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PRESENTED



# CERIANTHARIA AND ZOANTHARIA

BY

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WITH THIRTY-FOUR TEXT-FIGURES AND ONE PLATE.

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## CERIANTHARIA

THE Ceriantharia taken by the Great Barrier Reef Expedition were only two, the one a new species of the genus *Arachnanthus*, the other a new, small larva, which I have with some hesitation referred to the genus *Anthoactis* Leloup.

### *Arachnanthus australiae* n. sp.

DIAGNOSIS.—A small species. Marginal and labial tentacles rather short, not numerous. Arrangement of the tentacles as in *Arachnanthus bocki* Carlgr. Directive labial tentacle absent. Actinopharynx rather long. In the lower part 6–8 mesenteries, in the upper 12 attached to the broad siphonoglyph, which does not reach up to the oral end of the actinopharynx. Hyposulcus about half as long as the actinopharynx. Directive mesenteries reaching to the aboral part of the hyposulcus. Second proto-mesenteries ( $P_2$ ) without plecto- and telocraspedon, sterile, their free parts about of the same length as the actinopharynx.  $P_3$ , B- and b-mesenteries with short orthocraspedon and long plectocraspedon, their free parts about as long as the hyposulcus. M- and m-mesenteries diminishing in length towards the multiplication chamber, the oldest almost reaching to the aboral pole, with very long orthocraspedon and short telocraspedon. Two or three of the oldest M- and m-mesenteries with an acontiid. Structure of the orthocraspedon on  $P_2$ , M and B that of Type 1. Telocraspedons broad with a deep longitudinal furrow. Acontioids similar to those of other species of *Arachnanthus* with strong muscles. Endoderm of  $P_2$  and M-mesenteries with very numerous curved nematocysts, which in B-mesenteries are more sparse.

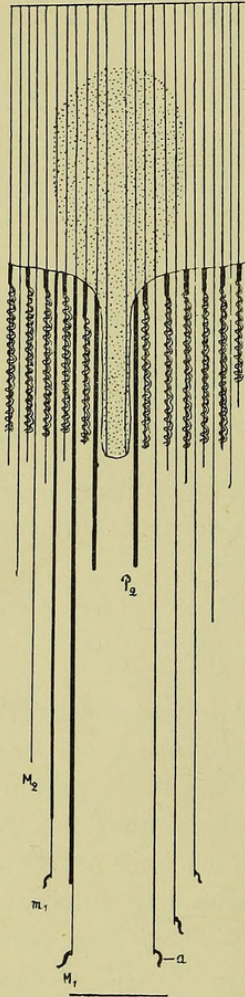
COLOUR in formalin.—Column yellowish, marginal tentacles on their insides with up to 6 yellowish cross-bands, at the base between the tentacles red-brown stripes, sometimes continued on the oral disc, inside of the labial tentacles red-brown. Nine tentacles around the directive chamber uncoloured; at the base of the labial tentacles at the



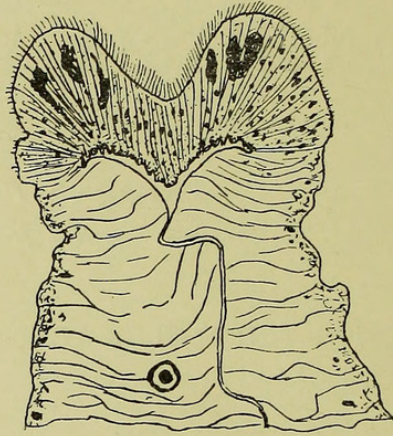
insertions of the mesenteries red-brown stripes; uppermost part of the actinopharynx yellowish, largest part of it and the siphonoglyph uncoloured.

**DIMENSIONS.**—Length of the body 7.5 cm., greatest breadth 0.7 cm., length of the marginal tentacles 0.7 cm., that of the inner 0.15 cm.

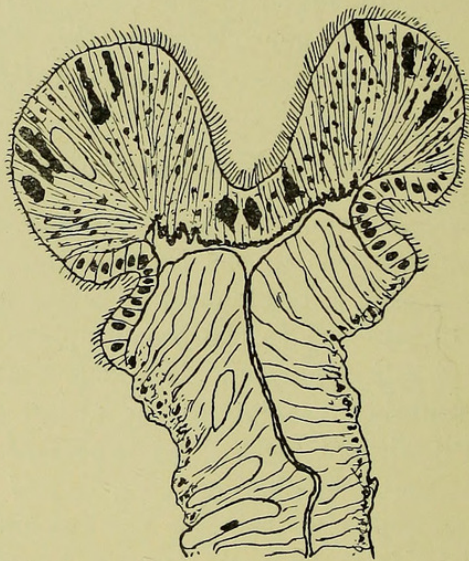
TEXT-FIG. 1.



TEXT-FIG. 3.



TEXT-FIG. 2.



TEXT-FIG. 1.—*Arachnanthus australiae* n. sp. Diagram of the arrangement of the older mesenteries. Thick lines, orthocraspedons; folded parts, plectocraspedons, siphonoglyph and hyposulcus dotted. *a.* Acontiods. See text.

TEXT-FIGS. 2, 3.—*Arachnanthus australiae* n. sp. Transverse section of an orthocraspedon (fig. 2) and of a telocraspedon (fig. 3) of the first metamesentery ( $M_1$ ).

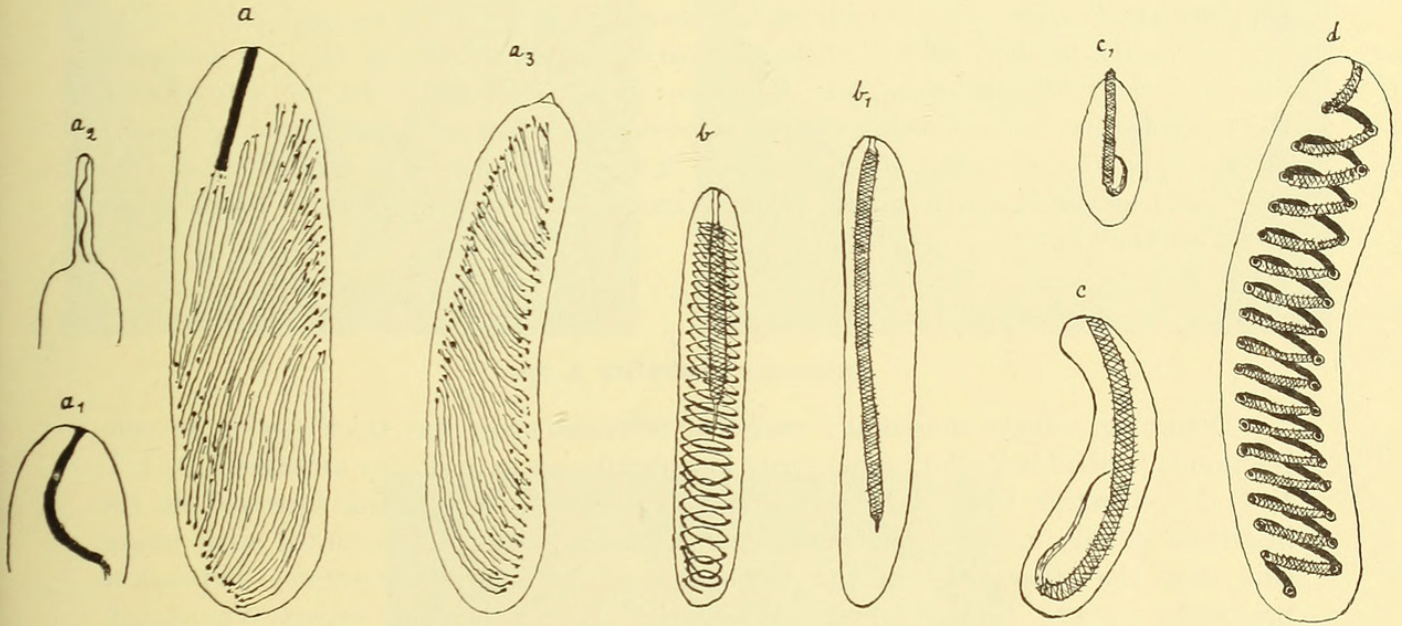
**OCCURRENCE.**—General survey, Low Isles: 1 specimen.

The species has the same general structure as other species of *Arachnanthus*. The marginal and labial tentacles were arranged in a single cycle. The labial tentacles were 35 in number; a directive labial tentacle was absent. The actinopharynx was rather



long, the siphonoglyph broad, the hyposulcus long but considerably shorter than the actinopharynx, the hemisulci absent. In the lower part 6, possibly 8 mesenteries were attached to the siphonoglyph, in the upper part 12. The cilia of the siphonoglyph were twice as long as those of the actinopharynx. The arrangement and structure of the mesenteries I have described in the diagnosis. Certainly there was no plectocraspedon and probably no telocraspedon on the second protomesenteries ( $P_2$ ). It was difficult to decide whether a telocraspedon was present or absent here, as the aboral end of  $P_2$  was strongly convoluted; if present, the telocraspedon may have been very short.

I have given a diagram of the oldest mesenteries and of the actinopharynx in Text-fig. 1. As in the collection only a single specimen was present, which I did not want to



TEXT-FIG. 4.—*Arachnanthus australiae* n. sp. Nematocysts.  $c, c_1$  from the cnidoglandular tract of the filaments; all the others from the ectoderm of the column. All nematocysts at the same magnification. See text.

destroy too much, I have marked the boundary between the orthocraspedon and the telocraspedon only on the left metamesenteries  $M$  and  $m$ ; on the other  $M$ - and  $m$ -mesenteries the ortho- and telocraspedons are not marked. Text-figs. 2 and 3 show the structure of the orthocraspedon and the telocraspedon. The ascending and descending limbs were distinct in the acontiods, but their gland-cells were macerated. There is, however, no doubt that the acontiods were of the same structure as in other species of *Arachnanthus*.

I have examined the cnidæ in maceration preparations in different parts of the animal. There were, however, no capsules wholly exploded. I think, nevertheless, that it is possible apart from the capsules  $c, c_1$  (Text-fig. 4) to determine their structure. The cnidæ of the column were very numerous and of different kinds: (A) Atrichous cnidæ (Weill), (1) large and broad,  $42-50 \times 12-14\mu$ , numerous; (2) large but narrower,  $42-52 \times 7(8.5)\mu$  (Text-fig. 4,  $a_3$ ), numerous; (3) small,  $19-23 \times 5-6\mu$ . In the figure  $a$  and  $a_1$  it seems as if the thread should be provided with a handle (a differentiated, thickened part of the thread), but this is not the case, as we see in the figure  $a_2$ , where the thread is



ejected a little. (B) Probably microbasic mastigophors (Weill), either with the handle about half as long as the capsules (Text-fig. 4*b*) or longer (Text-fig. 4*b*<sub>1</sub>),  $33-39 \times$  about  $5\mu$ . (C) Cnidæ of the type *c*, *c*<sub>1</sub>, often curved,  $41-48 \times 5-6.5\mu$ , sparse. (D) Very rare, as I think holotrichous cnidæ (Weill),  $43-55 \times 11-12\mu$  (Text-fig. 4*d*). As far as I can see the thread had barbs; the capsules were stained with methylene-blue in contrast with the spirocysts. (E) Spirocysts  $19-20 \times 2\mu$ , rather few. In the ectoderm of the tentacles there were numerous spirocysts up to about  $36 \times 6\mu$ ; atrichous cnidæ  $35-41 \times 6-8.5\mu$ , sparse; microbasic mastigophors about  $31 \times 5\mu$ , sparse; and nematocysts of the type *c*, often curved,  $37-44 \times 7-9\mu$ . The ectoderm of the actinopharynx had atrichous cnidæ  $29-41 \times 5-7\mu$ ; microbasic mastigophors  $29-36 \times 5-6\mu$ , and cnidæ of the type *c*,  $41-46 \times 7-10\mu$ . In the middle tract of the filaments spirocysts occur; in the cnidoglandular tract there were microbasic mastigophors,  $30-32 \times 5.5-6\mu$ , and cnidæ of the type *c*, partly smaller,  $16.5-19 \times 3.5-5\mu$ , partly larger,  $38-46 \times 7-10\mu$ . Outside the filaments the *c*-capsules were very numerous in the endoderm. In the ectoderm of the tentacles and actinopharynx I have exceptionally observed small capsules, possibly of the type *b*, measuring  $16-19 \times$  almost  $2.5\mu$ . The species is not identical with *Cerianthus nobilis* Hadd. & Shackl. from Warrior and Thursday Islands, Torres Strait and Port Darwin.

*Anthoactis australiae* n. sp.

DIAGNOSIS.—Body obconical; marginal tentacles short but thick (owing to contraction?); labial tentacles forming only low protuberances, probably arranged 1, 1, 1, I, 1, 1, 1; directive labial tentacle certainly absent. Actinopharynx furrowed at the insertions of the mesenteries. Siphonoglyph (sulcus) little differentiated with longer cilia than the other parts of the actinopharynx, without nematocysts; hyposulcus practically absent; hemisulci long. Mesenteries 11, most of them strongly vacuolated. Directive mesenteries short, P<sub>2</sub> the longest mesenteries, with long orthocraspedon and well developed plectocraspedon; P<sub>3</sub> with short orthocraspedon but long plectocraspedon, somewhat longer than the directives; M<sub>1</sub> with orthocraspedon and probably telocraspedon but no plectocraspedon; B<sub>1</sub> as P<sub>3</sub> but considerably shorter. Ciliated tracts of type 3. Mesenterets on all stronger mesenteries.

COLOUR.—Unknown.

SIZE.—Height and breadth 0.2 cm.

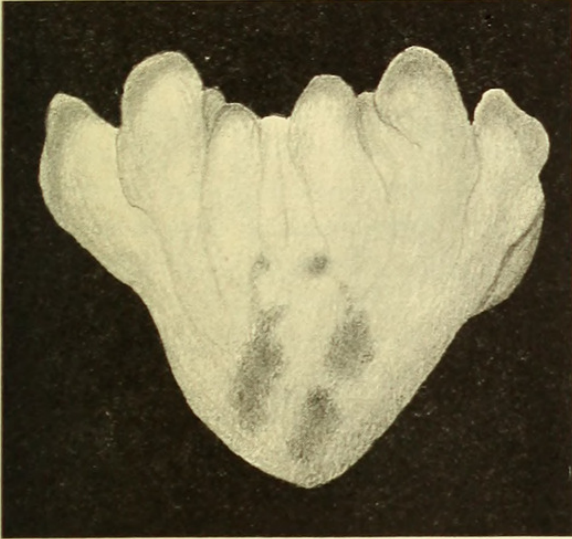
OCCURRENCE.—3 miles off Low Isles, coarse silk townet, 1 specimen.

The figures 5-7 show the larva from different sides. Of the 9 marginal tentacles, 4 on each side of the directive tentacle, were short and thick, the youngest left smallest. Their facies was certainly somewhat altered owing to contraction. When beginning my examination of the specimen I could not decide whether the elevations of the oral disc were rudimentary labial tentacles or not, but after making cross-sections of the whole animal I think that they probably are. If so the species is not an *Isodactylactis* Carlgr., but must be referred to the genus *Anthoactis* proposed by Leloup (1932), though there possibly may be some differences as to the filaments of the first metamesenteries. In my species it seems as if there were no plectocraspedon present, but it is very difficult to decide that with certainty, as the filaments and the epithelia were on the whole not well preserved.

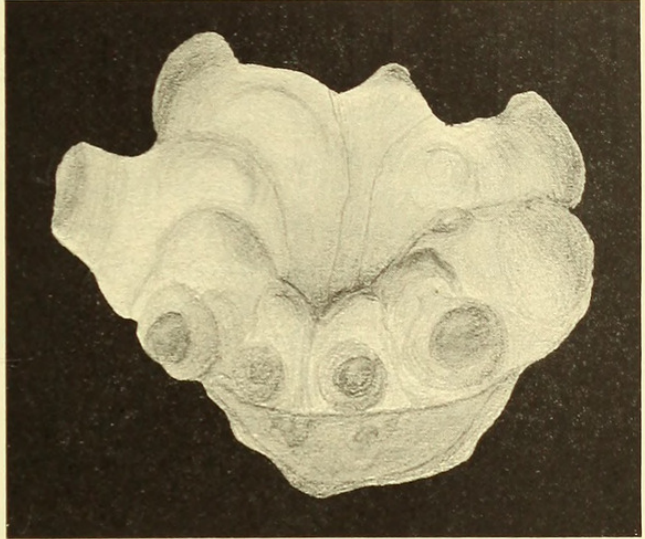


Leloup's diagram of both his species seems to show that the first metamesenteries are provided with plectocraspedons. In every case no directive labial tentacle is present in

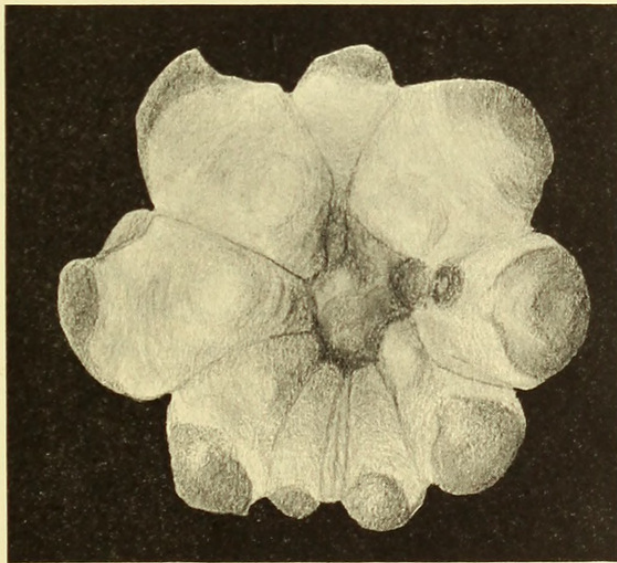
TEXT-FIG. 5.



TEXT-FIG. 6.



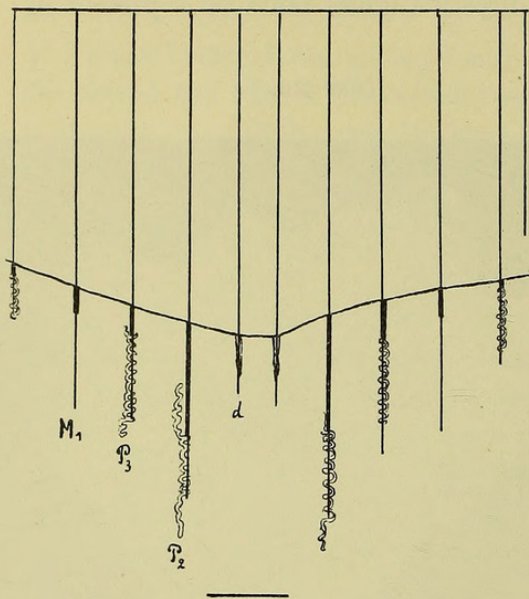
TEXT-FIG. 7.

TEXT-FIGS. 5-7.—*Anthoactis australiae* n. sp.

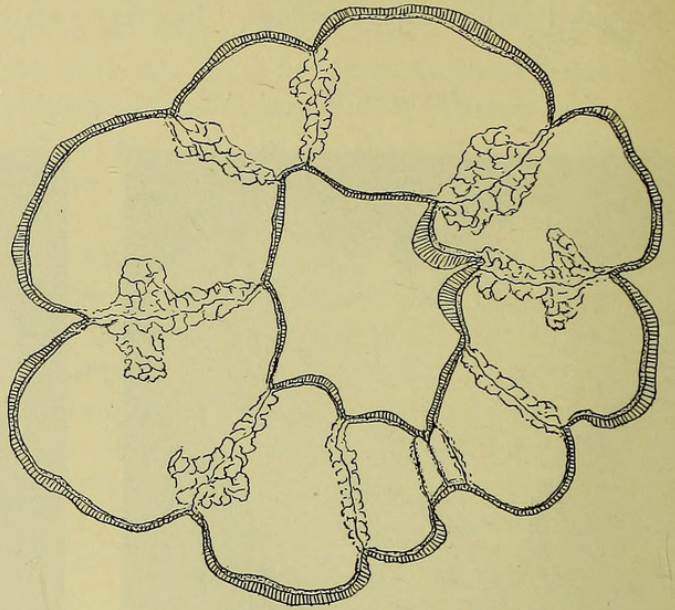
*australiae*. I have given a diagram of the mesenteries in Text-fig. 8, and figured a section of the 11 mesenteries present in the region of the upper part of the actinopharynx (Text-fig. 9) on the right hand. Where the ectoderm is thickened, two labial tentacles have, however, been cut, because the section is somewhat oblique. Text-fig. 10 represents a section of the right third protomesentery in the region of the cnidoglandular tract.



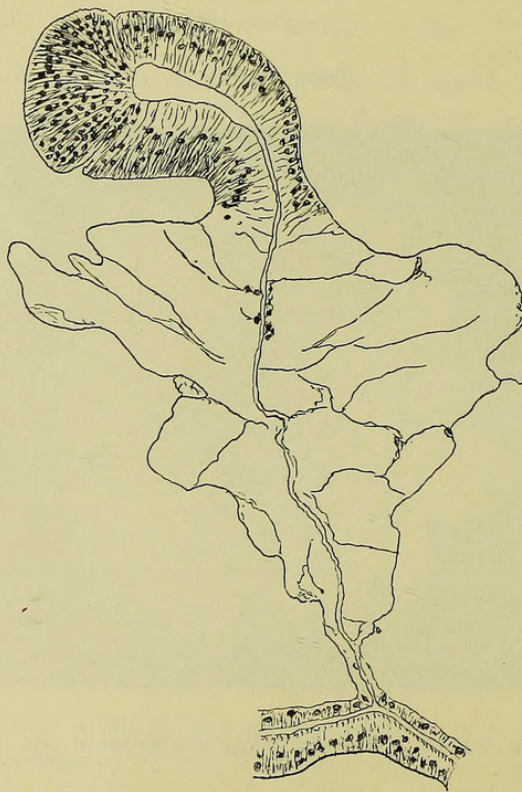
TEXT-FIG. 8.



TEXT-FIG. 9.



TEXT-FIG. 10.



TEXT-FIG. 8.—*Anthoactis australiae* n. sp. Diagram of the arrangement of the mesenteries. Thick lines, orthocraspedons; folded parts, plectocraspedons. *d*. Directives.

TEXT-FIG. 9.—*Anthoactis australiae*. Transverse section of the body in the region of the actinopharynx.

TEXT-FIG. 10.—*Anthoactis australiae* n. sp. Transverse section of the third, right protomesentery ( $P_3$ ).



## ZOANTHARIA

Everyone examining the Zoantharia has learnt how difficult it is to determine the members of this group of Anthozoa. It is true that at present the species can be referred to the right genus at least by an anatomical examination, but it is more difficult to decide if a specimen belongs to a species already described or if it is new to science. It is clear that a species, the description of which is old and based only on external characters, is generally very difficult to identify, because many forms of Zoantharia look like each other superficially, and only when the holotype is available for examination or one can get specimens from the place from which the holotype was described is the identification of the species sure or almost sure. But certain anatomical characters such as those given by Haddon and Shackleton, 1891, the first authors to have used extensively the anatomy of Zoantharia for systematic purposes, are generally not sufficient to identify a species. For purposes of classification further anatomical details are necessary. Thus, as I have already shown (1912), a species cannot be diagnosed without knowledge of the size and distribution of the cnidæ. This has been confirmed in a paper of Siefert (1928), who examined the cnidæ of some genera not investigated by me.

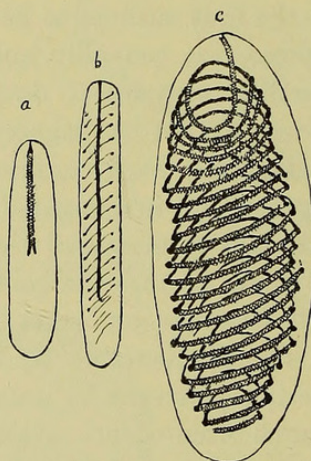
As far as I can see Seifert has mostly measured the cnidæ on slides. I think that such measurement gives too low values, because the cnidæ seem to shrivel a little during treatment, and it is more difficult to make an exact measurement on slides than in maceration preparations. As to the filaments it is, however, necessary to complete the examination on slides, because it is not easy to isolate the filaments from the other parts of the mesenteries, where cnidæ often occur. As to the distribution of the cnidæ Seifert has distinguished three groups of *Zoanthus* as well as of *Palythoa*. There is no doubt that these genera can be arranged in more groups, as we see from the descriptions here given.

Seifert distinguished among the Zoantharia three categories of cnidæ: spirocnidæ (new name for spirocysts), gyrocnidæ (or macrocnidæ, if the gyrocnidæ are large), and craspedocnidæ. Weill (1934, p. 92) is of the opinion that this classification is "encore moins utilisable que la précédente"—the division of certain capsules into penicilli and spirulæ). True that Seifert has made several mistakes as to the base of the thread partly owing to his examination of the cnidæ on slides. His classification was, however, an attempt to systematize the cnidæ of the Zoantharia. But it is not difficult to identify Seifert's gyrocnidæ and macrocnidæ with Weill's holotrichs, and his craspedocnidæ with microbasic mastigophors (compare Text-fig. 11 *c* and *b*). Unfortunately the cnidæ of Zoantharia seldom are exploded in preserved material, so that it is sometimes difficult to decide to which type a nematocyst belongs. Although I myself have seen the present nematocysts only in an unexploded state, I can state here that the type *b* (Text-fig. 11) is a microbasic mastigophor. As to the type *a*, it is difficult to determine if it is a microbasic mastigophor or an amastigophor. It is possibly the former, but I prefer to leave this question unanswered for the moment. Thus it is certain that in the Zoantharia at least three types of cnidæ occur. Weill has observed only two in *Zoanthus proteus*, but this is certainly wrong. If he had examined the filaments, he would without doubt have found mastigophors. I hope to have occasion to discuss Weill's division of the nematocysts of the Anthozoa in another paper.



I have here for the first time given figures of the canal system of the column from surface-preparations of three *Zoanthus*-species, as also figures of the canals in the lower part of the mesenteries of several species of *Palythoa*. Although certainly rather large variations in the appearance of the canal system occur in a species—in some species probably more than in others—it seems to me that the canal system too can be of use when we diagnose a species. But in order to get as good an idea as possible of the typical appearance, it is necessary to make preparations of more than one specimen of a species. In the present paper I have also examined the macrocnidæ (holotrichs) in the mesenterial canals, where these cnidæ are as a rule larger than in other parts of the body.

For comparison especially of the cnidæ I have examined *Zoanthus coppingeri* and *jukesii*, as also *Palythoa kochii*, *cæsia*, *howesii* and (*Gemmaria*) *mutuki* described by Haddon



TEXT-FIG. 11.—Nematocysts of *Palythoa projecta* n. sp. (a, c) and of *Palythoa howesii* (b). (a) From the filament; (b) microbasic mastigophor from the ectoderm of the coenenchyme; (c) holotrich from a mesenterial canal.

and Shackleton (1891) from Torres Strait. I beg to express my thanks to the directorate of the British Museum for the loan of the species. Before I go over to the description of the species taken by the Great Barrier Reef Expedition I will give some notes on the *Zoanthus*-species described by these authors.

#### *Zoanthus coppingeri* Hadd. & Shackl.

Of these species I have examined one specimen having a bud near its base. I have sectioned the uppermost part of the polyp, and can corroborate the observations made by Haddon and Shackleton as to the extraordinarily rich development of the canal system in the mesogloea of the column. In surface preparations at the level of the actinopharynx one can see that there are two nets of canals situated in two different planes but communicating with each other, one with thicker canals lying more superficially, and one with thinner canals situated more deeply in the mesogloea. The first is certainly the one communicating with the ectoderm; the latter has very coarse knots in the rather close meshes.

As to the sphincter I do not understand the terms "upper" and "lower" sphincter in the paper of Haddon and Shackleton (1891), though the terms are distinctly explained in a



later paper of Haddon and Duerden (1896), where in *Z. shackletoni* the authors talk of a proximal or lower sphincter, which is well developed, and of a distal or upper portion being much smaller—this statement agreeing with the figure. In the paper of 1891 Haddon and Shackleton say of *Zoanthus coppingeri*—"the upper portion [of the sphincter] being slightly shorter than the lower one", and of *Zoanthus macgillivrayi*, "the upper [sphincter] being the longer of the two parts". Comparing these statements with figs. 3 and 5, Pl. 67, of the sphincters of both specimens, it seems as if both sphincters should be of about the same size; if there is any difference, to judge from the figures the upper sphincter of *Z. coppingeri* is somewhat stronger than the lower one, whereas in *Z. macgillivrayi* it is weaker. Thus I think that Haddon and Shackleton have wrongly named that part of the sphincter, which in an invaginated state of the polyps is uppermost, the upper; it is in fact the lower or proximal sphincter. This supposition has been confirmed by an examination of the sphincters of *Zoanthus jukesii*. True that the distal sphincter was not well preserved, but there is no doubt that it is much weaker than the rather strong proximal sphincter. Haddon and Shackleton state that the upper sphincter is the longer.

The specimen examined had 52 mesenteries.

The holotrichs of the ectoderm of the column were  $17-23 \times 6-7\mu$  long and rather common; those of the tentacles  $18-24 \times 6-6.5\mu$ ; those of the actinopharynx  $20-24 \times 6-7\mu$ ; those of the filaments  $22-24 \times 6.5-7\mu$ , few; the microbasic mastigophors in the ectoderm of the actinopharynx  $14-22 \times 2.5$  to almost  $3\mu$ ; those of the filaments  $22-24 \times 6.5-7\mu$ ; nematocysts of the type *a* in the ectoderm of the actinopharynx about  $17 \times 4.5-5\mu$ ; in the filaments  $15-18 \times 4.5-5\mu$ ; spirocysts of the tentacles  $17-29 \times$  about  $2-4\mu$ , numerous.

*Zoanthus jukesii* Hadd. & Shackl.

The holotrichs of the ectoderm of the column were  $14-17 \times 5-6\mu$  long, numerous; those of the tentacles  $13-17 \times 5.5-6.5\mu$ , very common; those of the actinopharynx  $13-17 \times 5-6\mu$ , not so numerous; those of the filaments  $14-17 \times 5-6\mu$ ; the microbasic mastigophors in the ectoderm of the actinopharynx were  $19-24 \times 2.5-3.5\mu$ , few; those of the filaments  $30-35 \times 4.5-5\mu$ . I have not found any spirocysts in the maceration preparations of the tentacles.

As to the sphincter, compare *Z. coppingeri*.

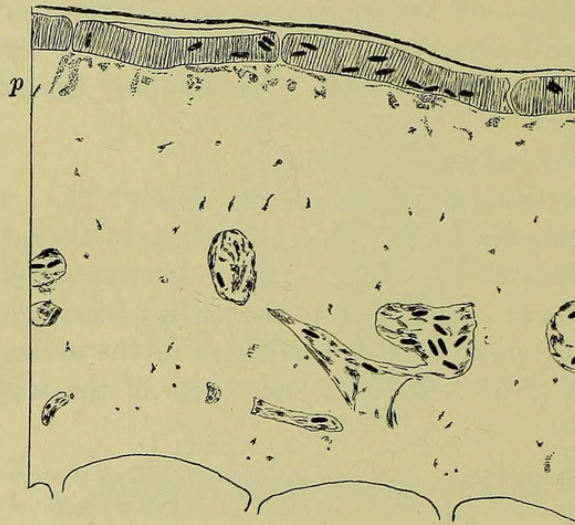
None of the *Zoanthus*-species described below is identical with Haddon's and Shackleton's species, or with *Zoanthus (Acrozoanthus) australiae* Saville-Kent, which is associated with a tubicolous annelid, and according to Haddon (1898, p. 404) has a very strong distal sphincter, stronger than the proximal one.

*Zoanthus anneae* n. sp.

DIAGNOSIS.—Small cylindrical polyps, not closely packed together, and connected with each other by a rather thick coenenchyme forming now a flattened disc, now broad or more seldom thin stolons. Ectoderm of the scapus discontinuous, with numerous holotrichs but without zooxanthellae. Mesogloea of the column rather thick with numerous, pigmented, irregular cells mostly situated close to the ectoderm, with thicker and thinner canals forming an irregular network. In the mesogloea, moreover, scattered



small cells. Canals with holotrichs but without zooxanthellae. Ectoderm of the tentacles without zooxanthellae but with very numerous spirocnidae. On the outside of the tentacles close-packed holotrichs. The distal (upper) sphincter rather weak, the proximal sphincter very strong, long and occupying almost the whole mesogloea. Actinopharynx longitudinally furrowed, the siphonoglyph only a little differentiated. Mesenteries 46–54, micromesenteries well developed. Endoderm with numerous zooxanthellae. Holotrichs of the column  $13-18 \times 4.5-5.5\mu$  long, numerous; those of the tentacles  $13-17 \times 5-5.5\mu$ ; those of the actinopharynx  $13-17 \times 5-6\mu$ ; those of the filaments (14)  $17-19 \times 5.5-6\mu$ ; those of the mesenterial canals  $14-17 \times 5-6\mu$ . Nematocysts of the type *a* (Text-fig. 11) (14)  $17-22 \times 4.5-5.5\mu$ , numerous; spirocysts of the tentacles very numerous,  $12 \times 2-18 \times 3\mu$ .



TEXT-FIG. 12.—*Zoanthus annea* n. sp. Transverse section of the scapus. *p*. Pigmented cells close to the ectoderm. The holotrichous cnidae in the ectoderm and canals black. In the mesogloea are cells and pieces of canals.

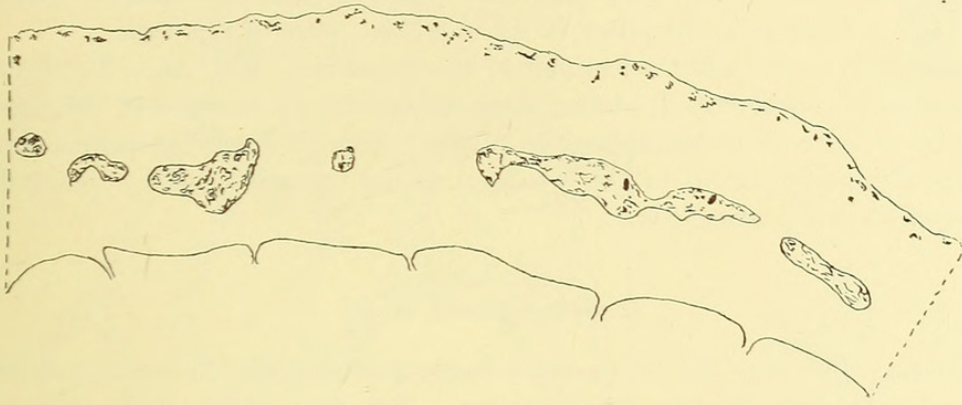
COLOUR in formalin.—Black grey, in the lower part paler; boundary tract of the mesenteries greenish or greenish gray.

SIZE of the polyps in contracted state.—Breadth 0.3–0.4 cm., height 0.3–0.5 cm.

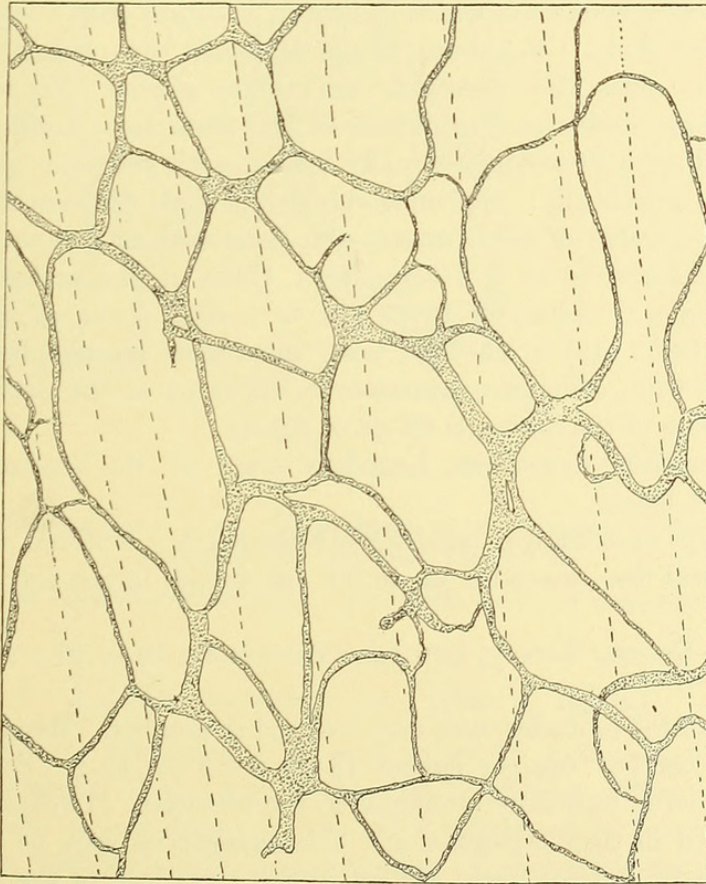
OCCURRENCE.—Three Isles, 6.v.29, St. 46; some colonies on pieces of limestone.

I have sectioned four specimens showing good agreement in their organization. The pigmented cells of the mesogloea are often more numerous than those figured in Text-figs. 12 and 13. On surface preparations, after scraping off the ecto- and endoderm, one can see that the pigmented cells are rather regularly arranged. Sometimes they are situated a little deeper down in the mesogloea. The canals of the mesogloea show in cross-sections an appearance of a ring-sinus (Text-fig. 13), and are mostly situated in the middle of the mesogloea. In preparations made from the surface of the scapus, however, the canal system forms an irregular net of wider and narrower meshes representing finer and larger canals, often strongly swollen in the knots of the meshes (Text-fig. 14). Occasionally the canals are connected with the ectoderm. The ectoderm of the tentacles was thicker on the outside than on the inside. The mesenteries were 46, 48, 50 and 54





TEXT-FIG. 13.—*Zoanthus anneae* n. sp. Transverse section of the scapus. The ectoderm is here not figured.



TEXT-FIG. 14.—*Zoanthus anneae* n. sp. Canal system in the mesogloea of the scapus below the actinopharynx. The discontinuous lines mark the insertions of the mesenteries. Text-figs. 14, 15, 17, 18 are figured at the same magnification and are similarly orientated.



in number. I have not observed any nematocysts of the type *b* (Text-fig. 11) in the ectoderm of the tentacles and filaments, unless opaque or almost opaque cnidae, in the former  $9-14 \times 2.5\mu$  long, in the latter  $10-12 \times 2.5-3\mu$ , were of this type.

The species is named after a member of the expedition, Mrs. Anne Stephenson.

The species is characterized, among other things, by the presence of the superficially situated, pigmented cells in the mesogloea of the column, by very numerous spirocnidae and very numerous holotrichs in the ectoderm of the tentacles, and by the structure of the canal system in the mesogloea.

*Zoanthus fraseri* n. sp.

DIAGNOSIS.—Polyps of the colonies not closely packed, rising from a flat coenenchyme or connected with each other by broad stolons. Ectoderm of the scapus discontinuous, with a rather thick cuticle, without zooxanthellae, but with numerous holotrichs. Mesogloea of the scapus rather thick, with scattered cells, sparse lacunae, almost without pigmented cells, its canal system well developed, forming an irregular network of wider and narrower meshes of broad canals. Upper sphincter weak in comparison with the strong, elongated, lower sphincter, which, however, occupies only about the half of the thickness of the mesogloea. Ectoderm of the tentacles with rather few spirocysts in their apex; on the sides the spirocysts are almost absent. No zooxanthellae, but numerous holotrichous cnidae on the outside of the tentacles. Actinopharynx narrow, its ectoderm smooth or a little longitudinally folded, with yellowish gland-cells distally and pigmented cells proximally. Siphonoglyph only a little differentiated. Mesenteries 54–58, thin. Ciliated tracts of the filaments well developed, as also the boundary tract. Holotrichs of the column  $14-17 \times 5-6.5\mu$  long; those of the tentacles  $13-17$  ( $19$ )  $\times 5-6\mu$ ; those of the actinopharynx  $13-17$  ( $19$ )  $\times 5-6\mu$ ; those of the filaments and mesenterial canals  $12-17$  ( $19$ )  $\times 4.5-6.5\mu$ , few; microbasic mastigophors of the actinopharynx  $14-19 \times 2.5-3\mu$ , common; nematocysts (type *a*) of the actinopharynx about  $22 \times 4.5\mu$ , few; those of the filaments  $22-26 \times 3.5-5\mu$ .

COLOUR in formalin.—Colourless, boundary tract of the macromesenteries dark green grey to almost black.

SIZE of the polyps in strongly expanded state about  $1.8 \times 0.25$  cm., in a state with the tentacles and the oral disc expanded up to 0.8 cm. broad, in strongly contracted state 0.45 cm. broad.

OCCURRENCE.—General Survey, Low Isles, Section 3A, 10.iii.29; several colonies on piece of limestone.

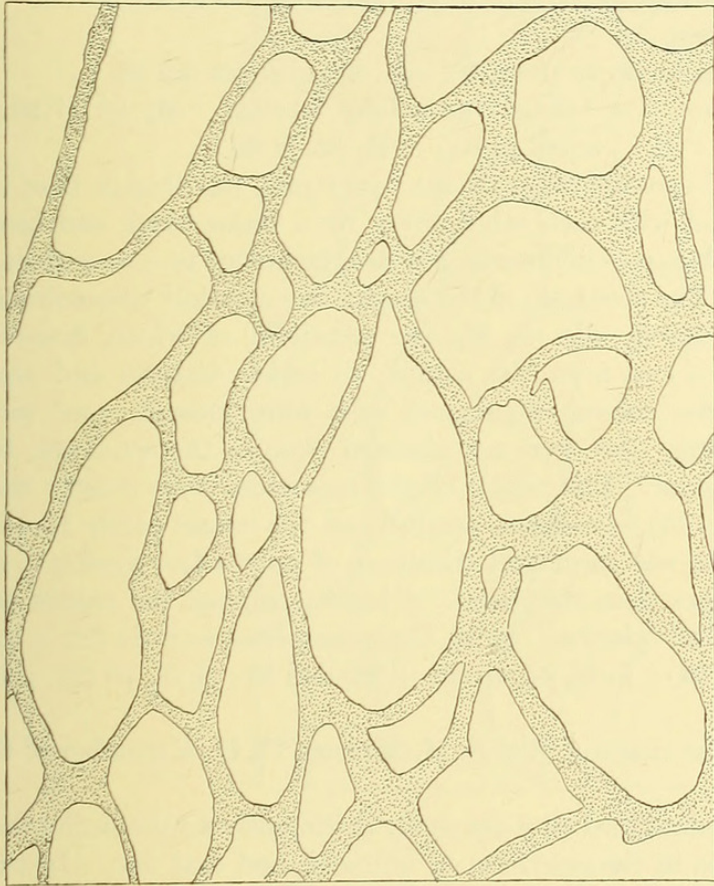
The spirocysts of the tentacles were very reduced in number. Beside holotrichs there were in the tentacles few opaque cnidae  $13-14 \times 2.5-3\mu$  long. Zooxanthellae were present in the endoderm, especially numerous in the tentacles. Two sectioned specimens show good agreement in their organization. The mesenteries were 54 ( $28 + 26$ ) and 58 in number. I have figured the canal system in the mesogloea of the column (Text-fig. 15) and of a mesentery with the strong boundary tract (Text-fig. 16).

REMARKS.—The species is easily distinguished from *Z. anneae* by the almost complete lack of the pigmented cells in the mesogloea and by the reduced number of spirocysts in the tentacles.

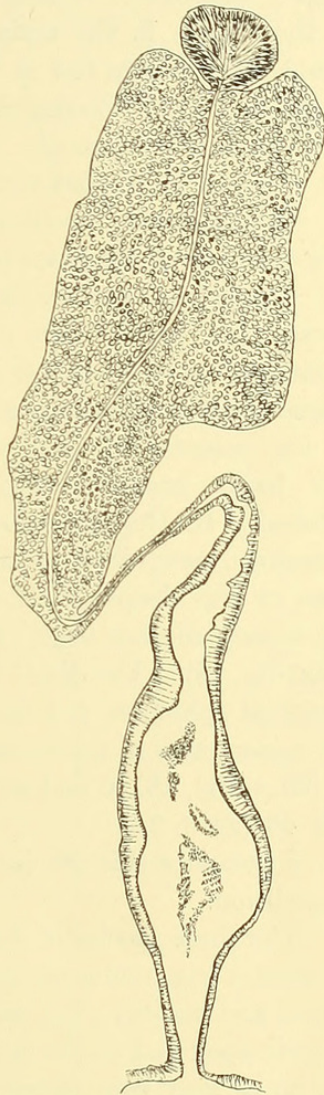
I have named the species after Miss E. A. Fraser, D.Sc., a member of the expedition.



TEXT-FIG. 15.



TEXT-FIG. 16.



TEXT-FIG. 15.—*Zoanthus fraseri* n. sp. Canal system in the mesogloea of the scapus below the actinopharynx. Compare Text-fig. 14.

TEXT-FIG. 16.—*Zoanthus fraseri* n. sp. Transverse section of a macromesentery.

*Zoanthus mantoni* n. sp. (Plate I, fig. 3.)

DIAGNOSIS.—Polyps connected with each other by rather thick stolons or a flat coenenchyme. Ectoderm of the scapus thin, discontinuous. Pigmented cells present, situated mostly more or less deeply in the thick mesogloea of the column. Its canals fine or rather fine, forming mostly larger meshes. Upper sphincter rather weak, lower sphincter very long, diminishing downwards, forming large meshes in its distal part. Actinopharynx smooth or a little folded; siphonoglyph rather distinct, its mesogloea, however, not thickened; hyposulcus distinct. Mesenteries 44–50, micromesenteries well developed. Holotrichs in the ectoderm of the column  $12-17 \times 4.5-6.5\mu$ , very numerous; those of the tentacles  $14-17 \times 4.5-5\mu$ , mostly on their outside; those of



the actinopharynx  $12-17 \times 5-6\mu$ , rather common; those of the filaments  $13-18 \times 5-6\mu$ ; microbasic mastigophors of the actinopharynx  $12-18 \times 2.5-3\mu$ ; nematocysts of the type *a* in the actinopharynx  $19-25 \times 3-5\mu$ ; in the filaments (14)  $19-23 \times 3-4 (4.5)\mu$ . Spirocysts few in the apex of the tentacles, very rare in other parts, not present in the oral disc. Zooxanthellae absent in the ectoderm, numerous in the endoderm.

COLOUR in formalin. Yellowish.

SIZE in contracted state. Height up to about 0.7 cm., breadth 0.2-0.3 cm.

OCCURRENCE.—General Survey, Low Isles. One colony labelled "M<sub>8</sub> 28.iii.29"; two colonies—large piece labelled "M<sub>2</sub>", small piece; "M<sub>3</sub> 22.iii.29".

The polyps were cylindrical, in contracted state the upper part was thicker than the lower. The polyps were connected with each other either by a rather thick and broad coenenchyme or by rather thick stolons—differences due to attachment to a mussel-shell, coarse sand or calcareous algae. The ectoderm of the scapus was certainly discontinuous in the colonies M<sub>2</sub> and M<sub>3</sub>, probably also in M<sub>8</sub>, the ectoderm of which, however, was badly preserved and mostly lost from the cuticle, to which diatoms and algae adhered. In the mesogloea of the column pigmented cells were present—now more numerous, now more sparse. Mostly they were not situated close to the ectoderm, but more or less deeply in the mesogloea. The canals of the mesogloea were mostly thin, the muscle meshes large (Text-fig. 17), sometimes smaller and the canals partly broader (Text-fig. 18). The distal sphincter was short and consisted of only a few meshes; the proximal sphincter 4-5 times longer than the distal. I have examined the cnidae and the mesenteries in specimens from all colonies. In M<sub>8</sub> the mesenteries were 44 (22 + 22), 46 (22 + 24), 48, 50 and 50 (26 + 24); in M<sub>2</sub> 44, 49 (23 + 26) and 50; in M<sub>3</sub> 46 (22 + 24) and 48 (24 + 24).

I associate this species with the name of Miss S. M. Manton, Ph.D., a member of the Expedition.

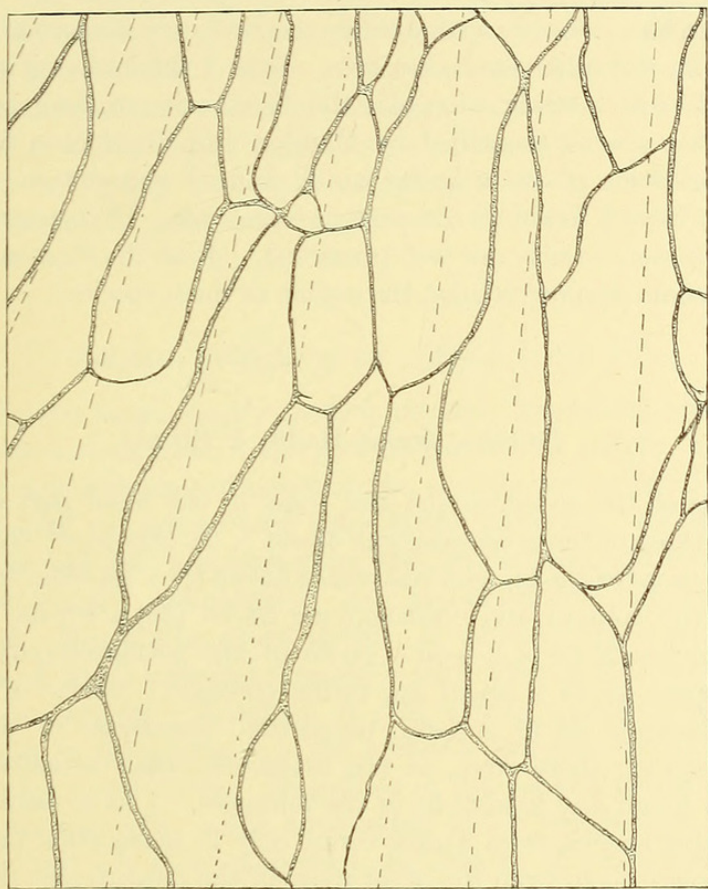
The three species of *Zoanthus* described here are easily distinguished from each other. *Z. anneae* has numerous spirocysts in the ectoderm of tentacles and oral disc. In two, *fraseri* and *mantoni*, the spirocysts in the tentacles are rare, and in the main present only in their apex and in the oral disc lacking (or if present extraordinarily rare?). *Z. fraseri* has no or very rare pigmented cells in the mesogloea of the column, while in *Z. anneae* and *mantoni* they are numerous; in the former they are arranged close to the ectoderm, in the latter mostly deeper in the mesogloea.

#### Genus *Palythoa* Lamx.

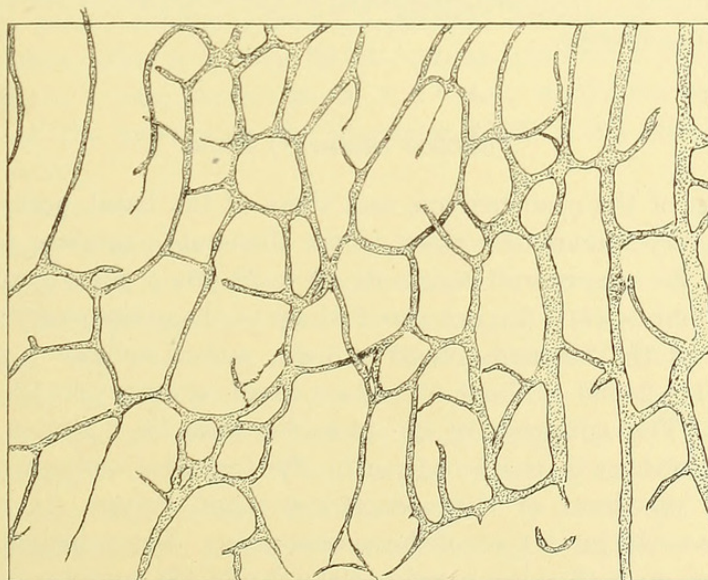
As to the distribution of the nematocysts in the genus *Palythoa*, Seifert (1928, p. 464) distinguished three types. The first type includes species having macrocnidae (holotrichs) in the ectoderm of the tentacles; to the second type belong all species lacking macrocnidae in the tentacles but having them in the ectoderm of the actinopharynx; the third type lacks macrocnidae in both these organs. In the ectoderm of the column only macrocnidae are present in all types. Among the present species none belongs to the first type. *P. stephensoni* and *kochii* should be referred to the second type, all the others to type 3. Seifert described no craspedocnidae (microbasic mastigophors) from the ectoderm of the tentacles and column, but from the actinopharynx (compare his figs. 4-6). As to the tentacles, there were always craspedocnidae in the present species. I think, therefore,



TEXT-FIG. 17.



TEXT-FIG. 18.



TEXT-FIGS. 17, 18.—*Zoanthus fraseri* n. sp. Canal system of the mesogloea of the scapus below the actinopharynx. Fig. 17 from a polyp of the colony labelled  $M_6$ ; fig. 18 from  $M_3$ .



that Siefert has overlooked them. More seldom they seem to occur also in the ectoderm of the column and coenenchyme, as in *P. howesii*, *projecta*, *kochii* and *shackletoni*. In the two latter, however, they are very sparse, while they are very numerous in the first species; the macrocnidae, on the other hand, are few. Thus I think that if we examine several types, we may take into consideration also the distribution of the craspedocnidae.

Of the *Palythoa* species described by Haddon and Shackleton from Torres Strait I have had for examination pieces of *kochii*, *caesia*, *howesii* and *mutuki* (*Gemmaria mutuki*). Only one, *howesii*, have I found in the present collection. Unfortunately Haddon's and Shackleton's species were mostly not well preserved. As to the filaments and mesenteries, I make, however, some comments upon the cnidae of these species.

*Palythoa kochii* Hadd. & Shackl.

The holotrichs of the coenenchyme and those of the basal part of the polyps were  $58-62 \times 24-26\mu$ ; those of the actinopharynx  $58-65 \times 24-26\mu$ , rare; those of the filaments  $60-67 \times 24-26\mu$ ; those of the mesenterial canals  $55-65 (?) \times 24-26\mu$ , few; the microbasic mastigophors of the column and coenenchyme  $24-26 (38) \mu 4.5-5\mu$  (very few found); those of the tentacles  $22-26 \times 3.5-5\mu$ ; those of the actinopharynx  $26-34 \times 4.5-5\mu$ ; those of the filaments  $43-53 \times$  about  $5\mu$ , rather common; cnidae of the type *a* (Text-fig. 11) in the filaments  $24-31 \times 5-6\mu$ , numerous; spirocysts of the tentacles about  $14-24 \times 3\mu$ . Moreover, there were, in the filaments, small nematocysts  $12 \times$  a good  $2.5\mu$ . I have not found any holotrichs in the tentacles. I have examined the filaments of this and the other species from Torres Strait only in maceration preparations and, as it is not easy to isolate them from the other parts of the mesenteries, there is a possibility that some of the holotrichs do not belong to the filaments. In the present collection of *Palythoa* I have examined the filaments also on slides, and in all species holotrichs were present in the filaments. Zooxanthellae occur in the ectoderm of the coenenchyme. One specimen had 42 mesenteries.

*Palythoa caesia* (?) Dana.

The holotrichs of the coenenchyme and those of the basal part of the polyps were  $38-50 \times 18-22\mu$ , very numerous; those of the filaments (compare above)  $65-67 \times 22-26$ , few; those of the mesenterial canals  $62-72 \times 22-26\mu$ ; the microbasic mastigophors of the tentacles  $29-31 \times (4) 4.5\mu$ , not rare; those of the actinopharynx  $29-34 \times 4.5-5\mu$ , numerous; those of the filaments  $50-55 \times 5-6\mu$ , rather common; nematocysts of the type *a* (Text-fig. 11)  $24-26 \times$  about  $5\mu$ . Also small nematocysts  $12-14 \times 2.5-3\mu$  occur in the filaments. The spirocysts of the tentacles were  $14 \times$  almost  $2-26 \times$  about  $3\mu$ . There were no holotrichs in the ectoderm of the tentacles and actinopharynx, and no holotrichs in the ectoderm of the coenenchyme and polyps. I have examined the mesenterial canals in the lower part of the mesenteries. The principal canal is here broad and sends out lobes on both sides, mostly to the inside. It contains numerous holotrichs.

As Haddon and Shackleton have pointed out, it is dubious if the species is Dana's *caesia*. I think not.



*Palythoa (Gemmaria) mutuki* (Hadd. & Shackl.).

Holotrichs in the ectoderm of the scapus  $36-48 \times 17-20\mu$ , rather common; those of the filaments  $43-50 \times 20-22\mu$ ; those of the mesenterial canals  $46-50 \times$  about  $19\mu$ , few; microbasic mastigophors of the actinopharynx  $24-28 \times 4-4.5$  (5)  $\mu$ ; those of the filaments  $22-31 \times$  about  $4.5\mu$ ; nematocysts of the type *a* in the ectoderm of the actinopharynx  $22 \times 5.5\mu$ , very rare, in the filaments  $19-31 \times 4.5-5\mu$ , common. The mesenterial canals seem to agree rather well with *P. yongei* described below, but they were not well preserved.

*Palythoa projecta* n. sp. (Plate I, fig. 6.)

DIAGNOSIS.—Polyps large, closely packed, strongly projecting above the surface of the coenenchyme when contracted. The greater part of the polyps, however, connected with each other by coenenchyme. Coenenchyme, column and especially the ridges of the scapules incrustated with calcareous and some sandy particles. Ridges of the scapules 21–22 (24). Tentacles 42–46. Actinopharynx with numerous longitudinal folds formed in the main of the ectoderm; siphonoglyph well developed, but not broad, its mesogloea distinctly thickened. Mesenteries about 42–46. Mesenterial canals with pigmented cells, below the filaments of rather various appearance, with lobes in the main directed towards the outside of the mesenteries. Ectoderm of the column incrustated with zooxanthellae, which are present also in the ectoderm of the tentacles and oral disc and in the endoderm. Ectoderm of the scapus continuous. Mesogloea of the column incrustated in, at most, its outer half, with numerous cells, in the upper parts of the polyps with few small lacunae, which in the lower part are more numerous and larger. Zooxanthellae in the lacunae. Ectoderm of the tentacles and oral disc, and especially that of the actinopharynx, pigmented. Holotrichs in the ectoderm of the column about  $65 \times 24\mu$ , rare; in the tentacles and the actinopharynx absent; in the filaments sparse,  $60-62 \times$  about  $24\mu$ ; in the mesenterial canals common,  $60-67 \times 22-24\mu$ . Microbasic mastigophors in the ectoderm of the column rather numerous  $30-31 \times 3-4\mu$ ; in that of the tentacles  $22-24 \times 3-3.5\mu$ ; in that of the actinopharynx  $25-30 \times 3.5-4\mu$ ; in the filaments  $43-46 \times$  about  $5\mu$ ; nematocysts of the type *a* in the filaments  $26-31 \times 4.5-5\mu$ ; spirocysts of the tentacles  $12-24 \times 2-3.5\mu$ .

COLOUR.—Unknown.

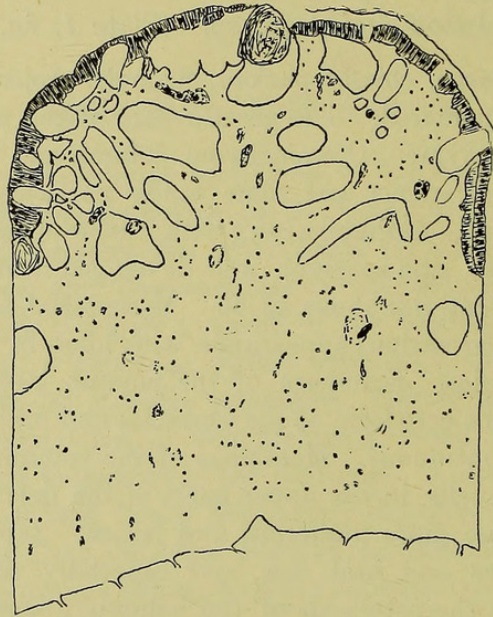
SIZE.—The colony was about  $8 \times 7$  cm., the breadth of the largest polyps 0.7–0.8 cm., that of the smallest 0.3–0.4 cm. in preserved state.

OCCURENCE.—Locality unknown, probably Low Isles; one colony.

The polyps are very close set, also in their contracted state, their distal part projected considerably, in large polyps 0.7–1 cm. beyond the surface of the coenenchyme, which, however, connected the greatest parts of the polyps with each other. The coenenchyme between the polyps was thin. The free part of the polyps, varying greatly in size, was broader proximally than distally, its upper outline in contracted state of the polyps rounded. The ectoderm of the scapus was continuous, rather thin and provided with a cuticle; the mesogloea very thick, with numerous small cells and, in the upper part of the polyps, with sparse, rather small lacunae (Text-fig. 19), which, in the lower part, are more numerous. The lacunae of the mesogloea between the polyps are very large;



exceptionally they can reach a size of  $1100 \times 200\mu$ , but those measuring about  $300 \times 200\mu$  were most numerous. They were provided with branched, pigmented cells like those in the mesenterial canals. The holotrichs are few in the lacunae or absent. The incrustation consisting of calcareous particles, some sandy grains and sponge spicules, was not strong, so that the colony felt rather soft; at least the inner half of the mesogloea of the column lacked incrustations, though here and there a particle was situated deeper. The zooxanthellae were numerous in the ectoderm of the coenenchyme and column, as also in the ectoderm of the tentacles and oral disc, but absent in the ectoderm of the actinopharynx. In the endoderm also the zooxanthellae were present. The sphincter was

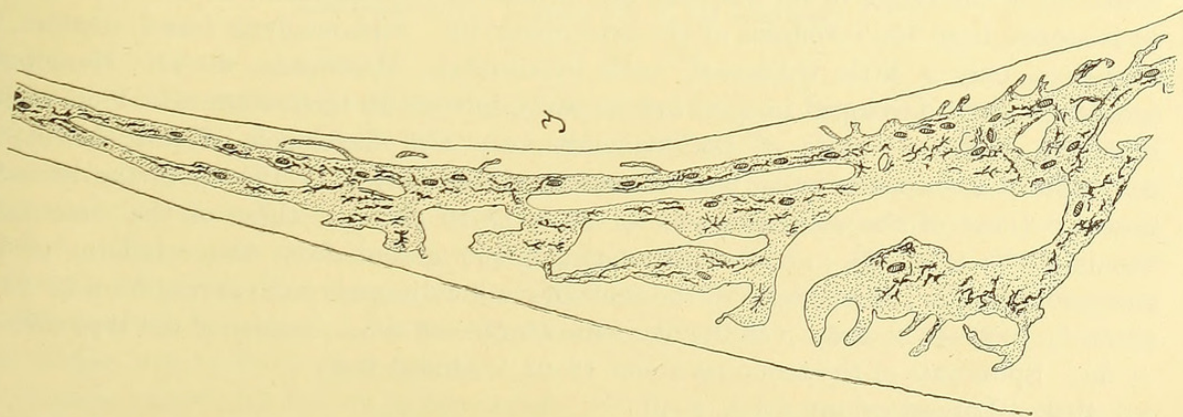


TEXT-FIG. 19.—*Palythoa projecta* n. sp. Transverse section of the scapus. Black circular points, zooxanthellae; black elongated figures, holotrichs. The cavities are remains of the decalcified incrustations. Entoderm not figured.

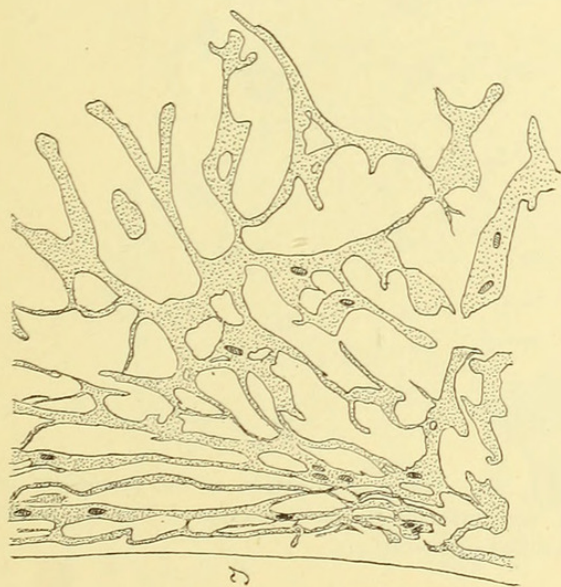
mesogloal, forming long rows of meshes, distally somewhat stronger than proximally. The ectoderm of the actinopharynx was high and folded, the folds supported by low triangular projections of the mesogloea. At the base of the ectoderm pigmented gland cells occurred. The siphonoglyph was well developed. The mesenteries were in the two examined specimens 42 and 46 ( $22 + 24$ ) in number and arranged after the microtype. They were thin, and thickened only in their outer parts and in the region of the boundary tract of the mesenteries. The mesenterial canals below the filaments (Text-figs. 20–22) varied in their appearance. The principal canal passed here on the inner side of the mesenteries, but was mostly longitudinally divided into thinner canals, from which branches ran out towards the outer side. Rarely the branches fused together, so that the canal system had a more compact appearance (Text-fig. 22). Mostly the canals were arranged as Text-figs. 20 and 21 show, the latter in broader, the former in smaller mesenteries. The canal system seems here to vary more than in the other species of *Palythoa* described below. I have examined many mesenteries, but owing to their thinness it was very difficult to get good preparations. The canals were provided with



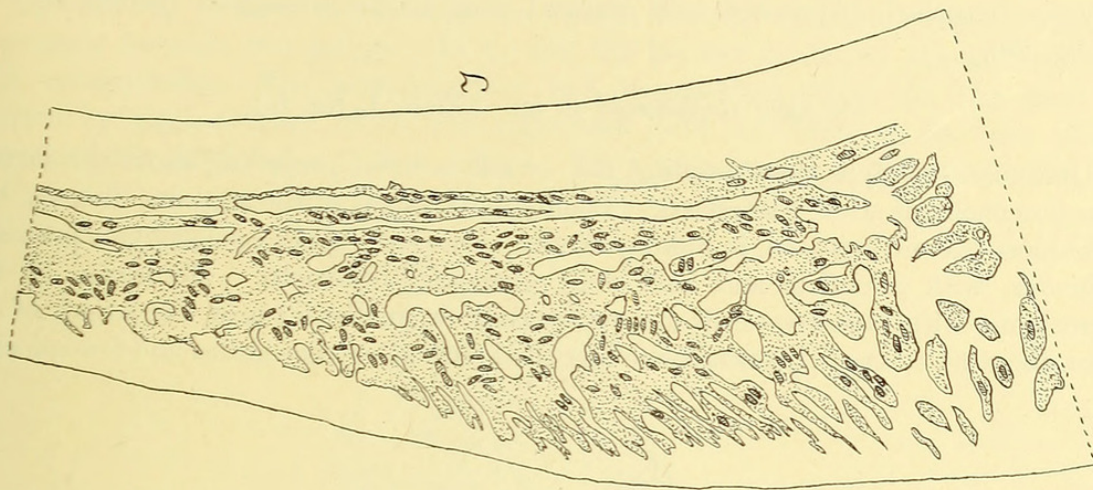
TEXT-FIG. 20.



TEXT-FIG. 21.



TEXT-FIG. 22.



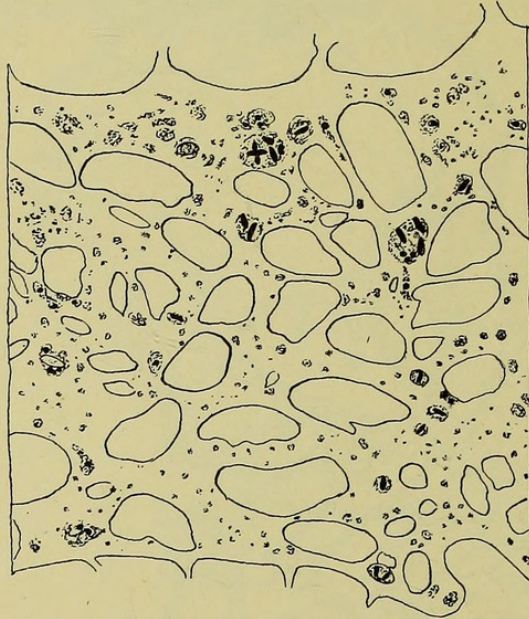
TEXT-FIGS. 20-22.—*Palythoa projecta* n. sp. Canal system with holotrichs from the basal parts of three macromesenteries. *I*, inner side of the mesenteries. In fig. 20 the pigmented cells also are figured.



numerous, branched, pigmented cells situated close to the mesogloea (shown only in Text-fig. 20).

*Palythoa stephensoni* n. sp. (Plate I, fig. 5.)

DIAGNOSIS.—Polyps close standing, not, or only a little, projecting above the surface of the coenenchyme when contracted. Colony flat; ridges of the scapulus distinct, but for the most part invaginated, in number 20–22. Ectoderm of the coenenchyme probably continuous, with a cuticle and with very numerous holotrichs. Mesogloea of the coenenchyme with numerous cells and rather large or smaller lacunae, the largest of the former about  $84 \times 74\mu$ . Coenenchyme incrustated with calcareous grains and few spicules.



TEXT-FIG. 23.—*Palythoa stephensoni* n. sp. Transverse section of the mesogloea between two polyps. Black circular points, zooxanthellae; black elongated figures, holotrichs. The cavities are remains of the decalcified incrustations.

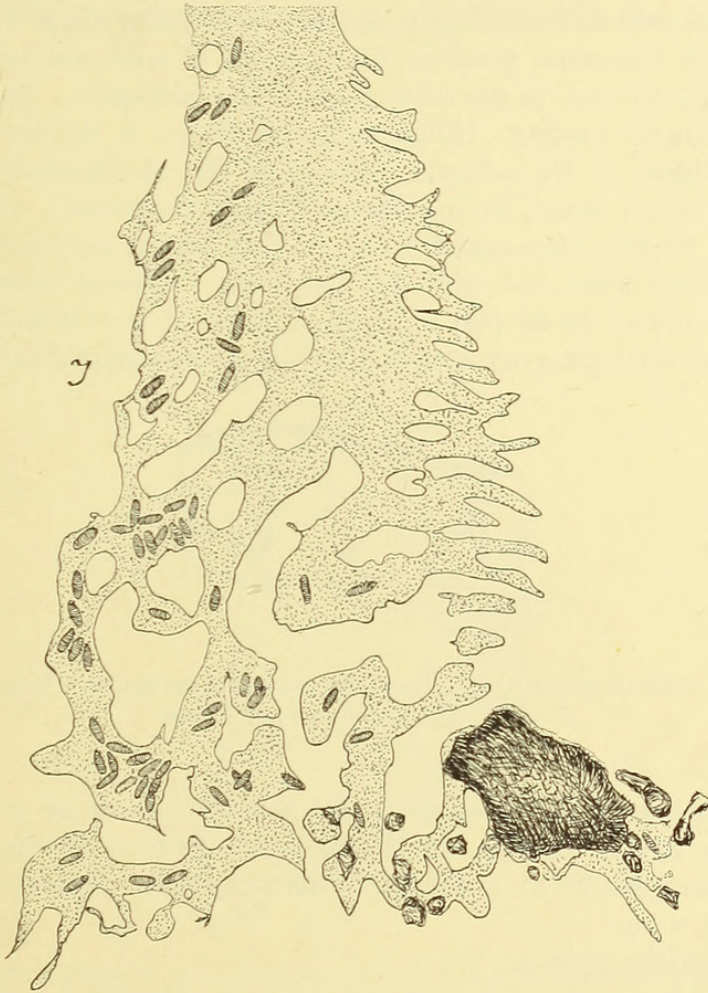
Zooxanthellae in the ectoderm as well as in the endoderm, especially numerous in the ectoderm of the ridges of the scapulus and in that of the tentacles and oral disc, absent, as it seems, from the ectoderm of the actinopharynx. Siphonoglyph broad, distinct, its mesogloea only a little thickened, with hyposulcus. Mesenteries 40–44. Mesenterial canals very well developed in their lowest parts, lobular on their outer side, more or less branched. Ciliated tracts of the filaments very well developed. Holotrichs in the ectoderm of the coenenchyme very numerous,  $41\text{--}48 (62) \times 17\text{--}19\mu$ , from the tentacles absent; those of the actinopharynx  $41\text{--}53 \times 17\text{--}19 (22) \mu$ ; those of the mesenterial canals  $65\text{--}73 \times 24\text{--}25\mu$ ; microbasic mastigophors absent from the ectoderm of the coenenchyme; in the ectoderm of the tentacles and actinopharynx varying from  $22\text{--}25 \times$  about  $3\mu$  to  $29\text{--}43 \times 4\text{--}5\mu$ ; in the filaments  $46\text{--}58 \times 5\text{--}5.5\mu$ ; cnidae of the type *a*  $20\text{--}26 \times 5\mu$ . Spirocysts of the tentacles about  $13\text{--}24 \times$  almost  $2\text{--}3\mu$ .

SIZE.—Largest colony  $4.5 \times 4$  cm.

OCCURRENCE.—General Survey, Low Isles, 20.v.29; 3 colonies.



Plate I, fig. 5, shows the exterior of a colony, Text-fig. 23 a transverse section of the mesogloea between two polyps. As we see, the lacunae contained holotrichous cnidae and zooxanthellae. The actinopharynx had longitudinal ridges, for the most part formed by the ectoderm, which was pigmented here and there at its base. I have examined the mesenteries in four polyps. They were 40 (20 + 20), 40, 44 and 44 in



TEXT-FIG. 24.—*Palythoa stephensoni* n. sp. Canal system with holotrichs from the basal part of a macromesentery. *I*, inner side of the mesentery.

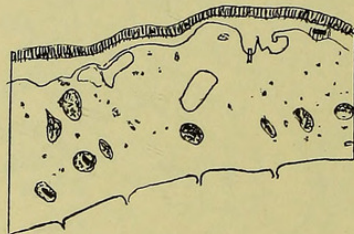
number. The mesenterial canal was only in its lowest part branched, showing lobular projections towards the outside of the mesenteries (Text-fig. 24). Sometimes there was a more compact canal on the inner side or it was divided into smaller canals; often it is more branched than Text-fig. 24 shows, but in all examined specimens these lobes were present. The canals contained very few pigmented cells, but the parts close to and inside the filaments, like the filaments themselves, were pigmented. The holotrichous cnidae were very numerous in the principal canal; commonly few in the lower part of the mesenteries, especially on their outside.

I have named this species in honour of Prof. T. A. Stephenson, the excellent author of the 'British Sea Anemones' and member of the Expedition.



*Palythoa yongei* n. sp. (Plate I, fig. 3.)

DIAGNOSIS.—A solitary species, sometimes forming small colonies of few polyps; in the latter case the erect polyps connected by a rather thin coenenchyme at their base. Ectoderm of the scapus with a thin cuticle, probably continuous, with few holotrichous cnidae and very sparse, perhaps no zooxanthellae. Mesogloea of the column comparatively thin, with scattered cells and rather large lacunae, containing sparse holotrichs. Incrustations consisting of calcareous particles, a few grains of sand and some spicules in the ectoderm of the column and in the outer parts of the mesogloea. Sphincter very long, forming a row of muscle meshes. Numerous zooxanthellae in the ectoderm of tentacles and oral disc. Ridges of the scapulus strong, 25–30. Actinopharynx longitudinally furrowed; siphonoglyph broad, its mesogloea strongly thickened; hyposulcus distinct. Mesenteries about 50–60. Mesenterial canals in their lowest part compact towards the outer side, with large lobes and with few holotrichs. Ciliated tracts well developed. Holotrichs of the column 48–58 ( $60 \times 19\text{--}22\mu$ ); those of the tentacles about  $43\text{--}47 \times 17\mu$ , few; from the actinopharynx absent, those of the mesenterial canals  $53\text{--}60 \times 19\mu$ ;



TEXT-FIG. 25.—*Palythoa yongei* n. sp. Transverse section of the scapus. For explanation see Text-fig. 23. Entoderm not figured.

microbasic mastigophors in the ectoderm of the tentacles about  $24 \times 4\text{--}4.5\mu$ , in that of the actinopharynx  $26\text{--}31 \times 4\text{--}4.5\mu$ , in the filaments  $36\text{--}38 \times 4\text{--}4.5\mu$ ; nematocysts of the type *a* in the filaments  $29\text{--}31 \times 4.5\text{--}5\mu$ , rather numerous. Spirocysts of the tentacles about  $14 \times 1.5\text{--}24 \times 3\mu$ .

COLOUR in formalin, greyish.

SIZE of two solitary polyps.—Length 0.8 and 1 cm., breadth 0.4 and 0.6 cm.

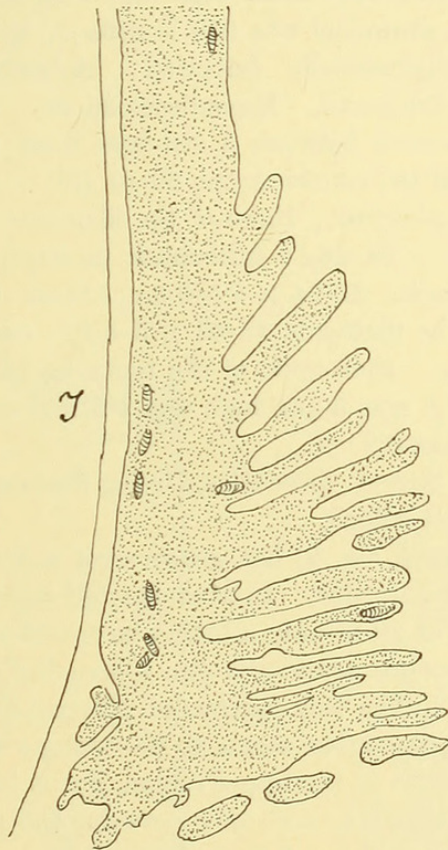
OCCURRENCE.—General Survey, Low Isles; 10.iii.29; 1 colony of three polyps. 22.iii.29, 1 polyp. 28.iii.29, 1 polyp (Plate I, fig. 3).

The three cylindrical polyps in the colony were connected with a rather thin coenenchyme at their base; the two solitary polyps had a broad base. The column of the smaller polyps was thin, in the larger polyps thicker. All polyps were contracted, the tentacles not visible, the ridges of the scapulus sometimes as in the figured specimen provided with irregular protuberances. The three largest polyps were in their middle part transversely furrowed. The ridges of the scapulus were in 4 polyps 25, 27, 27 and 30 in number.

The ectoderm of the column was not well preserved and I am not sure that it is continuous, as I have sometimes seen thin strings of mesogloea running out in the ectoderm, but whether these strings are really connected with the thin cuticle is dubious. I have found a few zooxanthellae in the ectoderm of the column, but possibly they do not belong



to the ectoderm. In any case, if present, they are very sparse here. The rather large lacunae in the mesogloea (Text-fig. 25) were often pigmented. The zooxanthellae were common in the ectoderm of the tentacles, more sparse in their endoderm. The ectoderm of the oral disc contained also numerous zooxanthellae; at its base large gland-cells were present. The ectoderm of the actinopharynx was longitudinally sulcated, that of the broad siphonoglyph unfolded. At the base of the ectoderm of the actinopharynx, as well as in the cnidoglandular and intermediate tracts, pigmented cells were situated.



TEXT-FIG. 26.—*Palythoa yongei* n. sp. Canal system with holotrichs from the basal part of a macro-mesentery. I, inner side of the mesentery.

Two examined polyps had 50 and 50 ( $24 + 26$ ) mesenteries. Owing to the number of ridges in the scapulus the largest polyp may have had 60 mesenteries. The muscles of the mesenteries were weak. In each mesentery a broad canal containing only a few holotrichs was present. In the basal part of the macromesenteries it ran near the inner side of the mesenteries and sent several lobes towards the outside (based on 4 mesenteries) (Text-fig. 26).

I have named this species after Dr. C. M. Yonge, the leader of the Expedition.

REMARKS.—The species reminds one of *Palythoa* (*Gemmaria*) *mutuki*, but seems to be different from this species. The cnidae of *mutuki* were considerably smaller (compare p. 193) than those of *yongei*, and the incrustations and the lacunae of the mesogloea are not as numerous in the present species as in *yongei*.



*Palythoa haddonii* n. sp. (Plate I, fig. 7.)

DIAGNOSIS.—Polyps of various sizes, the largest about 1 cm. broad; close-packed, scarcely or somewhat projecting above the surface of the coenenchyme when contracted. Ectoderm and mesogloea of the coenenchyme and column incrustated with calcareous and sandy particles; spicules and curious, elongated irregular bodies now in great number, now few and scattered. Ectoderm of the coenenchyme and scapus continuous, with zooxanthellae, which are present also in the ectoderm of the tentacles. Mesogloea of the coenenchyme with numerous very small cells and with lacunae of various sizes, but commonly large (the largest examined was  $270 \times 230\mu$ ). Ridges of the scapulus rather distinct. Actinopharynx longitudinally furrowed; siphonoglyph distinct, with long cilia; but its mesogloea not thickened. Mesenteries 36–48. Mesenterial canal below the filaments mostly richly branched between a stronger inner and a weaker outer canal. Holotrichs of the ectoderm of the coenenchyme  $50\text{--}61$  ( $70$ )  $\times$   $23\text{--}25\mu$ , absent in the ectoderm of tentacles and actinopharynx; those of the filaments  $46\text{--}50 \times 22\text{--}24\mu$ ; those of the mesenterial canals  $70\text{--}79 \times 24\text{--}26\mu$ ; microbasic mastigophors absent in the coenenchyme; those of the tentacles  $21\text{--}24 \times 2.5\text{--}3.5\mu$ ; those of the actinopharynx ( $34$ )  $36\text{--}48 \times 4.5\text{--}5\mu$ ; those of the filaments  $48\text{--}53 \times 5\text{--}5.5\mu$ ; nematocysts of the type *a* in the filaments  $22\text{--}26 \times 4.5\text{--}5\mu$ . Spirocysts of the tentacles  $12\text{--}27 \times 1.5\text{--}3\mu$ .

SIZE.—The figured colony was 5 cm. high and  $5.5 \times 4$  cm. broad, the largest polyp about 1 cm. broad, the smallest 0.2 cm.

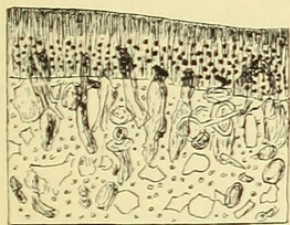
OCCURRENCE.—General Survey, Low Isles, Diving Station No. 1, 19.v.29; 3 pieces probably belonging to a single colony.

The figured colony (Plate I, fig. 7) has grown over a sponge and so has a cap-like facies; the other pieces were flattened. In a contracted state the polyps, being of very different sizes, projected not at all or only a little above the surface of the coenenchyme. The best extended polyp reached about 0.5 cm. above the surface. The ridges of the scapulus were partly visible in the less contracted polyps, and the distal outline of the polyps was rounded. The incrustation seems to be stronger in the coenenchyme and in the lower part of the polyps than in the upper region, but it is very unevenly distributed, now very strong, now inconsiderable and only between the polyps. Besides calcareous and sandy particles and a few spicules there are often numerous, curious, long, irregular, closely-set bodies (Text-fig. 27). I have not been able to determine their nature. The mesogloea of the coenenchyme contained numerous small cells and numerous lacunae of various size, the largest I have examined being  $270 \times 230\mu$ . In these lacunae zooxanthellae and sometimes also holotrichous cnidae were present. Sometimes numerous cells forming more or less distinct cell-islets were accumulated as an annulus in the vicinity of the polyps (Text-fig. 28). Five examined polyps had 36, 36, 42, 44 and 48 mesenteries. As to the mesenterial canals the distally undivided canal has, in the lower part of the mesenteries, split into two more or less distinct canals, one stronger on the inner side of the mesenteries, and one weaker and not so strongly marked on the outer side; between them there is a net of branches. Sometimes the canals are not so much divided as Text-fig. 29 shows. I never found such a lobulation of the principal canals as in *Z. yongei* in the many macromesenteries I have examined, all of which showed good agreement in the arrangement of their canals. The mesenterial canals contained very numerous holotrichs, but few pigmented cells.

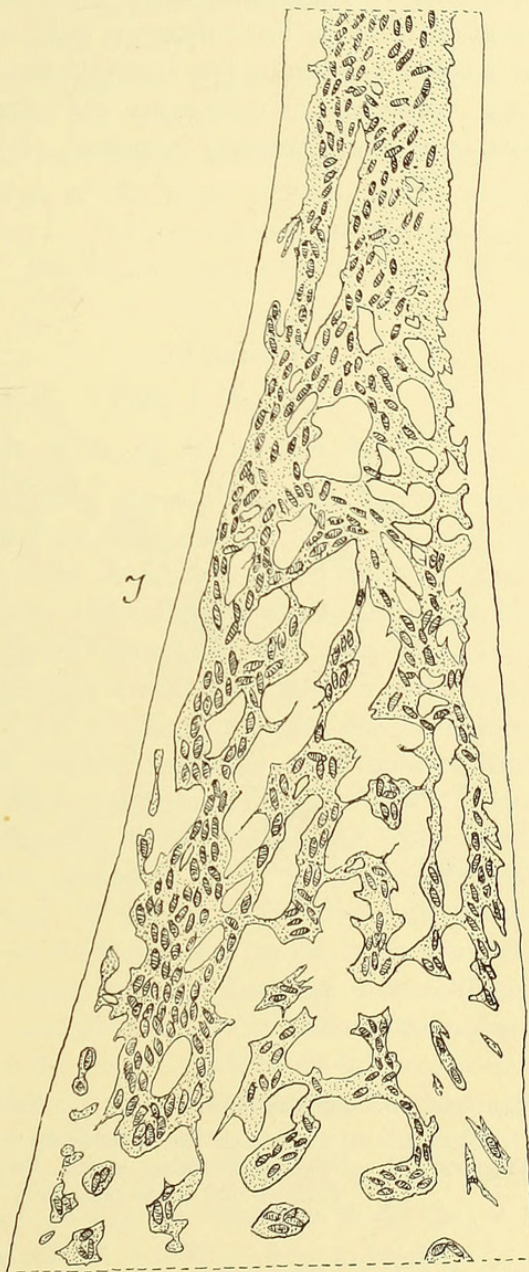


The species is named after Prof. A. C. Haddon, who was the first to use the anatomy of zoantharia for more extensive systematic purposes.

TEXT-FIG. 27.



TEXT FIG. 29.



TEXT-FIG. 28.



TEXT-FIG. 27.—*Palythoa haddoni* n. sp. Transverse section of the ectoderm and a part of the mesogloea of the scapus. In the mesogloea and ectoderm are curious incrustations. Black circular points, zooxanthellae. The cavities are remains of decalcified incrustations.

TEXT-FIG. 28.—*Palythoa haddoni* n. sp. Transverse section of the mesogloea between two polyps. At the border of the polyps cell-islets; in the interior cells, lacunae with zooxanthellae (black points) and cavities (remains of decalcified incrustations).

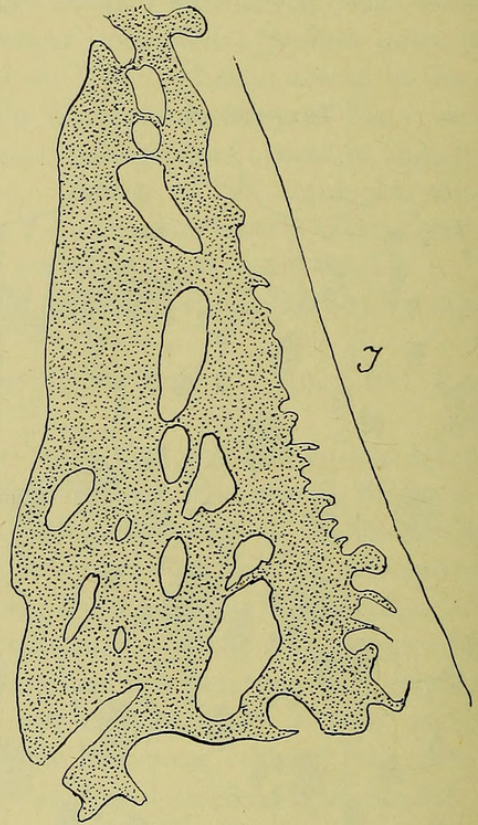
TEXT-FIG. 29.—*Palythoa haddoni* n. sp. Canal system with holotrichs from the basal part of a macromesentery. I, inner side of the mesentery.



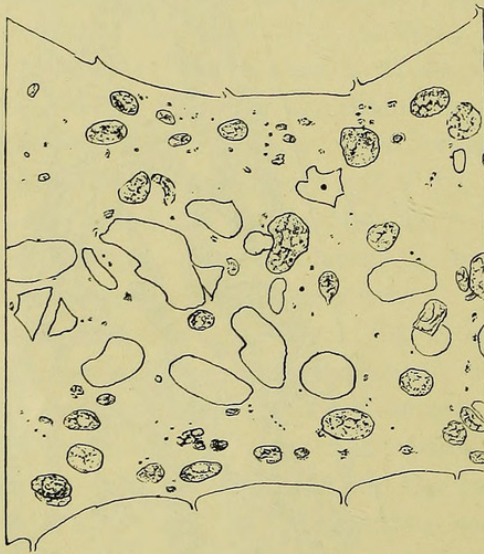
*Palythoa australiae* n. sp. (Plate I, fig. 1.)

DIAGNOSIS.—Polyps of ordinary size, close packed, projecting little above the surface of the coenenchyme when contracted. Colony rather low. Ectoderm of the coenenchyme continuous with zooxanthellae; numerous holotrichs but no microbasic mastigophors. Mesogloea with rather numerous cells and pigmented lacunae (the largest examined  $168 \times 144\mu$ ), containing few zooxanthellae and holotrichs. Incrustation of the mesogloea strong, consisting of calcareous and sandy grains and few spicules, the ridges of the scapulus especially strongly incrustated. Ridges of the scapulus hardly visible in contracted

TEXT-FIG. 31.



TEXT-FIG. 30.



TEXT-FIG. 30.—*Palythoa australiae* n. sp. Transverse section of the mesogloea between two polyps. Cells, lacunae and cavities of decalcified incrustations.

TEXT-FIG. 31.—*Palythoa australiae* n. sp. Canal system from the basal part of a macromesentery. I, inner side of the mesentery. The numerous holotrichs not figured.

state of polyps, in number about 20. Ectoderm of the tentacles with rather sparse zooxanthellae. Actinopharynx longitudinally furrowed, siphonoglyph distinct, its mesogloea strongly thickened; hyposulcus present. Mesenteries about 40. Mesenterial canal in the lowermost part of the mesenteries broad, almost unbranched or a little branched. Ciliated tracts of the filaments well developed. Holotrichs of the coenenchyme  $46-50$  ( $55$ )  $\times$   $21-24\mu$ ; those of the filaments  $63-72 \times 24-26\mu$ ; those of the mesenterial canals  $62-72 \times 22-26\mu$ , very numerous. Microbasic mastigophors of the tentacles  $24-26 \times 2.5-3\mu$ ; those of the actinopharynx  $24-29 \times$  about  $3.5$  ( $4$ )  $\mu$ ; those



of the filaments  $46-55 \times 5\mu$ ; nematocysts of the type *a* in the filaments about  $22 \times 4\mu$ . Spirocysts of the tentacles  $12 \times 2-24 \times 4\mu$ . There were no holotrichs in the ectoderm of the tentacles and actinopharynx.

COLOUR.—Unknown.

SIZE of the colony,  $3.5 \times 2.5$  cm., breadth of the largest polyps 0.6 cm.

OCCURRENCE.—Detailed Survey, 6.v.29; 1 small colony.

The mesenteries numbered 40 in the two examined large polyps. I have, in Text-fig. 30, given a reproduction of a section of the mesogloea between two polyps. The mesenterial canal (Text-fig. 31) seems, in its lower part, to be almost unbranched. It was, however, difficult to get good preparations of the canal system, as the macro-mesenteries were narrow in their proximal part. The mesenterial canals contained numerous holotrichs, as also pigmented cells; the latter were common also in the filaments and outside them.

*Palythoa howesii* Hadd. & Shackl. (Plate I, fig. 2.)

*Palythoa howesii* Haddon & Shackleton, 1891, pl. lxi, fig. 13; pl. lxiii, fig. 8.

DIAGNOSIS.—Polyps scarcely or slightly projecting above the surface of the coenenchyme when wholly contracted. Ridges of the scapulus distinct, broad, but in the contracted state of the polyps mostly not visible from the surface of the colony. Colony rather high. Coenenchyme, column and especially the ridges of the scapulus strongly incrustated with calcareous grains occupying the whole mesogloea and with some sandy particles. Ectoderm of the coenenchyme apparently continuous with zooxanthellae; mesogloea thick, with numerous cells and many, but not large, lacunae, the latter often with zooxanthellae and holotrichs. Ectoderm of the tentacles with zooxanthellae. Siphonoglyph well developed, its mesogloea thickened; hyposulcus distinct. Other parts of the actinopharynx longitudinally furrowed. Mesenteries 40-46. Mesenterial canals in their lowest part broad and only a little branched, without lobes on the inner or outer side. Ciliated tracts well developed, long. Ectoderm of the coenenchyme and column with holotrichs  $53-60$  ( $67$ )  $\times$  about  $26\mu$ —in the former few, in the latter somewhat more numerous. On the other hand, the microbasic mastigophors are extraordinarily numerous in the ectoderm of the coenenchyme, and present also in that of the column, but not in such numbers and measuring  $29-41 \times 5.5$  ( $6$ )  $\mu$ . Holotrichs in the ectoderm of tentacles and actinopharynx absent; in the filaments  $60-73 \times 24-29\mu$ ; in the mesenterial canals  $60-70 \times 22-26\mu$ , very numerous; microbasic mastigophors in the ectoderm of the tentacles  $22-26 \times 3-3.5\mu$ ; in that of the actinopharynx  $31-36 \times 4-4.5\mu$ ; in the filaments  $46-48 \times 5-5.5\mu$ . Nematocysts of the type *a* in the filaments  $29-36$  ( $41$ )  $\times 5-5.5$  ( $6$ )  $\mu$ , common; spirocysts of the tentacles about  $14 \times 2-26 \times 3.5\mu$  at least.

SIZE.—Breadth of the colony about  $6 \times 6.5$  cm.; breadth of the largest polyps 0.7 cm.; of the smallest 0.3 cm.

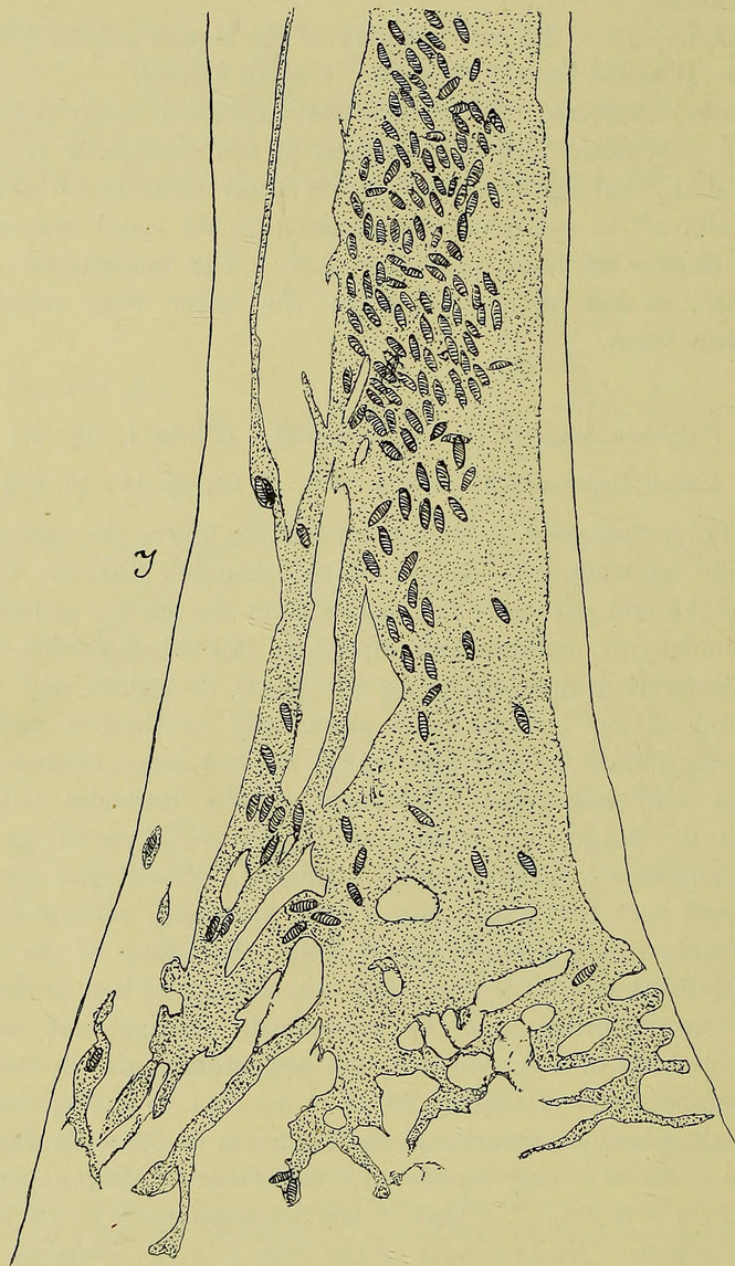
OCCURRENCE.—General Survey, Low Isles; the common *Palythoa* 20.v.29; 1 colony divided into two parts, the one smaller than the other and only at their bases communicating with each other.

FURTHER DISTRIBUTION.—Fringing reef, Thursday Island.

I have identified the present species with *P. howesii* Hadd. & Shackl., as the exterior of the colonies as well as the size and distribution of the cnidae among other



things agree rather well. The differences in organization are very small. The zooxanthellae were apparently more numerous in the ectoderm of the column in the present colony than in that described by Haddon and Shackleton. These authors give no information



TEXT-FIG. 32.—*Palythoa howesii* Hadd. & Shackl. Canal system with holotrichs from the basal part of a macromesentery. *I*, inner side of the mesentery.

about the number of the ridges of the scapulus and of the mesenteries. I have examined the mesenteries in five polyps. They were 40, 40, 41, 44 and 46 (24 + 22). A large polyp from the holotype had 44 mesenteries. The ridges of the scapulus may then have numbered 20–23. The mesenterial canal was broad in the undermost part of the mesenteries, and only a little or hardly branched, sometimes divided into two longitudinal canals. There are no such lobes issuing from the canal as in *projecta*. In Text-fig. 32



I have figured the canal of a mesentery in its lowest part. I have found much the same appearance of the canal system in some other mesenteries examined. The mesenterial canals contained numerous holotrichs and pigmented cells; the latter were present also in the filaments and outside them. Unfortunately I have not been able to make an examination of the canal system at the base of the mesenteries of the holotype, because the strongly extended and narrower mesenteries had been cut off in the piece lent to me by the British Museum.

The examination of the cnidae of the holotype showed good agreement with that of our colony. The cnidae of the holotype were as follows: Holotrichs in the ectoderm of the coenenchyme  $55-58 \times 24-26\mu$ , long, rather common; those of the mesenterial canals  $60-67 \times 24-26\mu$ , very common; microbasic mastigophors in the ectoderm of the coenenchyme  $38-41 \times$  about  $5\mu$ , rather common; in the ectoderm of the tentacles and actinopharynx  $22-26 \times 3.5-4\mu$  and  $30-34 \times 4.5-5\mu$  respectively, common; those of the filaments  $43-50 \times$  about  $6\mu$ ; nematocysts of the type *a*  $29-31 \times 5-6\mu$ , very common; spirocysts of the tentacles  $14 \times 2$  to about  $25 \times 4-4.5\mu$ . In the diagnosis above I have given the size and distribution of the cnidae in the present colony.

REMARKS.—In the gastral cavity of two polyps of the holotype there were two specimens of the parasitic genus *Baccalaureus*.\* The presence of the parasite was indicated by a porus on the side of the colony.

*Palythoa shackletoni* n. sp. (Plate I, fig. 4.)

DIAGNOSIS.—Polyps scarcely or slightly projecting above the surface of the coenenchyme when contracted. Ridges of the scapulus cover wholly or partly in contracted polyps. Coenenchyme, polyps and especially the ridges of the scapulus mostly strongly incrustated with calcareous grains, which occupy the whole or almost the whole mesogloea. Ectoderm of the coenenchyme and scapus continuous, with very numerous holotrichous cnidae and numerous zooxanthellae. Mesogloea of the coenenchyme and polyps thick, containing numerous cells and larger or smaller lacunae, especially in its inner part. Holotrichs and zooxanthellae in the larger lacunae. Zooxanthellae numerous in the ectoderm of tentacles and oral disc, and present in all parts of the endoderm. Microbasic mastigophors numerous in the apex of the tentacles. Siphonoglyph distinct, with thickened mesogloea; hyposulcus present. Other parts of the actinopharynx smooth or longitudinally sulcated, with numerous gland-cells at the base of the ectoderm. Mesenteries (40) 42–52. Mesenterial canals in their lowest part much branched, principal canal mostly on the inside of the mesenteries. Holotrichs in the ectoderm of the coenenchyme and polyps  $38-50 \times 17-22\mu$ ; those of the filaments  $55-67 \times 22-26\mu$ ; those of the mesenterial canals  $53-62 \times 22-24\mu$ , rather numerous. Microbasic mastigophors in the ectoderm of the tentacles and actinopharynx  $22-25 \times 2.5-3\mu$  and (26)  $29-31 \times$  about  $4\mu$  respectively, very numerous; those of the filaments  $46-53 \times$  about  $5\mu$ ; nematocysts of the type *a*  $19-24 \times 5\mu$  in the filaments, sparse; spirocysts of the tentacles about  $14-24 \times 2-4$  ( $4.5$ )  $\mu$ .

SIZE.—Largest colony  $7 \times 6$  cm.; largest polyps  $0.7-0.8$  cm. broad; the figured colony (Plate I, fig. 4) was  $6.5 \times 5.2$  cm.

OCCURRENCE.—General Survey, Low Isles, A71, 24.iv.29; 4 colonies.

There were no holotrichs in the ectoderm of the tentacles and actinopharynx.

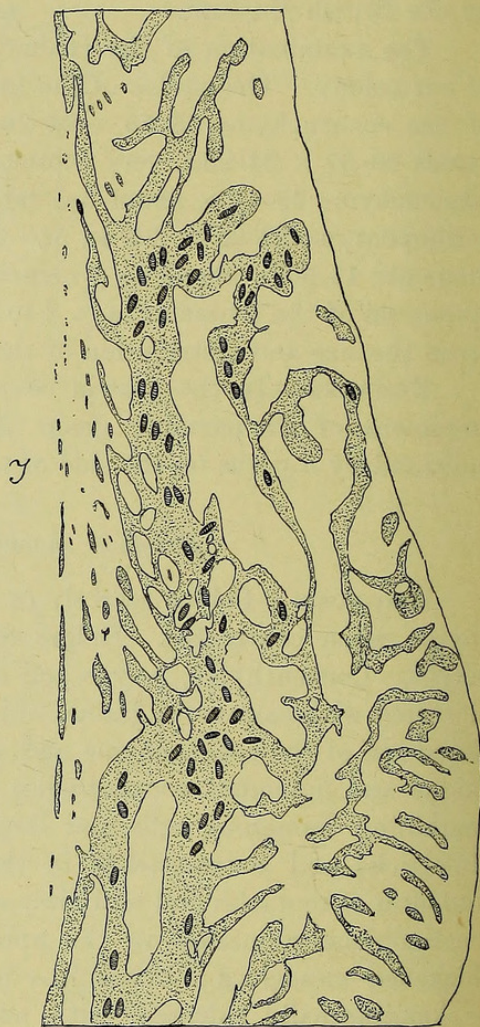
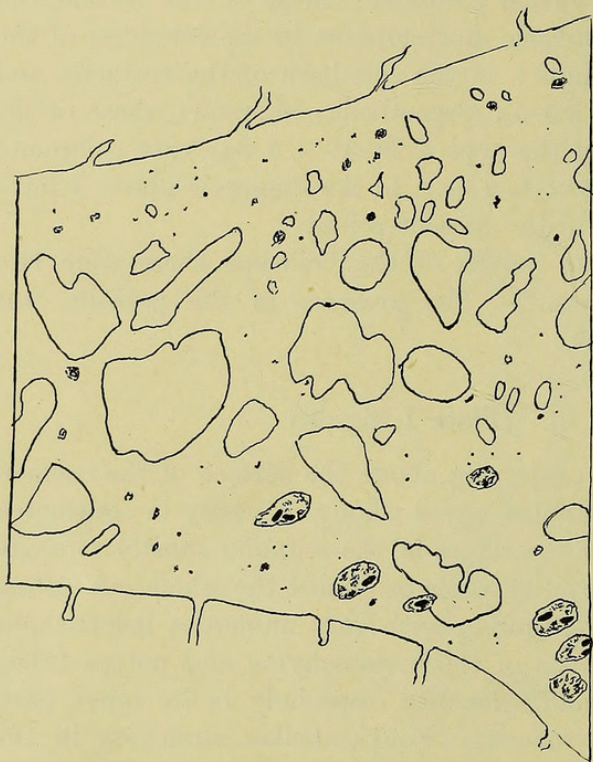
\* *Baccalaureus torrensis*, sp.n., Pyefinch, Proc. Linn. Soc., London, 1937, p. 156 [Editor].



and no microbasic mastigophors in the ectoderm of the coenenchyme and column. Text-fig. 33 shows a section of the coenenchyme between two polyps. The number of mesenteries varies. A small polyp had 40. The other examined polyps were provided with 42–52 mesenteries: 42 (20 + 22), 42 (20 + 22), 44, 46, 46, 46, 46, 48, 48, 50, 52.

TEXT-FIG. 34.

TEXT-FIG. 33.



TEXT-FIG. 33.—*Palythoa shackletoni* n. sp. Transverse section of the mesogloea between two polyps. Black elongated figures in the lacunae, holotrichs. Cells and cavities, remains of decalcified incrustations.

TEXT-FIG. 34.—*Palythoa shackletoni* n. sp. Canal system with holotrichs in the lower part of a macromesentery at the end of the cnidoglandular tract.

The mesenterial canals are more branched than in the other species of *Palythoa* described here and are strongly ramified even at the end of the filaments (Text-fig. 34). The reduced principal canal ran on the inner side of the mesenteries in five examined macromesenteries; in a sixth on the outer side.

The species is named after Miss Alice Shackleton, who, together with Prof. A. C. Haddon, described the zoantharia from Torres Strait.



Comparing the species of *Palythoa* described here, *howesii*, *projecta*, *haddoni* and *yongei* are certainly good species and easily to be distinguished from *P. stephensoni*, *shackletoni* and *australiae*, which are nearly related to each other. But as there seem to be some differences I have set up the latter as separate species. I agree with Haddon and Shackleton (1891b, p. 697) when they say: "But we would like to add another warning as to the extreme difficulty in identifying the species of this genus".

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DESCRIPTION OF PLATE I.

FIG. 1.—*Palythoa australiae* n. sp. Natural size.

FIG. 2.—*Palythoa howesii* Hadd. & Shackl. Slightly reduced.

FIG. 3.—*Palythoa yongei* n. sp., surrounded by four specimens of *Zoanthus mantoni* n. sp. Magnified four times.

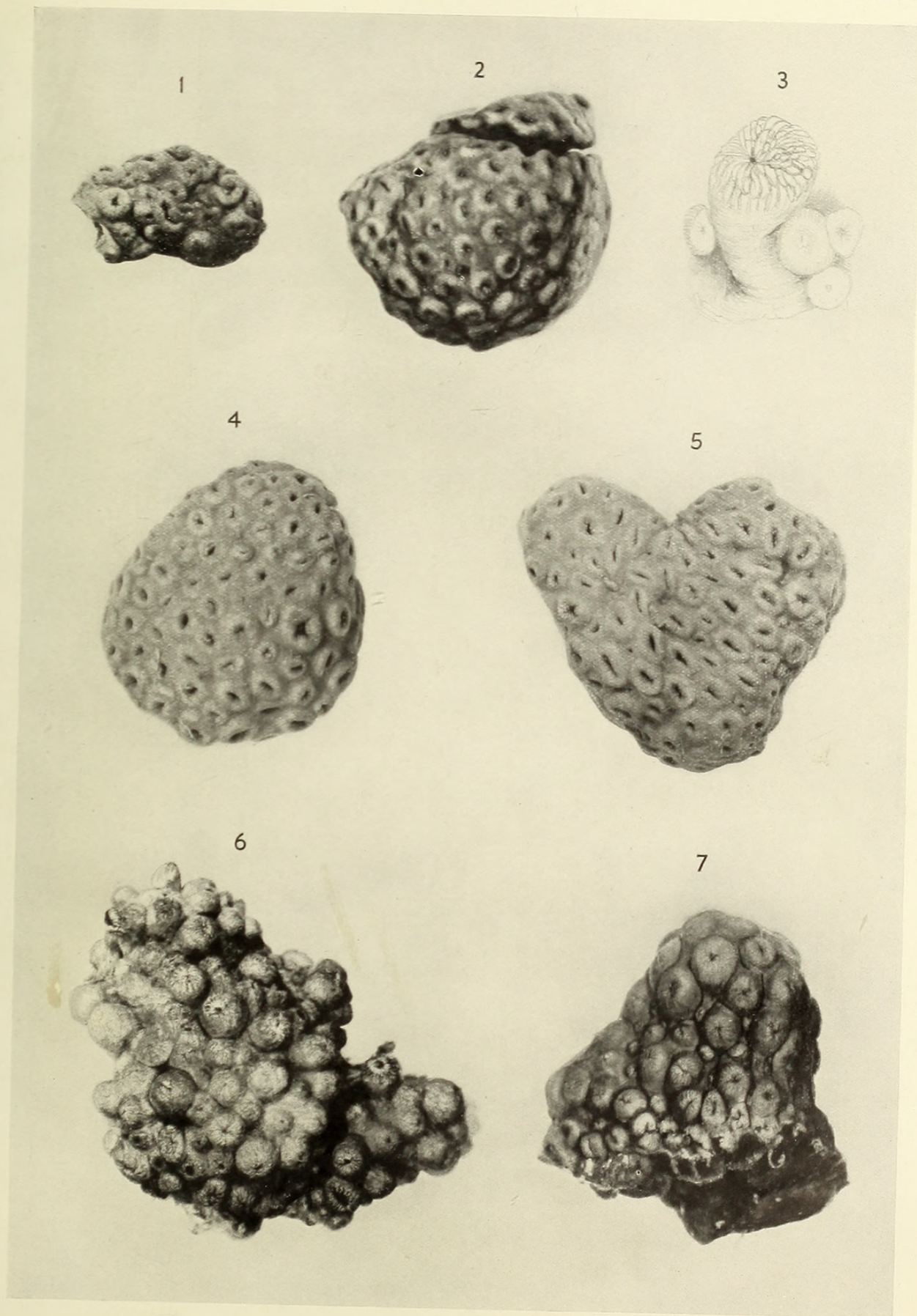
FIG. 4.—*Palythoa shackletoni* n. sp. Slightly reduced.

FIG. 5.—*Palythoa stephensoni* n. sp. Slightly reduced.

FIG. 6.—*Palythoa projecta* n. sp. Natural size.

FIG. 7.—*Palythoa haddoni* n. sp. Natural size.









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