 4 cm. (peduncle); "Thetis Expedition, Coast of New South Wales," one specimen (cut in two), measuring $9\frac{1}{2}$ x 5 x 4 cm.; and Station 54, Jervis Bay, 10 to 11 fathoms, three specimens, one (cut in two) measuring 11 x $5\frac{1}{2}$ x $4\frac{1}{2}$ cm., the other two a little smaller.

External Appearance.—The colony is massive, fleshy, ovoid, on a short massive peduncle. The test is firm, translucent and brownish-grey. The ascidiozooids all open on the upper part of the colony, but are not regularly arranged. The lower part of the colony is smooth.

Ascidiozooids not much retracted. They are large, up to 3 cm. and over in length, and from 1 to nearly 2 mm. broad. They lie in all directions in the test.

There is no atrial languet. Both apertures are six-lobed.

The test is firm and cartilaginous, and contains many bladder cells and small test cells.

The mantle is muscular, having many longitudinal muscle bands. Some, if not all, of these bands bifurcate before joining the sphincter, and there is more or less coalescence at the end of the thorax.

The branchial sac is well developed, about 3 mm. in length.

The stigmata are obscured and hard to make out, owing to the contraction of the mantle. There are twelve to fifteen, or possibly more rows, thirty to forty in a row, long and narrow. The transverse vessels are well developed and have the horizontal membranes described for *A. rotundatum* in the "Catalogue."

Dorsal lamina. A series of about twelve long languets, stout and ciliated.

Tentacles fairly numerous, and in two series, inner smaller and outer longer, placed alternately.

The stomach wall is folded longitudinally.

Incubatory pouch present, with tailed larvæ.

Post-abdomen with long vascular appendages.

Intestinal loop fairly long. Gonads partly in loop and partly in post-abdomen.

Localities.—Station 10, off Broken Head, 28 fathoms; Station 41, off Wata Mooli, 52 to 71 fathoms; Station 54, Jervis Bay, 10 to 11 fathoms.

AMAROUCIUM, *sp.* (?).

Station 23.

There is a small colony measuring about 3 x 1.5 cm., with some basal roots for attachment, which is in poor condition and cannot be identified with certainty—but is probably a species of *Amaroucium*.

Locality.—Station 23, Newcastle Bight, 16 to 19 fathoms.

PSAMMAPLIDIUM THETIENSE, *sp. nov.*

(Plate xci., figs 1—5).

External Appearance.—Colony massive, irregularly elongate-ovate in shape (Pl. xci., fig. 1) attached along a narrow area at each end of the lower surface. Length 6 cm., greatest breadth about $2\frac{1}{2}$ cm. Colour a brownish-grey.

The test is firm and gelatinous; the surface rough to the touch from the presence of scattered sand grains. These are most abundant at the surface, but do not form a continuous layer. Internally the sand grains and other foreign particles are very few in number. The test cells are small, there are a very few pigment cells but no bladder cells.

The ascidiozooids are not arranged in definite systems, but in places form lines running transversely to the long axis of the colony. They are about 4 mm. long, with a well-developed post-abdomen. The branchial aperture is six-lobed; the atrial aperture has a large and stout languet (Pl. xci., fig. 2). The mantle has both longitudinal and transverse muscles on the thorax; the abdomen and post-abdomen have longitudinal muscles only.

The branchial sac contains about ten rows of stigmata, which are about four times as long as they are broad (Pl. xci., fig. 4); the interstigmatic vessels are fairly wide, but narrower than the stigmata. The transverse vessels contain muscle fibres.

The dorsal lamina is composed of a series of languets, which are triangular and rather wide, overlapping slightly (Pl. xci., fig. 5).

The tentacles number sixteen and are of at least two sizes, possibly three.

The endostyle is markedly undulating.

The alimentary canal is a long narrow loop (Pl. xci., fig. 3). The œsophagus is long, narrowing near the stomach. The stomach is short and wide, almost quadrate in shape, the anterior end being the wider, the posterior tapering abruptly into the intestine; four or five longitudinal folds are visible on one side. The intestine is divided into three parts. There is first a narrow part succeeding the stomach about as long as the œsophagus; this is followed by a wider portion forming the loop, into which the narrow part opens abruptly; finally there is the rectum, which is generally filled with a series of dark faecal pellets from a point about opposite the stomach upwards to the anus. The anus has two conspicuous divergent lobes (Pl. xci., figs. 2 and 3).

Locality.—Coast of New South Wales.

PSAMMAPLIDIUM ORDINATUM, *sp. nov.*

(Plate xci., figs. 6—12).

Station 28.

Two colonies and some small fragments.

External Appearance.—The colony is massive, irregular in shape, and flattened. The ends of the ascidiozooids are visible on the surface, arranged in well-marked groups round small shallow depressions (Pl. xci., fig. 6), from which the common cloacal apertures rise as conical elevations, often conspicuously projecting (Pl. xci., figs. 6 to 9). The surface is hard and rough from the presence of much sand. The colour is dark brownish-grey. The largest colony measures 7.5 x 5 x 1 to 1.5 cm.

The test is exceedingly hard and dense from the great quantity of sand and other foreign material present. It is almost impossible to cut, being very hard, though not brittle; in fact, the actual test substance is practically only a cement binding together the enormous numbers of sand grains and other material. The test cells are small and not very numerous; no pigment cells nor bladder cells are visible.

The ascidiozooids are arranged at right angles to the surface, 5 mm. in length or more, with a long post-abdomen. The branchial aperture is six-lobed, and the atrial languet is stout.

The mantle has well developed muscles, the majority being longitudinal. There are a few transverse fibres on the thorax.

The branchial sac has about fifteen rows of stigmata, which are fairly long and narrow. The transverse vessels contain muscle fibres (Pl. xci., fig. 10).

The dorsal languets are narrow tentacular processes, not so long as the intervals.

The endostyle is undulating.

The alimentary canal forms a short loop. The stomach is globular with longitudinal folds, which on the side next the rectum show a tendency to break up and shorten into areolations (Pl. xci., fig. 11).

The gonads are in the post-abdomen, which grows out at its extremity into lobes (Pl. xci., fig. 12).

Locality.—Station 28, off Manning River, 22 fathoms.

PSAMMAPLIDIUM RUDE, *Herdman.*

An irregular sandy, incrusting lobed mass, growing over a mass of small barnacles (*Balanus*), apparently belongs to this

species found during the "Challenger" Expedition, but the locality of which is unknown—very possibly it was from Port Jackson.

Associated with this *Psammaplidium*, and more or less surrounded by it are several specimens of a small *Polycarpa*, which looks very much the same as the lobes of the Compound Ascidian, and is probably the "Challenger" species *Polycarpa pilella*, already known from Port Jackson.

Locality.—Coast of New South Wales.

Family DIDEMNIDÆ.

LEPTOCLINUM JUGOSUM, *sp. nov.*

(Plate xcii., figs. 1—6).

Stations 29, 34 and 44.

External Appearance.—The colony is large and massive, firm and smooth to the touch, and tends to grow up into elevated ridges and promontories, sometimes of a conical or pyramidal nature, and it is in consequence of this mountainous appearance that we have applied the specific name *jugosum*. Pl. xcii., fig. 1, shows a colony with three such elevations, one of conical shape and the other two of more irregular form, and at the apex of each is a large exhalant opening coming from a system of common cloacal cavities. Pl. xcii., fig. 2, is the top view of another colony of pyramidal form, showing a single conical peak supported lower down by three buttresses so as to produce the tri-radiate form shown in the figure. Other specimens, four or five in number, show more or less of the same ridged or mountainous appearance, with common cloacal apertures on the most prominent points, reminding one of the distribution of the oscula in some sponges. The edges of these cloacal apertures are thin, membranous, and somewhat frilled, suggesting that when the animal was alive the opening expanded into a funnel, possibly with everted margin. When a vertical section is made through one of the projecting points of the colony with its terminal aperture, it is seen that the opening leads into a series of large cloacal cavities traversed here and there by bands of test (Pl. xcii., fig. 3). The cavities become smaller as they get more remote from the terminal aperture. They are placed internal to the zone of the ascidiozooids, but leave more deeply still a central mass of solid gelatinous test (Pl. xcii., fig. 3).

The rest of the surface is smooth and has only a very few elliptical slit-like cloacal apertures irregularly scattered. The

anterior ends of the ascidiozooids form minute points, for the most part irregularly placed, occasionally for short distances in meandering lines.

The colour of the different specimens varies a little, but was probably in life a creamy-white. In some it has more of a grey tint. The test is massive and in sections the colony is seen to extend to several centimetres in thickness. A thin layer on the external surface is densely crowded with stellate calcareous spicules. The next layer around the bodies of the ascidiozooids has a few spicules, decreasing in number as they get further from the surface (Pl. xcii., fig. 4).

The central part of the test, forming by far the greater part of its bulk, is of a dense gelatinous or almost cartilaginous consistency, of a translucent grey colour, and contains no spicules. The test as a whole is closely packed with minute rounded and stellate test cells, and there are also many larger rounded granular pigment cells. There are no bladder cells.

The calcareous spicules in the test are large and have numerous short, stout, triangular processes. Pl. xcii., fig. 5 shows the character of this spicule, and Pl. xcii., fig. 4, gives an indication of the distribution around the ascidiozooids.

The small ascidiozooids have the thorax and abdomen connected by a narrow pedicle. Retractor muscle bands are present in the test.

The mantle is fairly muscular over the thorax, the muscle bundles running longitudinally. It has a very long branchial siphon, and the test lining this is densely crowded with stellate spicules forming a plug, which seems in these preserved, contracted specimens to fill up the greater part of the branchial opening (Pl. xcii., fig. 4).

The branchial sac is wide, and contains four rows of rather short, wide, elliptical stigmata, eight to ten in a row. The transverse vessels are wide, and contain muscular fibres (Pl. xcii., fig. 6).

The endostyle is of considerable size; the alimentary canal has the usual course, and the stomach is large, smooth, and globular without any folds. The relation of parts can be seen in Pl. xcii., fig. 4.

The tentacles are sixteen, of at least two sizes, placed alternately.

The dorsal lamina is represented by a series of long tentacular languets.

Many young buds are present in this species.

Localities.—Station 29, Manning Bight, 18 to 17 fathoms, one specimen measuring $8 \times 4\frac{1}{2}$ cm., and another measuring 10×7 cm.; Station 34 (off Port Jackson, 36 to 39 fathoms), one specimen, measuring $8 \times 4 \times 3\frac{3}{4}$ cm.; Station 44, two specimens, one (on back of crab) measuring $6\frac{1}{4} \times 5 \times 4$ cm., and the other measuring $4 \times 3\frac{1}{2}$ cm.; off Cape Three Points, 34 to 23 fathoms, one specimen measuring $14 \times 10 \times 5$ cm.

LEPTOCLINUM INCANUM, *Herdman.*

Station 53.

Several small incrusting colonies of a thin white *Leptoclinum*, attached to the base of *Colella elongata*, probably belong to this species already known from the Australian coast.

Locality.—Station 53, off Crookhaven River, 23 fathoms.

Family BOTRYLLIDÆ.

SARCOBOTRYLLOIDES PANNOSUM, *Herdman.*

Station 54.

One small colony of this Australian species was trawled by the "Thetis." It measures $20 \times 8 \times 3$ mm., and is of a dark purplish-brown colour. In texture it is soft and flabby, and is not very well preserved.

Locality.—Station 54, Jervis Bay, 10 to 11 fathoms.

SARCOBOTRYLLOIDES JACKSONIANUM, *Herdman.*

Station 53.

One colony forming a pyriform mass, measuring about 6 cm. x 2.5 cm., was trawled by the "Thetis." It is of a dark greyish-brown colour and shows the large ascidiozooids arranged clearly in systems varying from circles or ellipses to long meandering lines. The common cloacal apertures are quite distinct, and, in fact, in all characteristics this specimen agrees well with the description of the species in the "Catalogue." It is perhaps rather more pigmented than the original specimen, but that is not an important matter.

Locality.—Station 53, off Crookhaven River, 23 fathoms.

THALIACEA.

Family SALPIDÆ.

SALPA COSTATA-TILESII, Quoy and Gaimard—Cuvier.

Station 16.

Five large specimens of the aggregated form of this species were obtained, all rather damaged, two being empty tests only. They measure from $10\frac{1}{2}$ cm. up to $16\frac{1}{2}$ cm. in length, the greatest width being 7 cm.

This is the *Salpa infundibuliformis*, Quoy and Gaimard, first found by Freycinet's Expedition in southern seas. It is, however, widely distributed, having been recorded from the Atlantic, Pacific, and Indian Oceans and the Mediterranean. Ritter records it as being by no means rare on the Californian coast.

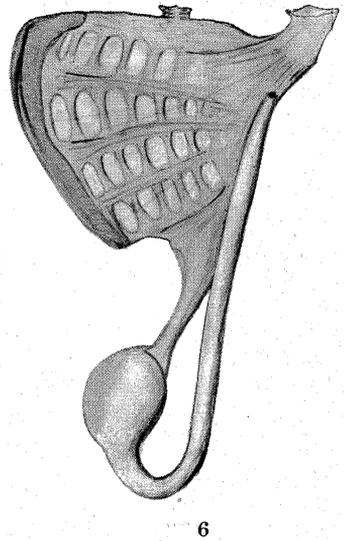
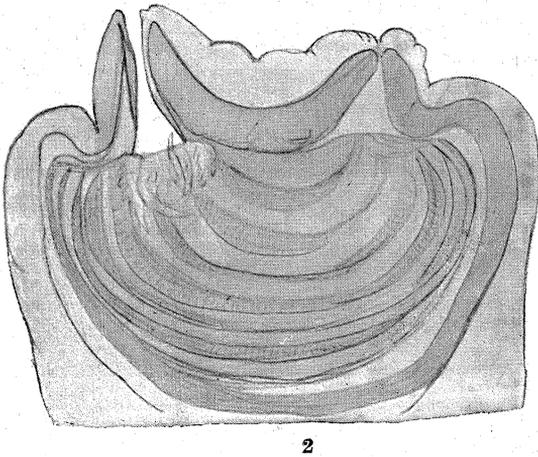
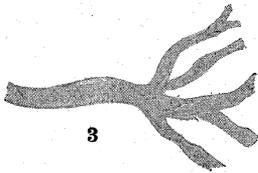
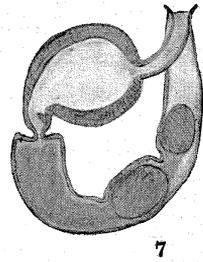
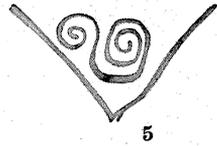
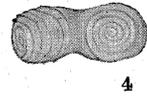
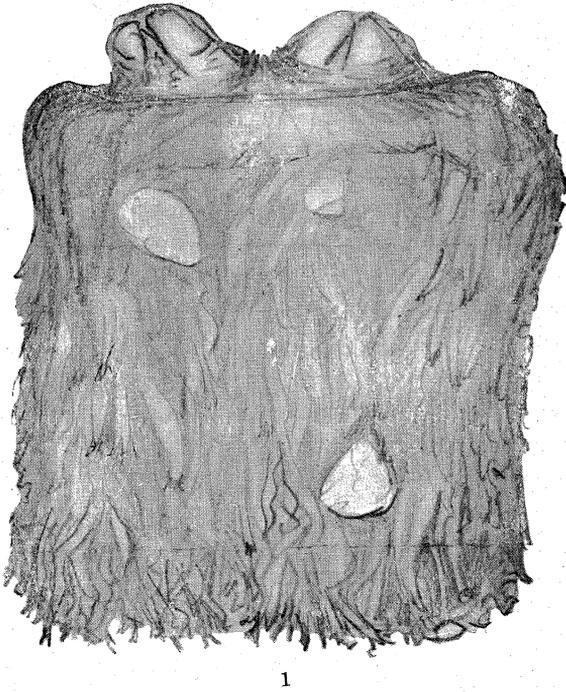
The "Thetis" specimens are very large, and, although belonging to the aggregate generation, they are not united. Ritter states that in his experience they remain united until about 7 cm. in length, but the smallest of these before us is at least $10\frac{1}{2}$ cm.

It is in the highest degree probable that other smaller Pelagic Tunicata were obtained in the nets during the "Thetis" Expedition: but these large specimens are the only Thaliacea that reached us with the collection.

Locality.—Station 16, off Bird Island; tow-net.

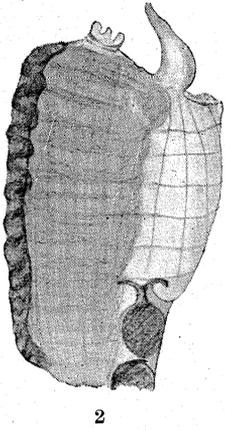
EXPLANATION OF PLATE XC.

- Fig. 1.—*Microcosmus herdmani*, von Drasche. Natural size, to show external characters.
- Fig. 2.—The same, cut open to show test, mantle, and branchial sac.
- Fig. 3.—One of the branched, tag-like, sandy processes from the test.
- Fig. 4.—The dorsal tubercle, enlarged, to show the two prominent spires.
- Fig. 5.—*Polycarpa stephenensis*, Hrdn. Dorsal tubercle, enlarged.
- Fig. 6.—*Colella plicata*, Hrdn. Ascidiozoid, magnified.
- Fig. 7.—*Colella elongata*, Hrdn. Alimentary canal, magnified.

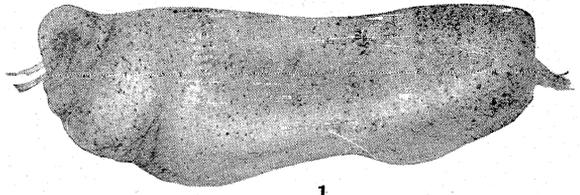


EXPLANATION OF PLATE XCI.

- Fig. 1.—*Psammaphidium thetiense*, sp. nov. Colony, natural size.
- Fig. 2.—Part of an ascidiozoid of the same, magnified.
- Fig. 3.—Alimentary canal, magnified.
- Fig. 4.—Part of branchial sac, magnified.
- Fig. 5.—Languets of dorsal lamina, magnified.
- Fig. 6.—*Psammaphidium ordinatum*, sp. nov. Colony, natural size.
- Fig. 7.—Part of surface enlarged, to show arrangement of ascidiozooids.
- Fig. 8.—Another part, more enlarged, showing ascidiozooids and common cloacal aperture.
- Fig. 9.—Common cloacal papilla, still more enlarged, showing ridges.
- Fig. 10.—Part of branchial sac, magnified.
- Fig. 11.—Stomach, showing arrangement of grooves, magnified.
- Fig. 12.—End of post-abdomen, showing lobes, magnified.



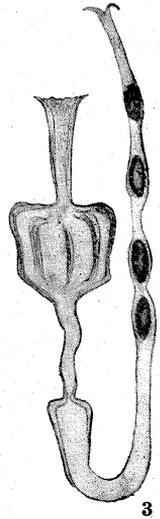
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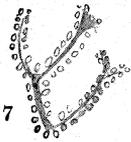
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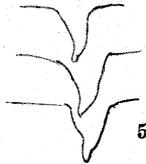
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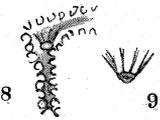
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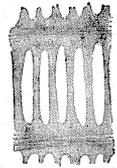


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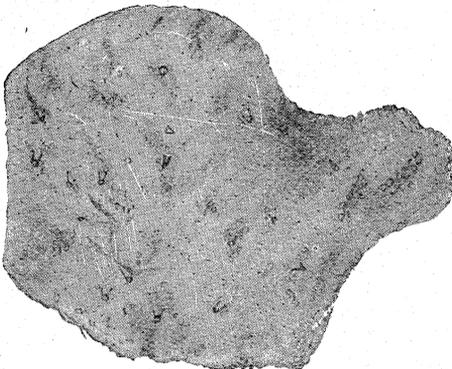
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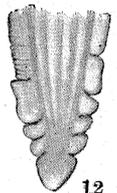
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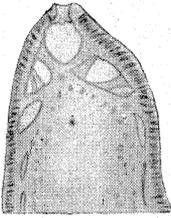
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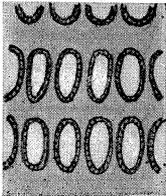
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EXPLANATION OF PLATE XCII.

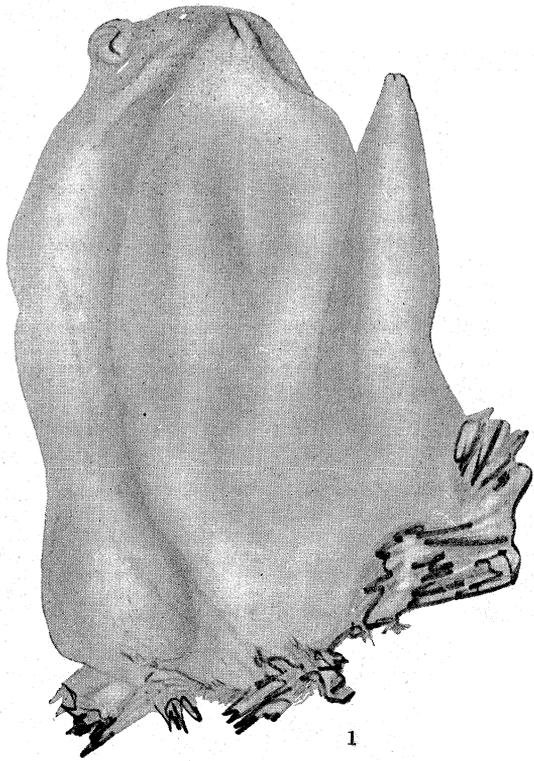
- Fig. 1.—*Leptoclinum jugosum*, sp. nov. Natural size, to show external characters.
- Fig. 2.—Another colony, looked at from above, natural size.
- Fig. 3.—Section of a peak, passing through an inhalent aperture, natural size.
- Fig. 4.—Section of test, showing an ascidiozoid and the arrangement of spicules—x 40.
- Fig. 5.—A spicule from the test—x 300.
- Fig. 6.—Portion of branchial sac, showing stigmata, magnified.



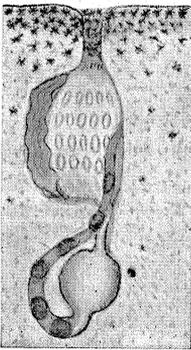
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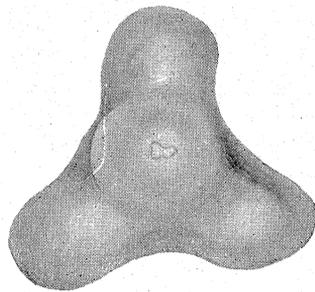
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