SIBOGA-EXPEDITIE.

Siboga-Expeditie

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VOORHEEN

E. J. BRILL

LEIDEN

Siboga-Expeditie
XXVIIIa

THE POLYZOA OF THE SIBOGA EXPEDITION

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PART I

ENTOPROCTA, CTENOSTOMATA AND CYCLOSTOMATA

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PART I

ENTOPROCTA, CTENOSTOMATA and CYCLOSTOMATA.

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I. INTRODUCTION.

It has usually been supposed that the conditions under which marine animals occur in the Tropics are specially unfavourable for the growth of Polyzoa. LAMOUROUX [1]), speaking of "Corallines", states that "il semble qu'une grande chaleur leur soit contraire"; while ORTMANN [2]) remarks "Anderseits scheinen die Tropen eine Grenze für die Bryozoengebiete zu bilden"; and, ten years later, NORDGAARD [3]) accepts the view that Polyzoa are rare in low latitudes. It has indeed been clear for some time that the belief in the absence of Polyzoa from Tropical localities is due merely to insufficient knowledge; but if any further proof were needed, the results of the 'Siboga' Expedition would be amply sufficient to disprove the view that Tropical conditions are in any way antagonistic to the growth of Polyzoa. It may safely be asserted that, in Malay waters at least, Polyzoa are present in large numbers, both of species and of individuals; and that they occur from the littoral region down to the greatest depths investigated. The 'Siboga' collection is far the richest that has at present been made in any Tropical region; and it is specially important in supplying information with regard to a district which had previously been almost unknown. Further to the South, the Australian forms have received much attention from BUSK, MACGILLIVRAY, HINCKS, WATERS, MAPLESTONE and others. ORTMANN's paper, already referred to, gives some information with regard to Japanese species. But with the exception of papers by HINCKS [4]), KIRKPATRICK [5]), Miss THORNELY [6]) and WATERS [7]), little recent work has been done on the marine Polyzoa of the Indo-Malay region, the importance of which from the point of view of Geographical Distribution need not be emphasized.

The official list of the localities at which specimens were collected during the voyage of the 'Siboga' includes 323 numbered Stations; and Polyzoa were found in about 134 of these. In some cases the number of species obtained was very large. Thus in a single bottle from Station 144 about 38 species were discovered. Although this is very much more than the average number found, the process of sorting the material has been a very arduous one,

1) LAMOUROUX, J. V. F., 1816, p. XXXIII.
2) ORTMANN, A., 1889, p. 67.
3) NORDGAARD, O., 1900, "Norske Nordhavs-Exp.". XXVII, "Polyzoa", p. 27.
4) HINCKS, T., 1884, 1887.
5) KIRKPATRICK, R., 1888, 1890^1, 1890^2.
6) THORNELY, L. R., 1905, 1907, 1912.
7) WATERS, A. W., 1909, 1910, 1913, 1914.

particularly since it has been necessary to subject nearly the whole of it to a careful microscopical scrutiny. In a large number of cases a specimen which was placed in the collection ot Polyzoa, during the original sorting of the material, has been found, on examination, to have other species growing on it; and many of the most interesting specimens have been discovered as the result of their occurrence on some other species which was conspicuous enough to be referred to the Class under consideration. I cannot doubt that if it had been possible to examine the entire collection, of animals of all kinds, many Polyzoa would have been recorded which have escaped discovery. This is particularly likely to be true of the more inconspicuous forms, such as Entoprocta and Ctenostomata, for instance. The genus *Loxosoma*, belonging to the former group, is obviously very abundant in Malay waters. In other parts of the world, species of *Loxosoma* have been found commonly on such animals as Sponges, Tunicates, Polychaets and Gephyrea. Most of the specimens of *Loxosoma* which presumably occurred on members of these groups collected by the 'Siboga' have escaped detection, as the "hosts" in question were not submitted to me for examination. Discoveries of specimens of *Loxosoma* on members of these groups have for the most part been due to the accidental inclusion of fragments of the respective "hosts" in bottles labelled as Polyzoa. The systematic examination of the 'Siboga' collection of Hydroids would almost certainly have resulted in a considerable addition to the list of specimens and species recorded; while it may further be pointed out that the material submitted for examination included hardly any Algae.

The collection worked out was received in 583 bottles and tubes, which were numbered consecutively from 1 to 583 in the order in which they happen to have been received. Although these numbers were given, in the first instance, for convenience of reference during the progress of the work, I have considered it important to record them in the subjoined systematic account of the collection. It will thus be possible to verify or correct my statements by reference to the actual specimens on which they are respectively based. I think it well to emphasize this point because, in some accounts which have been published — for instance in Busk's 'Challenger' Reports — it is sometimes difficult to know what specimens are referred to, in the case of an account based on specimens from several distinct localities, and perhaps not rightly referred to the same species.

The specimens here recorded thus bear arbitrary numbers, from 1 to 583; and in each case the species found in a single bottle are further distinguished by letters (A, B, C ....), given to them in the order in which they were sorted out. Every specimen in the collection thus bears a distinctive symbol of its own. I propose to give a list of the specimens examined, arranged under Stations, at the end of the Report.

In view of the fact that no general account of the Oriental species has hitherto been published, and of the convenience of having the description of the Polyzoon-fauna of so important a district recorded in one place, I have ventured to prepare figures of nearly all the species, even though many of them are already well known. This course appears to me the more defensible because the publication of figures will enable other workers to criticise more effectively the correctness of my determinations. In many works which have been published — and on which, it may be, conclusions relating to Geographical Distribution have been based — the reference of a specimen to a particular species depends entirely on the unsupported statement of the author of the Memoir in question; and it cannot be doubted that in a considerable proportion of cases the determinations have been incorrect.

In addition to the specimens collected by the 'Siboga' I have made special use of the following collections:

(1) A collection made by Dr A. C. HADDON in Torres Straits, 1888—1889. This formed the subject of a paper by KIRKPATRICK [1]), and the specimens thus described are preserved in the British Museum. A supplementary part of the Collection, which had not been examined, was subsequently presented by Professor HADDON to the University Museum of Zoology, Cambridge (Reg. Feb. 24, 1898), and was found to contain a number of species which had not been recorded by KIRKPATRICK. The specimens in the Cambridge collection are the ones which are more particularly considered in the present Report.

(2) Specimens from Singapore, presented to the Cambridge Museum by the late Professor C. STEWART (Reg. April 26, 1899); the late Mr F. P. BEDFORD (Reg. Nov. 11, 1899); and Dr R. HANITSCH (Reg. June 19, 1900).

(3) A collection from Japan, in the neighbourhood of Tokyo, received at the Cambridge Museum from Mr A. OWSTON (Reg. June 23, 1902). These are included only so far as they appear to belong to the same species as those contained in the other Collections.

1) KIRKPATRICK, R., 1890[2].

II. DESCRIPTIONS OF SPECIES.

Class POLYZOA J. V. Thompson, 1830.
= BRYOZOA Ehrenberg, 1831.

Sub-Class I. ENTOPROCTA [1]) Nitsche.
1869, Zeitschr. wiss. Zool., XX, p. 596.

Fam. LOXOSOMATIDAE [2]) Hincks.

Loxosomidae Hincks.
1880, "Hist. Brit. Mar. Pol.", p. 571.

I have indicated above my reasons for believing that the species of this Family here recorded form but a small proportion of those that really occur in Malay waters. The specimens found have been discovered, without exception, accidentally, in the course of the examination of some other species. The Family is obviously abundantly represented in the Indo-Malay Archipelago; and it cannot be doubted that a more systematic search would result in the discovery of other species, particularly if attention were paid to Sponges, Polychaets, Gephyrea and Tunicates.

I am acquainted with but few references to the Loxosomatidae outside the Atlantic, Mediterranean and Arctic areas; and it may be worth while to mention the cases in question. In a paper on the Hydrozoa and Polyzoa of the China Sea, KIRKPATRICK [3]) has recorded *L. crassicauda*? from the Tizard Bank, 27 fathoms. After examining the original material (Brit. Mus., 89. 8. 21. 71.) I am unable to refer any of the 'Siboga' specimens to the same species; and the condition of Mr KIRKPATRICK's specimens does not justify me in expressing an opinion with regard to the correctness of his determination. WHITELEGGE [4]) has recorded *Loxosoma* sp. from *Phascolosoma australis* (sic). HASWELL [5]) has mentioned an undetermined *Loxosoma* which he found on the large chaetae of *Coppingeria longisetosa* at Port Molle, Queensland. In his

1) By many writers the name ENDOPROCTA is employed. I know of no reason for departing from the form originally introduced by NITSCHE.

2) It was recognized by KOWALEWSKY (1866, "Beitr. Anat. u. Entw. *Loxosoma neapolitanum*", Mém. Acad. Imp. St Petersbourg, (7) X, N⁰ 2), that *Loxosoma* must be regarded as the representative of a new Family at least.

3) KIRKPATRICK, R., 1890[1], p. 17.

4) WHITELEGGE, T., 1889. "List Mar. & Fresh-water Inv. Fauna Port Jackson". J. Proc. Roy. Soc. N. S. Wales, XXIII. Pt II, p. 293.

5) HASWELL, W. A., 1891, "Obs. Chloraemidae". Proc. Linn. Soc. N. S. Wales, (2) VI, p. 330, Pl. XXVI, fig. 1.

Report on the Polyzoa of the Belgian Antarctic Expedition, Waters[1]) states that he has found a *Loxosoma* (undetermined) among material from Lizard Island, Queensland; and the same author[2]) has more recently recorded *L. kefersteinii* from the Sudanese Red Sea. I have myself found a species (probably new) of Loxosomatidae, in the Collection of the British Museum (86. 6. 8. 3.), growing abundantly on *Amathia wilsoni* Kirkpatrick, from Port Phillip, Victoria. I am not convinced that Calman's record[3]) of *Loxosoma?* on a Crab (*Xanthias haswelli*) from Christmas Island, Indian Ocean, really refers to this genus.

The discrimination of the species of *Loxosoma* is often very difficult in the absence of living specimens, or at least of specimens which have not been killed with special care. The number of the tentacles is a character of importance in distinguishing the species from one another; and unless the animals have been killed in an extended condition it cannot always be ascertained with certainty. I am aware of the fact that my descriptions leave much to be desired.

The following is a list of the species of Loxosomatidae which I have distinguished in the present Report; with the approximate number of their tentacles and the average length of fully adult specimens. It must, however, be remembered that the state of preservation is not good enough to allow me to speak with certainty as to the number of tentacles in some cases; so that a margin of error must be allowed for in the third column. The total lengths given (calyx + stalk) are at most an indication of the relative sizes. It may be presumed that in most, if not all, cases the length of the living animal, with fully extended stalk, materially exceeds these measurements.

SPECIES.	"HOST".	Approximate number of tentacles	Total length, in μ.
Loxocalyx lineatus n. sp.	*Halichondria.*	10?	900
Loxocalyx leptoclini Harmer	*Cephalodiscus sibogae* Harmer	10	500
Loxosoma lanchesteri n. sp.	*Phascolosoma pellucidum* var.	20 +	1230
Loxosoma sluiteri n. sp.	*Phascolion convestitus* Sluit.	8	400
Loxosoma annulatum n. sp.	*Retepora, Schizoporella.*	9	500—600
Loxosoma velatum n. sp.	*Retepora.*	14—16	500
Loxosoma cirriferum n. sp.	*Retepora.*	14—18	650
Loxosoma circulare n. sp.	*Retepora.*	12	300
Loxosoma pusillum n. sp.	*Retepora.*	8—10	250
Loxosoma troglodytes n. sp.	*Lepralia celleporoides* Busk.	9	190
Loxosoma breve n. sp.	*Schizoporella, Cellepora.*	9	200
Loxosoma subsessile n. sp.	*Conescharellina.*	8	120
Loxosoma loricatum n. sp.	*Canda.*	8 (10)	180
Loxosoma cocciforme n. sp.	*Siphonicytara.*	10—12	260

In a recent work Mortensen[4]) has proposed the division of *Loxosoma* into three genera, which he characterises as follows:

1) Waters, A. W., 1904, p. 100.
2) Ibid., 1910, p. 252.
3) Calman, W. T., 1911, Ann. Mag. Nat. Hist. (8) VIII, p. 550.
4) Mortensen, Th., 1911, "A new Species of Entoprocta, *Loxosomella antedonis*", Danmark-Expeditionen til Grønlands Nordøstkyst 1906—1908, Bind V, Nr 8, København.

(I) *Loxosoma* Keferstein: Genotype *L. singulare* Keferstein.

The foot is a sucking disc, provided with straight and oblique muscles. No foot-gland, even in the buds.

(II) *Loxocalyx* Mort. (nov.): Genotype *L. raja* Schmidt.

Foot-gland present in the adult, as well as in the buds; the foot usually with wing-like expansions. Only straight muscles are developed in the foot.

(III) *Loxosomella* Mort. (nov.): Genotype *L. crassicauda* Salensky.

Foot-gland present in the buds, but not in the adults. Only straight muscles are present in the foot.

The persistence of the foot-gland in the adult is a feature which marks off a certain number of the species from the rest; and perhaps entitles them to generic rank. I feel less convinced that the other species are sufficiently well known to warrant the separation of *Loxosomella* from *Loxosoma*.

Loxocalyx Mortensen.

1911, t. cit., p. 406.

The 'Siboga' collection contains two species which are referable to this genus. The state of preservation of the first of these is not good enough to allow several important points to be made out. I am unable, for instance, to state definitely what is the number of the tentacles; but on the whole I think I am justified in describing it as a new species.

I therefore record it under the name of

1. *Loxocalyx lineatus* n. sp. (Pl. II, figs. 1—3).

332. C., on a Siliceous Sponge (*Halichondria* sp. [1])). Stat. 64. Kambaragi Bay, Tanah Djampeah, 0—32 Metres; coral, coral-sand.

Calyx from 220 to 320 μ long, 190—230 μ broad; with moderately developed lateral membranous expansions. Number of tentacles uncertain, perhaps 10. A series of vesicular cells encircles the distal part of the lophophore. Buds not numerous. Stomach with well developed lateral lobes. Stalk from 570 to 670 μ long, usually about twice the length of the calyx; marked by four longitudinal lines (the nature of which is uncertain), to which the specific name refers. Foot with well marked alate expansions and a persistent foot-gland.

The specimens were found on the outside of a species of *Halichondria*, of narrow cylindrical form.

Several Polychaets belonging to the family Syllidae occurred in the interior of the cylindrical branches of the Sponge.

The examples selected for figuring bear only one bud each, represented merely by a subspherical swelling. In other individuals the bud of one side had nearly reached its limit of

1) I am indebted to Mr R. Kirkpatrick for this determination.

growth, but the next bud of the same side was merely a minute tubercle. It may accordingly be concluded that in this species there is only one well developed bud at a time.

The following species of *Loxosoma* are referable to MORTENSEN's genus *Loxocalyx*; though the specific characters are by no means well ascertained in all cases; and it is uncertain whether they all deserve specific rank:

Loxosoma alatum Barrois 1877.
Loxosoma cochlear Schmidt, 1876.
Loxosoma leptoclini Harmer, 1885.
Loxosoma neapolitanum Kowalevsky, 1866.
Loxosoma pes Schmidt, 1878 (which has been regarded as a synonym of *L. alatum*).
Loxosoma raja Schmidt, 1876.
Loxosoma tethyae Salensky, 1877.

Of these, *L. alatum*, *L. cochlear*, *L. pes*, *L. raja* and *L. tethyae* have been recorded as occurring on various Sponges. In most of these species the stalk appears to be less than twice the length of the calyx, but in *L. tethyae* it is generally at least twice as long. In this respect the 'Siboga' specimens agree more nearly with that species than with any of the others. No adequate figure of *L. tethyae* appears to have been published; but it is worth calling attention to certain figures, by O. G. COSTA, which have not, I think, been previously cited in the accounts of this species, but which are of interest as being probably the earliest figures of any species of *Loxosoma*. The figures in question were published in COSTA's "Fauna del Regno di Napoli", "Zoofiti", the title-page of which bears the date 1838. The real dates of publication are given in 'Isis', 1846, Heft IX, p. 718; and relying on the information there given and on the dates which occur on the edges of the sheets, the Section headed "Genere Tezia; *Tethya* Lamk." was really dated Nov. 18, 1843 (pp. 1—8), Jan. 3, 1844 (pp. 9—16), and May 14, 1844 (pp. 17—24). On pp. 11 and 12 of this Memoir COSTA gives an account of certain polyp-like structures which he regarded as belonging to the *Tethya*. The figures 1, 2 and 5, at the top of Pl. I, illustrating the description, are perfectly characteristic representations of *Loxosoma tethyae*; figs 1 and 5 showing the general form of the calyx and stalk, and fig. 2 being a good representation of the foot, and showing further the arrangement of the ectoderm-cells of the stalk in eight longitudinal rows; a feature to which I called attention in my Memoir on *Loxosoma* [1]), without being at that time acquainted with COSTA's figures and description. It need hardly be remarked that as COSTA regarded the *Loxosoma* as a part of the Sponge, he did not give it any generic or specific name.

The calyx of *L. tethyae*, as seen in COSTA's figures, is relatively narrow, and is not furnished with thin lateral expansions. There can thus be little doubt that the 'Siboga' specimens are not to be referred to that species. From *L. leptoclini* they differ in the absence of the group of cells, at the distal end of the calyx, characteristic of that species [2]), as well as by the much longer stalk. *L. raja* Schmidt [3]) has a specially broad calyx; but its broadest part is at

1) HARMER, S. F., 1885, Quart. J. Micr. Sci., XXV, p. 262.
2) Ibid., Pl. XIX, fig. 2.
3) SCHMIDT, O., 1876, Arch. mikr. Anat., XII, Pl. I, fig. 1.

its proximal end. *L. cochlear* Schmidt[1]) has only 8 tentacles, a number which is almost certainly smaller than that of the 'Siboga' specimens. *L. pes*[2]) has a stalk which is commonly shorter than the calyx. *L. neapolitanum*[3]) is very insufficiently known; but its calyx is narrow and the stomach does not appear to have well marked lateral lobes. *L. alatum* was very incompletely characterised by BARROIS[4]), its original describer, and it is almost impossible to decide whether this form is identical with any of the others or not. The specimens which have more recently been referred to this species by JULLIEN and CALVET[5]) are very different from BARROIS' figure in the proportions of the stalk, which in JULLIEN and CALVET's specimens is considerably shorter than the calyx; and it appears doubtful whether they belong to *L. alatum*.

It seems justifiable, as the result of these considerations, to regard the 'Siboga' specimens as the representatives of a new species.

2. *Loxocalyx leptoclini* Harmer. (Pl. I, fig. 1).

Loxosoma leptoclini Harmer, 1885, Quart. J. Micr. Sci. XXV, p. 263.

402. D., on *Cephalodiscus sibogae* (slide 402. A.). Stat. 204. Between Islands of Wowoni and Buton, 75—94 Metres; sand with dead shells.

A single specimen of *Loxocalyx* was found on one of the slides of the above species of *Cephalodiscus*. The foot-gland is well developed and the foot has strongly marked alate expansions. The calyx is hardly more than half as long as that of *L. lineatus*; and the stalk is not quite twice as long as the calyx. The lateral lobes of the stomach are strongly marked, and there are almost certainly ten tentacles. The calyx measures 180 μ in length, and 147 μ in breadth. The stalk is 320 μ long.

The specimen differs so much in size from those described above as *L. lineatus* that it can hardly be referred to the same species. The brood-pouch contains two embryos, and ovaries are present, without testes. Its measurements approach closely those of *L. leptoclini*, with which it agrees in the general proportions of the stalk and body, in the number of the tentacles, in the prominence of the lateral lobes of the stomach, and in the form of the wings of the foot. It appears to me better to refer it provisionally to this species than to describe it as new.

Loxosoma Keferstein.

1862, "Unt. nied. Seethiere", Zeitsch. wiss. Zool. XII, p. 131.

1. *Loxosoma lanchesteri* n. sp. (Pl. II, figs 4, 5).

Size large. Calyx pear-shaped, narrower distally, the broadest part close to the proximal end and almost equalling its length. Lateral parts of the calyx somewhat depressed, the median part more convex. Stalk much longer than the calyx, cylindrical proximally, and without foot-

1) In BREHM's "Thierleben", Ed. 2, 1878, Bd X, fig. on p. 181.
2) Cf. my remarks on this species, t. cit., p. 262.
3) KOWALEVSKY, A., 1866, Mém. Acad. St Petersbourg, (7) X, N⁰ 2, figs 1, 2.
4) BARROIS, J., 1877, "Rech. Emb. des Bryozoaires", p. 9, Pl. XVI, fig. 4.
5) JULLIEN, J. and CALVET, L., 1903, "Res. Camp. Sci. Prince de Monaco", XXIII, p. 29, Pl. II, figs 4*a*—4*d*.

gland in the adult, but dilating as it approaches the calyx, which, like the distal part of the stalk, is marked by transversely running grooves, giving a crenulated appearance to the profile of these parts. Stomach with some indication of lateral lobes. Buds as many as four at a time (two on each side). Tentacles numerous, at least 20 in number. Sexes apparently separate.

The specimens to which this description refers do not form part of the 'Siboga' Collection, but were found at Singapore and Pulu Java, Malacca, by Mr W. F. LANCHESTER, after whom I have the pleasure of naming the species, on the tails of two specimens of a Sipunculid, determined by him as *Phascolosoma pellucidum* var. They were presented to the University Museum of Zoology at Cambridge, but the type-specimen will be transferred to the British Museum, while a duplicate will be placed with the 'Siboga' Collection.

The material is unfortunately badly preserved, and some of it was further injured by the use of oil of cloves, which produced great contraction. The specimens transferred from absolute alcohol directly to Canada balsam dissolved in the same fluid [1]) are much more satisfactory.

The measurements of the largest specimen found (fig. 4) are as follows: — length of calyx, 346 μ; breadth of calyx, at its widest part, 308 μ; length of stalk, 896 μ; breadth of stalk, at the proximal end, 58 μ; breadth of the stalk, just before it joins the calyx, 134 μ. The other specimens are smaller; the smallest having the measurements (given in the same order) 180, 166, 300, 51 and 77; two other individuals being intermediate in these measurements between the largest and the smallest specimens. It will be seen that the individuals of the present species may be described as very large; and this is sufficiently brought out by comparing the figures given with those of other species [2]).

The number of tentacles cannot be given with certainty; but it is at least 20, and is probably more. The alimentary canal is not well shown, but the intestine, rectum and some indication of the stomach may be seen in fig. 4. The specimen here represented appears to be a male; a pair of organs which are almost certainly testes being visible in the figure. The buds are only visible in one of the slides which is not successfully mounted; but, in one individual, four buds are present; — a large one on each side (the two not differing much in size) and a small one at the base of each of the larger ones. The buds are not well enough preserved to decide the question whether a food-gland is present or not.

It can hardly be doubted that the present species is different from other species which have hitherto been described from the tails of Sipunculids (*L. phascolosomatum* Vogt, 1876; *L. murmanicum* Nilus, 1909; *L. brumpti* Nilus, 1909; *L. minutum* Osburn, 1910; and *L. sluiteri*, described below). It has some resemblance to *L. antedonis*, described by MORTENSEN (1911) from the cirri of *Hathrometra (Antedon) prolixa* Sladen, from Greenland.

2. *Loxosoma sluiteri* n. sp. (Pl. I, fig. 7).

373. A. On *Phascolion convestitus* Sluiter. Stat. 105. 6° 8' N., 121° 19' E., 275 Metres; coral-bottom.

Calyx about 150 μ in length, and about 85 μ in breadth, without cirri or lateral

1) For the use and advantages of this method, see my paper in Quart. J. Micr. Sci., XLVI, Pt 2. 1902, p. 264.

2) The figures were all drawn to the same scale; but it must be noted that while those on Pl. I were only reduced 2/3, those on Pl. II are reduced 1/2.

expansions. Buds? Tentacles 8. Stomach without lateral lobes. Stalk from one and a half to twice as long as the calyx, reaching a length of 310 μ, ending in a small disc of attachment, without food-gland.

The specimens here described were sent to me, in June, 1902, by Prof. C. Ph. Sluiter, who had found them in the course of his examination of *Phascolion convestitus*, which has been described by him as a new species in the 'Siboga' Report [1]) on the Sipunculids and Echiurids obtained by the Expedition. I have the pleasure of naming this species of *Loxosoma* after its discoverer.

The occurrence of the *Loxosoma* has already been recorded by Prof. Sluiter in his Report. As there pointed out, the Polyzoon occurred on all the specimens of the *Phascolion*, principally on the posterior extremity of the body, although a few were found on the anterior end as well.

Loxosoma has frequently been recorded on the skin of Sipunculids. The best known species is *L. phascolosomatum* Vogt, usually found on species of *Phascolosoma*; differing in many respects from the 'Siboga' form, and notably in the great length of its stalk. A *Loxosoma* was recorded by Brumpt [2]) from *Phascolion strombi* at Roscoff; but it was neither described nor named. Two species have more recently been described by Nilus [3]) from *Phascolion spitzbergense* found in the Kola Fjord, on the Murman Coast of Barents Sea. Of these, *L. murmanicum* was found on the anterior end of the *Phascolion*, and *L. brumpti* on its posterior end. The aboral ends of the calyx and the stalk of *L. murmanicum* are covered by a thick brown cuticle; thus differing from the 'Siboga' species. *L. brumpti* does not possess this thick cuticle, but bears two projecting organs, believed to be sense-organs, one on either side of the oral end of the calyx. Both the species described by Nilus are said to have 8 tentacles; but it may be noted that in fig. 8, given by that author of *L. brumpti*, 9 are indicated. *L. minutum* Osburn [4]), found on *Phascolion strombi* and *Phascolosoma eremita* in the Woods Hole region, E. coast of N. America, is less than ·5 mm. in length, and has "about eight" tentacles. The stalk is shorter than the calyx and terminates in a well marked, circular pedal disc.

I have had some hesitation in giving a new name to the 'Siboga' species, since I have been unable to obtain any evidence with regard to some of its most important features, such as the number of the buds and the character of the gonads. The absence of buds is specially noteworthy, particularly in view of the fact that many of the individuals are small, with a calyx-length of not more than 76 μ. It is possible that they are all young individuals which have been produced by the metamorphosis of larvae. The 'Siboga' species is a very small form, its calyx-length of 150 μ being much smaller than that of *L. murmanicum* (352 μ), which, moreover, has a very short stalk, or than that of *L. brumpti* (320 μ), which it more nearly approaches. The number of tentacles (8) is identical with that of both species described by Nilus.

So far as I have been able to ascertain, there is no specific difference between the

1) Monogr. XXV, 1902, p. 32, 33.
2) Brumpt, L., 1897. Arch. Zool. Exp. (3) V, p. 494.
3) Nilus, G., 1909, Trudui St Peterb. Obschch. XI, I. N° 4, c. r. Seances, p. 157.
4) Osburn, R. C., 1912, Bull. Bur. Fisheries (Washington, D. C.). XXX, p. 212.

individuals which occur at the anterior end of the *Phascolion* and those which are found on its posterior end.

It may be useful to note a few other references to the occurrence of *Loxosoma* on Sipunculids, and particularly on *Phascolion*. Besides the records of *L. phascolosomatum* on *Phascolosoma* the following may be mentioned:

L. phascolosomatum, found on *Phascolion* by ANDERSSON [1]) in E. Greenland and by NORMAN [2]) in E. Finmark.

Loxosoma sp., found on *Phascolion* by MARION [3]) at Marseilles; by LEVINSEN [4]) in the Kara Sea; and by THÉEL [5]) in the Gullmarfjord, S.W. Sweden; on *Phascolosoma* by VERRILL [6]) on the Atlantic Coast of the United States; and on *Phascolosoma australe* by WHITELEGGE [7]) in Port Jackson.

3. *Loxosoma annulatum* n. sp. (Pl. I, figs 2—6).

Type. 195. D. On *Retepora*, 195. A., Stat. 274. 5° 28'.2 S., 134° 53'.9 E., 57 Metres; sand and shells, stones.

24. E. On *Retepora*, 24. A., Stat. 53. Bay of Nangamessi, Sumba, 0—36 Metres; coral-sand; near the shore, mud. (On *Mimosella tenuis* slides, 24. C.[2], 24. C.[3]).

133. H. On *Retepora*, 133. B., Stat. 164. 1° 42'.5 S., 130° 47'.5 E., 32 Metres; sand, small stones and shells.

247. E. On *Retepora*, 247. A., Stat. 310. 8° 30' S., 119° 7'.5 E., 73 Metres; sand and dead coral.

[For other specimens which appear to belong to this species, see below, p. 13].

Calyx rather small relatively to the stalk, usually from 140 to 190 μ long and 100 to 130 μ broad; somewhat broader distally than proximally, where it passes continuously into the stalk, without a sudden diminution in breadth. Cirriform organs small, usually one pair, opposite the distal end of the stomach (fig. 2); occasionally one or two cirri on the more distal part of the calyx. Tentacles 9, with an unpaired distal tentacle; rarely 11. Stomach without lateral lobes. Gonads? Buds usually on one side of the calyx only, not more than two at a time, the tip of the stalk prolonged beyond the attachment to the parent in the old state. Stalk varying greatly in length, but always longer than the calyx, sometimes more than three times as long; broader, relatively to the calyx, than in other species found on *Retepora*, conspicuously annulated, without foot-gland, which is, however, present in the buds.

The specific name refers to the annulated character of the stalk: — a feature which may be due to contraction, but is not seen in the other species, similarly preserved.

I am not acquainted with previous records [8]) of the occurrence of *Loxosoma* on *Retepora*; but, judging from the evidence of the 'Siboga' Collection, it must be extremely common on

1) ANDERSSON, K. A., 1902, "Bry. schwed. Exp.", Zool. Jahrb. Syst., XVI, p. 555.

2) NORMAN, A. M., 1903, "Notes Nat. Hist. E. Finmark", Ann. Mag. Nat. Hist. (7) XI, p. 574.

3) MARION, A. F., 1879, "Drag. Marseille", Ann. Sci. Nat., Zool. (6) VIII, p. 33.

4) LEVINSEN, G. M. R., 1886, "Bry. Kara-Havet", Dijmphna-Togtets zool.-bot. Udb., p. 327.

5) THÉEL, H., 1907, "Sver. Zool. Hafsstation Kristineberg", Ark. f. Zool., IV, p. 71.

6) VERRILL, A. E., 1879, "Prelim. Check-List Mar. Inv.", Prepared for the U. S. Comm. of Fish and Fisheries. Author's Edition. New Haven, p. 31.

7) WHITELEGGE, T., 1890, "List Mar. and Fresh-water Fauna Port Jackson", J. Proc. Roy. Soc. N.S. Wales, XXIII, p. 131.

8) Except my own preliminary notice, referred to on p. 12.

species of that genus in Malay waters. Specimens of *Retepora* which I refer provisionally to seven species have been found to be thus infested. In many cases, the *Loxosoma* was only discovered during the examination of a microscopic preparation of the Retepore; and it cannot be doubted that I have failed to detect it on many specimens on which it is really present; although in examining the numerous Retepores in the collection I have throughout looked for *Loxosoma*. My evidence goes to show that there is no restriction of a particular species of *Loxosoma* to one species of *Retepora*; and the same species of "host" may bear more than one species of *Loxosoma*. In the majority of cases the Entoproct is not the only commensal organism, the *Retepora* being infested simultaneously with a Gymnoblastic Hydroid, with an elongated hypostome bearing diffusely arranged tentacles. From the fact that this Hydroid produces buds which appear to be destined to break off as free Medusae I refer it to the genus *Syncoryne*. I have already called attention to the occurrence of the *Loxosoma* and *Syncoryne* on Retepores in my Presidential Address to Section D at the Dublin meeting of the British Association [1]. The *Loxosoma* is most commonly found on the frontal side of the Retepore; but the specimens 337. J., which I have selected as the types of *L. cirriferum*, occurred mostly on the basal sides or backs of the branches. I have usually, though not always, found the Entoprocts on parts of the Retepores in which the polypides were in full functional activity.

Most of the other species of *Loxosoma* appear to have an even number of tentacles. In *L. annulatum* I have, however, counted nine with certainty in several specimens, and I have been able to ascertain that the odd tentacle is situated distally. In one case there appear to be 11 tentacles.

The stalk varies in length more than in most species. The extreme measurements which I have made are 166 μ and 454 μ. Its breadth is considerable, and may be as much as 51 μ. The robust stalk and the rather narrow calyx give this species a very different appearance from *L. circulare*, for instance.

In most species of *Loxosoma* the old bud is attached to the parent by the tip of its stalk. In the present species the tip is prolonged beyond the point of attachment; a feature which was described by CLAPARÈDE [2]) and confirmed by NITSCHE [3]) in *L. kefersteinii*. I have had some difficulty in deciding how the foot-gland of the bud is related to this prolonged tip; but the evidence of 247. E. seems to show that the attachment of the bud is at first quite normal (fig. 3), the foot-gland running from the point of attachment, along the oral side of the stalk, to the commencement of the calyx. At this region there is at first an indentation between the stalk and the calyx; but this soon disappears, and the opposite end of the stalk begins to grow towards the lophophoral end of the parent. The attachment or "umbilicus" of the bud then lies on that side of its stalk which is opposite to the surface containing the last remains of its foot-gland (figs. 4, 5).

1) HARMER, S. F., 1909. Report Brit. Ass., Dublin Meeting, 1908, p. 721.

2) CLAPARÈDE, E., 1870. "Beitr. Anat. u. Entw. d. Seebryozoen". Zeitsch. wiss. Zool., XXI, p. 171. Pl. X, fig. 4.

3) NITSCHE, H., 1875. "Bau u. Knospung v. *Loxosoma kefersteinii*". Ibid., XXV, p. 454; and 1875, "Ueb. d. Knospung d. Loxosomen". Ibid., XXV, Suppl. Bd. p. 370, Pl. XXV, fig. 4.

It would appear, from this singular arrangement of the end of the young stalk, that *L. annulatum* is related to *L. kefersteinii*; but the number of its tentacles is considerably smaller than in that species, and buds are developed less profusely.

The following specimens probably belong to the present species; but as neither of them is associated with a Retepore I have thought it best to record them separately:

> 416. J. On *Schizoporella*, 416. G. (slide). Stat. 321. 6° 5'.5 S., 113° 30' E., 82 Metres; fine grey mud.
> 130. P. With *Valkeria tuberosa*, 130. G.², Stat. 164. 1° 42'.5 S., 130° 47'.5 E., 32 Metres; sand, small stones and shells.

Each of the above specimens is represented by a single individual.

416. J. is attached to the frontal wall of a zooecium of a species of *Schizoporella*. It is seen sideways, in a position unfavourable for examination. Its general shape and size correspond well with the specimens from Retepores. Its stalk shows distinct indications of annulation, and has an expanded disc of attachment, without foot-gland. There is an advanced bud, on one side, the tentacles of which appear to be 9, or about 9, in number.

130. P. occurs on a *Valkeria* slide, but the Ctenostome had no doubt been growing on some other object; and its association with the *Loxosoma* on the same slide may have been purely accidental. There is not sufficient reason to assume that it was really the "host" of the *Loxosoma*. The specimen appears to agree closely with the preceding individual, and is probably correctly referred to the present species.

4. *Loxosoma velatum* n. sp. (Pl. I, figs 8—10).

> 24. D. On *Retepora*, 24. A. Stat. 53. Bay of Nangamessi, Sumba, 0—36 Metres; coral-sand; near the shore, mud.

Calyx (without the expanded membranous margins) about 205 μ long, and (with the margins) about 198 μ broad; expanded laterally into a very broad, thin, velate margin, which extends on to the distal part of the stalk. Length of calyx plus velum, 320 μ. In young individuals (fig. 9), in which the velum is not yet differentiated, the stalk appears to expand widely as it joins the calyx. The calyx bears a varying number (less numerous in young specimens) of cirriform organs, some of which may be branched. 4 or 5 of these organs are generally present on each side; the distal pair forming horn-like structures in the region of the lophophore, and the others being borne by the edges of the velum. Buds not more than three at a time, a nearly mature bud being accompanied by a small bud on its own side and a bud of intermediate age on the opposite side. Tentacles apparently about 14—16, the lophophore transversely elongated in the retracted condition. Stomach with the lateral lobes barely indicated. Sexes separate; a pair of testes or a pair of ovaries being present. Stalk, without its velate portion, longer than the part of the calyx which contains the lophophore and stomach; with small projecting papillae laterally; ending basally in a small disc of attachment; with no foot-gland in the adult, but a well developed gland in the buds.

Found attached to a species of *Retepora*.

The specimens here described were found with *L. circulare*, from which they are easily distinguished by the velate expansion of the adult, or by the expanded junction of the stalk and calyx, due to the development of the velum, in immature individuals (fig. 9). The velum is not unlike the similar expansion in *L. annelidicola* Van Ben. and Hesse [1]), from which species *L. velatum* differs conspicuously in other respects, as for instance in the general form and in the presence of a foot-gland in the bud, a structure which, according to Prouho [2]), is absent at all stages in *L. annelidicola*.

5. *Loxosoma cirriferum* n. sp. (Pl. I, figs 11—13).

Type. 337. J. On *Retepora*, 337. C. Stat. 71. Makassar, 0—32 Metres; mud, sand with mud, coral. (And on the *Retepora* slide, 337. C.[2]).
193. E. On *Retepora*, 193. A.[3] Stat. 274. 5° 28 .2 S., 134° 53′.9 E. 57 Metres; sand and shells, stones.
193. G. On *Retepora*, 193. F.[1]. Stat. 274. Ibid.
297. D. On *Retepora*, 297. A.[1]. Stat. 273. Off Pulu Jedan, Aru Islands, 13 Metres; sand and shells.

[The addition of a numeral to the symbol representing the Retepore indicates, as in other cases, that the *Loxosoma* is be found on the slide so designated. Thus 193. E is to be found on the *Retepora* slide marked 193. A.[3]].

Calyx relatively large, reaching a length of 280—310 μ, and a breath of 270 μ; broader distally than proximally. Its margin bears a varying number of cirriform appendages, commonly dilated proximally and with a filiform termination, sometimes branched. Tentacles 14—18 in number, less numerous in young individuals. Stomach more or less globular, without distinct lateral lobes. Sexes separate; the females with a short row of eggs in the ovary, and carrying as many as six or seven embryos in their vestibule (fig. 12). Buds as many as three at a time: an old bud being associated with a young bud on its own side and one of intermediate age on the opposite side. The last attachment of the bud to the parent is by the tip of the stalk, the foot-gland running along the oral side of the stalk as far as the commencement of the calyx. Stalk variable in length (doubtless partly as the result of varying contraction); sometimes slightly shorter than the calyx, but sometimes considerably longer, and reaching a length of 400 μ; terminating proximally in a slightly marked disc of attachment, without foot-gland.

The specific name which I have chosen for the present species indicates what I regard as one of its most distinctive features. The apparent variability of the occurrence ot the cirri may be due to the fact that these structures are deciduous or easily affected by reagents. Nickerson [3]) has given reasons for believing that the "flask organs" of *L. davenporti* are not permanent structures, but are deciduous, while others may develop later; and he comments on the complete absence of these structures in some individuals. While not expressing himself

1) Cf. Prouho, H., 1891, Arch. Zool. Exp., (2) IX. Pl. V.
2) Ibid., p. 110.
3) Nickerson, W. S., 1901. J. Morphol., XVII, pp. 357. 358, Pl. XXXII, fig. 11, Pl. XXXIII. figs 16—19.

positively on the subject, he is inclined to regard them as being glandular in nature. The cirri of *L. cirriferum* appear to be of the same nature as the "flask organs"; but I think that they are tactile organs, which are probably of special use in enabling the *Loxosoma* to avoid injury by the formidable avicularia of the Retepore.

Cirriform organs have been described in certain other species of *Loxosoma*. The structures shown at the margin of the calyx in *L. harmeri* by SCHULTZ [1]) are probably of this nature. More or less similar organs have been described by ASSHETON [2]) in *L. loxalinum* and *L. saltans*. The two "posterior sense-organs" of which I have given an account [3]) in *L. crassicauda* Sal. are perhaps more specialised organs of the same general nature; while more or less similar structures have been described by VOGT [4]) in *L. phascolosomatum*, by NILUS [5]) in *L. brumpti* and by MORTENSEN [6]) in *L. antedonis*. But these species are all sufficiently different in other respects from *L. cirriferum* to make it impossible to refer the 'Siboga' specimens to any of them.

Young individuals of *L. cirriferum*, whether advanced buds or recently detached free forms, show no trace of the cirri, which appear to increase in number as the individual grows larger. Thus the small male specimen shown in fig. 13 has only two pairs of cirri. The small specimens also differ from the large ones in another important particular, since they appear to have a smaller number of tentacles. As in many other cases, in this genus, I have found it difficult or impossible to count the tentacles certainly. I have found evidence, however, that the full number of the tentacles is 18, although other specimens, smaller in size, seem to have no more than 16 or 14; or perhaps in some cases 12. It thus appears that, in the present species at least, there is a progressive increase in the number of cirri and tentacles after the individual has become free.

L. cirriferum differs from the species next to be described in the fact that the females, or the older ones at least, carry a number of embryos simultaneously in their vestibule. Correlated with this fact is the occurrence of a short row of eggs (about 3) in the ovary (figs 11, 12); other species frequently having only one recognisable egg at a time in each ovary. Male specimens are usually smaller than females, although I have found a male almost as large as the largest females. I find no evidence of protandry; and eggs may be produced by females which are no larger than the male shown in fig. 13.

The buds in this species occupy a relatively proximal position. In the smaller individuals they are developed opposite what may be considered the middle of the stomach; but this organ has a considerable extension on the lophophoral side of the insertion of the buds, which are thus situated nearer the proximal end than the distal end of the stomach (fig. 13). In old individuals (fig. 12) the proximal insertion of the buds is very marked. It will be obvious from the figures that buds are borne indifferently by males and females.

1) SCHULTZ, E., 1895, Trudui St Peterb. Obschch., XXV, Sect. de Zool. & Physiol. Pt II. text-fig. on p. 51.
2) ASSHETON, R., 1912, Quart. J. Micr. Sci., LVIII, pp. 118, 124, Pl. VI, figs 1, 10.
3) HARMER, S. F., 1885. Quart. J. Micr. Sci., XXV, p. 273, Pl. XIX, fig. 1.
4) VOGT, C., 1876, Arch. Zool. Exp. V, p. 312. Pl. XI. fig. 3, Pl. XII. fig. 1.
5) NILUS, G., 1909. Trudui St Peterb. Obschch., XL, Livr. 1, N^o^ 4, c. r. séances, p. 168, text-fig. on p. 165.
6) MORTENSEN, TH., 1911, "Danmark-Exsped. Grønlands Nordøstkyst", V, N^o^ 8. p. 400, Pl. XXVI. figs 2—4. 6.

6. *Loxosoma circulare* n. sp. (Pl. I, figs 14—16).

Type. 24. B. On *Retepora*, 24. A. Stat. 53. Bay of Nangamessi, Sumba, 0—36 Metres; coral-sand; near the shore, mud.

281. E. On *Retepora*, 281. D. Stat. 43. Off Pulu Sarassa, Postillon Islands, 0—36 Metres; coral.

? sp. 358. B. On *Retepora*, 358. A. Stat. 240. Banda anchorage, 9—45 Metres; black sand, coral, Lithothamnion.

Calyx smaller than in the preceding species, usually from 150 to 190 μ long and from 125 to 150 μ broad; nearly circular in the retracted state of the tentacles. Two pairs of tactile appendages, at the margins of the proximal half of the calyx. Tentacles probably 12. Stomach with indications of lateral lobes. Sexes separate; the females with a single large yolky egg in the ovary and with not more than two embryos in the vestibule (fig. 14). Buds as in *L. cirriferum*, provided with a foot-gland. Stalk usually slightly shorter than the calyx, from which it is sharply marked off; from 110 to 155 μ in length in the preserved specimens, and 26—32 μ broad; terminating in a well marked disc of attachment, without food-gland in the adult state.

The specific name which I have chosen for this *Loxosoma* refers to the nearly circular outline of the calyx, when the tentacles are retracted.

I was at first in considerable doubt whether this form should be regarded as distinct from *L. cirriferum*. The difference in the female specimens of the two forms seems, however, to justify its separation. Only one egg is produced at a time in each ovary; and there are accordingly only two embryos simultaneously in the vestibule. Both eggs and embryos are larger than in *L. cirriferum*, as will be seen by comparison of the figures given of the two species. The possibility is perhaps not excluded that the specimens here described are young forms of *L. cirriferum*; and that with increasing size and age the number of the eggs increases and their size diminishes; but I do not think that this view is, a probable one.

The specimens 358. B. are distinctly larger than the ones of which the measurements are indicated in the diagnosis, their calyx reaching a length of 288 μ and a breadth of 224 μ. I am not sure that they are rightly referred to the present species.

7. *Loxosoma pusillum* n. sp. (Pl. I, figs 19, 20).

Type. 133. G. On *Retepora*, 133. B. Stat. 164. 1°42'.5 S., 130°47'.5 E. 32 Metres; sand, small stones and shells.

133. C. On *Retepora*, 133. B. Stat. 164. Ibid.

193. H. On *Retepora*, 193. C.[2], C.[3]. Stat. 274. 5°28'.2 S., 134°53'.9 E. 57 Metres; sand and shells, stones.

108. AM. On *Retepora*, 108. B.[2] Stat. 144. North of Salomakiëe (Damar) Island, 45 Metres; coral bottom and Lithothamnion.

Size of individuals small, the calyx commonly not more than 100 μ long and about 75 μ broad; in larger specimens as much as 147 μ long and 128 μ broad; resembling that of *L. circulare* in general shape; and sharply marked off from the stalk. Cirriform organs minute, one pair being present opposite the proximal half of the stomach. Tentacles 8—10, but sometimes not more than 6 in young specimens. The thickened epithelium of the stomach extends round the sides of the organ, leaving only a small proximal part lined by thin epithelium. Sexes separate; the mature female showing a large yolky egg in one of its ovaries, and carrying one embryo in the middle of its vestibule. Buds situated rather proximally, as many as two pairs being present simultaneously; a foot-gland developed in this stage. Stalk varying in length according to its degree of contraction; when stretched, as much as 160 μ long and 19 μ broad; when contracted, not more than 110 μ long and accordingly broader (32 μ). The stalk has a well marked disc of attachment, without foot-gland in the adult state.

This form has a considerable resemblance to *L. circulare*, of which it may indeed be a dwarf variety. The number of tentacles is, however, smaller than in that species; and only one embryo appears to be developed at a time. I have, moreover, only found one pair of cirriform organs. These differences are, perhaps, not inconsistent with the view that it is a small form of *L. circulare*; but it seems to me preferable to describe it as a distinct species.

In size and number of tentacles the present species resembles *L. sluiteri*, which differs from it in its narrower calyx. It is, besides, very improbable that the same species of *Loxosoma* would occur on two "hosts" so different as a Sipunculid and a Retepore.

Loxosoma spp. incert.

89. B. On *Retepora*, 89. A. Stat. 116. West of Kwandang Bay, entrance, 72 Metres; fine sand with mud.
150. F. On *Retepora*, 150. A. Stat. 204. Between Islands of Wowoni and Buton, 75—94 Metres; sand with dead shells.
108. AG. On *Retepora*, 108. B. Stat. 144. North of Salomakiëe (Damar) Island, 45 Metres; coral-bottom and Lithothamnion.
216. C. On *Retepora*, 216. A. Stat. 285. South coast of Timor, 34 Metres; Lithothamnion.
231. B. On *Retepora*, 231. A. Stat. 305. Solor Strait, off Kampong Menanga, 113 Metres; stony bottom.
410. E. On *Retepora*, 410. B. Stat. 305. Ibid.
On *Retepora*. Singapore, R. Hanitsch Collection, Mus. Zool. Cambridge, Reg. Apr. 10, 1900.

Specimens of *Loxosoma* were observed on the *Retepora* indicated above; but as microscopic preparations were not made it would be unsafe to attempt to refer them to their respective species.

8. *Loxosoma troglodytes* [1]) n. sp. (Pl. I, figs 17, 18).

Type. 131 T., in compensation-sac of 131. A., *Lepralia celleporoides*. Stat. 164. 1°42'.5 S., 130°47'.5 E., 32 Metres; sand, small stones and shells. (Also on mounted slides of 131. A.).
142. D., in the same position and from the same Station (on slide 142. A., *L. celleporoides*).
322. I., in the same position, in 322. F., *L. celleporoides*. Stat. 50. Bay of Badjo, W. coast of Flores, 0—40 Metres; "mud, sand and shells, according to locality".

Size small. Form of the retracted animal pear-shaped, the narrower part being represented by the stalk, which passes almost continuously into the calyx. Total length, including the stalk, about 185—192 μ; breadth of the calyx 102—109 μ. The calyx bears two or more

1) τρωγλοδύτης, "one who creeps into holes, a cave-dweller".

tactile processes at its distal end. Retracted lophophore nearly circular, with 9 tentacles. The contracted stalk is about the same length as the calyx, its wall possessing a layer of strong longitudinal muscles: proximal end of stalk more or less pointed, without foot-gland in the adult state. Buds not numerous, not more than two present on the side bearing the oldest bud. Gonads?

The Cheilostome in which this species of *Loxosoma* has been found is the form which was described by BUSK [1]) as *Lepralia celleporoides*. The middle of the frontal surface of this species is occupied by a very large "median pore", of variable shape. The pore, which is shown by BUSK in Pl. XVII, fig. 4*b*, is morphologically an "ascopore" [2]), since I find that it is the external opening of a large compensation-sac, which contains the *Loxosoma*. The occurrence of Entoprocta as normal inhabitants of the compensation-sac of a Cheilostome has not previously been recorded, so far as I am aware. The unusually large size of the ascopore in *L. celleporoides* renders the compensation-sac an eligible dwelling-place for the *Loxosoma*, which has no difficulty in protruding its calyx through the one of the lobes of the ascopore to the outer water, as shown by several individuals which have died in this extended attitude. It need hardly be pointed out that the stalk is correspondingly elongated in such specimens.

In the retracted condition in which the great majority of the individuals have been preserved, the proximal end of the stalk is usually attached to one side of the compensation-sac, the calyx lying just underneath the ascopore, through which its tactile processes are commonly visible. The aboral surface of the *Loxosoma* lies uppermost, so that the orifice of the vestibule faces the cavity of the compensation-sac. In many parts of the host the majority of the zooecia, or all of them, contain *Loxosoma*; from one to three individuals occuring in a single compensation-sac, the calyces all radiating in the direction of the ascopore.

The *Loxosoma*, whose cave-dwelling habit I have indicated by the specific name suggested, is not the only organism which has taken advantage of the large size of the ascopore; since, in many zooecia, one or more of the tubes of the Infusorian *Folliculina* are attached to the wall of the compensation-sac, near its orifice; the tube projecting through the ascopore to the outer water. Where *Folliculina* occurs I have not found the *Loxosoma*, although some zooecia contain neither of the two organisms. The *Loxosoma* is usually absent in zooecia which have lost their polypides.

In many cases the tactile processes of the *Loxosoma* are two in number, disposed symmetrically, as in figs 17 and 18. But in other cases three may be present; or there may be two tactile processes, both situated on one side of the middle line; or four, symmetrically disposed.

In many species of *Loxosoma* the tentacles are present in an even number. But in the present species nine tentacles were counted in all cases where the number was definitely ascertainable. Of these, four tentacles belong to the proximal end of the lophophore, and the odd tentacle is the distal one.

The form of an old bud is shown in fig. 17, where a young bud is seen on the distal

1) BUSK, G., 1884, 'Challenger' Report, Pt XXX, p. 142.
2) LEVINSEN, G. M. R., 1909, "Morph. and Syst. Stud. Cheilostomatous Bryozoa", Copenhagen, p. x.

side of the base of the older one. I have been unable to ascertain whether a foot-gland is present in the bud or not; and I cannot give any reliable information with regard to the gonads.

9. *Loxosoma breve* n. sp. (Pl. I, figs 29—31).

? *Loxosoma singulare* Waters, 1914. "Mar. Fauna Brit. E. Afr.", Proc. Zool. Soc., p. 855 (on *Schizoporella nivea*, mostly on the opercula).

131. U. On *Schizoporella*, 131. B.[1] (Type), 131. B.[1]; and on *Cellepora*, 131. Q.[2], Q.[1]. Stat. 164. 1° 42'.5 S., 130° 47'.5 E. 32 Metres; sand, small stones and shells.

Size small, total length of the preserved and retracted specimens not exceeding 230 μ. Of this, the largest specimen found, the calyx measures 147 μ in length and the stalk 83 μ; the calyx is 128 μ broad, and the stalk is as much as 70 μ broad. In other specimens which are better extended the stalk is more elongated, and thinner, measuring 134 μ in length and only 16 μ in breadth. The calyx varies in form according to its degree of contraction, but is oval in those which appear to be best preserved. Several short tactile processes occur on the distal part of the calyx. Number of tentacles 9. Stomach globular. Buds produced in small numbers (not more than one at a time found). Sexes apparently separated, a single individual showing a pair of ovaries, each with a fairly large egg. Stalk of adult terminating in an expanded disc of attachment, without foot-gland.

I have found this species on slides of a *Schizoporella* [1]), and a *Cellepora*, both from the same Station; several individuals being present on each slide. In the case of the *Schizoporella*, the attachment is to the outer side of the operculum of the "host"; and the specimens show distinct tactile processes. The *Cellepora* preparations had been decalcified; and it is uncertain how the *Loxosoma* were attached. These specimens show no tactile processes; but it does not seem necessary to separate them from the others on that account.

The species appears to be related to *L. troglodytes*, but is distinguished from it by the want of the conspicuously strong longitudinal muscles of the stalk which are characteristic of that form.

10. *Loxosoma subsessile* n. sp. (Pl. I, figs 32, 33).

260. G. On *Conescharellina*, 260. D.[1]. Stat. 318. 6° 36'.5 S., 114° 55'.5 E. 88 Metres; fine yellowish grey mud.

Size minute, total length not exceeding about 128 μ in the preserved material. Calyx not much broader distally than proximally, the well marked lateral lobes of the stomach being accommodated by a corresponding breadth of this part of the calyx, which measures from 90 to 110 μ in length and 74 to 94 μ in breadth. Tentacles 8. Buds one on each side. Stalk extremely short, about 26 μ long; much narrower than the calyx, from which it is sharply separated; without foot-gland or marked disc of attachment.

1) *L. singulare* has been recorded from a *Schizoporella* by G. A. Cornish, 1907, "Rep. Mar. Pol. Canso. N. S. [Nova Scotia]". 39th Ann. Rep. Dep. of Marine and Fisheries, Fisheries Branch (Ottawa), p. 80.

The specific name refers to the shortness of the stalk. I have found this species on one ocasion only, on a species of *Conescharellina*. Its minute size and general proportions of calyx and stalk distinguish it satisfactorily from the other 'Siboga' species. I am able to give the number of tentacles, with some confidence, as 8. In this respect the present species agrees with *L. nitschei* Vigelius [1]; which it also resembles (judging by the figures given by that author) in general form. The "height" is given by VIGELIUS as about 150 μ; but the original figures give no indication of the strongly developed lateral lobes of the stomach which seem to be characteristic of the 'Siboga' species. *L. nitschei* was found by VIGELIUS on *Menipea ternata*; the locality being Barents Sea, as may be inferred from the localities of the "host" given in the same paper.

I have recently had the opportunity of examining specimens of *Loxosoma* found by Miss R. E. ROPER in great abundance in a tank in the Dove Marine Laboratory at Cullercoats, Northumberland, and recorded by her [2] as *L. nitschei*. If this determination be correct, as I am disposed to think, the 'Siboga' species is probably distinct from the form described by VIGELIUS: — a conclusion which has much *a priori* probability from the widely distant localities of the two forms under consideration. Miss ROPER has commented on the fact that the total length recorded by VIGELIUS is less than half that of the living Cullercoats material; and in this respect I can confirm her observations. It may be worth while to record my own experience of this species, as bearing on the value to be ascribed to measurements of specimens of *Loxosoma* which have not been preserved with special care. The specimens of Miss ROPER's species examined by me were received alive, and were narcotised with cocaine, in order to preserve them with their tentacles extended. Even in the narcotised condition there is some difficulty in killing them without contraction. In some of the individuals in which contraction had occurred, the general proportions were very similar to those figured by VIGELIUS, the stalk being much shorter than the calyx. It must be admitted that even in these cases the measurements considerably exceed that given by VIGELIUS, the total length being not less than 371 μ in adult individuals; of which 243 μ belong to the calyx and 128 μ to the stalk. In others which had been killed more suddenly with strong osmic acid the stalk measured as much as 320 μ in length, its breadth being noticeably less than that of the more contracted specimens. The total length in an expanded specimen may be as much as 590 μ. It is thus obvious that the stalk of a *Loxosoma* which has been preserved without being narcotised is likely to be considerably shorter than the stalk of the living, fully extended animal; although the measurements of ordinary, preserved material may be of some value comparatively, since the contraction probably takes place more or less equally in the majority of the specimens.

Although the Cullercoats specimens are thus considerably larger than those from Barents Sea described by VIGELIUS I think it is on the whole probable that they belong to the same species. If this conclusion is justified, the 'Siboga' specimens here described differ from

1) VIGELIUS, W. J., 1882. "Cat. Polyzoa 'Willem Barents'", Nied. Arch. Zool., Suppl. Bd I, p. 19, Plate, figs 4*a*, 4*b*, 5. The species is also recorded, doubtfully, by K. A. ANDERSSON, on *Flustra membranaceo-truncata* Smitt, from E. Greenland (Zool. Jahrb. Syst. XVI. 1902. p. 555).

2) ROPER, R. E., "The Marine Polyzoa of Northumberland", Dove Marine Laboratory, Cullercoats, Report for the Year ending June 13th, 1913, p. 56.

L. nitschei so greatly in size that they can hardly be regarded as belonging to the same species. It must, however, be pointed out that the Cullercoats specimens agree with them in the transverse elongation of the stomach: — a fact which would not have been suspected from an inspection of VIGELIUS' rather diagrammatic figures of the Barents Sea *Loxosoma*.

11. *Loxosoma loricatum* n. sp. (Pl. I, figs 21—25).

Type. 177. N., on *Canda*, 177. A. Stat. 257. Du-roa Strait, Kei Islands, 0—52 Metres; coral.
108. AJ., on *Canda*, 108. K. Stat. 144. Anchorage N. of Salomakiëe (Damar) Island, 45 Metres; coral bottom and Lithothamnion.
*279. G., on *Canda*, 279. B. Stat. 250. Anchorage off Kilsuin, W. coast of Kur Island, 20—45 Metres; coral and Lithothamnion.
204. G., on *Canda*, 204. A., Stat. 282. Anchorage between Nusa Besi and the N. E. point of Timor, 27—54 Metres; sand, coral and Lithothamnion.
*270. M., on *Canda*, 270. E. Stat. 303. Haingsisi, Samau Island, 0—36 Metres; Lithothamnion.
224. B., on *Canda*, 224. A. Stat. 305. Solor Strait, off Kampong Menanga, 113 Metres; stony bottom.

Size small, the total length not exceeding about 160—210 μ. The calyx, which is about 80—108 μ broad, is covered on its posterior or aboral side by a well marked chitinous lorica, about 130—160 μ in length, and thus reaching nearly to the proximal end of the stalk. The lorica is specially gibbous or even subcarinate in its proximal half, the distal half being more flattened. It is sometimes marked by lines, longitudinal in the proximal half and concentric with the distal margin in the distal half (fig. 25); but these may have been artificially produced by contraction. The lorica is almost conterminous with the calyx, since the stomach extends nearly to its proximal end. The calyx bears a pair of minute projecting papillae, probably tactile organs, at the sides of the lophophoral region (fig. 21); they are situated on its anterior side, close to the edges of the lorica. Lophophore small, with 8—10 tentacles. Stomach without lateral lobes, rather elongated. Buds few, not more than one (on one side only) visible. Stalk extremely short, slightly overlapped by the lorica, and much shorter than that structure; ending proximally in a distinct disc of attachment, about 52 μ broad, without foot-gland. Gonads?

The specimens here described were all found on the same species of *Canda* (to be described in a later part of this Report). Their position appears to be nearly constant, the *Loxosoma* usually occurring on the frontal side of the "host" attached to the distal end of a zooecium, near its outer margin (fig. 25). More rarely a *Loxosoma* was found on the back of a branch. The vibracular seta of the host can be moved to the frontal side of the branch, where it takes up a more or less transverse position, just distally to the point of attachment of the *Loxosoma*. The stalk of the Entoproct often lies over the seta, the calyx being directed towards the distal end of the *Canda*, and having its anterior or vestibular side facing the branch. It may be presumed that the *Loxosoma* is not seriously incommoded by the movements of the seta; but it is obvious that as it commonly lies transversely across it, it must

The specimens marked with an asterisk were examined only with a low power, in spirit.

move into an upright position every time the seta is moved to the back of the branch. From the relative positions of the *Loxosoma* and the seta, it might be supposed that the Entoproct would sometimes be crushed between the seta and the frontal surface of the branch, when the seta is brought round to the front. But I find no evidence that this actually happens, since the seta always lies on the branch, when in the position referred to, with the *Loxosoma* outside it. It may be supposed that the *Loxosoma* reacts very quickly to the stimulus of the movement of the seta, or that it habitually holds itself in an erect attitude, so that it avoids the danger of being injured to which it might otherwise be exposed.

In some parts of the *Canda*, every zooecium has a single *Loxosoma*, in the position above described. I have not found more than one *Loxosoma* on any zooecium.

The number of the tentacles seems to be usually 8, as in *L. nitschei* and *Loxocalyx cochlear*; but I think I am right in saying that it may sometimes rise to 10. I am unable to decide whether a food-gland is present in the bud or not; and I have no reliable observations about the gonads.

The present species is quite distinct from any other with which I am acquainted. In its loricate condition it approaches *L. cocciforme*, described below; but the lorica is less developed than in that species, and does not extend far enough to cover the stalk completely [1]).

It may be remarked that the dried and shrivelled remains of the *Loxosoma* are sometimes quite recognisable in dry preparations of the *Canda*.

12. *Loxosoma cocciforme* n. sp. Pl. I, figs 26—28).

112. L. On 112. D., *Siphonicytara* (Cheilostomata). Stat. 156. 0° 29'.2 S., 130° 5'.3 E., coarse sand and broken shells. (Mounted on the slides 112. D.).

Form of the calyx resembling that of a Scale-Insect, nearly circular in outline, but becoming narrower at the proximal end, attached by a concave or flattened surface to the outside of its "host", its opposite surface convex. Length of calyx about 220—270 μ, breadth 190—220 μ. Margin very thin all round. The calyx is covered, on its free surface, by a thick cuticle. Stomach small, without distinct lateral lobes. Tentacles usually 10, but in the larger individuals 12. Lophophore transversely elongated, the opening of the vestibule transversely oval during retraction and situated on the attached or concave side of the animal. Buds not numerous. Sexes apparently separate. Stalk extremely short, not nearly so long as the calyx, by which it is completely concealed in the retracted state, in which condition the long axis of the stalk is more or less at right angles to the attached surface. The stalk terminates in a disc of attachment, without foot-gland.

This peculiar species has the form which is sufficiently indicated by the specific name which I propose for it. It was found closely adherent to the surface of the Cheilostome on which it was growing, in most cases just on the distal side of a peristome. The majority of

1) A chitinous aboral shield on the calyx has been described by ANNANDALE (1908, Fauna Brackish Ponds Port Canning", Pt VII. Rec. Ind. Mus., II, Pt I, p. 14) in the species described by him as *Loxosomatoides colonialis*; which is, however, quite distinct from the 'Siboga' species in other respects.

the individuals were on the "back" of the host; but some were found on its "front" surface. The form of the body may be regarded as an exaggeration of that of *L. annelidicola* Van Beneden and Hesse; as represented by PROUHO[1]). But while in *L. annelidicola* the marginal expansion is incomplete at the proximal end, leaving an emargination through which the short stalk projects, the proximal end of *L. cocciforme* is not emarginate and completely covers the retracted stalk. The two species appear to be related to one another, although I have not been able to ascertain whether the bud of *L. cocciforme* possesses a foot-gland, a structure which is completely absent, even in the buds, according to PROUHO[2]), in *L. annelidicola*.

The buds of *L. cocciforme* are obviously not numerous, as is indicated by fig. 26, in which a single, moderately large bud is seen on one side, projecting beyound the margin of the calyx of the parent-individual. Ovaries and testes appear to occur in different individuals; — as I have found to be the case in all the other 'Siboga' species in which I have been able to obtain definite evidence on the subject. In the specimen represented in fig. 28 several embryos are seen inside the vestibule.

WATERS[3]) has recorded *L. singulare*, Franz-Josef Land, from a depth of 234 fathoms; and states that this appears to be the greatest depth at which the genus has been found. The present species, from 469 Metres (= about 256 fathoms), was obtained in even deeper water than the record indicated.

Fam. 2. PEDICELLINIDAE Johnston[4]).

There has been considerable difference of opinion with regard to the number of genera which should be recognised in this Family. While the type-genus possesses a stalk which is uniformly muscular and has no differentiated enlargement at its base, a number of other species are distinguished by having a specially contractile portion at the origin of the stalk from the stolon. Several of the 'Siboga' species are thus characterised; but the following species comes within the original genus.

Pedicellina M. Sars.

1835, "Beskr. og Iagtt. over Bergenske Kyst levende Dyr", p. 4.

This genus is distinguished from *Barentsia* by having a stalk of uniform thickness, not differentiated proximally into a special muscular enlargement.

1) PROUHO, H. 1891, Arch. Zool. Exp. (2) IX, Pl. V, figs 3, 7.

2) t. cit., pp. 110, 113.

3) WATERS, A. W., 1904, "Bry. Franz-Josef Land", H. J. Linn. Soc. Zool., XXIX, p. 181.

4) In the 'Challenger' Report, Part 50, 1880, p. 40, BUSK gives "Pedicellinidae Hincks"; referring apparently to "British Marine Polyzoa, 1880, p. 563, where the Family is characterised. But, as shown by BUSK's citations, JOHNSTON, in his "History of the British Zoophytes", Ed. 2, 1847, p. 381, had already used "Family Pedicellinae", referring to GERVAIS, 1837, as giving "Polypiaria Pedicellinea". In GRAY's "List of the Specimens of British Animals in the British Museum", Part I, 1848, p. 93, "Fam. Pedicellinidae" is definitely used, and it is defined on p. 145. The facts thus seem to be that JOHNSTON established a Family for the genus which M. SARS had described in 1835, although GRAY was the first to use it with the termination -idae, and to give it a diagnosis.

1. *Pedicellina compacta* n. sp. (Pl. II, figs 13, 14).

293. B. Stat. 273. Anchorage off Pulu Jedan, Aru Islands, 13 Metres; sand and shells (on 293. A., *Adeonella*).

Total length about 660 μ, the stalk not much longer than the calyx. Tentacles about 12. Stalk relatively thick, uniform in diameter or diminishing towards the calyx; without spines. Stolon-branches given off freely from the bases of the stalks, one or two usually present, on each side, in this position. Sexes apparently separate.

The specific name refers to the comparatively thick and short stalk; though the condition shown in figs 13 and 14 is no doubt that of contracted specimens. A diminution in size of the stalk at its distal end, often observable, doubtless indicates that this part is less contracted than the more proximal portion.

I have found this species only once, on a species of *Adeonella*, which in some parts is profusely covered with it. The general character of the stolon is identical with that of other species, a barren part alternatiug with a stalk-bearing portion. A chitinous diaphragm passes across the stolon at no great distance from the base of a stalk; and this is equally true of the main stolon and of its lateral branches. The crowded arrangement of the individuals of the colony is due partly to the fact that the barren stolon-segments are short, and partly to the fact that lateral stolon-branches are given off very freely, as shown in fig. 14, where two are present on each side. In individuals in which I have been able to count the tentacles, the number has been 12; and I regard this as the typical number. In some cases, as in the specimen show in fig. 13, the rectum has an erect position. I think that this condition is associated with the development of a brood-pouch from the floor of the vestibule, since in young calyces in which there is no brood-pouch the rectum is recumbent on the wall of the stomach. The gonads seem to be female in all the individuals in which they can be made out; and this appears to indicate that the sexes are separate and that all the specimens mounted belong to a female colony.

The measurements (in μ) of the individual represented in fig. 13 are: — length of calyx, 300; of stalk, 360; total length, 660; breadth of calyx, 230; of stalk, 60—70.

The majority of the known species of Pedicellinidae belong to the genus *Barentsia*; and there are comparatively few which fall within *Pedicellina* s. str. Of these, the form which most nearly resembles the present species in general appearance is *P. australis*, described by RIDLEY [1]) from Sandy Point, Straits of Magellan, 7—10 fathoms. With this species it agrees in the number of tentacles ("about 12"), but differs from it in size; the measurements given by RIDLEY for his species including the following: — total length 2.5 mm., calyx 1 mm. I have verified these measurements from the type-slide (79. 12. 27. 36) in the British Museum, although I find that the total length, 2.5 mm., is obtained by including the breadth of the stolon-segment from which the stalk arises. It thus appears that the calyx alone of RIDLEY's species is longer than the total length of the 'Siboga' form: and the difference in size is so marked that it seems impossible to refer the 'Siboga' species to *P. australis*.

1) RIDLEY, S. O., 1881. "Zool. Coll. 'Alert'". Proc. Zool. Soc., p. 60. *Pedicellina australis* Jullien, is a *Barentsia*; see the account of *B. discreta* in the present Report, p. 20.

Another species which may be noticed in the present connexion is *P. breusingi*, described by STUDER [1]) from Kerguelen Id, zone of Florideae. This species is said to differ from *P. australis* Ridley, in the number of its tentacles (16—18), in the irregular form of its stolon, in the absence of diaphragms in the stolon, and in the shape of the calyces. It may be surmised that the supposed absence of diaphragms was due to a mistake in the observation, since it is not in agreement with what is known of other Pedicellinidae.

Barentsia Hincks.

Barentsia Hincks, 1880, "Hydr. and Pol. Barents Sea", Ann. Mag. Nat. Hist. (5) VI, p. 285.
Ascopodaria Busk, 1886, 'Challenger' Rep., Pt. 50, p. 41.
Arthropodaria Ehlers, 1890, "Z. Kenntniss d. Pedicellineen", Abh. Gottingen, XXXVI, p. 144.
Gonypodaria Ehlers, 1890, t. cit., p. 144.

The Genus *Barentsia*, characterized by having a muscular enlargement at the proximal end of its stalk, was established by HINCKS in 1880 for a new species, *B. bulbosa* [2]), from Barents Sea. This species differs from most of the forms which have subsequently been added to the genus in the fact that the stalk gives rise laterally to new stalks; a feature which is also shown by *B. variarticulata* Andersson [3]) and by *Gonypodaria ramosa* Robertson [4]). In 1884 HINCKS [5]) instituted a new genus, *Pedicellinopsis*; but he subsequently [6]) expressed the opinion that it was synonymous with *Barentsia*. In 1886 BUSK defined the genus *Ascopodaria*, admiting its identity with *Barentsia*, but justifying his use of the name partly on the ground that he had used it as a MS. name in 1879, and that it had been mentioned in that year by ALLMAN. ALLMAN's reference to the genus is, however, unaccompanied by any diagnosis, so that *Ascopodaria* was a *nomen nudum* when HINCKS described *Barentsia*. In 1890 EHLERS introduced the two genera *Arthropodaria* and *Gonypodaria*, the former characterised by its jointed stalk.

The genera thus described have been criticised by various authors. RITCHIE [7]), in a recent paper, has given reasons for regarding *Arthropodaria* and *Gonypodaria* [8]) as synonyms of *Barentsia*, on the ground of the variation, in the characters which have been used to distinguish those genera, observable within the limits of a single species; and he suggests that any species of *Barentsia* can probably give rise to a joint in its stalk. This is perhaps going beyond the evidence, since jointing has not been described in by any means all the species.

But that the stalk can become jointed in certain cases is clearly shown by many observations, including his own here referred to. In two species the faculty of forming joints

1) STUDER, T., 1889, "Forschungsreise 'Gazelle'". III. Theil. Zool. & Geol., p. 140.

2) See also the description, by W. J. VIGELIUS, 1884, of the same species in "Die Bryozoen 'Willem Barents'", Bijdr. tot de Dierkunde, XI, p. 85, figs on Pl. VIII.

3) ANDERSSON, K. A., 1902. "Bry. schwed. Exp.". Zool. Jahrb. Syst. XVI, p. 557. It seems doubtful whether this species is really distinct from *B. bulbosa*.

4) ROBERTSON, A., 1900, "Stud. Pacific Coast Entoprocta". Proc. Cal. Acad. Sci. (3) Zool. II, N⁰ 4, p. 337.

5) HINCKS, T., 1884. "Contr. Gen. Hist. Mar. Pol.". XIII, Ann. Mag. Nat. Hist. (5) XIII. p. 364.

6) Ibid., 1893. Appendix, Ann. Mag. Nat. Hist. (6) XII, p. 140.

7) RITCHIE, J., 1911. "On an Entoproctan Polyzoon...", Trans. R. Soc. Edinburgh, XLVII, Pt 4, p. 840.

8) WATERS (1904, "Rés. Voy. Belgica", "Bry.", p. 100) had previously expressed this opinion with regard to *Gonypodaria*.

leads to a specially regular transverse segmentation of the stalk. These are (I) *B. benedeni* Foettinger; which is discussed by RITCHIE; and (II) *Urnatella gracilis* Leidy. In the latter case in particular it is clearly shown from the descriptions of LEIDY [1]) and DAVENPORT [2]) that the segmented condition is the result of constrictions formed in a stalk which is at first like that of *Pedicellina*. In both *B. benedeni*, which constituted the type of EHLERS' genus *Arthropodaria*, and *Urnatella*, the stem-joints may give rise to buds which become new individuals, in much the same way as in *B. bulbosa*, the genotype of *Barentsia*. It is not impossible that the condition seen in *Pedicellinopsis* is another development of the same process, if it be permissible to regard the erect stems which bear the *Barentsia*-like individuals as modified stalks of individual units of the colony. Of this there is no direct evidence, so far as I am aware; but the account given by BUSK [3]) of the structure of the main "stems" (see particularly figs 10 and 11 of his Pl. IX) suggests that this may be their real meaning. *P. fruticosa* would, on this view, be strictly comparable with *B. bulbosa*, but distinguished from it by the much more profuse development of lateral buds from an original stem.

Urnatella, which is referred by DAVENPORT [4]) to the Pedicellinidae, doubtless deserves generic recognition, from the peculiar characters of its stolon, represented by a basal plate of attachment; as well as by reason of structural characters of the calyx. The question whether *Pedicellinopsis* should be regarded as a valid genus appears to me a more open one; since the general architecture of the colony is very different from that of the forms usually referred to *Barentsia*. I have accordingly not included it in the synonymy at the head of this account. But whether *P. fruticosa* should be included or not in *Barentsia*, this genus includes a considerable range of modifications of the stalk, as follows:

(I) stalk simple, without joints or lateral buds (usual form of *B. gracilis* M. Sars);
(II) stalk unjointed, but producing lateral buds (*B. bulbosa* Hincks; *B. variarticulata* Andersson);
(III) stalk jointed, bearing lateral buds (*Gonypodaria ramosa* Robertson);
(IV) stalk more regularly jointed, with few or no lateral buds (*Arthropodaria benedeni* Foettinger).

These are probably to be understood merely as different conditions which may be assumed within the genus, and not as subgeneric groups; since, as FOETTINGER [5]) and RITCHIE have shown, the stalk of *B. gracilis* (assuming, with RITCHIE, that this species includes *B. belgica* Van Ben.) may be unsegmented or segmented; and since the differences between my third and fourth groups are mainly differences of degree.

It may not be out of place to enter a protest in this place at the use of the word "polypide", by certain authors, to signify the calyx of a member of the Pedicellinidae. The calyx consists of the body-wall of this part of the animal, including the alimentary canal and other organs. The term "Polypide" was introduced by ALLMAN [6]), at the Meeting of the British

1) LEIDY, J., 1884, "*Urnatella gracilis*", J. Acad. Nat. Sci. Philadelphia. (2) IX. p. 0.
2) DAVENPORT. C. B., 1893. "On *Urnatella gracilis*", Bull. Mus. Comp. Zool. Harvard, XXIV, p. 19.
3) BUSK, G., 1886, p. 42.
4) DAVENPORT. C. B.. l. cit., p. 30.
5) FOETTINGER, A., 1886, "Sur l'Anat. des Pedicellines de la côte d'Ostende". Arch. de Biol., VII, p. 301.
6) ALLMAN. G. J., 1851, Rep. 20th Meeting Brit. Ass., p. 307: see also his "Monogr. Fresh-Water Pol.", 1856, pp. 8, 41, 42.

Association held at Edinburgh in 1850, for "the retractile portion of the Polyzoa"; or, in other words, for the alimentary canal, the tentacles with their sheath, and the ganglion, of the Ectoprocta. The term "zooecium", in the sense in which it is now used, was employed later (as "zooœcium") by SMITT [1]). Although the idea, once current, that the polypide and the zooecium represent two different kinds of individuals has long been given up, the terms are in almost universal use in describing Polyzoa. NITSCHE [2]) indeed expressed the opinion that the calyx of an Entoproct represented the polypide only of Ectoprocta; but it is more in accordance with the present state of our knowledge to regard a *Pedicellina*-individual as comparable with an entire unit (zooecium + polypide) of one of the Ectoprocta. The term "polypide" if applied to the Entoprocta should thus be used for the alimentary canal, tentacles and certain other organs which it might be difficult to particularise; the body-wall of the calyx, stalk and the corresponding stolon-segment being the morphological equivalent of the zooecium of Ectoprocta.

1. *Barentsia gracilis* M. Sars [3]). (Pl. II, fig. 12).

Pedicellina gracilis M. Sars, 1835, "Beskr. og Iagtt." (Bergen), p. 6, Pl. I, figs 2*a*, 2*b* (Bergen).
Pedicellina gracilis Smitt, 1871, "Krit. förteckn.", V, Öfv. K. Vet.-Ak. Förh." XXVIII, p. 1133 (Sweden, Spitsbergen; nodes of stalk mentioned).
Pedicellina gracilis Hincks, 1880, "Hist. Brit. Mar. Pol.", p. 570, Pl. LXXXI, figs 4—6.
Pedicellina gracilis Hincks, 1884, "Pol. Q. Charlotte Islands", Ann. Mag. Nat. Hist. (5) XIII, p. 208 (Queen Charlotte Islands).
Pedicellina gracilis Levinsen, 1894, "Zool. Danica", IV, 1 Afd., "Mosdyr", p. 96, Pl. IX, fig. 30 (Denmark; nodes of stalk figured).
Pedicellina gracilis Hilgendorf, 1898, "Occ. *Pedicellina* N. Zealand", Trans. N. Zeal. Inst., XXX (N. S. XIII), p. 218, Pl. XXII, fig. 1 (New Zealand; nodes of stalk figured).
Barentsia gracilis Hincks, 1887, "Pol. Adriatic", Ann. Mag. Nat. Hist. (5) XIX, p. 312 (Adriatic; nodes of stalk mentioned).
Barentsia gracilis Hincks, 1889, "Pol. St Lawrence", Ann. Mag. Nat. Hist., (6) III, p. 432, Pl. XXI, figs 10, 10*a* (St Lawrence).
Barentsia gracilis Carus, 1889, "Prodr. Zool. Med.", II, p. 53.
Barentsia gracilis Kirkpatrick, 1890, "Hydr. Pol. China Sea", Ann. Mag. Nat. Hist. (6), V, p. 17 (Tizard Bank, between Philippine Islands and Malay Peninsula, 27 fathoms).
Barentsia gracilis Ostrooumoff, 1896, "Otchet Exp. 'Selianik'", Bull. Ac. Imp. St Pétersb., (5) V, p. 58 (Sea of Marmara).
Barentsia gracilis Calvet, 1902, "Bry. Cette", Trav. Inst. Zool. Montpellier, (2) Mém. 11, p. 94 (Cette).
Barentsia gracilis Waters, 1904, "Rés. Voy. Belgica", Zool., "Bryozoa", p. 100 (Queensland).
Barentsia gracilis Waters, 1910, "Rep. Mar. Biol. Sudanese Red Sea", J. Linn. Soc., Zool., XXXI, p. 251 (Red Sea).
Barentsia gracilis Ritchie, 1911, "On an Ent. Pol.", Trans. Roy. Soc. Edinb., XLVII, Pt 4, pp. 841, 845, Plate, figs V—VII (Ostende, Isle of Man; nodes of stalk figured).

1) SMITT, F. A., 1865, "Krit. förteckn." I, Öfv. K. Vet.-Akad. Förhandl., N° 2, p. 115, note: in place of "djurhus" of a previous paper. It is not generally remembered that it had been used, many years earlier, for the animals themselves, by LAMOUROUX, whose actual words are "Les Polypiers, qui seraient mieux nommes peut-être *Zoocies* ou *Synzoociphytes*" ("Hist. Pol. Cor. Flex.", 1816, p. XIII).

2) NITSCHE, H., 1871, "Beitr. Kenntn. Bry.", III, Zeitschr. wiss. Zool., XXI, p. 483.

3) Here, as in other cases, references to the synonymy will be found in Miss E. C. JELLY's "Synonymic Catalogue" (1889). RITCHIE, 1911, has given a recent synonymy of this common and widely distributed species; which makes it unnecessary for me to do more than refer to the original description and to those notices of the species which are important, in the present connexion, from the point of view of Geographical Distribution, or in other ways.

Barentsia gracilis Annandale, 1912, "Occ. Ent. Ind. Waters", Rec. Ind. Mus., VII, p. 205 (Madras).

Barentsia gracilis Waters, 1914, "Mar. Fauna Brit. E. Afr.", Proc. Zool. Soc., p. 855.

Ascopodaria gracilis Kirkpatrick, 1888, "Pol. Port Phillip", Ann. Mag. Nat. Hist. (6) II, p. 21 (Victoria[1]).

Ascopodaria gracilis Ehlers, 1890, "Kenntn. Pedicellineen", Abh. Göttingen, XXXVI, p. 142.

Ascopodaria gracilis Robertson, 1900, "Stud. Pac. Coast Ent.", Proc. Cal. Acad. Sci. (3) Zool. II, p. 345 (California).

Pedicellina gracilis, var. *nodosa* Lomas, 1886, "Rep. Pol. L. M. B. C. Distr.", Proc. Lit. Phil. Soc. Liverpool, XL, p. 160, Pl. III, fig. 2 (Isle of Man; the variety was distinguished by the nodes of the stalk).

Ascopodaria nodosa Lomas, 1887, "On *Asc. nodosa*", Ibid., XLI, p. XLVI.

Ascopodaria nodosa Lomas, 1889, "Second Rep. Pol. L. M. B. C. Distr.", Proc. Biol. Soc. Liverpool, III, p. 217.

Barentsia nodosa Duerden, 1893, "New and rare Irish Pol.", Proc. R. Irish Acad. (3) III, p. 135, Pl. V, fig. 4.

Gonypodaria nodosa Ehlers, 1890, t. cit., p. 144.

433. B. Stat. 7. Reef of Batjulmati, Java, reef; coral and stones (on 2. A., *Scrupocellaria ferox*).

20. J. Stat. 50. Bay of Badjo, W. coast of Flores, 0—40 Metres; mud, sand and shells (on 20. I., *Scrupocellaria*).

24. F.⎫ Stat. 53. Bay of Nangamessi, Sumba, 0—36 Metres; coral-sand; near the shore, mud
31. J.⎭ (on 24. C.[3], *Mimosella tenuis*; and on 31. I.[2], *Scrupocellaria*).

427. D. Stat. 60 and 303. Haingsisi, Samau Island, Timor, 0—36 Metres; Lithothamnion (on 427. B.[1], *Catenaria*).

337. H.⎫ Stat. 71. Makassar, 0—32 Metres; mud, sand with mud, coral (on 337. A., *Scrupo-*
338. D.⎭ *cellaria*; and on a Hydroid on slide 338. C., *Valkeria atlantica*).

37.ZA.⎫ Stat. 77. Borneo Bank, 59 Metres; fine grey coral-sand (on 37. O., *Canda*; and on
41. C. ⎭ 41. A., *Bugula*).

108. AH. Stat. 144. Anchorage North of Salomakiee (Damar) Island, 45 Metres; coral-bottom and Lithothamnion (on 108. AE., *Beania*).

376. P. Stat. 213. Saleyer, 0—26 Metres; coral-reefs, mud and mud with sand (on 376. C., *Schizoporella*).

425. C. Banda Sea (on sea-weed, on slide 425. B., *Aetea*).

296. E. Stat. 273. Anchorage off Pulu Jedan, Aru Islands, 13 Metres; sand and shells (on 296. B.[1], *Catenicella*).

259. G.⎫ Stat. 318. 6° 36'.5 S., 114° 55.5 E., 88 Metres; fine yellowish grey mud (on 259. C.,
415. B.⎭ *Carbasea cribriformis*; and on 415. A., *Flustra reticulum*).

262. F. Stat. 319. 6° 16'.5 S., 114° 37 E., 82 Metres; fine yellowish grey mud (on 262. E., *Flustra reticulum*).

555. K. Stat. 320. 6° 5 S., 114° 7 E., 82 Metres; fine grey mud (on 555. C., *Bugula*, mounted on slide 555. J.[2], *Lageniporá*).

Singapore, Mus. Zool. Cambr., Reg. Nov. 11, 1899, F. P. BEDFORD Coll., 5 fathoms.

Japan, Mus. Zool. Cambr., Reg. June 23, 1902. A. OWSTON Coll., near Tokyo, 30—40 fathoms.

Size small, usually less than 1 mm. in total length (stalk + calyx). Thin part of the stalk variable in length, not infrequently showing an incomplete, or more rarely a complete muscular node towards its distal end, or near the middle. Tentacles apparently about 14.

The present species has been found, in the majority of cases, in small quantities, on

1) In Mr KIRKPATRICK's specimens from Port Phillip, in the Collection of the British Museum (88. 5. 17. 20 and 22) I do not find that the distal end of the chitinous part of the stalk is pointed like the corresponding part of *Pedicellinopsis fruticosa*, as described by that author in the paper cited.

slides which have been mounted to illustrate other species of Polyzoa. It is obvious that it is widely distributed in the Malay Archipelago; and I have no doubt that it might be found on Hydroids, Polyzoa, etc., from many Stations from which I have not recorded it.

The 'Siboga' specimens agree closely with those from Europe. The individual shown by SARS in fig. 2*b* of the original description resembles them in having the indication of a muscular joint on the stem. In one specimen (337. H) I have found one complete stalk-joint, and a second, more distally placed joint which is not completely formed. Other examples of jointed specimens of this species are noted in the synonymy. The lengths, in μ, of the several parts of the individual shown in fig. 12 are as follows: — calyx, 190; thin part of stalk, 420; muscular base, 150; total length, 760; breadth of calyx, 180. The thin part of the stalk varies greatly in length in the specimens examined. I have not been able to ascertain the number of the tentacles with certainty, but it seems to be about 14. In the specimens 338. D., but not in other cases, I have noticed a few short, curved spines on the calyx, on the soft piece of the stalk next the calyx, and on the stem-joint, if this is present. WATERS (1910, p. 282) records similar spines in specimens of this species from the Sudanese Red Sea, Trieste and the South coast of England. Most of the specimens seem to be sexually immature.

The present species differs conspicuously from others obtained by the 'Siboga' in its delicate character and much smaller size.

2. *Barentsia discreta* Busk. (Pl. II, figs 8, 9).

Ascopodaria discreta Busk, 1886, "Challenger Reports", L, "Polyzoa", Pt II, p. 44, Pl. X, figs 6—12 (Tristan da Cunha, 100—150 fathoms).
Ascopodaria discreta Ehlers, 1890, "Kenntn. Pedicellineen", Abh. Göttingen, XXXVI, p. 143.
Ascopodaria discreta Thornely, 1905, HERDMAN's "Rep. Pearl Oyster Fisheries", Publ. by the Roy. Soc., Suppl. Rep. XXVI, p. 128 (Ceylon).
Barentsia discreta Kirkpatrick, 1890, "Hydr. Pol. China Sea", Ann. Mag. Nat. Hist. (6) V, p. 17 (Tizard Bank, 27 fathoms).
Barentsia discreta Waters, 1904, "Rés. Voy. Belgica", Zool., "Bryozoa", p. 99, Pl. VII, figs 6*a*—*f*; Pl. VIII, figs 17*a*—*c* (Île Londonderry, Magellanes Chili).
Barentsia discreta Waters, 1905, "Bry. Cape Horn", J. Linn. Soc., Zool., XXIX, p. 230.
Barentsia discreta Osburn, 1910, "Bry. Woods Hole". Bull. Bur. Fisheries (Washington), XXX, p. 214, Pl. XVIII, figs 5, 5*a* (Woods Hole Region, U. S. A.; Florida).
Barentsia discreta Annandale, 1912, "Occ. Ent. Ind. Waters", Rec. Ind. Mus. VII, p. 205 (Port Canning, India). The reference to this species does not seem certain.
Barentsia discreta Sumner, Osburn and Cole, 1913, "Biol. Surv. Woods Hole", Bull. Bur. Fisheries, XXX, Pt I, p. 108; Pt II, p. 596.
Barentsia discreta Osburn, 1914, "Bry. Tortugas Islands", Publ. 182, Carnegie Inst. Washington, p. 185 (Florida).
Ascopodaria misakiensis Oka, 1890, Zool. Mag. N° 20 (memoir not seen).
Barentsia misakiensis Oka, 1895, "Sur *B. misakiensis*", Zool. Mag., VII, N° 78, p. 76, Pl. XII, figs 1—8 (S. of Tokyo).

WATERS (1905) gives *Pedicellina australis* Jullien, 1888 ("Miss. Sci. Cap Horn", VI, "Bryozoaires", p. 13, Pl. VIII, fig. 4) (*nec* RIDLEY, 1881) as a synonym of the present species; and OSBURN, 1914, regards *B. timida* Verrill 1899—1900 ("Tunicata and Molluscoidea of the Bermudas", Trans. Conn. Acad., X, p. 594) as being probably another synonym.

195. B. Stat. 274. 5°28'.2 S., 134°53'.9 E., 57 Metres; sand and shells, stones (on *Retepora*, 195. A.).
131. S. Stat. 164. 1°42'.5 S., 130°47'.5 E., 32 Metres; sand, small stones and shells (on *Lepralia celleporoides*, 131. A.).
337. I. Stat. 71. Makassar, 0—32 Metres; mud, sand with mud, coral.
348. A. Stat. 213. Saleyer, 0—36 Metres; coral-reefs, mud, and mud with sand (on *Adeonella*, 347. A.).

Size large, reaching a total length (calyx + stalk) of at least 3 mm. Tentacles about 20—24. Stalk with a large proximal muscular portion and a very long, cylindrical, distal portion, without spines but covered with a thick cuticle, the inner layer of which is perforated by numerous pores.

If the synonymy given above is correct, *B. discreta* has a wide distribution. The specimens originally described by BUSK were dredged off Tristan da Cunha, 100—150 fathoms (Brit. Mus. 99. 7. 1. 4447). It has been recorded more recently by KIRKPATRICK from the Tizard Bank, China Sea, 27 fathoms (Brit. Mus. 89. 8. 21. 66); by Miss THORNELY from Ceylon; by ANNANDALE from India; by OKA from near Tokyo, 5—10 Metres; by WATERS from Île Londonderry, Canal Français, Magellanes, Chili; by OSBURN from Woods Hole, Mass. and from Florida; and, assuming the correctness of WATERS' synonymy, by JULLIEN from Île Hoste (near Cape Horn), 26 Metres; and perhaps by VERRILL from the Bermudas. The 'Siboga' localities fall into two groups; — Stat. 274 and Stat. 164 from near the N. W. extremity of New Guinea; and Stat. 71 and Stat. 213 from the S. end of the Straits of Makassar and the neighbourhood.

I have no doubt that the 'Siboga' specimens belong to the same species as the forms described by OKA under the name of *Barentsia misakiensis*. The original description given by that author appeared in Japanese; and I derive my knowledge of his results from his later paper (1895), which was published in French. I have been able to verify his account of the Japanese form by the examination of specimens obtained from near Tokyo, 40—53 fathoms, in the University Museum of Zoology, Cambridge (Reg. June 23, 1902). Although I have counted 23 tentacles in one of the Japanese individuals, coming within the limits (20—24) given by OKA, another was found to have as many as 29. BUSK gives 16—20 for the specimens from Tristan da Cunha. But independently of the fact that the range of variation in the number of tentacles in Pedicellinidae has not been satisfactorily decided, too much stress must not be laid on statements with regard to the number, unless the author in question has had specially good opportunities of counting them with certainty. I am thus not disposed to attach too much importance to OKA's statement (1895, p. 5) that *B. misakiensis* can easily be distinguished from *B. discreta* by the larger number of its tentacles.

The present species appears to be well characterised by its large size; by the great length of the narrow portion of the stalk; and, above all, by the curious pores with which this part of the stalk is provided. These pores may perhaps be regarded as vestigial spines. Similar pores are known to occur in the stalks of certain other Pedicellinidae, as in *Pedicellinopsis fruticosa* Hincks, in *Barentsia macropus* Ehlers and in *B. (Gonypodaria) ramosa* Robertson.

In all these respects the 'Siboga' specimens agree closely with those from Japan. This may be illustrated, with regard to size, by the following measurements, in μ:

	'Siboga', 195. B.	Japan.		'Siboga', 195. B.	Japan.
Length of calyx .	432—688	448—752	Breadth of calyx .	384—460	440—560
Length of narrow part of stalk . .	880—2224	1600—2176	Breadth of narrow part of stalk . .	45	45
Length of basal part of stalk . .	272—430	432—576	Breadth of basal part of stalk . .	140	192
Total length . . .	1584—3000	2480—3104			

It will be seen that some of these measurements are variable, the size of the calyx, however, depending on its age; and the dimensions of the basal muscular part of the stalk probably depending on its state of contraction. The Japanese specimens have, moreover, the appearance of being less contracted than those obtained by the 'Siboga'. But there can be no question that the narrow part of the stalk is very variable in length; the cuticle being so thick that the question of contraction need not be considered. The variability in length appears, however, to be mainly the result of differences in growth. The individuals near the growing points have short stalks; and it is clear, from a comparison of these with older specimens, that growth continues for a long time in the neighbourhood of the calyx, where the cuticle disappears. Oka has called attention to the fact that the calyces are deciduous and are readily regenerated; a property which this species shares with other Pedicellinidae: — for instance *Pedicellina cernua* [1]). In the Japanese specimens I find that this process may be associated with an increase in the length of the stalk, a distinct annular mark being visible at the junction of the old and of the regenerated portions. The part thus added is very variable in length, but it may be as long as the original stalk. Sometimes two or even three annular marks are visible, indicating as many successive regenerations. In the specimen figured (fig. 9) there is some alteration of the cuticle near the middle of the stalk, suggesting that a joint might have been formed later here; and in another specimen a joint, with indications of the development of longitudinal muscles, has actually been formed in a corresponding region. Specimens of *B. discreta* with a jointed stalk have been figured by Waters (1904, Pl. VII, figs *6a*, *6d*).

The peculiar pores of the thinner part of the stalk traverse the inner layer of the cuticle, but are closed by an external layer which, according to Oka, differs from the inner stratum by staining with eosin. The position of the pore is sometimes, but not always, indicated by a very slight convexity of the outer surface of the stalk. The basal, muscular portion of the stalk is usually not separated from the thinner part by a diaphragm, although some of the Japanese specimens show an annular thickening of the chitin, projecting slightly into the cavity of the stalk, in that position. In one of the 'Siboga' specimens (337.1) the diaphragm is well developed, and the longitudinal muscles of the basal thickening of the stalk are inserted into it.

The stolon is composed of alternating segments, divided from one another by discoidal diaphragms perforated at the middle. Each alternate segment gives off a stalk, the intervening segments being barren. This arrangement may be considered typical in the Pedicellinidae and has been correctly described by Oka for the present species. A lateral branch of the stolon is

1) Cf. my paper on that species in Quart. J. Micr. Sci., XXVII, 1887, p. 256.

commonly given off, at right angles, on each side of the polypiferous segments (fig. 8). In one case (195. B.[2]) two branches are given off on one side and one on the other.

I have noticed two slight differences between the 'Siboga' specimens and those from Japan. In the latter there is a long cylindrical oesophagus, and the stomach has a conspicuous lobe projecting from its ventral (lophophoral) side towards the oesophagus. In the 'Siboga' specimens the cylindrical part of the oesophagus is short, while the lobe of the stomach is not present, although it is perhaps represented by a slight indentation in the inner surface of the epithelium, in the position of the lobe of the Japanese specimens. These differences do not seem to warrant a separation of the two forms, in view of the close resemblance which exists in other respects.

Oka states that the sexes are separate and that the colonies are unisexual.

The present species seems to be nearly allied to *B. macropus* Ehlers, 1890 and to *B. timida* Verrill. The latter name is regarded as probably a synonym of *B. discreta* by Osburn, 1914.

3. *Barentsia laxa* Kirkp. (Pl. II, figs 10, 11).

Barentsia laxa Kirkpatrick, 1890, "Hydr. Pol. Torres Straits", Proc. R. Dublin Soc. (N. S.) VI, p. 624, Pl. XVII, fig. 6.

88. A. Stat. 115. East side of Pajunga Island, Kwandang Bay, reef. On a Coral (*Porites*).
380. D. Stat. 47. Bay of Bima, 55 Metres; mud with patches of fine coral-sand.

Size large, reaching a total length of nearly 3.5 mm. Basal muscular part of stalk either without appendages or bearing a pair of distally situated, pointed, membranous appendages. Thinner part of stalk at first cylindrical, then increasing in width and annulated with numerous rings; this part of the stalk very flexible.

The characters of the stalk are markedly different from those in the previous species, in which the greater part of the length is rendered rigid by a strong development of the cuticle. In *B. laxa* it is obvious that the contractility is not confined to the basal portion, but is also present in the greater part of the length of the stalk. This is shown by the extremely variable shape of the preserved specimens, in which the annulated part of the stalk is curved into all sorts of positions [1]; and is also indicated by the fact that longitudinal muscles can be distinguished in this region.

The measurements of the specimen represented in fig. 11 are as follows (in μ):

Length of calyx	480	Breadth of calyx	365
Length of distal part of stalk	2500	Breadth of stalk, near calyx	80
Length of muscular base of stalk	480	Breadth of stalk, near muscular base.	32
Total length	3460	Breadth of muscular base	190

1) In the contractile character of the distal part of the stalk this species resembles a form of *Barentsia* from Newport, R. I., U. S. America, described by Leidy ("*Urnatella gracilis*", J. Acad. Nat. Sci. Philadelphia, (2) IX, 1884, p. 14, text-fig. on p. 11), and considered by him to be nearly allied to *B. gracilis*. The stalk of *B. major* Hincks ("Pol. St Lawrence", I, Ann. Mag. Nat. Hist. (6) I, 1888, p. 220, Pl. XV, fig. 2) and of its var. *elongata* Jullien and Calvet (1903, p. 27, Pl. II, fig. 3) is similarly annulated. In *B. variabilis* Calvet and in *B. capitata* Calvet (1904. „Bry. Hamburg. Magalhaensische Sammelreise", pp. 40, 41, Pl. III. figs 1, 2), a stiff, chitinous part of the stalk is succeeded distally by an annulated, flexible part.

The calyx is ovoid in form, and the alimentary canal lies in close contact with the body-wall. The number of the tentacles has not been counted with certainty, but it appears to be about 20. The two rounded bodies seen in fig. 11 close to the intestine are gonads, the one nearer to the intestine being almost certainly an ovary, and the more orally situated body having the appearance of a testis. If this observation be correct the species is hermaphrodite.

There has been considerable difference of opinion among authors with regard to the question whether the Pedicellinidae are hermaphrodite or dioecious; and it seems probable that both conditions really occur in the Family. In the well known account given by NITSCHE, the hermaphrodite condition is clearly figured [1]); but in this case the ovaries are on the oral side of the testes. If my account is correct the opposite condition appears to be characteristic of the present species, in which, moreover, the gonads lie close to the intestine, instead of being separated from it by a large brood-pouch. But as the gonads are clearly young in fig. 11 it is not impossible that their position might have been shifted later by the development of a brood-pouch from the floor of the vestibule.

The stolon appears to be quite normal in its characters; and a branch may be given off from the base of a stalk (fig. 10).

Regeneration of the calyces is indicated by their very varying size in the specimens 88. A.; a large stalk often bearing a very small calyx.

The measurements given above refer to N° 88. A., in which the muscular base of the stalk bears no distal appendages. In 380. D. the stalk is not more than one third the length of that shown in fig. 11 (88. A.), but is not easy to measure in consequence of the curved attitude it has assumed. From the observations above recorded on *B. discreta* it is not improbable that the very long stalks of 88. A. may have been the result of regeneration of the calyces. The specimens 380. D. are, however, characterised by the constant possession of a pair of membranous appendages, attached to the distal end of the muscular base of the stalk; the characters of which are so similar, in other respects, to those of 88. A. that it does not seem to be necessary to refer the two sets of specimens to different species.

The determination of the 'Siboga' specimens has been verified by comparison with the type-specimens (Torres Straits, 6—7 fathoms; 90. 11. 22. 1.) in the British Museum. The types agree closely with 88. A. in size, in the absence of membranous appendages on the muscular base, and in the flexible character of the distal part of the stalk, which, moreover, shows traces of the 'annulated' character noticed in the 'Siboga' specimens. The total length, as recorded by KIRKPATRICK, is 3000 μ; the calyx being 400—500 μ in length and 350—400 μ in breadth. It may be remarked that the distal part of the stalk in the original figure of this species is represented in a condition shrivelled by the action of reagents.

4. *Barentsia geniculata* n. sp. (Pl. II, figs 6, 7).

Type. 260. E. Stat. 318. 6° 36'.5 S., 114° 55'.5 E., 88 Metres; fine yellowish grey mud (on 260. A., *Stichoporina simplex*).

1) NITSCHE, H., 1870. ("Ub. d. Anat. v. *Pedicellina echinata*", Zeitschr. wiss. Zool., XX, p. 20, Pl. II, fig. 2. D., Pl. III, fig. 5.

262. H. Stat. 319. 6° 16.5 S., 114° 37' E., 82 Metres; fine yellowish grey mud (on 282. B., *Stichoporina simplex*).

Size large, reaching a total length of about 2.85 mm. Stalk interrupted by two or three muscular joints, the intervening parts covered by a well developed cuticle, which is smooth or has only the barest traces of tubercles. These internodes are cylindrical in form, expanding as they reach the joints. Tentacles probably not less than 20—24.

I am unable to refer this species to any of the forms of *Barentsia* previously known. In general appearance it has considerable resemblance to the jointed forms of *B. discreta* described by WATERS [1]) from Île Londonderry, Chili. WATERS gives *Pedicellina australis* Jullien (*non* RIDLEY) as a synonym of *B. discreta*; and a reference to JULLIEN's account [2]) shows that in the form described by that author the stalk may be jointed. It is not impossible that the specimens here described may be identical with JULLIEN's species, although it appears improbable that they are jointed forms of *B. discreta*, since the pores so characteristic of the stalk of that species are not present.

The muscular base of the stalk is divided from the next part by a chitinous diaphragm. WATERS has described a similar arrangement in his Chilian specimens; but in those which I have referred to *B. discreta* the diaphragm is usually not present, or is represented (in Japanese specimens) by a slight annular thickening of the cuticle, which hardly projects into the cavity of the stalk.

A similar diaphragm occurs on the distal side of each of the stem-joints; and, as WATERS has suggested, it perhaps serves for the insertion of the longitudinal muscles of the basal dilatation and of the joints. Evidence of the insertion of muscles into a diaphragm has been alluded to in the description of *B. discreta* (see p. 31).

The following are the lengths, in μ, of the several parts of the individual shown in fig. 6: — basal dilatation, 250; first internode of stalk, from the proximal diaphragm to the commencement of the joint, 860; first joint, to its distal diaphragm, 150; second internode of stalk, 580; second joint, 130; third internode, 270; calyx, 400; total, 2640. The breadth of the calyx is 310 μ.

I am not able to state the number of the tentacles with certainty, but it appears to be about 24. The specimen figured seems to be a female, with an embryo in its brood-pouch.

The stem-internodes of this species are much longer than those of *B. (Arthropodaria) benedeni* Foettinger. They more nearly resemble those of a specimen referred by RITCHIE [3]) to *B. gracilis*, which is, however, a much smaller species than the one here described. The length (in the figure) of the longest individual shown by RITCHIE in fig. 5 is about 115 mm. As the figure is said to be × 140, this gives a total absolute length of less than 1 mm.

1) WATERS, A. W., 1904, p. 99, Pl. VII, figs 6*a*, 6*d*.
2) JULLIEN, J., 1888, p. 13, Pl. VIII, fig. 4.
3) RITCHIE, J., 1911, Trans. R. Soc. Edinburgh, XLVII, Pt 4, p. 841.

Sub-Class II. **ECTOPROCTA** Nitsche.

1869, Zeitschr. wiss. Zool., XX, p. 596.

Order I. GYMNOLAEMATA Allman.

1856, "Mon. Fresh-water Pol.", p. 10.

Sub-Order I. CTENOSTOMATA Busk.

1852, J. MACGILLIVRAY's "Voy. Rattlesnake", I, p. 346.

Halcyonellea Ehrenberg (*pars*), 1839, Üb. d. Bild. d. Kreidefelsen", Phys. Abh. k. Ak. Wiss. Berlin, A. d. Jahre 1838, Tab. II.

Group A. CARNOSA Gray.

1841, "Syn. Brit. Mus.", 43rd Ed., p. 149.
1848, "List Brit. Animals Brit Mus.", I, pp. 91, 144.

Alcyonellea Hincks, 1880, "Hist. Brit. Mar. Pol.", p. 490.
Alcyonellea Waters, 1910, "Rep. Mar. Biol. Sudanese Red Sea", "Bryozoa II", J. Linn. Soc. Zool., XXXI, p. 240.

The present group includes what may be termed the encrusting forms of Ctenostomata. For this series HINCKS has used the name "Halcyonellea Ehrenberg", placing in it the Families Alcyonidiidae, Flustrellidae and Arachnidiidae. The name Halcyonellea had been previously employed, in a more or less similar sense, by other writers, as by JOHNSTON [1]). But a reference to the original introduction of the term will show that EHRENBERG [2]) gives "Halcyonellea. Federbusch-Polypen. Genera: *Halcyonella* et Sertularinorum reliquiae". Taking into consideration EHRENBERG's earlier account [3]), where *Alcyonella* includes *A. stagnorum* (= *A. fungosa* auctt.) and *A. articulata* (= *Paludicella*), it follows that the name "Halcyonellea", as originally introduced, referred to the Phylactolaemata as much as to the Ctenostomata. In EHRENBERG's later and more complete classification (1839, l. c.), Halcyonellea included *Halcyonella* and various Ctenostomata (*Vesicularia*, *Bowerbankia*, *Farrella*, *Valkeria* and *Alcyonidium*), besides *Stephanidium* [a Hydroid?] and *Dynamene* [a Hydroid]. In view of these facts I employ GRAY's name, which comprised in the text of the work (1848) two Families only: — the Alcyonidiadae, consisting, with one exception, of species of *Alcyonidium*; and the Pedicellinidae. The latter are, however, transferred to the order Cornea in the Appendix (p. 145) of the same Catalogue, so that the Carnosa were there left by GRAY with the single Family Alcyonidiadae.

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1) JOHNSTON, G., 1847. p. 358.
2) EHRENBERG, C. G., 1834, "Die Corallenthiere d. rothen Meeres", Abh. k. Akad. Wiss. Berlin, p. 153, sep.
3) Ibid., 1831, "Symbolae Physicae", "An. Evert.". Dec. 1, "Phytozoa Polypi", sheet a.

Fam. ALCYONIDIIDAE Johnston.

Alcyonidees (part) Lamouroux, 1813, Ann. Mus. Hist. Nat. XX, p. 284.
Alcyonidulae Johnston, 1838, "Hist. Brit. Zooph.", Ed. 1, p. 300.
Alcyonidulae Couch, 1844, "Cornish Fauna", III, p. 132.
Alcyonidiadae Johnston, 1837, Trans. Berwicksh. Nat. Club, I, p. 108.
Alcyonidiadae Gray, 1848, "List Brit. An. Brit. Mus.", I, pp, 91, 144.
Alcyonidiidae Hincks, 1880, "Hist. Brit. Mar. Pol.", p. 490.

Alcyonidium Lamx.

Alcyonidium Lamouroux, 1813, "Essai Gen. Thalassiophytes" (Suite). Ann. Mus. Hist. Nat. (Paris) XX, p. 285.
Alcyonidium Lamouroux, 1821, "Exp. Méthod.", p. 71.

Alcyonidium was introduced by LAMOUROUX (1813) as a genus of Sea-weeds. The genotype is *A. diaphanum* = *A. gelatinosum* L.

No specimens of *Alcyonidium* have been found among the 'Siboga' dredgings; but I include the genus in the present Report on the evidence of a single specimen from Torres Straits.

As WATERS [1]) has pointed out, *Alcyonidium* has rarely been recorded from the Southern Hemisphere. Besides *A. antarcticum*, described in the Memoir here referred to, WATERS mentions *A. flabelliforme* Kirkpatrick, 1902 (Antarctic), *A. flustroides* Busk, 1886 (Cape of Good Hope) and *A. gelatinosum*, mentioned by HINCKS [2]) as having been found off the coast of Natal. In the absence of any evidence on the subject, some doubt may be expressed with regard to the correctness of the last determination. To the list given by WATERS may, however, be added *A. mytili*, recorded by KIRKPATRICK (1888) from Victoria and *A. mytili* Calvet from Tierra del Fuego. From Oriental waters Miss THORNELY has given *A. mytili* as occurring in the Gulf of Manaar. These records are quoted in the subjoined synonymy. From the Northern Pacific Miss ROBERTSON [3]) has described four species of the genus, three of which are determined as belonging to British species. In a later paper [4]) the same author has described another species, *A. pedunculatum*, besides giving a new description of the remarkable *Ascorhiza occidentalis* Fewkes, 1889, also referred to the Alcyonidiidae. It has, however, been pointed out by WATERS [5]) that *Ascorhiza* is synonymous with *Clavopora*, described by BUSK [6]) in 1874 from the dredgings of the 'Porcupine' in the Mediterranean, in deep water off the African coast.

It may be concluded from these facts that the Alcyonidiidae are mainly Northern forms, and specially Atlantic. In other parts of the world they would appear to be most common in the North Pacific. As the genus *Alcyonidium* extends into high latitudes in the Atlantic area, its occurrence elsewhere may have been due to its invasion of the Pacific from the North.

1) WATERS, A. W., 1904. "Res. Belgica", "Bryozoa", p. 86: see also 1904, "Bry. Fr.-Josef Land", II, J. Linn. Soc. Zool., XXIX, p. 178.
2) HINCKS, T., 1880. p. 492.
3) ROBERTSON, A., 1900. "Harriman Alaska Exp.", "Bryozoa", Proc. Washington Acad. Sci., II, pp. 329, 330.
4) Ibid., 1902, "Obs. on *Ascorhiza* . . and Related Alcyonidia", Proc. Calif. Acad. Sci., (3) Zool., III, pp. 104— .
5) WATERS, A. W., 1910. p. 240.
6) BUSK, G., 1874, "*Clavopora hystricis*", Quart. J. Micr. Sci., (N. S.) XIV, p. 261.

1. *Alcyonidium polyoum* Hassall. (Pl. III, fig. 1).

Sarcochitum polyoum Hassall, 1841, "Suppl. Cat. Irish Zooph.", Ann. Mag. Nat. Hist. VII, p. 484.
Alcyonidium mytili Dalyell, 1848, "Rare and Remark. An. Scotland", II, p. 36, Pl. XI, figs 1—14.
Alcyonidium mytili Hincks, 1880, "Hist. Brit. Mar. Pol.", p. 498, Pl. LXX, figs 2, 3.
Alcyonidium mytili Levinsen, 1894, "Zool. Danica", IX, "Mosdyr", p. 81, Pl. VII, figs 33—37.
Alcyonidium mytili Silbermann, 1906, "Unt. *Alcyonidium mytili*", Arch. f. Naturg., Jahrg. 72, Bd I, p. 265, Pls XIX, XX.
Alcyonidium mytili Osburn, 1912, "Bry. Woods Hole", Bull. Bur. Fisheries, XXX, p. 251, Pl. XXVIII, figs 74, 74*a*.
Alcyonidium mytili Sumner, Osburn and Cole, 1913, "Biol. Surv. Woods Hole", Bull. Bur. Fisheries, XXXI, Pt I, pp. 108, 109; Pt II, p. 606.

The following records, without description or figure, may also be noticed:

Alcyonidium mytili Robertson, 1900, "Bry. Harriman Alaska Exp.", Proc. Washington Acad. Sci., II, p. 329.
Alcyonidium mytili Calvet, 1904, "Bryozoen", Hamburg. Magalhaensische Sammelreise, p. 38.
Alcyonidium mytili Thornely, 1905, HERDMAN's "Rep. Pearl Oyster Fisheries Gulf of Manaar", Publ. by the Roy. Soc., Suppl. Rep. XXVI, p. 127.

KIRKPATRICK's *A. mytili*, from Victoria ("Pol. Port Phillip", Ann. Mag. Nat. Hist., (6) II, 1888, p. 17, Pl. II, figs 6, 6*a*) does not appear to me to belong to this species.

It is probable that *Sarcochitum polyoum* Hassall, 1841, is the form assumed by old colonies of *A. mytili*. If this be the case, HASSALL's name has the priority, as has been pointed out by OSBURN (1912). DUERDEN [1]) has recorded *A. mytili* from Dublin Bay, and considers that it is identical with HASSALL's species, from the same locality. SILBERMANN (1906, p. 266), in a recent study of *A mytili*, comes to the conclusion, however, that this species is distinct from *A. polyoum*.

Murray Islands, Torres Straits, 15—20 fathoms, on *Euthyris obtecta* Hincks. Mus. Zool. Cambridge, Reg. Sept. 1, 1900; now transferred to the British Museum.

Zoarium forming a thin film, the interzooecial septa very distinct. Zooecia more or less hexagonal, averaging about 450 μ in length; the orifice on a low papilla which is not quite terminal.

I do not feel certain that the present form is correctly referred to the European species; but there is nothing in the characters given above to forbid this association.

The single specimen under consideration forms an extremely thin, transparent film encrusting a part of the frontal surface of a colony of *Euthyris obtecta*. Its interzooecial septa, which are very distinct, have been developed without any relation to those of the Cheilostome on which it is growing. Some of them cross the opercula of the *Euthyris*, the corresponding polypides of which have degenerated, although they are present beyond the growing margin of the *Alcyonidium*: — indicating that the degeneration has been the result of the occlusion of the orifices.

The orifice of the *Alcyonidium* is of the usual type, being very small and circular, or transversely oval, in the retracted condition, and being situated at the summit of a low papilla,

1) DUERDEN, J. E., 1894, "Notes Mar. Inv. Rush. Co. Dublin", Irish Nat., III, p. 232.

which is not quite terminal. The tentacles are about 12 in number. The tentacle-sheath may lie either to the right or to the left of the intestinal limb of the alimentary canal; no uniformity in this respect being discoverable, even in the zooecia of a single longitudinal row. The pharynx is short; and in the retracted condition its proximal end forms the extremity of the first limb of the alimentary canal. The oesophagus, formed of transparent cells, is long and passes distally. It is remarkable for its width [1]), which exceeds that of the caecum of the stomach. The stomach and its caecum are noticeably small, and together do not greatly exceed the length of the rectum, which is well developed. The parietal muscles are small and delicate, the fibres occurring singly. The retractor-muscles form a conical group, embracing the proximal end of the lophophore. Reproductive organs are absent.

Waters [2]) has given a useful list of the number of tentacles believed to be characteristic of various species of *Alcyonidium*. None of these records are so low as 12 except those of Lamouroux and Fleming (both referring to *A. gelatinosum*; which, according to Hincks, has 15—17 tentacles); and Waters considers that the number 12 has been incorrectly recorded by those authors. The number given for *A. mytili* is 15—18, on Hincks' authority, while Silbermann [3]) gives 16—20. It is difficult to count the retracted tentacles of a Polyzoon seen in frontal view, in an entire preparation; but in the case of the Torres Straits specimen the zooecia are so transparent that the probable error of my enumeration is not very great.

As in other cases, there is some irregularity in the size and shape of the zooecia, which are, however, fairly regularly hexagonal. They average about 400 μ in length and 290 μ in breadth. The longest and narrowest measured is 560 by 225 μ; and the broadest zooecium is 400 by 385 μ.

It should not be concluded, without further evidence, that the thinness of the zoarium is really characteristic of the Torres Straits form. *A. polyoum* from European waters is well known to increase in thickness during growth, the central parts of the colony thus acquiring a very different appearance from that of the delicate marginal regions (cf. Silbermann, 1906, p. 268).

Fam. Flustrellidae Hincks.

Flustrellidae Hincks, 1880, "Hist. Brit. Mar. Pol.", p. 504.

Elzerina Lamx.

Elzerina Lamouroux, 1816, "Hist. Pol. Cor. Flex.", p. 122.

1. *Elzerina blainvillii* Lamx. (Pl. III, fig. 2).

Elzerina blainvillii Lamx, 1816, t. c., p. 123, Pl. II, figs 3 *a*, 3 B.
Elzerina blainvillii Lamx, 1821, "Exp. Méthod.", p. 3, Pl. 64, figs 15, 16.

1) A similar character seems to be indicated in the form from Woods Hole, referred to *A. mytili* by Osburn (1912, Pl. XXVIII, fig. 74 *a*); and it is also shown by Silbermann (1906, Pl. XIX, figs 1—4) in specimens from the Baltic.

2) Waters, A. W., 1904, "Bry. Franz-Josef Land" II, J. Linn. Soc., Zool., XXIX, p. 180.

3) Silbermann, 1906, t. cit., p. 272, Pl. XIX, figs 6, 7.

Elzerina blainvillii Lamx, 1824, "Encycl. Method.", "Zoophytes", p. 317.
Elzerina blainvillii Blainville, 1834, "Man. Actinol.", p. 453, Pl. LXXX, figs 2, 2*a*.
Elzerina blainvillii Milne Edwards, 1836, LAMARCK's "Hist. An. s. Vert.", 2 Ed., II, p. 240.
Elzerina blainvillii Gray, 1843, DIEFFENBACH's "New Zealand", II, p. 293.
Verrucularia dichotoma v. Suhr, 1834, Flora, XVII. Jahrg., I. Bd, p. 725, Pl. I, figs 9, *a*, *b*.
Verrucularia dichotoma Busk, 1884, Challenger Report, Pt XXX, p. 48.
Verrucularia dichotoma MacGillivray, 1887, "Cat. Mar. Pol. Victoria", Trans. R. Soc. Vict., XXIII, pp. 189, 205 (Sep., 3, 19).
Verrucularia dichotoma MacGillivray, 1890, McCOY's "Prodr. Zool. Vict.", II, Dec. XX, p. 348, Pl. 195, figs 6—7*a*.
Verrucularia dichotoma Whitelegge, 1890, "List Mar. F.-W. Fauna Port Jackson", J. Proc. R. Soc. N. S. Wales, XXIII, p. 123.
Farciminaria dichotoma Busk, 1861, Quart. J. Micr. Sci., (N. S.), I, p. 155, Pl. XXXV, figs 1—1*b*.
Farciminaria blainvillii Hutton, 1891, "Rev. List Mar. Bry. N. Zealand", Trans. Proc. N. Z. Inst., XXIII, p. 104.
Flustrella dichotoma Hincks, 1884, Ann. Mag. Nat. Hist. (5) XIII, p. 366, Pl. XIV, figs 2—2*b*.
Flustrella dichotoma Hincks, 1893, Ibid., (6) XII, p. 141.

Torres Straits, A. C. HADDON Coll., Mus. Zool. Cambridge, Reg. Feb. 24, 1898; now transferred to the British Museum.

Timor, Australasia (LAMOUROUX); Algoa Bay (v. SUHR); Victoria (BUSK, HINCKS, MACGILLIVRAY); Port Jackson, Sydney (WHITELEGGE and Mus. Zool. Cambr.); New Zealand (GRAY, HUTTON).

Zooecia constituting erect cylindrical branches, arranged in 4, 6 or more series, and opening all round the branch. In 4-serial specimens the arrangement is *Farciminaria*-like, the branch being a 4-sided prism, each surface formed by one of the rows of zooecia. Most of the free surface of the zooecia constituted by a frontal membrane, into which the parietal muscles are inserted; the frontal membrane not extending to the proximal end, which is the "peduncle" of HINCKS (1884). Orifice resembling that of *Flustrella hispida*, but without a distinct upper lip. The lower lip is well marked, and lateral lips are indicated. Spines absent.

The specimens described by HINCKS were 6-serial. In colonies in the Cambridge Museum which had formed part of Mr HINCKS' collection I find this arrangement in most of the branches; but one branch is 4-serial. In a specimen from Port Jackson, in the same Museum, some of the branches are also 6-serial; but just before a bifurcation the branch may be widened and flattened, as many as 5 rows appearing on each of the flat surfaces. But even in this colony one of the branches is 4-serial. If thus appears that, although six rows are commonly present, the number may be either greater or less. The Torres Straits specimen here described shows an increase in the number of the rows to 8 in one place, just before a bifurcation.

The diameter of the branch drawn (fig. 2) is 600 μ. The middle zooecium is 1030 μ long, and its frontal membrane is 370 μ broad at its widest part.

The present species has not been found in the 'Siboga' dredgings; but I include it here on the evidence of a single fragment obtained by Dr A. C. HADDON in Torres Straits. It belongs to a series of species, of erect habit and with more or less cylindrical branches, which appear to be characteristic of Southern waters. In addition to the species here described, this assemblage includes *Flustrella binderi* Harvey [1]) and *F. hispida* var. *cylindrica* Hincks [2]). From these two species [3]) *E. blainvillii* differs in the absence of spines.

Verrucularia dichotoma was originally found at Algoa Bay and was described as an Alga by v. SUHR; and there has been considerable doubt with regard to its systematic position. BUSK (1861) referred it and *Flustrella binderi*, with some hesitation, to the Cheilostome genus *Farciminaria*; but later (1884) he accepted v. SUHR's genus, which he placed in the Farciminariidae. HINCKS (1884) gave reasons, which he maintained in his later account (1893), for considering *V. dichotoma* a species of *Flustrella*, in opposition to the opinion of BUSK and MACGILLIVRAY (1887, 1890). In placing it in the Flustrellidae I agree with HINCKS; and after examining the species above mentioned, it seems to me that the structure of the orifice corresponds closely with that of the common European *F. hispida*.

GOLDSTEIN [4]) has suggested that *Farciminaria* may be a synonym of *Elzerina*, but if LAMOUROUX' species is the one here considered, this opinion cannot be maintained. In the original account of *E. blainvillii* the "substance" of the colony is described as being "presque membraneuse"; — suggesting an absence of calcification. The specimens are said, moreover, to have been found on sea-weeds from Timor and Australasia; and their occurrence in the Malay Archipelago is a reason for referring the Torres Straits specimen to the same species.

It may be noted that *Flustrella flabellaria* Kirkpatrick [5]), from the China Sea, appears to be a *Pherusa*, so far as I can ascertain from a figure given by that author and from the mounted slide (89. 8. 21. 128) in the British Museum.

A few words may be added with regard to the unfortunate results of attempting to apply the Law of Priority strictly to a group like the Polyzoa, in which the earlier names cannot always be identified with certainty. The familiar and universally employed generic name *Flustrella* Gray, 1848, is antedated by *Flustrella* Ehrenberg [6]), 1839. EHRENBERG's name was introduced for a Cretaceous species, *Flustrella concentrica*, a member of a Family Asterodiscina, where it is associated with *Lunulites* and *Cupularia*, two genera of Selenariiform Polyzoa, and with *Orbitulites*, one of the Foraminifera. On p. 132 of EHRENBERG's work, *F. concentrica* is defined as "microscopica cellularum minutissimarum laevium seriebus concentricis, interdum spira-"libus, apertura singularum parva rotunda". In the 'Tabellarische Charakteristik d. Bryozoen-Classe' following p. 120, the words "forma indeterminata plana (libera)" appear to indicate that *Flustrella* was introduced for a Selenariiform Polyzoon; but, so far as I am aware, EHRENBERG's genus has not been recognised by later writers. GRAY's name has in fact held the field for 66 years, and the Family Flustrellidae, based on it, has also come into universal use. I venture to think that this is a case in which the Law of Priority should be ignored [7]).

1) Cf. BUSK, 1861, Quart. J. Micr. Sci. (N. S.) I, p. 156.

2) HINCKS, T., 1884, Ann. Mag. Nat. Hist. (5) XIII, p. 365: see P. H. MACGILLIVRAY, 1887, Trans. R. Soc. Vict., XXIII, p. 220.

3) *Echinella placoides* Korotneff (Biolog. Centralbl. XXI, 1901. p. 311), a spinous form from Lake Baikal, may possibly belong to the same assemblage. ANNANDALE ("Fauna Brit. Ind.", "F. W. Sponges ... and Pol.", 1911, pp. 199, 202) regards it, perhaps rightly, as a synonym of *Hislopia*.

4) GOLDSTEIN, J. R. Y., 1882, "New Species Bry. Marion Islands", Trans. R. Soc. Vict., XVIII, p. 44. note.

5) KIRKPATRICK, R., 1890[1], p. 23, Pl. IV, figs 3, 3*a*.

6) EHRENBERG, C. G., 1839, "Üb. d. Bildung d. Kreidefelsen", Phys. Abh. k. Akad. Wiss. Berlin, A. d. Jahre 1838, p. 132 and Tab. I.

7) *Flustrella* D'Orbigny, 1850—1852, p. 282, is a third introduction of this generic name.

It seems to me further that it would be undesirable to attempt to replace *Flustrella* Gray by either *Elzerina* Lamouroux, 1816, or *Verrucularia* v. Suhr, 1834. There is some doubt as to the species which Lamouroux intended; while it can hardly be considered proved that the branching Southern species which I have included under *Elzerina* really belong to the same genus as the European species. Even if it be admitted that *Elzerina* should be placed in the Flustrellidae, it may still be considered that the zoarial form justifies its separation from *Flustrella*. To refer the branching species to the same genus as the encrusting European species may be to suggest a wrong idea with regard to the geographical range of *Flustrella*. *F. hispida* has a remarkable bivalved larval form which, so far as is known, is almost peculiar to that species. In the absence of information with regard to the larvae of the Southern species, it would be unsafe to assume that they are really congeneric with *F. hispida*. It thus appears to me preferable to retain Gray's name for *F. hispida*; and in view of the fact that this has been generally accepted for so many years I venture to think that it would be better not to disturb it even if it were admitted that it is synonymous with *Elzerina* and *Verrucularia*. *Elzerina* may perhaps be retained for the erect, branching Oriental and Southern species.

PALUDICELLEA, STOLONIFERA AND VESICULARINA.

Before discussing the systematic arrangement of the Ctenostomata included below under these groups, the method adopted for mounting preparations may be indicated.

In spite of the delicate nature of the body-wall in the genera here considered; — which might have been expected to render them easily permeable to reagents; — it is well known that the microscopical preparation of this group of Polyzoa is attended with special difficulties. It is most desirable to find some method of mounting a type-specimen in Canada balsam, and thus to give it as permanent a character as possible; but, in spite of many experiments which I have made, I have been unable to discover any process by which the transference into that substance can be effected satisfactorily. There is no difficulty in obtaining material which is well preserved in either spirit or formalin. But on using oil of cloves, or creasote, a shrivelling of the body-wall almost invariably takes place; suggesting that the cuticle is specially impermeable to anything in the nature of an oil. This property increases with age, so that while the very young zooecia can sometimes be transferred to the oil without any undue amount of shrinkage, the older zooecia and the older parts of the "stolon" commonly collapse when treated with a reagent of this nature. In some cases, moderately successful results can be obtained by dispensing with the use of an oil and transferring the preparation directly from absolute alcohol to Canada balsam dissolved in absolute alcohol, as recommended in my paper on the Morphology of the Cheilostomata [1]). But even when this procedure is followed the results are often very disappointing. In a few cases I have had some success by

1) Harmer, S. F., 1902. Quart. J. Micr. Sci., XLVI, p. 264.

treating the specimen for some hours with an extremely dilute solution of Eau de Javelle, with the view of increasing the permeability of the cuticle: — a method which has been recommended for the preparation of Nematoda: but the reagent in question readily destroys the internal organs if used too strong, and it is very difficult to regulate its action in such a way as to obtain a successful result.

I have thus been obliged to depend mainly on glycerine-preparations. The specimen is transferred from 70 p.c. alcohol into a solution of glycerine in 70 or 90 p.c. alcohol which is sufficiently dilute to cause no appreciable contraction of the body-wall of the spirit-material. The specimen is then left exposed to the air, in an open watch-glass, for about two days, during which the greater part of the spirit evaporates; and is finally mounted in some of the glycerine which has thus concentrated itself to a strength which is in equilibrium with the air.

For mounting the slides I have made use of a method which has been elaborated by Mr C. F. ROUSSELET, to whom I have to express my acknowledgments for information which he has kindly given me. A "cavity-slide", or one in which a depression has been ground, is used for this purpose; and the first operation is to make an extremely narrow ring of gum-dammar dissolved in benzol, immediately outside the depression in the slide. This process is effected with the aid of a turn-table; and the benzol evaporates so quickly that the slide is ready for use as soon as the ring has been made. The object of this procedure is to raise the cover-glass (a circular one, the diameter of which is slightly greater than the ring of gum-dammar) above the level of the slide. After placing the specimen, in glycerine, in the cavity of the slide and putting the cover-glass in place, the excess of glycerine is removed as completely as possible by means of a fine pipette or filter-paper. If this operation has been successfully accomplished a circular space is left between the gum-dammar and the edge of the cover-glass into which the cementing substance can be introduced. The escape of the glycerine is thus prevented by a circular ring of cement between the outer margin of the cover-glass and the slide and forms a more efficient closure than in the more usual method of mounting, in which the cement merely passes from the slide over the edge of the cover-glass to its upper surface.

The cements used have been, following Mr ROUSSELET's advice; — first a ring of "picture-copal" varnish, allowed to dry for 24 hours; and after that several successive rings, added at intervals of a day, of a mixture of equal parts of picture-copal varnish and gold-size. For thicker specimens a glass-cell has been used, cemented to an ordinary slide, instead of the cavity-slide. In order to avoid the escape of the cement into the cavity enclosed by the cell, the glass-ring should receive several successive rings of the copal-gold-size mixture, on its lower edge, several days before the cell is required. The attachment of the cell is then readily effected by placing it in position on the slide and heating it over a flame. Before the glycerine is placed in the cell the upper surface of the glass-cell should receive a ring of the cement which should be left for some hours, long enough to allow it to become partially dry. The cover-glass should be slightly larger than the diameter of the cell, so that a narrow margin, to which the cement can adhere on the under side, is left projecting beyond the cell. Several successive rings of cement are added, as in the case of the cavity-slides.

It should be added that Mr ROUSSELET prefers formalin to glycerine as a medium for mounting; but I have myself used glycerine on the ground that there is less risk of drying up if the cementing process has not been completely successful.

The arrangement of the genera of non-encrusting Ctenostomata is admittedly a matter of great difficulty; and they have been grouped in a considerable variety of ways by different authors. WATERS[1]) has pointed out that the Division Stolonifera, as used by many authorities, includes more than one type of structure, and that its type-genus, as originally introduced by EHLERS, is *Hypophorella*. He accordingly suggests the following classification: —

VESICULARINA. "Usually 8—10 tentacles; a gizzard; the zooecia grow direct from the stem and "have no independent movement". Genera: — *Zoobotryon*, *Bowerbankia*, *Amathia*, *Vesicularia*, ? *Avenella*, *Buskia* (*B. socialis*), *Cryptopolyzoon*.

STOLONIFERA. "There is a delicate creeping rhizome, which at intervals expands, and from "these expansions the zooecia arise usually in pairs; no gizzard". Genera: — *Hypophorella*, *Farrella*, *Valkeria*, *Mimosella*, *Triticella*, *Cylindroecium*, *Buskia* (*B. setigera*).

WATERS is uncertain where to place *Arachnidium* (which may be allied to *Cylindroecium*), *Victorella* and *Arachnoidea*.

ROUSSELET[2]) has proposed the association of the fresh-water genera *Paludicella*, *Victorella*, *Pottsiella* and *Arachnoidea*, with the marine genera *Arachnidium* and *Cylindroecium*[3]), under the name of "Cruciform Stolonifera"; for which the name *Paludicellea*, already in use with a more restricted meaning, might be employed. The study of the 'Siboga' material seems to me to lend much support to this grouping, which is based on the fact that each zooecium typically gives off a terminal daughter-zooecium, and another on each side, more or less at right angles to the parent; thus producing a cruciform arrangement of uniserial zooecia. The term "stolon", which is sometimes applied to the narrow tubes which connect the expanded parts of the zooecia, is not very suitable in this connexion, since the tubes in question are merely the proximal parts of the zooecia themselves.

Group B. PALUDICELLEA.

Paludicellea Allman, 1856, "Mon. F.-W. Pol." Ray Soc., pp. 10, 76.
Paludicellina Jullien, 1888, "Miss. Sci. Cap Horn", VI, "Bry.", p. 7.
Paludicellina Annandale, 1911, "Faun. Brit. Ind.", "Freshwater Sponges ... and Pol.", p. 190.

In this division may provisionally be associated the Families Paludicellidae, Victorellidae, Arachnidiidae and Nolellidae (= Cylindroeciidae, auctt.), the first of which does not come within the province of this Report.

1) WATERS, A. W., 1910, pp. 238, et seq.
2) ROUSSELET, C. F., 1907, Proc. Zool. Soc., p. 252.
3) Described as *Nolella* in the present Report.

Fam. 1. VICTORELLIDAE Hincks.

Homodiaetidae Saville Kent, 1870, Quart. J. Micr. Sci. (N. S.) X, p. 35.
Victorellidae Hincks, 1880, "Hist. Brit. Mar. Pol.", p. 558.
Victorellides Loppens, 1908, "Bry. d'eau douce", Ann. Biol. lacustre, III, pp. 149, 170, 171.
Paludicellidae (part), Annandale, 1911, t. cit., p. 191.

The present Family was originally defined, unsatisfactorily, by SAVILLE KENT, under the name Homodiaetidae, for *Victorella pavida*, described in the same paper as a new genus and species. KENT's Family-name was replaced by HINCKS, in 1880, on the ground that a Family-designation should be taken from a typical genus. ANNANDALE has recently proposed to include the Victorellidae in Paludicellidae; but this association has been criticised by BRAEM [1]), on the grounds that *Victorella* has a typical development of the funicular system, and that this is not the case in *Paludicella*; and that the former produces larvae, while the latter lays eggs [2]). LOPPENS (1908) has called attention to resemblances between Victorellidae and Cylindroeciidae.

Victorella Saville Kent.

Victorella Saville Kent, 1870, Quart. J. Micr. Sci. (N. S.) X, p. 34.
Victorella Hincks, 1880, "Hist. Brit. Mar. Pol.", p. 559.
Victorella Kraepelin, 1887, Abh. Naturw. Ver. Hamburg, X, p. 93.
Victorella Rousselet, 1907, Proc. Zool. Soc., p. 255.
Victorella Braem, 1911, Trav. Soc. Imp. St Petersbourg, XLII, Lief. 2, p. 30.
Victorella Annandale, 1911[1], "Fauna Brit. Ind.", "Freshw. Sponges [etc.]", p. 194.
Victorella Annandale, 1911[2], "Syst. Notes Cten. Pol.", Rec. Ind. Mus., VI, p. 195.

For many years after its first description by SAVILLE KENT the genus *Victorella* was only known to include the single species *V. pavida*, which has been recorded from brackish water in England, Germany and Australia [3]). In 1887, KRAEPELIN [4]) described a new species, under the name of *Paludicella mülleri*, from the Ryckfluss at Greifswald, N. Germany, in a locality where the percentage of salt in the water was about 0.3 p.c. (p. 95). This species has been referred by later writers (BRAEM, p. 33, ANNANDALE) to *Victorella*. In 1907 *V. symbiotica* was described by ROUSSELET from Lake Tanganyika. In 1911 BRAEM gave an account of another new species, *V. continentalis*, from Lake Issyk-Kul, in Turkestan, from water which is described (p. 4) as salt, but to so small an extent that cattle will drink it. The genus has also been recorded from the salt lake Birket-el-Qurun in Egypt. ANNANDALE [5]) refers specimens from this locality to *V. symbiotica*, while BRAEM (t. cit., p. 33) states that those he has examined belong to the same group as *V. pavida*, etc., and that *V. symbiotica* belongs to another group, characterised by a different structure, not particularised, of the alimentary canal. ANNANDALE [6]) has described a new species, *V. bengalensis*, from fresh and brackish water pools in India.

1) BRAEM, F., 1914, "Die Knospung v. *Paludicella*", Arch. f. Hydrobiol., IX, p. 546, n.
2) Ibid., 1896, "Die geschl. Entw. v. *Paludicella*", Zoolog. Anzeiger, XIX, p. 55.
3) WHITELEGGE, T., 1890. "List Mar. and F.w. Inv. Fauna Port Jackson". J. Proc. Roy. Soc. N. S. Wales, XXIII, p. 322, (Cook's River).
4) KRAEPELIN, K., t. cit., p. 100, text-figs on p. 159.
5) ANNANDALE, N., 1911[2], p. 197.
6) Ibid., 1911[1], p. 195; 1911[2], p. 197.

It follows from the above summary that the genus *Victorella* has nearly always been found in inland brackish waters, although ANNANDALE [1]) states that it is known to exist in the littoral zone of the sea in Europe. The occurrence of the following species among the 'Siboga' dredgings is thus of special interest. I record it as: —

1. *Victorella sibogae* n. sp. (Pl. III, figs 12—15).

Type. 451. B. Stat. 64. Kambaragi Bay, Tanah Djampeah, 0—32 Metres; coral, coral-sand; trawl, dredge and shore-exploration (On a chitinous tube, perhaps of a *Phyllochaetopterus*).
331. B. Stat. 64. do., do. (on *Tubucellaria fusiformis*).
337. K. Stat. 71. Makassar, 0—32 Metres; mud, sand with mud; dredge and shore-exploration. (Also on slide 337. G.[1], *Nolella papuensis*, from the same Station). (On the axis of an Alcyonarian).

The original label of 451. B. stated the depth as 32 Metres; and that of 331. B. as 30 Metres. It thus appears that the specimens were dredged and were not from the "shore-exploration" included in the official list of the Stations. 337. K. was marked 27—36 Metres.

Zoarium partly adherent, partly giving rise to erect growths. Zooecia large, very variable in form; sometimes with the erect portion less developed than the adherent part (fig. 13), but in other conditions with the adherent part evanescent (fig. 12). Daughter-zooecia produced sparingly, from the side of the parent, or as terminal buds continuing its direction. Distal end of the zooecium more or less rounded, the orifice only slightly quadrangular. Polypides with numerous tentacles.

Previous authors are agreed in stating that the genus *Victorella* is characterised by having 8 tentacles. In the present species the number is certainly much larger. I have been unable to ascertain it accurately, but I think it is safe to say that it is not less than 16, and probably more than 20. I can find no other character which would justify the separation of this species from *Victorella*, the generic diagnosis of which will accordingly have to be amended, with regard to the number of tentacles, if *V. sibogae* is to be included in it. In certain other respects, as in the mode of branching and in the characters of the oesophageal limb of the alimentary canal, the present species shows very definite resemblances to others which are referred to the same genus.

The cuticle of *V. sibogae* is thick and brownish in the older parts, but it is sufficiently transparent to allow the internal structures to be seen fairly well in mounted specimens. The condition is, however, very different from the "extreme transparency" alluded to by HINCKS in *V. pavida*. Numerous transverse or circular wrinkles run across the ectocyst (fig. 14), to a degree which varies in different zooecia and in different parts of the same zooecium.

The general architecture of the colony conforms closely with the type prevalent in the genus. The difference between attached and free parts is so great that it might be supposed at first sight that two species were present; but this is quite in agreement with what is known of other species. In the basal parts of the colony (fig. 13) a considerable proportion of the

1) ANNANDALE, N., 1911^2, p. 197.

zooecium is adnate, the free part being less than half the total length. In this condition, terminal and lateral buds are developed; the former from the distal end of the attached part of a zooecium, and the latter from one of its sides. A single zooecium may give off either one or two lateral buds; in the cases observed, from one side only. All the zooecia in fig. 13 are still in the adnate condition. In other parts, however (fig. 12), the zooecia increase greatly in length, and become completely erect As described by ANNANDALE [1]), in his account of the generic characters, the adnate part of the zooecium becomes hardly distinguishable, or quite indistinguishable, in this state. Lateral buds may be developed at either end of the zooecium (the basal and distal buds of ANNANDALE [2])), or from a more central position; all these conditions being shown in fig. 12.

The free portion of the zooecium is circular or oval in transverse section; and the orifice, which is at the end of this part, is not sharply quadrangular, although showing indications of having this shape (figs 14, 15). The free end of the zooecium appears rounded during retraction, so long as the polypide is functional. When the polypide begins to degenerate, the end may become pointed, as shown in one of the zooecia in fig. 12, where the degeneration is indicated by the atrophy of the vestibule; the tentacles and alimentary canal not showing much change. This difference of shape between zooecia with and without a functional polypide is in accordance with what is known of other Ctenostomes; and is alluded to below, under *Valkeria atlantica*. The condition in which the zooecia have been preserved does not enable me to make any statements about the collar.

The parietal muscles [3]) are unusually strong, no doubt in correlation with the thickness of the ectocyst. In the proximal part of the zooecium (fig. 15) their groups include a considerable number of fibres, which are so long that in a side view of the zooecium they may appear like bundles of circular muscles. The groups extend along the whole length of the zooecium, the number of fibres becoming less at the oral end.

The polypide is relatively small, although sometimes considerably larger than in fig. 15, so that the body-cavity is spacious. The vestibule is of moderate length, and the retracted tentacles are bent at their distal end. HINCKS (1880) has placed *Victorella* in his Campylonemidan Series, characterised (p. 550) by having 8 tentacles, two of which are always everted, in the protruded condition, and by having no gizzard. KRAEPELIN (1887, p. 95) has stated that the tentacles are all straight, and are therefore not Campylonemidan, in HINCKS' sense; while LOPPENS (1908, p. 9) makes a similar statement. It is obvious that the large number of tentacles possessed by the present species is a further departure from HINCKS' definition. In correlation with the large amount of space available in the body-cavity, the alimentary canal of the retracted polypide retains its U-like character, instead of having the oesophagus bent on the pharynx. The statement that there is no gizzard has been criticised by ANNANDALE, who describes a part to which he

1) ANNANDALE, N., 1911[1], p. 194.

2) Ibid., 1911[2], p. 195.

3) In his account of the genus in the "Fauna of British India", ANNANDALE states (p. 195) that parietal muscles are absent. It may be worth while to point out that an *erratum*-slip deletes this statement; since insertions of this kind are very apt to be lost or overlooked. In his "Syst. Notes", published in the same year, ANNANDALE has made use of the parietal muscles for the discrimination of species of the genus.

gives that name[1]). As bearing on the correctness of the reference of the present species to *Victorella*, the existence of a region (fig. 15) corresponding with ANNANDALE's "gizzard" may be specially emphasised. I am not sure, however, that the part in question really corresponds with the gizzard of other Ctenostomata, as it would appear to represent the oesophagus of other forms; the preceding part of the alimentary canal, between it and the tentacles, corresponding with the pharynx.

The existence of a distinct funiculus does not seem to be at all common in marine Polyzoa, in most of which there is a more diffuse arrangement of the "funicular tissue". *Victorella*, however, is described as having a single funiculus, and it is therefore important to notice that the present species forms no exception to this rule. In cases where I can obtain distinct evidence, I find that the interzooecial septum is perforated by two pores, which lie side by side. Through each of these passes a strong strand of the funicular tissue, the two cords uniting, shortly after penetrating the septum, into a single cord which extends through the body-cavity to be inserted into the wall of the stomach.

Regeneration of the polypides is indicated by the fact that the zooecium often contains one or two brown bodies (fig. 15).

The measurements of two of the zooecia figured, in μ, are as follows, and may be taken as a fair representation of the size:

fig. 15: length (not quite complete) 3100; breadth, 650.
fig. 14: length . . . . 1300; breadth, 600.

V. sibogae may be regarded as a specially robust member of its genus, as shown by the large size of its zooecia, the thickness of its cuticle and the strong development of its parietal muscles, and the large number of its tentacles. It appears to be nearly related to *V. bengalensis* and *V. continentalis*, in both of which the number of tentacles is, however, stated to be 8; while both are described as having winter-buds or resting buds. These have not been found in the present species; and it may be surmised from its occurrence in the sea that they do not occur in it.

It has often been assumed that *Victorella* is a form which has recently migrated into fresh water, as indicated by its occurrence in brackish water. A different view is held by BRAEM, who considers[2]) that its preference for brackish water, taken in conjunction with the localities from which it has been recorded, indicates an ancient adaptation; and that *Victorella* is in fact a "relict" form which may still be found in localities which contain suitable brackish water. The occurrence of a species of the genus in definitely marine localities appears to support the older view rather than the one suggested by BRAEM; unless indeed it were assumed that it could have been derived from a form like *V. bengalensis*, living close to the sea and secondarily colonising it. Except on this view it would hardly be possible to assume, in the light of the evidence afforded by *V. sibogae*, that most of the generic characters of *Victorella* had been evolved in relation to its fresh-water habitat.

1) See especially ANNANDALE, 1911[1], pp. 191, 195; where the "gizzard" is said not to function as that name would indicate, but to be merely a chamber for the retention of solid particles: and 1911[2], Pl. XIII. fig. 6. where the structure in question (*b*) is more distinctly indicated.

2) t. cit., p. 34.

One of the principal arguments relied on by BRAEM is the occurrence of *V. continentalis* in Lake Issyk-Kul, a sheet of water which lies at a high level far in the interior of Asia. But when it is remembered that *V. bengalensis* gives rise to resting buds, it is not very unsafe to suppose that these might be carried from one place to another, on the feet or beaks of migratory birds, without losing their power of germination; and that very long intervals might be bridged over in this way.

Whatever view is adopted with regard to this point, it is interesting to find a marine species of *Victorella* in a locality which may be regarded as central with reference to the Indian Coast and Lake Tanganyika, two of the localities from which species of the genus have been recorded. This fact becomes even more significant when taken in conjunction with the occurrence, recorded below, in the Malay Archipelago of a species of *Arachnoidea* which appears to be closely related to *A. ray-lankesteri* of Lake Tanganyika.

Fam. 2. ARACHNIDIIDAE Hincks.

Arachnidiidae Hincks, 1880, "Hist. Brit. Mar. Pol.", p. 508.
Hislopiidae (pars), Annandale, 1911, "Syst. Notes Cten. Pol.", Rec. Ind. Mus. VI, p. 197.

Zoarium adnate, branching typically in a cruciform manner, though frequently showing some irregularity in this respect. Zooecia consisting of a narrow proximal part, often much elongated, and of a much dilated distal part. Orifice subterminal, on a low papilla or a much elongated peristome [1]). Genera, *Arachnidium*, *Arachnoidea*.

Arachnidium Hincks.

Arachnidia Hincks, 1859, Rep. 28th Meeting Brit. Ass., Leeds, 1858, Notices and Abstr., p. 128.
Arachnidia Hincks, 1859, Quart. J. Micr. Sci., VII, p. 131.
Arachnidia Hincks, 1862, Ann. Mag. Nat. Hist. (3) IX, p. 471.
Arachnidium Hincks, 1877, Ann. Mag. Nat. Hist. (4) XX, p. 216.
Arachnidium Hincks, 1880, "Hist. Brit. Mar. Pol.", p. 508.

The first notice cited above mentions the description of "a new generic type, *Arachnidia* "*Hippothöoides*, a delicate Ctenostomatous Polyzoon, curiously resembling in general appearance "the well-known *Hippothoa*". The second is a copy, not literally exact, of the first. A formal diagnosis was published in the 1862 paper; but the information given in the 1859 notices is probably sufficient to justify this year as the date of the introduction of the genus.

In 1877 HINCKS uses the form *Arachnidium*, giving the derivation as "dim. of ἀράχνιον, a spider's web", and stating that the name "*Arachnidia*" had been given "wrongly". I believe that the amended form has been employed in practically all later accounts of the genus, and it seems to me desirable to decide that the original name should be regarded as a *lapsus calami*, and that it may therefore be replaced by the correct form *Arachnidium*, in accordance with

1) I use the term "peristome" as the equivalent of the free, terminal portion of the zooecium, bearing the orifice, without implying that it is the morphological equivalent of the parts so designated in Cyclostomata and Cheilostomata.

Art. 19 of the Rules of Nomenclature[1]. I must admit that this procedure involves stretching the Rule, but it has the advantage of making the name of the genus next to be described more different from that of the present genus than would otherwise be the case.

1. *Arachnidium irregulare* n. sp. (Pl. III, figs 3—6).

376. B. Stat. 213. Saleyer, 0—36 Metres; coral-reefs, mud, and mud with sand. (On the dermal membrane of a Siliceous Sponge).

Zooecia discrete, relatively large. Daughter-zooecia given off irregularly (hence the specific name), separated from the parent by a diaphragm and at first narrow and cylindrical, then expanding into a broad part, varying in form, and containing the viscera. Orifice borne on a prominent, broad mammilla, situated subterminally, marked by concentric transverse lines, but not angulated. Tentacles numerous.

The present species has been found once only. The spirit containing it had almost dried up on arrival.

Hincks (1862) stated, in characterising the genus, that "The *Arachnidia* may be "regarded as an *Alcyonidium* with its cells detached from one another, and held together by a "delicate thread". *A irregulare* conforms well with this definition; the "delicate thread" being merely the proximal end of a zooecium. The length of this part is variable. The entire zoarium is very closely adherent to the substratum, and the wide part of the zooecium is depressed, and varies much in outline.

The cruciform disposition of the zooecia is usually apparent in *Arachnidium*; and the present species shows distinct traces of it (fig. 3), accompanied by some irregularity. Thus I find that in *A. irregulare* there is commonly no symmetrically placed distal daughter-zooecium, but that a zooecium is given off from each of the distal corners of the parent. This may be the result of a displacement of the symmetry, by which one of the lateral zooecia appears to form a pair with the distal zooecium (fig. 5). In other cases (fig. 4) two zooecia are given off on one side and none on the other, the distal zooecium being median in the specimen figured. In some cases (fig. 3) the two lateral zooecia are not opposite one another.

The orifice is borne on a massive mammilla, which is about half as broad as the attached part of the zooecium, from which it rises nearly at right angles. The mammilla shows no trace of angulation, but is circular in transverse section, and is marked by conspicuous annulations. The "collar" which is characteristic of the more typical Ctenostomata is not well shown in the preparations, but it appears to be present and of considerable size.

The tentacles are rather short and are numerous: — probably about 26—30. The oesophagus is of moderate length (fig. 6) and the stomach and its caecum are large. In some of the zooecia there appear to be several large embryos, one of which, contained in an ovisac provided with radiating muscles, is shown in fig. 5. The vestibule has persisted, but the rest of the polypide has degenerated.

In view of the variability of the proximal part of the zooecium it is not easy to state

1) IXe Congrès, Int. Zool., Monaco (1913). 1914. p. 899.

the average length. The total length of the zooecium shown in fig. 5 is 1360 μ. The length of the narrow part of the proximal zooecium in fig. 4, measured to the level of the proximal lateral diaphragm, is 600 μ; and that of the broad part of the zooecium, from the same diaphragm, is 1030 μ. The total length of the distal zooecium in the same figure is 1250 μ, while that of the short zooecium shown in fig. 3 does not exceed 700 μ, measured to the distal end of the adherent part. The zooecia are usually about 500 μ in greatest breadth, and the diameter of the narrow proximal portion is about 50 μ.

A. fibrosum has been recorded by Miss THORNELY [1]), without description, from the Gulf of Manaar.

Arachnoidea [2]) J. E. S. Moore.

Arachnoidia Moore, 1903, "The Tanganyika Problem", p. 297, text-fig. on p. 296.
Arachnoidia Rousselet, 1907, "Zool. Res. Third Tanganyika Exp.", Proc. Zool. Soc., p. 255, Pl. XIV, figs 5, 6.
Arachnoidea Annandale, 1911, Rec. Ind. Mus., VI, p. 198.

1. *Arachnoidea protecta* n. sp. (Pl. III, figs 7—11).

378. E. Stat. 71. Makassar, 0—32 Metres; mud, sand with mud, coral.

Zooecia discrete, relatively large, surrounded at their edges by irregular processes. Mode of branching as in *Arachnidium*. Orifice borne on a long peristome, with thick chitinous walls, strongly quadrangular when the polypide is retracted. Collar unusually large. Tentacles not less than 16.

The genus *Arachnoidea* was described by MOORE (1903) from about 20 fathoms in Lake Tanganyika, the single species found being designated *A. ray-lankesteri*. A later description of the same species, also from Tanganyika material, has been given by ROUSSELET (1907). ANNANDALE (loc. cit.) has referred it to the Fam. Hislopiidae. LOPPENS [3]) considers *Arachnoidea* inseparable from *Arachnidium*.

The occurrence of a marine species which can be referred to MOORE's genus seems to me of particular interest. But the resemblances between the 'Siboga' specimen and those from Lake Tanganyika are too striking to be overlooked; and I feel no doubt that the forms from the two localities must be placed in the same genus. As MOORE pointed out, *Arachnoidea* closely resembles *Arachnidium* in its general characters; but I think he was justified in separating it from this genus by reason of the character of the peristome. In *Arachnidium* this part forms a rounded mammilla, as shown in figs 3—6, referring to *A. irregulare*. HINCKS accordingly compared the genus with an *Alcyonidium* having discrete zooecia. In *Arachnoidea*, on the contrary, the part in question is much elongated. Its wall is protected by a chitinous layer which shows no trace of the circular annulations in a relatively soft cuticle which were found in the preceding species. In the retracted state, the peristome is quadrangular, the actual orifice being perfectly square (fig. 11). It is true that in *Arachnidium fibrosum* Hincks [4]), the distal

1) THORNELY, L. R., 1905, p. 127.
2) The name as originally introduced is *Arachnoidia*. I propose to regard this as a *lapsus calami* for *Arachnoidea*.
3) LOPPENS, K., 1908, "Bry. d'Eau douce", Ann. Biol. lacustre, III, pp. 150, 154, 174.
4) HINCKS, T., 1880, p. 511.

part of the zooecium is said to have a similar character; but specimens sent to the British Museum (13. 7. 10. 4.) from Cullercoats, Northumberland, by Miss R. E. Roper[1]), and apparently referable to *A. fibrosum*, have an orifice which seems to be of the typical *Arachnidium* form; the appearance of an elongated tube being obvious only in those individuals in which there is some eversion of the kamptoderm.

The 'Siboga' specimens were growing on the surface of what seemed to be a fragment of the axis of an Alcyonarian. I did not succeed in removing them sufficiently completely to be able to describe the arrangement of the zooecia in any detail; but there appears to be no essential difference, in this respect, between the present species and *Arachnidium irregulare*. In the existence of marginal crenulations, the present form closely resembles *Arachnoidea ray-lankesteri*. The very large collar (figs 9, 10) distinguishes it from that species, and is the feature referred to in the specific name suggested.

When fully protruded the collar forms an elongated cone, the sides of which are but slightly divergent. It is supported by strong ribs, each of which ends distally in a strong tooth (fig. 10), which is not quite terminal but projects into the cavity of the collar, the distal edge of which is everted in such a way as to form a marked angle with the rest of the structure. In zooecia in which the peristome is not so long (fig. 8) the proximal end of the retracted collar may be seen projecting into the general zooecial cavity.

The specimens are not well enough preserved to allow me to describe the anatomy; but I have evidence that the tentacles are numerous and not less than 16 in number.

The measurements (in μ) of the specimens figured are as follows: — total length of the zooecium to the left of fig. 8, including its narrow proximal part, 2700; without this part, 750; breadth of the zooecium (fig. 11), 650; length of the peristome, when completely retracted, 400—700; diameter of the same part, 120; length of the collar, 370; diameter of the collar at its base, 75; at its distal end, 190; of the proximal part of the zooecia, 40—50.

A. protecta seems to be closely allied to *A. ray-lankesteri*. The marginal crenulations of the zooecium are not quite so marked, or so regular as in that species, in which, moreover, the peristome is less strongly chitinised and is not so quadrangular as in the 'Siboga' material. Rousselet, in the paper cited above, figures no collar; and I have been unable to satisfy myself of its existence in the specimens from Lake Tanganyika (Brit. Mus., 08. 5. 24. 9a, 9b, 11a—11c) described by that author. The differences in these parts seem to be a sufficient justification for describing the 'Siboga' specimens as the representatives of a new species.

Annandale[2]) has recently described a form to which he gave the name of *Platypolyzoon investigatoris* n. g., n. sp., from the telson of *Squilla investigatoris*, obtained off the S. W. coast of Arabia, in 110 fathoms; and considers that it is allied to *Arachnidium* or perhaps to *Arachnoidea*. In the great length of its peristome it resembles the latter genus, from which it differs in the characters of the attached part of the zooecium.

1) Roper, R. E., 1913. Dove Marine Laboratory, Cullercoats, Report for year ending June 1913. p. 53. Pl. II. figs 2. 2a.
2) Annandale, N., 1912. Rec. Ind. Mus. VII. Part II. Nº 13, p. 124.

Fam. NOLELLIDAE (new name).

Cylindroeciidae Hincks, 1880, "Hist. Brit. Mar. Pol.", p. 534.

If, as explained below, the familiar name *Cylindroecium* should be replaced by *Nolella* Gosse, it appears to follow that the Family-name Cylindroeciidae, used by HINCKS and other authors, should be replaced by Nolellidae, taken from the type-genus.

The form which I describe below as *Nolella annectens* is so similar to *Arachnoidea* on the one hand and to species of *Nolella* on the other hand that it is difficult to decide to which of the two genera it should be referred. In its young state (Pl. IV, fig. 1) this species may show a strong resemblance to *Paludicella*. Somewhat later, with a greater development of the peristome (fig. 8), the zooecium becomes very similar to *Arachnoidea*; while in its final state (fig. 3) it may be considered definitely a *Nolella*. In an intermediate condition of development it differs from *Arachnoidea* mainly in being less dilated in its adnate portion.

Nolella annectens thus supports the view that the Families Paludicellidae, Arachnidiidae and Nolellidae should be associated together as proposed by ROUSSELET [1]). WATERS [2]) is also inclined to regard *Arachnidium* as allied to *Nolella*.

The resemblance of *Victorella* to *Nolella* (*Cylindroecium*) was remarked by KRAEPELIN [3]); and this view has been supported by DELAGE and HÉROUARD [4]) and by LOPPENS [5]).

The Family Nolellidae is characterised by the great development of the peristomial part of the zooecium. This region is typically much elongated and its ectocyst frequently includes muddy particles. The adnate portion of the zooecium is represented by a delicate stolon-like tube and by the base of the peristome, into which it usually passes abruptly, although it more rarely dilates gradually as it approaches this part. The branching is of the cruciform type. Gizzard absent. In some cases the embryos are known to pass separately into hernia-like evaginations of the peristome.

The general structure of the zooecium in this Family is well shown in figures by CALVET [6]).

Nolella P. H. Gosse.

Nolella Gosse, 1855, Ann. Mag. Nat. Hist. (2) XVI, p. 35.
Nolella Gosse, 1856, "Man. Mar. Zool.", II, p. 21.
Cylindroecium Hincks, 1880, "Hist. Brit. Mar. Pol.", p. 535.

On p. 540 of his "British Marine Polyzoa", HINCKS mentions *Nolella stipata* Gosse as a doubtful species, which is "Probably referable to *Cylindroecium*". In his original account (not referred to by HINCKS) GOSSE gives the following diagnosis: —

1) ROUSSELET, C. F., 1907, "Zool. Res. Third Tanganyika Exp.", Proc. Zool. Soc. p. 252.
2) WATERS, A. W., 1910, p. 241.
3) KRAEPELIN, K., 1887, "Deutsch. Süsswass. Bry.", Abh. Naturw. Ver. Hamb., X, p. 168.
4) DELAGE, Y. and HÉROUARD, E., 1897, „Traite Zool. Concrète", V, p. 90.
5) LOPPENS, K., 1908, "Bry. d'eau douce", Ann. Biol. lacustre, III, p. 149.
6) CALVET, L., 1900, "Contr. Hist. Nat. Bry. Ect. Mar.", Trav. Inst. Zool. Univ. Montpellier, Mem. 8, Pl. VII, figs 12, 13; Pl. IX, figs 10, 11.

"Genus *Nolella* (mihi).
"Cells erect, subcylindrical, springing singly, but closely, from an undefined polymorphous "incrusting mat; tentacles eighteen, forming a bell. Name from *nola*, a little bell".

The zooecia of *N. stipata* are described as being about 1/36 inch long, whitish and sub-opaque; the opacity making it impossible to ascertain whether a gizzard is present or not. The number of tentacles is stated to distinguish it from all recognised genera except *Avenella*.

The emphasis laid by GOSSE on the number of the tentacles, taken in conjunction with his remarks on the opacity of the body-wall and with his figure (Pl. IV, fig. 29) leave little doubt in my own mind that the form described by him is identical with *Cylindroecium giganteum*, which HINCKS describes as possessing 18—20 tentacles. The conclusion that *Cylindroecium* must be regarded as a synonym of *Nolella* thus appears to me in the highest degree probable.

Nolella stipata had previously been noticed by BUSK [1]), with a reproduction of GOSSE'S figure, in his original account of *Farrella (Cylindroecium) gigantea*.

Representatives of the present genus have been described from Oriental waters by various authors; and it is probable that some of these belong to one or other of the two species here considered. In several of these cases no description or figure is published; and I must content myself with giving the following references to the accounts in question, without attempting to decide to what extent they correspond with the species described in this Report:

Cylindroecium papuense Kirkpatrick, 1888, "Pol. Port Phillip", Ann. Mag. Nat. Hist. (6) II, p. 20 (Victoria).

Cylindroecium giganteum Hincks, 1887, "Pol. Hydr. Mergui Archipelago", J. Linn. Soc., Zool., XXI, p. 128 (said to be indistinguishable from British specimens).

Cylindroecium giganteum Waters, 1910, "Rep. Mar. Biol. Sudanese Red Sea" "Bry. II", J. Linn. Soc., Zool., XXXI, p. 251 (diameter of stolon, 0.03—0.04 mm.).

Cylindroecium giganteum Thornely, 1912, "Mar. Pol. Ind. Ocean", Trans. Linn. Soc. (2) Zool., XV, Pt 1, p. 157 (no description).

Cylindroecium giganteum Waters, 1914, "Mar. Fauna Brit. E. Afr.", Proc. Zool. Soc., p. 854.

Cylindroecium dilatatum var., Kirkpatrick, 1890, "Hydr. Pol. China Sea", Ann. Mag. Nat. Hist. (6) V, p. 17 (no description; the mounted specimen (Brit. Mus. 89. 8. 21. 67.), from Tizard reef, has deteriorated to such an extent that no conclusions can be drawn from it).

Cylindroecium dilatatum Thornely, 1905, HERDMAN'S "Rep. Pearl Oyster Fish. G. of Manaar", Publ. by the Roy. Soc., Suppl. Rep. XXVI, "Polyzoa", p. 128 (no description).

Cylindroecium dilatatum Thornely, 1907, "Rep. Mar. Pol. Ind. Mus.". Rec. Ind. Mus., I, Pt 3, N° 13, p. 196 (spinous dilatations occur at the bases of the zooecia; — Mangalore, 26—31 fathoms).

Cylindroecium dilatatum Waters, 1910, t. cit., p. 251 (the zooecium has numerous fine latitudinal lines; tentacles about 20; diameter of stolon about 0.02 mm.).

1. *Nolella papuensis* Busk. (Pl. IV, figs 10—20).

Cylindroecium papuense Busk, 1886, Challenger Rep., Pt L, p. 38, Pl. VIII, fig. 2.

[2]) *322. A. Stat. 50. Bay of Badjo, W. Coast of Flores, 0—40 Metres; mud, sand and shells.
337. G. Stat. 71. Makassar, 0—32 Metres; mud, sand with mud, coral.

1) BUSK, G., 1856, „Zoophytology", Quart. J. Micr. Sci., IV, p. 94, Pl. V, fig. 4 (= *N. stipata*).
2) The specimens marked * were not examined as microscopical preparations.

56. B. Stat. 80. Borneo Bank, 2° 25' S., 117° 43' E., 40—50 Metres; fine coral-sand.
*465. B. Stat. 91. Muaras Reef, E. coast of Borneo, 0—54 Metres; hard coral-sand, coral (on a Sponge).
88. B. Stat. 115. E. side of Pajunga Island, Kwandang Bay; reef-exploration (on *Porites*).
108. P. Stat. 144. Anchorage N. of Salomakiee (Damar) Island, 45 Metres; coral-bottom and Lithothamnion (on a *Hydroid*).
*396. L. Stat. 162. Between Loslos and Broken Islands, W. coast of Salawatti, 18 Metres; coarse and fine sand with clay and shells.
130. H. } Stat. 164. 1° 42'.5 S., 130° 47'.5 E., 32 Metres; sand, small stones and shells. (130.0 is
130. O. } on slide 130. M[2], *Bowerbankia ? imbricata*).
*566. G. Stat. 204. Between Islands of Wowoni and Buton, 75—94 Metres; sand with dead shells.
376. A. Stat. 213. Saleyer Anchorage. 0—36 Metres; coral-reefs, mud and mud with sand. (On slides 376. B.[3], B.[4], *Arachnidium irregulare*).
276. A. } Stat. 250. Anchorage off Kilsuin, W. coast of Kur Island, 20—45 Metres; coral and
*279. E. } Lithothamnion.
195. C. Stat. 274. 5° 28.2 S., 134° 53'.9 E., 57 Metres; sand and shells, stones.

Zooecia varying greatly in size, according to the state of their development, the ectocyst usually striated transversely and including numerous particles of fine mud. Adnate portion represented merely by the stolon-like proximal portion and by the base of the cylindrical portion, which consists almost entirely of the peristome. This base gives off four or more stolon-like threads, which may bifurcate after a time and ultimately pass into new peristomes. Fertile zooecia containing several embryos near their distal end, and often very irregular in outline in the region of the ovary or embryos.

The specific differences between the forms which have been referred to *Nolella* or *Cylindroecium* are at present very obscure; particularly if I am right in believing that the same species may be extremely variable, in respect of the size of the zooecia, according to its degree of development. I have referred the present species to *N. papuensis* Busk mainly on account of the identity in locality; although an examination of Busk's specimens in the British Museum (87. 12. 9. 941. and 99. 7. 1. 4435.) leads me to think that the reference is correct. But the question whether *N. papuensis* is synonymous with *N. gigantea* is so difficult that I am not prepared to answer it. The fertile zooecia of the present species have a close resemblance to those described by Prouho[1]), apparently from Banyuls, under the name of *C. dilatatum*. But, from the examination of Hincks' type-specimen (Brit. Mus., 99. 5. 1. 1510), unfortunately a dry specimen from which little can be made out, I am not confident that Prouho's reference was correct. The 'Siboga' specimens also show considerable resemblance to *N. gigantea* Busk[2]), the type from Tenby (S. Wales), in the British Museum (99. 7. 1. 4434.) being much like the large 'Siboga' specimens. Busk does not mention the embryos, several of which are, however, present in his specimen, although they appear to contain more yolk than in the 'Siboga' form. Another slide (99. 7. 1. 4426) in the British Museum, also from Tenby, was labelled by Busk "*Cylindroecium giganteum* var., seu *C. dilatatum*". The zooecia are not more than half the length of those on the other Tenby slide; but this may merely indicate that the British species is as variable in length as the Malay form.

1) Prouho, H., 1892. Arch. Zool. Exp. (2) X, p. 626, Pl. XXIV, figs 14—17.
2) Busk, G., 1856, "Zoophytology", Quart. J. Micr. Sci., IV, p. 93, figs 1—3.

I have had great difficulty in deciding whether all the specimens indicated above belong to a single species or not. But as I have been unable to find satisfactory distinguishing features, it seems best to consider that only one species is represented; and that the differences observed depend on the state of development.

This conclusion is supported by the fact that the zooecia on the same slide, and almost certainly belonging to the same species, vary within wide limits. The young zooecia are relatively short; while the old ones may be extremely long[1]. Some of the oldest zooecia, indicated as such by the large amount of mud in their ectocyst, are, however, not longer than many of the young individuals. The evidence obtained points to the conclusion that on the degeneration of the polypide the zooecia may shorten considerably, partly by contraction and probably in part by the loss of the distal end of the peristome. In some of these cases (fig. 10) regeneration of the zooecium has occurred, the younger part being sharply marked off from the older part, not only by a distinct line but also by having an ectocyst with few foreign inclusions. It thus appears that in some cases the zooecium, after reaching a considerable length, may become shorter on losing its polypide, and may then grow longer once more when regeneration takes place. In other cases there is no great shortening when the polypide degenerates. But as this process involves the loss of the vestibule, a new vestibule must be regenerated; and this is probably accompanied by an increase in length of the peristome. Embryos have only been found in large zooecia; a fact which may indicate that several generations of polypides have been present, the zooecium having increased in size with each such occurrence. The extent of the differences observed is brought out by the series of measurements recorded below.

The peristomes are for the most part cylindrical along their whole course. The orifice is usually square; but this is less obvious than in the following species (*N. annectens*). The vestibule is rather short. The collar is presumably present, but I have not obtained certain evidence of its existence. If present it must be very delicate, and thus strikingly different from that of *N. annectens*. The tentacles are about 18 in number, and are either quite straight during retraction or are bent at their distal ends (fig. 19). The oesophagus is short, and is succeeded by a distinct proventriculus. The caecum of the stomach is long. Strong parieto-vaginal muscles are inserted into the vestibule; and parietal muscles are present, their fibres being generally arranged two in a group.

Daughter-zooecia, commencing as stolon-like threads, are given off from the base of the cylindrical part of the zooecium. Four are often present, arranged in the typical cruciform manner. But a complication is introduced by the fact that the "stolons" may bifurcate. If the division takes place at their point of origin, the zooecium may appear to give rise to a larger number of "stolons", up to as many as eight. Each such tube is separated from the parent-zooecium by a diaphragm, although the tube which represents the proximal end of the parent-zooecium may show no diaphragm. The zooecium in such cases consists of a thread-like proximal

1) A similar variability has been noticed by SMITT (1865. "Om Hafs-Bry. utveckl. och Fettkr.", Öfv. K. Vet.-Ak. Forh., Årg. 22. p. 30: and 1866, "Krit. forteckn." II. Årg. 23, p. 525. Pl. XIII, fig. 39), in the species of the same genus described by him as *Farrella* and *Vesicularia fusca*.

portion, dilating into what has been described above as the adnate portion of the peristome, which gives off other "stolons".

Some of the 'Siboga' specimens show embryos, in the situation which has been indicated by previous authors, and in particular by PROUHO [1]). The embryos develop, according to this author, in the body-cavity, at the distal end of a zooecium, three or four being present at one time. When the larva has reached its full development, it pushes out the body-wall of the zooecium and thus gives rise to a hernia-like protrusion, into which it passes. The outgrowth eventually bursts, the larva escaping directly to the exterior. Small tubes projecting from the body-wall may remain as indications of the spots where larvae have escaped in this way. PROUHO's account appears to be based on the actual observation of the escape of the living larvae.

Specimens which agree closely with PROUHO's description are figured in this Report (Pl. IV, figs 10—12, 17). In fig. 10 an additional length of peristome has been added by regeneration. At the distal end of the older part an egg is visible; while at the distal end of the regenerated part there are two embryos. In fig. 12 three embryos occur in a similar position. In fig. 17 two embryos are seen, near the middle of the length of the zooecium, each enclosed in a thin hernia-like protrusion of the body-wall. It may be assumed, in view of the evidence brought forward by PROUHO, that these would shortly have escaped to the exterior. In fig. 11 there is again evidence of regeneration of the distal end of the zooecium. The younger part contains an embryo distally; while more proximally it shows irregularities in its outline, indicating that embryos have escaped in this region. An egg is present in this part, so that the process would probably have been repeated here.

Figs 19 and 20 possibly represent a different species. The vestibule contains several rounded bodies which may be eggs. I cannot obtain certain evidence on this point; but if the bodies in question are really of this nature, the specimen (108. P.) probably belongs to a distinct species, characterised by producing eggs which pass into the vestibule, either undergoing their development there or reaching the exterior and developing in the water outside, as in certain other Polyzoa (*Membranipora pilosa*, *Alcyonidium albidum*, *Hypophorella expansa*) which have been described by PROUHO [2]). To this list of species, in which the egg is laid and undergoes its development in the external water, may be added *Paludicella articulata* (BRAEM, alluded to above, p. 44); while CALVET [3]) states that this is the case in *Alcyonidium cellarioides*, *Pherusa tubulosa* and *Flustrella hispida*. It may, however, be remarked that the inclusion of *Pherusa* in this list is directly opposed to the account which has been given by PROUHO [4]), who states that the embryos develop in the tentacle-sheath of an atrophied polypide; and that the development of the embryo of *Flustrella hispida* takes place inside the zooecium, as I have myself observed; while Mrs PACE [5]) has published an account of this species which shows that the position in which the embryos develop is identical with that described by PROUHO for *Pherusa*.

1) PROUHO, H., 1892. "Contr. Hist. Bry.". Arch. Zool. Exp. (2) X, p. 626, Pl. XXIV, figs 14—17.
2) Ibid., t. cit., p. 607. and elsewhere.
3) CALVET, L., 1900, "Contr. Hist. Nat. Bry. Ect. Mar.". Trav. Inst. Zool. Univ. Montpellier, N. S., Mem. 8, p. 260.
4) PROUHO, H., t. cit., p. 565.
5) PACE, R. M., 1906. "Early stages Dev. *Flustrella hispida*". Quart. J. Micr. Sci., L, p. 451.

The following measurements, in μ, will give some idea of the great differences in the size of the zooecia, in different conditions of their growth:

	337. G.	276. A.	130. H.	108. P.
A. Length of young zooecium.			900 1520	1055 1330
B. Length of old zooecium, with functional polypide.		2590 2800	3280 3680 3920	
C. Length of old zooecium, with degenerated polypide.	800 1520	1010	370 1120	
D. Length of old zooecium, containing embryos.	3135 3360			
E. Greatest diameter of young zooecium (A).			190 175	175 175
F. Greatest diameter of old zooecium (B).		175 160	255 240 290	
G. Greatest diameter of old zooecium (C).	225 240	145	190 255	
H. Greatest diameter of old zooecium (D).	320 335			

The measurements given under E—H belong to the same zooecia as those recorded in A—D.

The longest zooecium measured (130. H.) is nearly 4 mm. long [1]). An old zooecium which has lost its polypide, and probably the distal end of its peristome, from the same Station, is no more than 370 μ in length; which is less than that of the young zooecia. The specimens with embryos (337. G.) are both more than 3 mm. long. 108. P., which consists entirely of small zooecia, gives measurements which fall well within the limits of the young zooecia in 130. H. The greatest diameters recorded are from zooecia with embryos (337. G.).

2. *Nolella annectens* n. sp. (Pl. IV, figs 1—9).

380. I. Stat. 47. Bay of Bima, 55 Metres; mud with patches of fine coral-sand.

Zooecia extremely variable in form; with or without a proximal stolon-like portion. The basal adnate portion is very variable in size and shape, and the free tubular part (peristome) is equally variable in length and in the angle it makes with the adnate portion. The peristome

1) *Cylindroecium altum*, described by KIRKPATRICK (1888, Ann. Mag. Nat. Hist. (6) II. p. 19) from Port Phillip, Victoria, reaches a length of 4.6 mm.

becomes quadrangular distally, with a thick cuticle, and the orifice is square. Collar very strong. Three buds are given off typically from each zooecium; — one from the distal end of the adnate part, and one from each side in the same region (exceptionally two on one side).

The specimens here described were deeply embedded in the substance of a Monaxonid Sponge, which had to be dissected away in order to expose the Polyzoon. The variable character of the peristomial region was probably the result of the conditions under which the Polyzoon was growing; since the length and direction of the peristome would no doubt be dependent on the extent to which the zooecium was immersed in the Sponge.

In the youngest specimen drawn (fig. 2), the basal dilatation is represented by a triangular swelling, in which a young polypide-bud is present. The terminal bud is already cut off by a septum from the parent-zooecium. The lateral bud of one side is represented by a large pointed process in which no septum has yet appeared; while that of the other side is a smaller process of the same kind which has not developed symmetrically with the other one. The peristome has not yet made its appearance.

In a later stage (fig. 1) the zooecium is *Paludicella*-like in shape; being represented almost entirely by a pear-shaped portion which is continuous proximally with a very long tube, of stolon-like form. The tube is, however, not a stolon in the proper sense, since it gives off no buds; but is to be regarded, as in other similar cases, merely as the narrow proximal end of the zooecium. The peristome is a short rounded elevation, much like the corresponding part of a *Paludicella*-zooecium. This specimen shows a terminal bud, but only one lateral bud.

Fig. 8 represents a fully developed zooecium, in which the peristome is still very short, but has the quadrangular form which is characteristic of the fully developed state. It will be observed that this individual has no narrow proximal portion. The terminal and lateral buds have been developed normally; and it will be seen that the lateral buds originate in the region of the distal part of the adnate portion; an arrangement which may be noticed in other drawings. In some cases, however, as in fig. 3, the adnate part is hardly developed, and the lateral zooecia then appear to be given off from the base of a long tubular, erect zooecium, as in more typical species of *Nolella*. The varying length of the part which may be considered adnate is responsible for the varying position of the lateral buds, which come off from the distal part of this region.

Figs 6, 7, 4, 5 show various conditions of the peristome, intermediate between figs 8 and 3. The peristome may either come off at a distinct angle from the adnate part (fig. 7) or may prolong its direction, with only a slight curve (fig. 5). In fig. 4 the zooecium is pear-shaped: the broader part being represented by the adnate portion of the zooecium and the narrower end by the peristome. In all these cases, the quadrangular shape of the distal part of the peristome is well marked, and is associated with a thickening of the cuticle in this region.

With the degeneration of the polypide further changes may take place. The quadrangular form of the peristome is lost and the kamptoderm becomes everted as far as the base of the collar, which projects freely to the exterior, though with some appearance of undergoing degeneration (fig. 9). The distal end of the zooecium is now rounded. In others the collar has been lost, and has probably been thrown off [1]), all traces of the vestibule having also disappeared. Some of these old zooecia are considerably longer than the individual shown in fig. 3, and a polypide-bud, or a young polypide, may be visible in their interior. It is natural to suppose that this would lead, in course of time, to the reconstitution of a normal orifice; and some of the variability in the length of the peristome may be the result of the successive formation of one or two polypides: each such formation being accompanied by an increase in length of the zooecium.

Fig. 4 shows the general structure of a zooecium. The strong collar is well seen in its retracted position, and the vestibule is provided with very strong parieto-vaginal muscles, running obliquely from the body-wall into the vestibule. The tentacles are moderately long; and they appear to be not less than 16 in number. The examination of other specimens shows that they are not less than 20, in some cases at least. The pharynx is short, and, in its retracted condition, lies close to the proximal end of the zooecium. The oesophagus is of great length and passes distally, to about the region of the middle of the bundle of tentacles. Here it opens into a large proventriculus, which may represent the gizzard of some other Ctenostomes. The proportions of this limb of the alimentary canal are different from those shown by CALVET [2]), in a longitudinal section of *N. dilatata*. The stomach and its caecum are large, and the rectum is slender. A series of strong parietal muscles is present, on each side, in the proximal end of the zooecium. The examination of other specimens shows that the fibres are arranged in groups.

The arrangement of the alimentary canal shown in fig. 4 is, however, not constant; and in fig. 7 it may be seen that the apex of the retracted caecum is directed distally. In some of the very long zooecia above described the alimentary canal has a U-like form, in correlation with the large amount of space available. The great elongation of the oesophagus is a characteristic feature of the present species.

The variability in the size and relative proportions of the parts of the zooecia will be brought out by thé following measurements, in μ:

Fig. 1; total length of the zooecium, including its narrow proximal part, measured along the curve, 4000; greatest diameter, 240; diameter of the narrow proximal portion, 40—60.
Fig. 3; total length, 2600; diameter of the distal half of the peristome, 150.
Fig. 4; total length, 1670; greatest diameter, 350; diameter of the distal end, 120.
(Not figured); total length of an old zooecium which has no narrow proximal part, and in which the polypide has degenerated, 5920.
Length of peristomes, measured from the angle formed with the terminal daughter-zooecium: — Fig. 1, 180; Fig. 8, 220; Fig. 7, 570; Fig. 4, 1000; Fig. 5, 1050; Fig. 3, 2150.

In several of its characters the present species shows a considerable resemblance to

1) BRAEM (1914, "Knosp. v. *Paludicella*". Arch. f. Hydrobiol. IX. pp. 539. 540) has described the throwing off of the tentacular apparatus, or a part of it, on the degeneration of the polypide in *Paludicella*.

2) CALVET, L., 1900, t. cit., Pl. VII. fig. 12.

Arachnoidea protecta; and this is specially obvious in an intermediate state of development. When the zooecia have reached their highest development they are hardly distinguishable from a typical *Nolella*. In the young condition the zooecium may be *Paludicella*-like.

Group C. Vesicularina Johnston.

Vesicularina (pars). Johnston, 1847, "Hist. Brit. Zooph.", Ed. 2, p. 367.
Vesicularina Waters, 1910, "Rep. Mar. Biol. Sud. Red Sea", "Bry. II", J. Linn. Soc., Zool., XXXI, p. 240.

The genera included by Johnston in the Vesicularina were *Serialaria* (*Amathia*), *Vesicularia*, *Beania*, *Valkeria*, *Bowerbankia* and *Farrella*. Of these *Beania* is now placed among the Cheilostomata, while *Valkeria* and *Farrella* have been transferred by Waters to the next division of the Ctenostomata. With these removals the Group remains almost identical with Waters's use of the name.

The Vesicularina may be defined as consisting of those Ctenostomes in which there is a relatively thick, branching, tubular axis, to which the zooecia are directly attached, by a contracted, or an expanded base. The axis is usually divided by diaphragms into internodes, each of which gives off a number of zooecia. Budding only from the axis. The number of tentacles is commonly 8—10. Gizzard present in most of the genera, and perhaps in all.

Family Vesiculariidae Johnston.

Vesiculariadae (pars), Johnston, 1838, "Hist. Brit. Zooph.", Ed. I, p. 247.
Vesiculariadae (pars), Johnston, 1847, Do, Ed. 2, p. 367.
Vesiculariadae (pars), Gray, 1848, "List. Brit. An. Brit. Mus.", I, pp. 94, 145.
Vesiculariidae Hincks, 1880, "Hist. Brit. Mar. Pol.", p. 512.

The Family, as originally introduced by Johnston, included *Vesicularia*, *Serialaria*, *Valkeria* and *Bowerbankia*. In the second Edition of his work the list of genera is identical with that given above for the Vesicularina. Hincks included *Avenella* in it; — an association on which I am not able to express a positive opinion. *Zoobotryon* doubtless belongs to this family.

As defined by Hincks, the Family consists of Ctenostomes having "Zooecia contracted "below, not closely united to the stem at the base, deciduous, destitute of a membranous area. Zoarium repent or erect". Part of this definition must certainly be excluded, since the zooecia in *Amathia* are not contracted proximally nor individually deciduous. The definition of the Family may provisionally be given as identical with that of the Vesicularina, since it is at present uncertain whether any of the genera referable to the group deserve separate Family rank. *Farrella*, which may belong to this Family, is believed to have no gizzard, a structure which is known to occur in most of the other genera.

In the group Paludicellea the appearance of a "stolon", in certain genera, is due to the fact that the proximal ends of the zooecia are much narrower than the expanded distal ends. In the Vesiculariidae nothing of the kind occurs. The axis is sharply marked off from the zooecia to which it gives rise; and even if its internodes are to be regarded as specially modified zooecia — a view which has been supported by some authors — there is no very direct evidence that this is the case, beyond the fact that the body-wall and the body-cavity of the axis-internodes do not differ in structure from the corresponding parts in the zooecia. It appears to me that the natural view to take of these internodes is that they represent parts of the colony which are not divided into zooecia, rather than that each of them is to be regarded as the morphological equivalent of a single zooecium. It is characteristic of the Vesiculariidae that each internode gives rise to a number of zooecia, the arrangement of which is distinctive of the several genera.

Vesicularia J. V. Thompson.

Vesicularia J. V. Thompson (pars), 1830, "Zool. Res.", N° IV, Mem. V, p. 97.
Vesicularia Farre, 1837, Phil. Trans., p. 402.
Vesicularia Hincks, 1880, "Hist. Brit. Mar. Pol.", p. 512.

The genus *Vesicularia* was introduced by Thompson (1830), who included in it *V. cuscuta*, *V. spinosa*, *V. pustulosa* and *V. imbricata*. Of these, the first was referable to Fleming's earlier genus *Valkeria*. Farre, in 1837, pointed out that *V. spinosa* differs from *V. cuscuta* in possessing a gizzard; and *Sertularia spinosa* Linn. has accordingly become the genotype of *Vesicularia*. The other two species included in the genus by Thompson are both referable to *Bowerbankia*.

Vesicularia, as now understood, (cf. Hincks, 1880) includes species with ovate, deciduous, distant zooecia, contracted at the base, the polypides possessing a gizzard. In this restricted form it appears to include but few species.

Busk added two species in the 'Challenger' Report: — *V. papuensis* from 28 fathoms, off the S. coast of New Guinea, and *V. trichotoma* from Bass Straits. The former at least is included in the 'Siboga' Collection.

1. *Vesicularia papuensis* Busk. (Pl. VI, figs 1—4).

Vesicularia papuensis Busk, 1886, Challenger Rep., Pt L, p. 36, Pl. VIII, figs 1—1*c*.
Vesicularia trichotoma Busk, Do, p. 37, Pl. VIII, figs 4—4*b*.

307. A. Stat. 273. Anchorage off Pulu Jedan, E. coast of Aru Islands, 13 Metres; sand and shells.

Zoarium reaching a length of 60 mm. Stem attached by a tuft of delicate rootlets, which become very fine by subdivision. Main stem covered by a thick cuticle, angulated at the nodes, the angulation being alternately on opposite sides. Each internode gives off two ordinary branches and sometimes a third which forms rootlets only. Stem jointed immediately on the distal side of the node; a similar joint occurring at the base of each branch. The branches subdivide somewhat differently from the main stem, as the principal axis is not prolonged, and the branching thus appears to be simply dichotomous. Zooecia very readily lost, arranged in two alternating series, on one aspect of the branch. Polypide possessing a gizzard and 8 tentacles. Vestibule and collar rather short.

In the main stem the two branches are both given off on the side towards which the angle of the stem is directed. The third branch, which gives rise to rootlets, may come off opposite the two ordinary branches (and therefore from the re-entrant angle of the stem), or quite asymmetrically. At the division of the branches the main stem is suppressed at each node. so that the two branches of the new order are alone left. A branch may bifurcate successively 3—5 times. The main stem is traversed by a diaphragm, possessing a central perforation, immediately beyond the node; and a joint is formed in this position by a diminution of the thickness of the cuticle (fig. 1). A similar development of a diaphragm and of a joint is seen at the origin of each branch; and the rootlets are also provided with a diaphragm at their points of bifurcation. The main stem usually has no zooecia, though a few may occur; but the presence of scars, sometimes in the form of small papillae (fig. 1), indicates that zooecia have been borne, in those positions, at an earlier period in the life of the colony.

The branches, on the contrary, are provided on one of their aspects with a double series of zooecia, sometimes represented merely by scars (fig. 1), which have a definite alternate arrangement. A single internode usually bears from 3 to 5 pairs of zooecia, although the number of zooecia is sometimes odd.

The zooecia are constricted at their base, as in other species of the genus, and are thus readily deciduous. I have not found any evidence that a new zooecium can be developed from an old scar [1]).

In form the zooecia are sub-cylindrical, the broadest point being in their proximal half (figs 2, 4). They agree precisely with those shown by Busk in his fig. 1 *b* (Pl. VIII) except that they become quadrangular towards the orifice; which, in the retracted condition, is quite square. This condition is not alluded to in Busk's description. The tentacles are 8 in number. The pharynx is rather large and is succeeded by a narrow, elongated oesophagus, which (in the retracted state) passes distally and then opens into a distinct gizzard, stated by Busk to be absent. The stomach and its caecum are large. Parietal muscles are present in several groups, usually of two fibres each.

The following measurements, in μ, of the several parts of the colony agree closely with those recorded by Busk:

Length of an internode of the main stem, 1900; diameter, 250.
Length of an internode of a branch, . . . 1100; diameter, 100—180.
Length of a zooecium, 480; greatest diameter, 150.

A specimen from Japan, in the Collection of the University Museum of Zoology at Cambridge [2]), is certainly referable to the present genus, but it appears to belong to a distinct species, so far as can be ascertained from the mounted slide, which is not a very successful preparation. The zooecia are distant from one another, the interspaces being nearly equal to two

1) Levinsen ("Regen. totale des Bry.", Bull. Acad. Roy. Sci. Danemark. Ann. 1907, N° 4, p. 152) has observed this regeneration in *Vesicularia* and *Bowerbankia*.

2) Off Tokyo, 53 fathoms. A. Owston Coll., Reg. June 23. 1902.

diameters of a zooecium. They thus appear to be arranged in a single row along the branch, and the alternate disposition is not obvious. The ends of the branches are rounded or truncate.

V. spinosa, the type-species, is distinguished by having "spinous" ends to the branches, composed of small barren internodes which are acutely pointed. The zooecia are not obviously paired, but occur in what looks like a single row, three being commonly developed by each internode, at considerable distances apart. In this respect, and in the apparently uniserial arrangement, it agrees with the Japanese specimen.

In two points — the character of the branching and the existence of a gizzard — the account given above differs from Busk's description. But I have convinced myself, by a comparison with the original material, that the 'Siboga' specimens, which are from a locality very near that from which *V. papuensis* was first described, really belong to Busk's species; and indeed that they agree extremely closely with his specimens. The type-material, in the British Museum, consists of a specimen, 87. 12. 9. 938, in spirit; and a slide, 87. 12. 9. 937, which was no doubt prepared from the spirit-specimen. In describing *V. trichotoma*, which immediately succeeds *V. papuensis* in the 'Challenger' Report (p. 37), Busk emphasises the trichotomous division of the primary branches as a peculiarity distinctive of the former species; and therefore as a difference between it and *V. papuensis*, in which the zoarium is said to branch dichotomously in one plane. It may be inferred with some confidence that Busk wrongly assumed the mode of branching visible in the mounted slide of *V. papuensis* (which shows only a lateral branch of the colony) to be the only mode occurring in the colony. But a reference to the spirit-specimen shows that in the main stem the branching of *V. papuensis* is as trichotomous as in the 'Siboga' specimen. The stem is in fact angulated at the nodes, from each of which a pair of divergent branches, not in one plane, are given off. In some of the nodes the stem might appear to dichotomise, if examined superficially; but on closer inspection it is seen that in these cases one of the two "branches" has a thick cuticle and in other respects shows itself to be the prolongation of the stem. The other branch has the thinner cuticle and the simple dichotomous mode of dividing which characterise the lateral branches in general.

With regard to the second point, the mounted slide, on which Busk probably relied, does not show the gizzard convincingly. But the zooecia of the spirit-specimen are sufficiently transparent to allow the gizzard to be seen quite distinctly. It is thus seen that *V. papuensis* conforms to the generic diagnosis given by most authors, in possessing a gizzard.

V. trichotoma is represented in the British Museum Collection by three slides (87. 12. 9. 939; 99. 7. 1. 4307; 99. 7. 1. 4310) which have unfortunately suffered greatly by the drying up of the medium in which the specimens were mounted. The trichotomous branching described by Busk is well seen, however, in those parts of the colony in which the stem is covered by a thick chitinous ectocyst. The terminal branches are "furcate", as Busk stated; and there is indeed no obvious difference between these forms and *V. papuensis*. The greater diameter of the stems mentioned by Busk as a distinctive feature of *V. trichotoma* seems to me also without much significance; since, as in the type of *V. papuensis*, the diameter becomes less in passing from the proximal to the distal parts of the colony. The balance of evidence appears to me in favour of regarding *V. trichotoma* as a synonym of *V. papuensis*.

Amathia Lamx.

Amathia Lamouroux, 1812 [1]), "Extr. mém. class. Pol. Cor. non entièrement pierreux", Nouv. Bull. Sci. Soc. Philomat. Paris, III, p. 184.
Amathia Lamouroux, 1816, "Hist. Pol. Cor. Flex.", p. 157.
Amathia Lamouroux, 1821, "Exp. Méth.", p. 10.
Amathia Lamouroux, 1824, "Encycl. Méthod.", "Zooph.", p. 42.
Amathia Waters, 1910, "Rep. Mar. Biol. Sud. Red Sea", "Bry. II", J. Linn. Soc., Zool. XXXI, p. 242.
Serialaria Lamarck, 1816, "Hist. Nat. An. sans Vert.", II, p. 129.

The genus *Amathia* has formed the subject of special Memoirs by Tenison-Woods [2]) and MacGillivray [3]); the former author giving a valuable account of its history, and the latter describing a number of Australian species. It is well represented on the Australian coast, but the 'Siboga' collection includes only two species.

1. *Amathia convoluta* Lamx. (Pl. V, figs. 1—5).

Amathia convoluta Lamouroux, 1816, t. cit., p. 160.
Amathia convoluta Lamouroux, 1824, t. cit., p. 44.
Amathia convoluta Tenisoon-Woods, 1880, t. cit., p. 100.
Amathia convoluta MacGillivray, 1895, t. cit., p. 133, Pl. A, figs 3—3*b*.
Serialaria crispa Lamarck, 1816, t. cit., p. 131 (fide Lamouroux, 1824, who gives *S. convoluta* Lamk as a synonym of *A. spiralis* Lamx).
Amathia crispa Pergens, 1887, "Contr. Hist. Bry. et Hydr. récents", Ann. Soc. Roy. Malacol. Belgique, XXII, Bull. des Séances, p. XC (= *Sirinx circumplicata* Desmarest and Lesueur, p. LXXXVIII).
Amathia spiralis Busk, 1886 (nec Lamx), Challenger Rep., Pt L, p. 34, Pl. VI, figs 2—2*b*.
Amathia semispiralis Busk, 1886, t. cit., p. 36, Pl. VIII, figs 3—3*b*.
Amathia semispiralis? Waters, 1887, "Bry. N. S. Wales", Pt III, Ann. Mag. Nat. Hist. (5), XX, p. 264.
?*Amathia tortuosa* Busk, 1886 (nec Tenison-Woods), t. cit., p. 34, Pl. VI, figs 1—1*b* (regarded by Waters, 1910, t. cit., p. 242, as identical with *A. convoluta*).
Amathia tortuosa Kirkpatrick, 1890, "Hydr. Pol. Torres Straits", Proc. R. Dublin Soc. (N. S.), VI, p. 612.

The following records may belong to this species; but the amount of information given is insufficient to enable any certain statement to be made: —

Amathia convoluta Haswell, 1881, "Pol. Queensland Coast", Proc. Linn. Soc. N. S. Wales, V, p. 43.
Amathia convoluta Whitelegge, 1889 [1890], "List Mar. & Fr.-water Inv. Fauna Port Jackson", J. Proc. R. Soc. N. S. Wales, XXIII, Pt II, p. 292.

1) Miss Jelly (1889, p. 279) and Nickles and Bassler (1900, p. 510), in their bibliographical lists, mention the title of a paper, without further reference, supposed to have been published by Lamouroux in 1910; and Tenison-Woods (1880, p. 97) gives the title in more detail. This paper appears not to exist. It is true that Lamouroux himself (1824, p. 43) states that he "proposed" the genus *Amathia* in 1910: but in his "Histoire des Pol. Cor. Flex.", 1816, p. 187, he gives 1812, with the reference cited above, as the date of the introduction of that genus: and in the Preface (p. VI) of the same work he explains that his memoir was presented to the French Academy in 1810, but actually appeared two years later (1812).

2) Tenison-Woods, J. E., 1880. "On the Genus Amathia". Trans. Proc. R. Soc. Vict., XVI, p. 97.

3) MacGillivray, P. H., 1895, "On the Australian Species of Amathia". Proc. R. Soc. Vict. (N. S.) VII, p. 131.

298. A. } Stat. 273. Off Pulu Jedan, E. coast of Aru Islands, 13 Metres; sand and shells.
544. A. }
194. D. } Stat. 274. 5° 28'.2 S., 134° 53'.9 E., 57 Metres; sand and shells, stones.
198. A. }
126. A. } Stat. 164. 1° 42.5 S., 130° 47.5 E., 32 Metres; sand, small stones and shells.
507. B. }
(sp. ?) 67. C. Stat. 99. Anchorage off N. Ubian, 16—23 Metres; Lithothamnion-bottom.

also the following specimens, in the Mus. Zool., Cambridge: —

T. S. 100. } Torres Straits, A. C. HADDON Coll., Reg. Feb. 24, 1898.
T. S. 201. }
Queensland, Holborn Island, Port Denison. From the remains of W. A. HASWELL's Coll., pres. by the Australian Mus., Reg. Oct. 23, 1899.

Zoarium large, erect, well branched, reaching a length of at least 132 mm. Stem thick at its base, where it is strengthened by rootlets given off at various points, the whole complex here reaching a thickness of 10 mm. The ordinary internodes, without the addition of rootlets, measure about 400—550 μ in diameter. Zooecia biserial, arranged in an open spiral curving round the stem, a considerable part of which is exposed. Each group of zooecia forms, as a rule, from $1^1/_2$ to 2 complete turns of the spiral, seldom as many as $2^1/_2$ turns. A thick diaphragm typically occurs at the distal end of each group of zooecia, a short interval separating the group from its successor. In branches which have reached the limit of their growth a spiral series may be broken up into several separate groups, each of a few pairs of zooecia, and isolated from one another by a considerable interval of bare stem. A branch is given off, on one side only, immediately on the proximal side of a stem-diaphragm; successive branches being alternate and on opposite sides of the stem. The zooecia are completely connate along their whole length when the kamptoderm is fully invaginated, and the edge of the entire series then forms an angular groove, the deepest part of which corresponds with the line separating the two series of zooecia, the outer walls of which project so as to form two sharp ridges bounding the groove. The oral wall of the zooecium thus slopes downwards into the groove; and the orifice is situated on the distal part of the flat surface so constituted. In transverse section the zooecium is much broader than long, and the basal attachment to the stem is thus oblong, the two longer sides being the proximal and distal ones, the two series usually interdigitating. Polypides with 8 tentacles and a gizzard.

The present species, which has a considerable resemblance to the Mediterranean *A. semiconvoluta* Lamx, as figured by HELLER [1]), is a robust one, and is characterised by possessing a nearly continuous spiral of zooecia, which is, however, broken up into groups by distinct intervals. The spiral is arranged in such a way as to leave a considerable part of the thick stem exposed to view. The stem is divided by stout diaphragms, perforated at their centre, into internodes, each of which corresponds with a single group of zooecia. In rare instances a diaphragm may fail to develop. The specimen 198. A. appears at first sight to have unusually long internodes, since an interval of as much as 65 mm. may occur between two successive

1) HELLER, C., 1867. "Bry. Adriat. Meeres", Verh. k. k. zool.-bot. Ges., XVII, p. 127. Pl. V, figs 1, 2.

branches. But the occurrence of branch-scars and of diaphragms shows that the internodes are really of the typical length; and that branches have either failed to develop or have been lost. When the stem has reached a certain age, a joint is formed in the region of the diaphragm, and a similar joint occurs at the base of the branch.

The basal view (fig. 4) of the zooecia is very characteristic. The zooecia of the two series are usually alternate, with interdigitating inner walls; but are sometimes opposite, the two zooecia being then separated by a wall nearly at right angles to the proximal and distal walls. At about the middle of the basal surface occurs a single communication-pore, by which the funicular tissue of the zooecium is continuous with that of the stem. On the outer side of the pore, the basal surface gives origin to a circular group of retractor muscles of the polypide. In the retracted condition, in which the specimens are preserved, the muscle-fibres appear very thick and short; being contracted to such an extent that the lophophore lies close to the basal wall. In parts near the growing tips many of the young polypide-buds are so placed that their lophophore is visible from its distal side (fig. 5); and the young tentacles are clearly seen to be 8 in number. In this stage of development the polypide-bud lies close to the basal and outer side of the zooecium, which has already acquired nearly its full length. The lophophore lies in the same position as that described above for the fully developed, adult polypide, in its state of complete retraction; and its plane is parallel to the surface of the parent-stem and almost in contact with that surface. The caecum of the young stomach lies close to the basal wall, projecting towards the line which separates the two series of zooecia. At a slightly later stage the tentacles are seen to be elongating in the direction of the principal axis of the zooecium; the young polypide still lying entirely in the basal part of the zooecium. A mass of cells, the commencement of the vestibule, is differentiated at the distal end of the tentacle-sheath; and at first lies well within the proximal half of the zooecium, in a position far removed from the future orifice, with which it soon becomes connected by a fine thread.

The zooecia in which the polypides are fully retracted are completely connate, as has been described above. When the kamptoderm is everted a free cylindrical portion is formed, as in the right hand zooecium of fig. 2. At the distal end of this is seen a comparatively small collar. When degeneration of the polypide takes place, as in the next six zooecia of the same figure, the everted kamptoderm, which has lost its vestibule and collar, forms a low mammilla, marked by numerous circular cuticular striae. The form of the orifice, in zooecia with a healthy polypide, is seen in the left part of the same figure, and is quadrangular, the vestibule being about one third the length of the zooecium. The details of the alimentary canal are not readily made out; but a distinct gizzard is present.

The zooecia, which are somewhat variable in length, are about 600—700 μ long. Their basal wall, as shown in fig. 4, is from 200 to 300 μ in breadth, and from 80 to 100 μ in length.

In the specimens from Stat. 164 (126. A., 507. B.) I have found a condition identical with that described by Busk[1]) in the specimens which he referred to *A. semispiralis* Kirchenpauer. An internode, distinguished as such by a diaphragm at each end, is shown in Busk's figs 3*a*, 3*b*

1) Busk, G., 1886, Challenger Report, Pt I., p. 36, Pl. VIII. figs 3, 3*a*, 3 .

as bearing two or three groups of zooecia, instead of a continuous spiral. But the groups in question may readily be regarded as parts of a single spiral. That this view is correct is proved by 126. A., in which, in one and the same branch, some of the internodes bear a single spiral, of the form typical in the present species, while in other internodes the spiral is more or less broken up, in various degrees. Thus in some cases the groups are separated from one another by intervals of bare stem, while in others successive groups touch at their bases, being manifestly parts of one spiral in which, here and there, two zooecia diverge from their bases, thus dividing the spiral into discrete groups. In some of the branches of the last order, in which the limit of growth has been reached, all the internodes bear these short discrete groups of zooecia.

The correctness of this conclusion has been confirmed by an examination of BUSK's type-material in the British Museum (87. 12. 9. 935, 936), from the 'Challenger' Station 188, S. of New Guinea. The spirit-specimen (936) has the same general appearance as that of the 'Siboga' material. A large proportion of the internodes, both in older and in younger parts of the colony, have the spiral broken up into 2 or 3 groups; but the reference of the specimen to the present species is indicated by the fact that in other parts the spiral is continuous and quite typical. The condition figured by BUSK as *A. semispiralis* may thus probably be regarded as one which is sometimes assumed by *A. convoluta*, under circumstances unfavourable to growth in full vigour. WATERS [1]) has described a similar specimen from Torres Straits. In the absence of figures I am unable to express any opinion on the question whether "*Serialaria* (*Vesicularia*?) *semispiralis*" Kirchenp. [2]) belonged to the same species or not.

Amathia convoluta Lamouroux and *Serialaria convoluta* Lamarck [3]) were described in the same year (1816); neither author giving a reference to the other. LAMOUROUX stated, however (p. VI) that in 1812 he had named a part of LAMARCK's collections for him: and TENISON-WOODS, in the Memoir (p. 96) cited above, has used this as one of the reasons for preferring LAMOUROUX' names to those of LAMARCK, in cases where the same names were used.

MACGILLIVRAY describes the spiral, in Victorian specimens, as being continuous but "interrupted at the division of the branches". The figures given by this author seem to show that the 'Siboga' specimens belong to the same species, although the groups of their successive internodes are apparently always separated by a slight interval. It is clear that BUSK, in the 'Challenger' Report, had wrongly ascribed the specimens recorded as *A. spiralis* to that species. Mr KIRKPATRICK [4]), who has for many years been in charge of the Polyzoa in the British Museum, has pointed out that *A. spiralis* Busk, is probably *A. convoluta* Lamx; and MACGILLIVRAY [5]) has come to the same conclusion.

PERGENS [6]) has called attention to a series of unpublished Plates, by DESMAREST and LESUEUR, of which the originals are said to belong to the Museum at Havre. The MS. describing these Plates was deposited by the authors, in 1829, in the Library of the Muséum de Paris,

1) WATERS, A. W., 1887: — see ref. in synonymy.
2) KIRCHENPAUER, G. H., 1869, "Museum Godeffroy. Cat. IV", Hamburg. p. XXXIV (Samoa).
3) This appears to be *A. spiralis* Lamx.
4) KIRKPATRICK, R., 1888, "Pol. Port Phillip". Ann. Mag. Nat. Hist., (6) II, p. 19.
5) MACGILLIVRAY, P. H., 1895. t. cit., p. 133.
6) PERGENS, E.: — see synonymy, under *A. crispa*.

where it is still preserved. From a copy of these unpublished Plates in my own possession I am able to state that Pl. XIII, fig. 4 of DESMAREST and LESUEUR gives what appear to be very characteristic figures of the species under consideration. According to PERGENS, the MS. name of this species is *Sirinx circumplicata*; and it is identified by him with *A. crispa* Lamarck. It is unfortunate that the original names and descriptions were never published by DESMAREST and LESUEUR; but it seems obvious that most of the names published by PERGENS in 1887 have no validity, as they refer to figures which are not technically in existence, and for the most part (as in the case under consideration) are mere citations of names, not accompanied by any kind of description. It may be worth while to emphasize the view that even in cases where PERGENS has given valid reasons for retaining these MS. names, they cannot be ascribed a date earlier than 1887, when they were first published; whereas PERGENS appears to have assumed that, after his introduction of them, they could be ascribed to the year (1829) when the MS. was deposited in the Paris Museum.

2. *Amathia distans* Busk. (Pl. V, fig. 6, 7).

Amathia distans Busk, 1886, Challenger Rep., Pt L, p. 33, Pl. VII, figs 1—1*c*.
? *Amathia distans* MacGillivray, 1895, "Austr. Species *Amathia*", Proc. R. Soc. Vict. (N. S.), VII, p. 134, Pl. C, figs 3, 3*a*.
? *Amathia distans* Thornely, 1905, HERDMAN's "Rep. Pearl Oyster Fisheries G. Manaar", Publ. Roy. Soc., Suppl. Rep. XXVI, "Pol.", p. 128 (Gulf of Manaar; no description).
? *Amathia distans* Thornely, 1907, "Rep. Mar. Pol. Ind. Mus.", Rec. Ind. Mus., I, p. 196 (Coast of Cheduba, Burma; Andamans; no description).
? *Amathia acervata* Lamouroux, 1824, "Encycl. Méthod.", "Zooph.", p. 45 (Japan).
? *Amathia tortuosa* Waters, 1910 (nec Tenison-Woods), "Rep. Mar. Biol. Sud. Red Sea", "Bry. II", J. Linn. Soc., Zool., XXXI, p. 243, Pl. XXIV, fig. 5.

433. E., 436. A. Stat. 7. Near Reef of Batjulmati, Java, 15 Metres and more; coral and stones.
20. A., 322. E. Stat. 50. Bay of Badjo, W. coast of Flores, 0—40 Metres; mud, sand and shells.
284. A. Stat. 58. Anchorage off Seba, Savu, 0—27 Metres; sand. (On a stone).
371. C. Stat. 273. Anchorage off Pulu Jedan, Aru Islands, 13 Metres; sand and shells.

Zoarium small, repent, attached here and there to the substratum by rootlet-like tubes. Internodes about 100 μ in diameter, with a thick cuticle. Zooecia biserial, in spiral groups which occupy the distal part of the internode and usually form one complete turn or less. The proximal part of the internode carries no zooecia, and about half the internode is thus bare. The branching appears dichotomous, owing to the fact that the prolongation of the stem and the lateral branch form nearly equal angles with the part of the stem preceding the bifurcation. The ramification is not regularly alternate, a branch being sometimes developed on the same side of the stem as its predecessor, but often growing out from a point which is 90° removed from that which gives rise to the preceding and succeeding branches. Consecutive branches thus commonly lie in two planes at right angles to one another, instead of lying, on opposite sides of the stem, in the same plane, as in *A. convoluta*. A transverse diaphragm, sometimes oblique, occurs at the distal end of the internode, in the region where the group of zooecia ends;

and the diaphragm at the base of the branch lies just on its proximal side. There are no definite joints in the region of the diaphragms, although the stem may be somewhat constricted, a short distance on the distal side of a diaphragm, both of the main stem and at the base of the branch. Zooecia not completely connate, the distal two-fifths or more being free, and subconical. Orifice terminal, obscurely quadrangular. Basal wall of the zooecium not conspicuously broader than long, the zooecia thus not having the compressed form characteristic of those of *A. convoluta*. Polypides with 8 tentacles and a gizzard.

The present species differs from *A. convoluta* in its smaller size, its repent habit, the smaller diameter of its stems and the shorter spirals formed by the groups of zooecia, and in the fact that its zooecia are not completely connate. It is attached to its substratum, which is sometimes a Sponge, by rootlets, which may be formed as a modification of an ordinary branch. The branch thus modified usually assumes an irregular, sinuous outline, and gives off a new rootlet here and there, a few diaphragms being developed.

The zooecia (with retracted polypides) reach a length of about 450—500 μ. The vestibule is nearly half the length of the zooecium and the collar is small. In some of the old zooecia the free terminal part is marked by numerous circular striae; a condition which probably indicates the approaching degeneration of the polypide.

The discrimination of the species of *Amathia* is well known to be difficult; and there is much uncertainty with regard to the synonymy. The present specimens appear to be indistinguishable from the type-specimen (Brit. Mus., 87. 12. 9. 926) of *A. distans*, described by Busk [1]) from Bahia, Brazil. With that species it agrees in its straggling growth, in the restriction of the spiral groups of zooecia to the distal half of the internode, in the fact that the zooecia are only partially connate, and in the measurements. The internodes are described by Busk as being 150 μ in diameter, and the zooecia are 400—500 μ in length. A South Australian form has been described by MacGillivray [2]), under the same name. The species recorded by Waters [3]) from the Sudanese Red Sea, under the name of *A. tortuosa*, is similar to the 'Siboga' specimens in the form of its zooecia, but its internodes seem to have a thin cuticle. I venture to doubt the correctness of Mr Waters' determination, since the zooecia are shown as very short and somewhat discrete; whereas in the original description of Tenison-Woods, the "great length of the pairs of cell" [4]) is emphasized, and they are represented as completely connate; the spiral being, moreover, much elongated and occupying most of the length of the internode. *A. distans*, mentioned by Waters in the same paper, is figured (Pl. XXIV, fig. 7) as having connate zooecia.

The 'Siboga' specimens show considerable resemblance to *A. pruvoti*, described by Calvet [5]) from Banyuls-sur-Mer; but they differ from that form in the fact that the zooecia are less completely connate.

1) Busk, G., 1886, loc. cit.

2) MacGillivray, P. H., 1895, loc. cit.

3) Waters, A. W., 1910, loc. cit.

4) Tenison-Woods, J. E., 1880, "On the Genus *Amathia*", Trans. Proc. R. Soc. Vict., XVI, p. 89. 2 figs. on unnumbered Plate. In Tenison-Woods' fig. 6, the zooecia appear rather short. It is possible that the words "the great length of the pairs of cells in each internode" were intended to refer to the length of the spiral group: — which would be more in accordance with the figure.

5) Calvet, L., 1911, "Deux Esp. Nouv. Bry. Mediterranée", Arch. Zool. Exp. (5) VIII, Notes et Revue, p. LIX, text-fig. on p. LX.

A. brasiliensis Busk (1886, p. 34, Pl. VII, figs 2—2*c*) resembles *A. distans* in many of its characters, but is a more robust species, its stems being about twice as broad as those of *A. distans*. The respective diameters are given by BUSK as ·3 mm. and ·15 mm.

It is not impossible that the present species is identical with *A. acervata*, described by LAMOUROUX (1824) from Japan.

Bowerbankia Farre.

Bowerbankia Farre, 1837, Phil. Trans., p. 391.
Bowerbankia Hincks, 1880, "Hist. Brit. Mar. Pol.", p. 518.
Bowerbankia Waters, 1910, "Rep. Mar. Biol. Sud. Red Sea", "Bry. II", J. Linn. Soc. Zool., XXXI, p. 240.

Zooecia arising irregularly from an erect or creeping axis, commonly in definite groups. Tentacles 8—10. Gizzard present.

Mr WATERS [1]) regards *Bowerbankia* as a synonym of *Zoobotryon* Ehrenberg, 1831. In this conclusion I am not at present prepared to follow him; as it seems to me that the zoarial characters are sufficiently distinct to warrant the separation of the two genera. I am, however, in agreement with him in thinking that *Bowerbankia biserialis* Hincks [2]) is a synonym of *Z. pellucidum*: that *Vesicularia bilateralis* MacGillivray [3]) and an unnamed form described by MACDONALD [4]) belong to the same genus, if not to the same species; and that *Dedalaea mauritiana* Quoy and Gaimard [5]) is probably also referable to *Zoobotryon*, as was suggested by DE BLAINVILLE [6]).

It may be noted that "*Zoobotryon* sp." has been recorded by WHITELEGGE [7]) from the neighbourhood of Sydney; and that *Z. pellucidum* has been described by Miss PHILIPPS [8]) from the Isle of Pines, New Caledonia. From the Atlantic region the same species has been recorded from Brazil (F. MÜLLER, 1860), Florida (OSBURN, 1914) and Bermuda (SMALLWOOD, 1910). In spite of its wide distribution I have not, however, found it among the 'Siboga' dredgings.

1. *Bowerbankia imbricata* Adams [9]) (? sp.). (Pl. VII, figs 15, 16).

Sertularia imbricata Adams, 1800, "Descr. Mar. An. Wales", Trans. Linn. Soc., V, p. 11, Pl. II, figs 5—11.
Bowerbankia imbricata Waters, 1910, "Rep. Mar. Biol. Sud. Red Sea", "Bry. II", J. Linn. Soc. Zool., XXXI, p. 248, Pl. XXV, figs 6—10.

1) WATERS, A. W., 1910, t. cit., pp. 240, 244.
2) HINCKS, T., 1887, "Pol. Adriat.", Ann. Mag. Nat. Hist. (5) XIX, p. 309, Pl. IX, figs 6, 6*a*.
3) MACGILLIVRAY, P. H., 1880. "S. Austr. Pol.". Trans. Proc. R. Soc. S. Austr., XII, p. 30, Pl. II, fig. 4.
4) MACDONALD, J. D., 1857, "Brief Descr. Cten. Pol.", Proc. Roy. Soc., VIII, p. 383 (reprinted, under the same title, in Ann. Mag. Nat. Hist. (2) XIX, 1857. p. 390).
5) QUOY and GAIMARD, "Voy. Astrolabe", "Zool.". IV, 1834, pp. 290—301; III, 1835, p. 952 (expl. of Plate): Atlas, "Zooph.", Pl. XXVI, figs 1, 2, 2[1]. For dates of publication see SHERBORN and WOODWARD, Ann. Mag. Nat. Hist. (7) VIII, p. 333.
6) BLAINVILLE, H. M. D. DE, 1834, "Man. Actinol.", pp. 679, 680: see also pp. 493, 494. Pl. LXXXI, figs 6, 6*a*. DE BLAINVILLE's actual words are "Il faut sans doute rapprocher de ce genre (*Dedalaea*) celui que M. EHRENBERG .... nomme *Zoobotrion*".
7) WHITELEGGE, T., 1889 (1890), p. 293.
8) PHILIPPS, E. G., 1899. pp. 441, 450.
9) The description and figures of this author are hardly recognisable; but in view of the desirability for stability in nomenclature, it seems to me best to assume that ADAMS' species was the one generally known as *Bowerbankia imbricata*.

Bowerbankia densa Farre, 1837, t. cit., p. 391, Pls XX, XXI.
Bowerbankia imbricata (incl. *B. densa*) Hincks, 1880, t. cit., p. 519, Pl. LXXIII, figs 1, 2.
? *Bowerbankia imbricata*, form *densa* Hincks, 1884, "Pol. Q. Charlotte Is", Ann. Mag. Nat. Hist. (5) XIII, p. 207.

20. D.
325. J. } Stat. 50. Bay of Badjo, W. coast of Flores, 0—40 Metres; mud, sand and shells.
382. B. Stat. 64. Kambaragi Bay, Tanah Djampeah, 0—32 Metres; coral, coral-sand.
338. B. Stat. 71. Makassar, 0—32 Metres; mud, sand with mud, coral.
130. L.
130. M. } Stat. 164. 1°42'.5 S., 130°47'.5 E., 32 Metres; sand, small stones and shells.
374. K. (No locality recorded). On *Perophora*.
Japan, Mus. Zool., Cambridge, Reg. June 23, 1902 (A. OWSTON Coll., 27. D., off Tokyo, 150 fathoms). (On *Bugula johnstoniae*).

Characters of the material here recorded: —

Zooecia arising in small groups from a creeping stolon; sometimes less definitely grouped or even arising singly. The stolon is occasionally septate, and gives off a few branches here and there. Zooecia elongate, subcylindrical, straight or somewhat curved, usually paired, their basal ends much wider than the stolon, sometimes produced into processes, and projecting on either side of it. Orifice square. Vestibule rather long, but variable in length; containing a moderately developed collar. Tentacles not numerous, probably not more than 10. Pharynx large, oesophagus short, bent during retraction, passing into a short conical proventriculus, which is succeeded by a well marked gizzard. Stomach and caecum large; intestine and rectum narrow. Parietal muscles extending along the whole length of the zooecium, the fibres usually arranged singly.

I think I am right in referring all the specimens above recorded to a single species; though some of them are obscured by the remains of Sponges in which they were more or less embedded. As in many other species of Ctenostomata, the zooecia vary much in length; but, as in other cases, this appears to depend largely on changes accompanying the histolysis of the polypide. The best specimen, part of which is shown in figs 15, 16, is 374. K., the locality of which, by some oversight, was not recorded. It is growing on the oral end of a *Perophora*, to which the stolon is for the most part adnate. The complete zooecium shown in fig. 16 is 980 μ long and 190 μ in diameter. The longest zooecium in fig. 15 is 1200 μ in length; but its vestibule has lost its connexion with the rest of the polypide, preparatory to histolysis, and the collar is completely protruded. The cuticle is very thin and transparent. The vestibule is provided with four groups of parieto-vaginal muscles, close to its proximal end; and there are four groups of similar muscles, close to the first set, but inserted into the junction of the vestibule and tentacle-sheath.

Several of the specimens show occasional diaphragms, traversing the stolon; but I am not able to state the typical arrangement of these structures.

The specimen from Japan appears to belong to the same species; but the preparation is not a very successful one. HINCKS[1]) has alluded to "a Vesicularian, apparently allied to

1) HINCKS, T., 1880, t. cit., p. 519, note.

B. pustulosa, which had been brought by Dr v. Martens from Yokohama", and had been recorded by Kirchenpauer [1]).

I think there is a high probability that the 'Siboga' specimens belong to the species which has been recorded by Waters, from the Red Sea, as *B. imbricata*, although I am not certain that his determination is correct. The specimens under consideration resemble those figured by Waters, but I cannot believe that the alimentary canal is correctly represented in fig. 8 of that author. It may also be identical with the *B. caudata* described by Annandale [2]) from Indian localities. But Waters does not admit that *B. caudata* is a good species, and points out that the tail-like process at the basal end of the zooecium is not distinctive, as it also occurs in some individuals of undoubted *B. imbricata*. The specimen (374. K.) figured in the present Report has no basal processes, which are, however, present in other 'Siboga' specimens (325. J., 382. B., 130 M.); either as a pointed prolongation of the kind figured by Annandale, or more commonly as several irregular processes, like those shown by Waters in his Pl. XXV, fig. 10; and regarded by him as rooting structures by means of which the zooecium is attached to its substratum. *B. imbricata*, according to the same author (p. 249) has the largest gizzard of any species with which he is acquainted, its transverse diameter being about 100 μ. This is in fair agreement with my own measurement of the gizzard of the specimen shown in fig. 16: the transverse diameter of which I find to be 90 μ. If the number of tentacles in the 'Siboga' specimens is 10, as I think is probably the case, this is a further agreement with *B. imbricata*; some of the other species of the genus being known to have only 8 tentacles.

Miss Robertson [3]) has recorded *B. imbricata* from the American side of the Pacific; but she has given no description of the specimens found there.

Group D. Stolonifera Ehlers.

Stolonifera (pars), Ehlers, 1876, "*Hypophorella expansa*", Abh. K. Ges. Göttingen, XXI, p. 126.
Stolonifera Waters, 1910, "Rep. Mar. Biol. Sud. Red Sea", "Bry. II", J. Linn. Soc. Zool., XXXI, p. 241.

Waters, l. cit., has proposed a new grouping of the genera formerly placed together as Stolonifera; and the distinctive characters of the Stolonifera, as thus restricted by him, have been stated above, on p. 43. The axis, in this group, is delicate, and thus contrasts with the more massive axis of the Vesicularina. It expands slightly here and there, a diaphragm being formed immediately on the distal side of the expansion, which gives rise either to new stolon-branches or directly to zooecia, which are usually arranged in pairs. A gizzard is usually absent.

1) The reference to Kirchenpauer's Memoir, which is not given by Hincks, is "Zoolog. Ergebn. Nordseefahrt", VI. "Bryozoa", II Jahresb. Komm. Unt. deutsch. Meere Kiel, 1874, p. 192.

2) Annandale, N., 1911, "Fauna of Brit. India", "Freshwater Sponges, Hydroids and Polyzoa", p. 189. See also the reference to Miss Thornely, there given.

3) Robertson, A., 1900, "Papers Harriman Alaska Exp.", Proc. Washington Acad. Sci., II, p. 331. In "Non-incrust. Cheil. Bry. W. Coast N. Amer." (Univ. Cal. Publ. Zool., II, N⁰ 5, 1905, p. 230) she figures "*B. imbricata*" with 8 tentacles, a fact which throws doubt on the correctness of the other determination.

Fam. VALKERIIDAE Hincks.

Valkeriidae Hincks, 1877, "On British Polyzoa", I, Ann. Mag. Nat. Hist. (4) XX, p. 532.
Valkeriidae Hincks, 1880, "Hist. Brit. Mar. Pol.", p. 551.

The Family Valkeriidae was defined by HINCKS in 1880, as the first of his group Campylonemida, which he supposed to be characterised by having two of the tentacles everted when protruded. The validity of this character has been criticized by other writers [1]; and the existence of two everted tentacles cannot at any rate be ascertained in most preserved specimens, in which the tentacles are usually retracted. HINCKS defines the Family as having "Zooecia contracted below, deciduous, destitute of a membranous area". The existence of 8 tentacles and the absence of a gizzard were given as characteristic of the Campylonemida in general.

Valkeria Fleming.

Walkeria Fleming, J., 1823, Wern. Mem., IV, Pt II, p. 490.
Valkeria (pars), Fleming, 1828, "Hist. Brit. An.", p. 550.
Valkeria Farre, 1837, Phil. Trans., p. 402.
Valkeria Hincks, 1880, t. cit., p. 551.
Valkeria Waters, 1910, t. cit., p. 241.

Zooecia ovate or cylindrical, narrow at their proximal end and deciduous, arising from the sides or from the distal end of an internode. Tentacles 8. Gizzard wanting. Orifice more or less quadrangular.

The present genus was named after Dr WALKER, and appears as *Walkeria* in FLEMING's original account (1823). In his later work (1828) FLEMING uses the form *Valkeria* without even mentioning the fact that it had at first been spelt differently. *Valkeria* has been universally adopted by later writers, and it appears to me most undesirable to revert to the original spelling.

1. *Valkeria atlantica* Busk. (Pl. VI, figs 5—12).

Farrella atlantica Busk, 1886, Challenger Rep., L, p. 37, Pl. VII, figs 3—3*g*.
? *Farrella atlantica* Thornely, 1905, HERDMAN's "Rep. Pearl Oyster Fisheries G. Manaar", Suppl. Rep. XXVI, publ. Roy. Soc., p. 128 (no description).
? *Farrella atlantica* Thornely, 1907, "Rep. Mar. Pol. Ind. Mus.", Rec. Ind. Mus. I, p. 196 (Burma; no description).
? *Farella atlantica* Thornely, 1912, "Mar. Pol. Ind. Ocean", Trans. Linn. Soc. 2 Ser., Zool., XV, p. 157 (no description).

433. C., 436. B. } Stat. 7. Near reef of Batjulmati, Java (from reef). On 435. A., *Farcimia*; etc.).
380. G. Stat. 47. Bay of Bima, 55 Metres; mud with patches of fine coral-sand. (Growing in profusion on Hydroids.)
20. E., 23. A., 325. M. } Stat. 50. Bay of Badjo, W. coast of Flores, 0—40 Metres; mud, sand and shells.

1) As by LOPPENS, 1908, "Bry. d'eau douce", Ann. Biol. lacustre, III, p. 149.

337. B. } 338. C. } Stat. 71. Makassar, 0—32 Metres; mud, sand with mud, coral. (On *Scrupocellaria*, etc.).

92. F. Stat. 117. Kwandang Bay, 80 Metres; sand and coral. (On *Perophora*).

393. C. Stat. 133. Anchorage off Lirung, Salibabu Island, 0—36 Metres; mud and hard sand. (On a Perforate Coral).

108. O. Stat. 144. Anchorage N. of Salomakiee (Damar) Island, 45 Metres; coral-bottom and Lithothamnion.

396. R. Stat. 162. Between Loslos and Broken Islands, W. coast of Salawatti, 18 Metres; coarse and fine sand with clay and shells.

501. H. Stat. 163. Anchorage near Seget, W. entrance Selee (Galewo) Strait, 29 Metres; sand and stone, mixed with mud. (On *Scrupocellaria*).

130. Q. } 139. F. } Stat. 164. 1°42'.5 S., 130°47'.5 E., 32 Metres; sand, small stones and shells.

445. B. { Stat. 181. Stat. 231. } Ambon Anchorage, 36—54 Metres; mud, sand and coral. (On *Caberea*).

348. B. Stat. 213. Saleyer, 0—36 Metres; coral-reefs, mud and mud with sand.

296. C. Stat. 273. Anchorage off Pulu Jedan, Aru Islands, 13 Metres; sand and shells.

415. D. Stat. 318. 6°36'.5 S., 114°55'.5 E., 88 Metres; fine yellowish grey mud. (On 415. C., *Carbasea cribriformis*).

Zoarium delicate, typically repent, but sometimes becoming detached from its substratum. Stolon slender, branching in a cruciform manner, consisting of a succession of internodes, of very varying length, separated from one another by diaphragms. Branches given off at the distal ends of the internodes, immediately before a diaphragm, and separated from the parent-internode by a lateral diaphragm. The lateral branches may consist of a simple series of internodes or may give rise to new branches. Zooecia arising from a vestigial internode, which may either replace a lateral branch or may occur immediately on the distal side of the base of a branch. Proximal end of the zooecium slender, stalk-like, usually short but sometimes greatly elongated. The rest of the zooecium is elongated, subcylindrical and relatively slender. Orifice terminal, subquadrangular; vestibule rather short; collar small and delicate. The histolysis of the polypide is followed by a great shortening of the zooecium, the body-wall of which becomes marked by numerous circular striae. Polypides with 8 tentacles, which may be bent at their tips during retraction. Gizzard wanting.

I can find no differences between the specimens here recorded and the species described by Busk as *Farrella atlantica*, from Bahia, Brazil. The 'Siboga' material has been compared with the type-specimens of Busk's species preserved in the British Museum (Slide 99. 7. 1. 4320, on *Amathia brasiliensis*; and unmounted material, on the same species, 87. 12. 9. 928; and on *A. distans*, 87. 12. 9. 926). The 'Challenger' specimens show the same differences in the form of the zooecia, in different states, that are here described. If the determination is correct it may be concluded that the present species has a wide distribution; and that it will probably be discovered in many intermediate localities. It is probably the species which has been recorded, without description, by Miss Thornely, from several localities in the Indian Ocean.

Waters [1]) has recorded *F. atlantica* from Zanzibar and British East Africa; but the muscles described at the proximal end of the zooecium appear to indicate that this species should be referred to *Mimosella*.

1) Waters, A. W., 1914, p. 852. Pl. IV, fig. 9.

It is very doubtful whether BUSK's species was correctly placed in *Farrella* [1]), which is characterised, according to the diagnosis given by HINCKS [2]), by having a bilabiate orifice. *F. repens* is said by the same author to have 10—12 tentacles.

From *V. uva* the present species seems to be separated by the mode of origin of the zooecia. The arrangement is both characteristic and constant, a single zooecium or a pair of zooecia being developed at the distal end of an internode, and always from a minute rounded or slightly pointed structure (figs 5—7) which appears to be a vestigial internode. The zooecia may be unilateral or may occur on both sides of the internode, sometimes with the addition of a lateral branch. In *V. uva* the distal end of the internode may give rise to several zooecia on each side.

In most of the specimens a considerable proportion of the zooecia have assumed the contracted form shown in figs 5, 6. This change, which has not escaped the notice of previous writers (e.g. WATERS[3])), and has already been alluded to in the description of several of the other Ctenostomes recorded in the present Report, is associated with the degeneration of the polypide. The shortened zooecia are usually more or less pear-shaped, but may assume irregular shapes (fig. 6). When fully formed they have no obvious contents except a brown body, or sometimes two of these structures. Fig. 5 shows that a new polypide may be developed in a zooecium which has undergone this change.

The zooecium contains no definite muscles by which the contraction could be effected; and the occurrence is perhaps due to a loss of turgidity, by the absorption of some of the water contained in the body-cavity. The process is probably aided by the contraction of the cuticle, which may be supposed to be elastic and somewhat stretched in the ordinary condition. The circular marking of the body-wall which is a characteristic feature of zooecia in this condition is satisfactorily accounted for on this hypothesis.

The zooecia in their active condition (fig. 7) have a form very different from that of those just described. They are elongated, straight or curved, and are more or less cylindrical, though frequently dilated in their proximal half. They have a very transparent body-wall, which is well stretched and has none of the circular markings of the contracted zooecia. At their proximal end they taper off into a stalk-like portion, which is usually short but in the specimen 393. C. (figs 9—12) is much elongated.

The vestibule is relatively short, and the collar is very delicate and small. The tentacles are 8 in number, and are commonly bent at their tips during retraction; in which condition the oesophagus is folded on the pharynx. There is no gizzard; in which respect the present species agrees with the usual definition of the genus.

Some of the zooecia (e. g. in 337. B.), of the ordinary, uncontracted form are fertile. The vestibule persists, but the rest of the polypide has atrophied, with the exception of a sac which encloses the embryo and is no doubt the remains of a tentacle-sheath. The embryo is

1) *Farrella* Ehrenberg. 1830. Üb. d. Bildung d. Kreidefelsen". Phys. Abhandl. k. Ak. Wiss. Berlin, a. d. Jahre 1838, Table II (= new name for *Lagenella* Farre, 1837, preoccupied by *Lagenella* Ehrb., 1832).

2) HINCKS, 1880, t. cit., p. 528.

3) WATERS, A. W., 1910, p. 239.

solitary and is elongated in the same direction as the zooecium, reaching about half its length and about three quarters of its width. An advanced embryo, to which this description refers, measures 205 by 70 μ.

The zooecia with functional polypides are 600—650 μ in length and 70—85 μ in greatest breadth (fig. 7); but the elongated zooecium shown in fig. 10 is 1140 μ long. In other cases the length may not exceed 450 μ. The contracted zooecia shown in fig. 5 are 220—250 μ in length and 70—90 μ in breadth. It may be noticed that the stalk-like proximal portion of these individuals remains uncontracted. The stolon is about 19 μ wide.

This very beautiful species may probably be regarded as the commonest Ctenostome in the area investigated, since I have found it from fourteen of the Stations, ranging from Java in the West to the Aru Islands in the East and Lirung in the North; the triangle defined by these three points including nearly all the Stations at which Polyzoa were found. It is so inconspicuous that it is not readily seen except by microscopic examination; and it has thus always been found accidentally, on some other species which has been large enough to have been recognised as belonging to the collection of Polyzoa. It is probable that an examination of the specimens of Hydroids and other objects obtained by the Expedition would result in its discovery from many Stations where I have not found it.

2. *Valkeria tuberosa* Heller. (Pl. VI, figs 13—20).

Valkeria tuberosa Heller, 1867, "Bry. Adriat.", Verh. zool.-bot. Ges. Wien, XVII, p. 129, Pl. VI, figs 3, 3*a*.
Valkeria tuberosa Carus, 1889, "Prodr. Faun. Med.", II, p. 52.
Valkeria tuberosa Vine, 1891, "Brit. Pal. Cten. Pol.", Proc. Yorksh. Geol. Polyt. Soc., XII, p. 91, Pl. IV, fig. 2 (recent, Naples; figured for comparison with fossil species).
Valkeria uva (pars), Waters, 1910, "Rep. Mar. Biol. Sud. Red Sea", "Bry. II", J. Linn. Soc. Zool., XXXI, p. 250, Pl. XXIV, fig. 13 (Naples).

332. B. Stat. 64. Kambaragi Bay, Tanah Djampeah, 0—32 Metres; coral, coral-sand. (On 332. A., *Micropora ratoniensis* Waters).
57. R. Stat. 80. Borneo Bank, 40—50 Metres; fine coral-sand.
488. I. Stat. 133. Anchorage off Lirung, Salibabu Island, 0—36 Metres; mud and hard sand.
130. G. / 505. B. / 562. A. } Stat. 164. 1°42'.5 S., 130°47'.5 E., 32 Metres; sand, small stones and shells. (On other Polyzoa, Hydroids, Alcyonaria, shell, etc.).
360. C. Stat. 240. Banda Anchorage, 9—45 Metres; black sand, coral, Lithothamnion-bank.
255. D. Stat. 311. Sapeh Bay, E. coast of Sumbawa, 0—36 Metres; mud and sand.

Zoarium repent, its narrow stolon attached to Polyzoa, Hydroids, Alcyonaria, shells and other objects. The stolon dilates at intervals into a slight swelling, cut off distally by a diaphragm and producing, on each side, a branch composed of short internodes, each of which gives off paired lateral branches like those of the main stem. Zooecia and new stolons are produced by the branches thus formed. Owing to this mode of branching and to the shortness of the internodes, the zooecia are crowded into a group which is circular in outline when seen from above. Zooecia subcylindrical, narrower at the base, of nearly uniform width, and relatively broad and short. Orifice terminal, more or less quadrangular. Everted kamptoderm considerably narrower than the zooecium and, like the vestibule, about half the length of the fully retracted zooecium; bearing a well developed collar. Tentacles 8, bent distally during retraction. Oesophagus long, folded on the pharynx when the polypide is retracted. Gizzard wanting.

This species was originally described by HELLER from the Adriatic. I should hardly have ventured to refer the 'Siboga' specimens to it if it had not been for the evidence of specimens from Naples [1]) in the collections of the British Museum (88. 11. 9. 38) and the University Museum of Zoology, Cambridge. These agree so closely with the Malay specimens, even in the character of the branching, that I am unable to detect any differences of importance. The groups of zooecia shown by HELLER in Pl. VI, fig. 3 have a close resemblance to those figured in the present Report. The lateral internodes are represented by HELLER as being almost spherical, although the Neapolitan specimens agree closely with those from the 'Siboga' collection in their form. When HELLER describes the zooecia as somewhat smaller at their distal end (his fig. 3*a*) he is no doubt alluding to zooecia like those shown in my own figs 19, 20.

The stolon of the Malay specimens is narrow, measuring about 45 μ in diameter; and the older parts have a thick, chitinous wall. The mode of branching is represented in fig. 15, from which it will be seen that it is identical with that of a specimen from Naples which has been figured by WATERS [2]). The parent-internode is marked off by a distal diaphragm, but there is no structure of this kind at the proximal end of the dilated portion. It gives off a pair of lateral branches, which in the specimen figured are each composed of two short internodes, prolonged into a stolon distally. Each of these internodes gives off a pair of lateral branches of similar constitution. The distal internode of each secondary branch commonly gives rise to (*a*) a distal stolon, (*b*) a pair of zooecia, (*c*) a pair of lateral stolons situated just proximally to the zooecia. This arrangement is, however, not constant, and a median zooecium may be formed distally in addition to a distal stolon, which comes off on the basal side of the zooecium. Other zooecia are given off by the other internodes of the system.

In fully developed groups of zooecia (fig. 13) it is usually difficult to ascertain the details of the branching, which may perhaps be more complex than in the specimen shown in fig. 15. In these groups the zooecia vary in form according to their state of development. The young zooecia are almost spherical (figs 14, 15); but the old ones, with functional polypides, have the form which has been described above as typical (figs 13, 16).

In a considerable number of cases the zooecia have died with the kamptoderm everted, as shown in fig. 17. This region is less than half the width of the rest of the zooecium, and is terminated by the collar, which is conical in form and has strongly marked ribs or folds. Zooecia in this condition usually show some indication of degeneration of the polypide, the first evidence of which is seen in the degeneration of the vestibule. There seems reason to believe that the collar is thrown off after this stage has been reached: — a process which I believe to take place commonly in Ctenostomata. In a later stage, when the histolysis of the polypide has advanced, the zooecia have the form represented in figs 19, 20 and also in HELLER's fig. 3*a*. The everted kamptoperm has become short and thick walled, and is usually marked by circular

1) Cf. also VINE, l. c.
2) WATERS, A. W., 1910, l. c.

cuticular striae. Many of these zooecia are practically empty of cellular contents except for one or two brown bodies: but in some of them a young polypide-bud can be seen close to the basal end of the zooecium. It may thus be inferred that in a certain proportion of cases the polypide is reconstituted in zooecia which have undergone histolysis.

The structure of zooecia with functional polypides is shown in fig. 16. The quadrangular orifice leads into a vestibule which is of great length, as it is about half the length of the zooecium. The lophophore lies near the basal end of the zooecium during retraction, and the tentacles are bent at their tips. Their number (8) could be ascertained with certainty from one or two polypides which had died with their tentacles protruded. The pharynx is large and lies in the prolongation of the line of the bundle of tentacles. The oesophagus commences close to the proximal end of the zooecium and runs distally. It is of considerable length and it opens into the stomach without forming a gizzard. The parietal muscles consist of a double series of sharply defined bundles, each of two or three strong fibres.

The zooecia contain a number of minute, sharply defined spherical vesicles, varying in diameter from 3.5 to 11 μ. These structures appear to be of the same nature as the "excretory vesicles" which I have described in certain Cheilostomata [1]) and Cyclostomata [2]).

The following measurements, in μ, will give an idea of the size of the zooecia and other parts: — length of zooecium with retracted polypide, 700—850; diameter, 200; length of vestibule or everted kamptoderm, 350—400; of collar, 210; diameter of stolon, 40—50.

Fam. Mimosellidae Hincks.

Mimosellidae Hincks, 1877, "On Brit. Pol.", II, Ann. Mag. Nat. Hist. (4) XX, p. 532.
Mimosellidae Hincks, 1880, "Hist. Brit. Mar. Pol.", p. 555.

This Family, which contains the single genus *Mimosella*, is distinguished by possessing a pair of muscles by which the main part of the zooecium is moveable on its narrow stalk-like proximal portion.

Mimosella [3]) Hincks.

Mimosella Hincks, 1851, "Notes Brit. Zooph.", Ann. Mag. Nat. Hist. (2) VIII, p. 359.
Mimosella Hincks, 1880, l. cit.
Mimosella Waters, 1910, "Rep. Mar. Biol. Sud. Red Sea", "Bry. II", J. Linn. Soc. Zool., XXXI, p. 241.

Zoarium erect or repent. Zooecia deciduous, narrow proximally, in which region there are paired muscles by means of which the zooecium can be moved on its stalk. Tentacles 8. Gizzard wanting [4]).

1) Harmer, S. F., 1891. "Excr. Processes Mar. Pol.". Q. J. Micr. Sci., XXXIII, p. 129.

2) Ibid., 1898, "Dev. *Tubulipora*". Q. J. Micr. Sci., XLI, p. 113.

3) Mr E. O. Ulrich has suggested that *Vinella*, a supposed Lower Silurian Ctenostomatous Polyzoon, is related to *Vesicularia* and probably to *Mimosella* (1890, "New Lower Silurian Bry.", J. Cincinnati Soc. Nat. Hist. XII, p. 173). See also Ulrich and Bassler, 1904. "Rev. Pal. Bry.", I, "Ctenostomata". Smithson. Misc. Coll. (Quarterly issue) XLV, pp. 256 et seq.

4) Vigelius, W. J., (1887, "Zur Morph. d. mar. Bry.". Zool. Anzeiger, X, p. 239) states that a gizzard is present in *M. gracilis*; but Waters (t. cit., p. 240) denies the existence of this structure in *Mimosella*.

1. *Mimosella bigeminata* Waters. (Pl. VII, figs 1—7).

Mimosella bigeminata Waters, 1914, "Mar. Fauna Brit. E. Afr.", "Bry. Cycl....", Proc. Zool. Soc., p. 851, Pl. III, figs 1—3 (Zanzibar Channel, 10 fathoms).

38. M. Stat. 77. Borneo Bank. 3° 27' S., 117° 36' E., 59 Metres; fine grey coral-sand.
396. O. Stat. 162. Between Loslos and Broken Islands, W. coast of Salawatti, 18 Metres; coarse and fine sand with clay and shells.
123. A. Stat. 164. 1° 42'.5 S., 130° 47'.5 E., 32 Metres; sand, small stones and shells.
359. C. Stat. 240. Banda Anchorage, 9—36 Metres; black sand, coral, Lithothamnion-bank.
374. D. Locality and depth not recorded.

Zoarium *Stirparia*-like, consisting of much elongated, attenuated, unbranched stems rising from a basal series of rootlets or stolons. Erect stems jointed, commencing with a few barren segments, followed by one or two with a single pair of zooecia; the remaining stem-segments bearing two pairs of zooecia at their distal end. Zooecia long, subcylindrical, provided with a proximal cone of muscles by which they are no doubt moved on the bracket-like support from which they originate. Vestibule short, with a very delicate collar. Tentacles 8. Alimentary canal not folded during retraction. A slight dilatation of the alimentary canal, at the junction of the oesophagus with the stomach, may be the morphological equivalent of a gizzard; but a structure actually of this nature can hardly be said to be present.

There can be little doubt of the corrrectness of the reference of this species to *Mimosella*, a genus which has the peculiarity of having its zooecia moveable on their stalk-like proximal ends. HINCKS has given a good description of these movements, from observations made on living specimens of *M. gracilis* [1]); and he compared the movements of the zooecia with those of the leaflets of *Mimosa*, the Sensitive Plant. He was unable to find any special muscles [2]), which could be regarded as the agents of these movements. In the 'Siboga' specimens it is easy to recognise these muscles in a group of cone-like form, situated at the extreme proximal end of the zooecium. The muscles in question originate in the bracket-like projection which supports the zooecium, and diverge to be inserted into the inner side of the body-wall of the zooecium (fig. 3). In suitably orientated specimens it can be seen that the cone consists of a pair of groups of fibres. HINCKS' observation that the movements of the zooecia continue after the loss of the polypide is accounted for by the fact that the muscular cone does not disappear when histolysis of the polypide takes place. The movements may perhaps be affected by a special arrangement of muscles, described below, in the stem-segments.

The general characters of the species may be illustrated by a description of the specimen shown in fig. 5. The erect stem originates from an internode of the creeping stolon from which rootlets diverge in various directions over the substratum. The stem is divided into segments by diaphragms; and at each such point it is jointed by a slight annular thinning of the cuticle, which is elsewhere sufficiently developed to give the stem-segments a rigid character. The first stem-segment is long (2160 μ) and bears no zooecia. It is followed by three other barren

1) HINCKS, T., 1851, "Notes Brit. Zooph.", Ann. Mag. Nat. Hist. (2) VIII, p. 359: and 1880, "Hist. Brit. Mar. Pol." pp. 556, 558.

2) They have, however, been figured by JOLIET (1888, "Études *Pyrosoma* ..... Rech. Bry. Roscoff et Menton", Paris, p. 112, Pl. V, fig. 5 *mz*) and by WATERS (1914, t. cit., Pl. III, fig. 1).

segments, which diminish successively in length. The next segment bears a pair of brackets, representing the bases of the distal zooecia of the more typical stem-segments; but the zooecia themselves, as in the next following segments, have fallen off. The next segment, and all its successors, bear two pairs of brackets, the proximal pair being situated more laterally than the distal pair. Between the proximal brackets the cuticle has an oval fenestra, closed by membrane, into which are inserted the ends of a linear series of short muscle-fibres [1]), which originate in the opposite wall of the stem-segment (figs 3, 4). It seems clear that the contraction of these fibres must increase the pressure of the fluid in the cavity of the segment. This presumably increases the turgidity of the segment, and probably makes it sufficiently rigid to withstand the strain caused by the contraction of the muscles which move the zooecia. Occasional fenestrae of more irregular form may be seen on other parts of the wall of the stem-segments.

Fifteen stem-segments have been omitted, and the upper part of the figure shows the remainder of the stem. The deciduous zooecia have disappeared from all the segments omitted in the figure, with the exception of one which bears a single zooecium, and from the two lower segments of this upper part of the stem; and some of the succeeding segments do not retain the full number of zooecia. But the constant occurrence of two pairs of brackets may be taken as a sure indication that each of these segments has borne its full number of zooecia at some time during the growth of the stem. Near the distal end, each segment has four zooecia.

The typical arrangement can be seen more clearly in figs 1, 2, showing the growing ends of two stems under a higher magnification. The zooecia originate near the tip of the stem as small rounded outgrowths, two pairs of which belong to each stem-segment. It is noteworthy that in an early stage of growth (fig. 1) the proximal zooecia are directed towards what may be called the back of the stem; i. e., the surface opposite to the one on which the brackets of the distal zooecia are situated. In the older segments all the zooecia may be directed towards the front of the stem; but it may be assumed that this position is not constant, and that there is a considerable range of movement in the fully grown zooecia.

The zooecia are attached by a narrow base, where a joint is present. When fully grown they are subcylindrical, and are terminated by an orifice, which is quadrangular in shape. The vestibule is short: — a character which appears to be correlated, in the non-incrusting Ctenostomes in general, with a feeble development of the collar. This structure is certainly very delicate in the present species. The tentacles, eight in number, remain unbent during retraction, and the alimentary canal similarly retains its U-like form (fig. 3). The oesophagus is short. The parietal muscles are delicate.

The rootlets are well chitinised and may be straight, sinuous or geniculate at intervals; doubtless in correlation with the nature of the substratum. At the points from which the erect stems arise, several internodes may be crowded together. In a particular case (fig. 6) the arrangement is as follows: — a rootlet ($r.^1$) gives rise to two successive internodes, with no interval between them. A diaphragm occurs at the commencement of the first internode ($i.^1$),

1) Muscle-fibres of a similar nature have been described by WATERS (1910, pp. 239, 250) in *Mimosella gracilis*, *Hypophorella* (fide EHLERS), *Farrella repens* and *Valkeria uva*. JOLIET (1877, "Contr. hist. Bry. côtes de France", Arch. Zool. Exp. VI, p. 293) had previously described them in *Lagenella nutans* (see the following species) and in *Valkeria*.

another between the two internodes, and a third at the distal end of the second internode ($i.^2$), after which the main rootlet is continued as a delicate thread. The distal internode gives off a pair of opposite rootlets, which do not branch; each being separated from the internode by a diaphragm. The proximal internode similarly gives off two opposite branches, but each of these at once becomes a short internode ($l.\ i.^1$), which gives off two dichotomously arranged branches. One of these, in each case, continues as an unbranched rootlet, while the other forms a new internode ($l.\ i.^2$), beyond which the branch is continued as a rootlet, while a pair of lateral rootlets are given off on either side, or one such rootlet on one side. This description may be summarised by saying that each branching of the rootlets is preceded by the formation of a short internode, which is separated from each rootlet with which it is in communication by a diaphragm. Some of these internodes give rise, further, to erect stems, as shown in fig. 5. On reversing the slide the base of an erect stem (*s*) may be seen to originate from the internode $i.^1$. The rootlet marked $r.^2$ proceeds for some distance without branching, and then forms a new internode from which another erect stem arises.

The total length of the stem shown in fig. 5, including the part which has been omitted in the drawing, is 12.35 mm., or nearly half an inch. The longest zooecium shown in the same figure is 750 μ in length; while the longer zooecium of fig. 3 is 740 μ long and 70 μ in greatest breadth. The proximal stem-segment of fig. 5 is 2160 μ long; while in the middle of the stem the segments average about 240 μ in length and about 40 μ in breadth. The larger rootlets are 32 μ broad. The diameter of the circular or oval bracket-like supports of the zooecia is about 20—22 μ.

The present species is strikingly different from *M. gracilis*, the genotype of *Mimosella*. Some of the most noteworthy respects in which it differs from that species are: — the jointed character of the erect stems, the greater relative length of the zooecia and the presence of four zooecia instead of two on each of the stem-segments.

Mr Waters, who found this species simultaneously with myself, has been kind enough to suppress the name which he had given to it in favour of the one I had proposed to introduce.

2. *Mimosella verticillata* Heller. (Pl. VII, figs 8—10).

Valkeria verticillata Heller, 1867, "Bry. adriat. Meeres", Verh. k. k. zool.-bot. Ges. Wien, XVII, p. 129, Pl. VI, fig. 4.
Hippuraria verticillata Hincks, 1887, "Pol. Adriat.", Ann. Mag. Nat. Hist. (5) XIX, p. 311, Pl. IX, fig. 8, 8*a*.
Hippuraria verticillata Carus, 1889, "Prodr. Faun. Med.", II, p. 51.
Hippuraria verticillata Ostrooumoff, 1896, "Otchet Exp. 'Selianik' ", Bull. Ac. Imp. St-Pétersb. (5) V, p. 78 (Sea of Marmara).
Lagenella nutans Joliet, 1877, "Contr. hist. Bry. côtes de France", Arch. Zool. Exp. VI, p. 293, sep. 101 (Roscoff).
Valkeria nutans / *Walkeria nutans* } Joliet, 1888, "Ét. *Pyrosoma*, suivies de Rech. Bry. Roscoff et Menton" (Paris), p. 106, Pl. V, fig. 4.

139. D. Stat. 164. 1°42'.5 S., 130°47'.5 E., 32 Metres; sand, small stones and shells.
39. C. Stat. 77. Borneo Bank. 3°27' S., 117°36' E., 59 Metres; fine grey coral-sand.
(? sp.) 130. F. Stat. 164. 1°42'.5 S., 130°47'.5 E., 32 Metres; sand, small stones and shells.

Stem branching, bearing at intervals groups of sub-verticillate zooecia, arranged on a series of short internodes given off on each side of a nodal region in the stem. Each of the lateral internodes bears a pair of elongated, sub-cylindrical zooecia, jointed at the base and there provided with a series of muscles by which they can no doubt be moved on their stalk-like proximal end. Vestibule longer than in *M. bigeminata*, the collar being stronger than in that species. Tentacles 8, usually bent during retraction; in which condition the oesophagus is folded on the pharynx. Gizzard absent.

The structure of the jointed base of the zooecia, with the existence of a cone of muscles, obviously for moving the zooecium on its stalk, appears to justify the reference of this species to *Mimosella*. But the disposition of the zooecia is very different from that found in *M. gracilis* and *M. bigeminata*. The mode of formation of the zooecium-bearing internodes is, however, not unlike that of the similar structures which, in *M. bigeminata*, give rise to rootlets; as will be seen by the comparison of fig. 9 with fig. 6. In fig. 9, representing the present species, it will be seen that the stem gives rise to a swelling (*i*) cut off distally from its prolongation by a diaphragm, but not separated from the stem by a proximal diaphragm. On each side, the swelling in question gives off a short internode which forms the commencement of a series of similar internodes arranged in such a way as to curve round towards the main stem (see also fig. 10). Each internode of the lateral series bears a pair of bracket-like projections, similar to those of *M. bigeminata*, each of which bears a zooecium. The internode is often prolonged into an ordinary stem, which after a time may give rise to a new group of zooecia (fig. 10). In addition to giving off these parts the internode may give off another internode, from one side; and this in its turn produces another internode, on the corresponding side; thus giving rise to the curved series which are so characteristic of this species. A new internode may, however, be formed medianly, between the two brackets which bear the zooecia.

The zooecium commences with a short cylindrical portion, attached to the bracket by a joint. It then dilates suddenly, a diaphragm being present in this position (fig. 8). From the diaphragm originate the fibres of a pair of muscles which together form a cone, their fibres being inserted into the inner side of the body-wall of the base of the dilated part of the zooecium. It seems clear, from this arrangement, that there must be some flexibility in the body-wall at the level of the diaphragm; and that the two bundles of muscles must be used for moving the zooecium, as in other species of *Mimosella*.

The vestibule is of moderate length, and its orifice is square. The collar is sufficiently strongly developed to be readily seen, in the retracted condition, inside the vestibule (fig. 8). The tentacles are generally more or less bent during retraction. The oesophagus is of considerable length and is bent distally on the pharynx when the polypide is retracted. The parietal muscles form the usual double series, extending along most of the length of the zooecium. They may occur singly, but they are usually in groups of two fibres, and sometimes of a larger number.

The zooecia are from 700 to 800 μ in length, and usually about 110 to 120 μ in breadth. The zooecium shown in fig. 8 is rather broader than usual, its greatest breadth being 170 μ. The main stems are 30—40 μ broad.

The specimen 130. F., although from the same locality as 139. D., appears to belong to a different species; and I am not even sure that it is a *Mimosella*. The preparation is unfortunately not good enough to allow its characters to be described satisfactorily. The zooecia are shorter than in the other specimens; and their bases do not appear to have the *Mimosella*-structure. The mode of branching is similar, though fewer internodes are present. Among the ordinary zooecia are smaller spindle-shaped structures containing a deeply stained mass, which appears to consist of a number of longitudinally arranged fibres. I am unable to decide what is the nature of these structures.

I think there can be no doubt that the specimens 139. D. and 39. C. are very closely allied to the species described by HELLER, HINCKS and JOLIET, as given in the synonymy at the commencement of the present account. The balance of evidence seems to be in favour of the view that the 'Siboga' specimens belong to HELLER's species.

HELLER's account was based on material collected on the Adriatic coast, and preserved in the Triest Museum. The specimens had been labelled by MENEGHINI as *Cuscutaria verticillata*; but this appears to have been merely a MS. name until it was recorded by HELLER. The original account specially mentions the fact that the zooecia commonly originate "paarig (3—4 Paare) von einem Puncte"; a description with which my own observations well agree. HINCKS, some years later, recognised HELLER's species from his own Adriatic material. He expressly comments on the narrow, jointed base of the zooecia: — a feature which had previously been described by JOLIET: — but he describes the "ventral" face of the zooecia as being almost entirely occupied by a membranous "area"; justifying the reference of the species to *Hippuraria* and to the Fam. Triticellidae. If an "area" really occurs in Adriatic specimens the 'Siboga' form probably does not belong to the same species. I think, however, that it is justifiable to feel some doubt with regard to the correctness of this part of HINCKS's description; partly because JOLIET has recorded nothing of the kind in what appears to be the same species; and partly because no information is given as to the way in which HINCKS' specimens had been prepared. Unless special precautions are taken in mounting, Ctenostomes of this type become much shrivelled in the process; and the appearance of a membranous area may have been due to artificial contraction. But in any case I feel justified, after examining BUSK's type-specimen of *Hippuraria egertoni* [1]) preserved in the British Museum in expressing the opinion that HINCKS' specimens had nothing to do with the form described by BUSK. In both the accounts which have been given by JOLIET, that author refers to the narrow peduncle on which the zooecia execute movements of "nutation". He further describes the muscles by which these movements are effected and regards them as modified parietal muscles; and in his later account he describes their origin from a diaphragm separating the zooecium from its peduncle in a way with which my own observations agree exactly. There is thus considerable reason for believing that both the Adriatic specimens and those from Roscoff described by JOLIET are referable to *Mimosella*. If the 'Siboga' specimens are rightly referred to the same species the distribution of this form must be a wide one.

1) See below, under *Triticella boeckii*.

3. *Mimosella tenuis* n. sp. (Pl. VII, figs 11—14).

? *Farrella atlantica* Waters (nec Busk), 1914, "Mar. Fauna Brit. E. Afr.", "Bry. Cycl....", p. 852, Pl. IV, fig. 9.
? *Mimosella* sp. Waters, t. cit., p. 852.

Type. 24. C. } 31. H. } Stat. 53. Bay of Nangamessi, Sumba, 0—36 Metres; Coral-sand; near the shore, mud.

Stolon very delicate, adnate and branching in a cruciform manner. Zooecia given off singly, from the middle line, by the internodes, and near their distal ends. The proximal end of the zooecium forms a narrow, subcylindrical peduncle, of varying length, expanding slightly at its distal end, where it joins the major part of the zooecium. A joint formed by the partial ingrowth of a fold of the body-wall is present at this level, and a pair of short muscular fans diverge from the fold and are inserted into the adjacent part of the body-wall of the zooecium, on the distal side of the joint. The zooecia are elongated and narrow, subcylindrical but tapering off into the peduncle at the proximal end. Orifice quadrangular, vestibule short. Polypides with 8 tentacles and a short, thick oesophagus. Gizzard wanting.

The present species has been found, in small quantity, from a single Station, where it was growing on *Retepora* (24. A.), *Scrupocellaria* and a Hydroid. It has a considerable superficial resemblance to *Valkeria atlantica*, but it is distinguished from that species by the mode of origin of the zooecia from the stolon and by the joint, with which a pair of muscles are connected, in the proximal region of the zooecium. This latter character appears to justify the reference of the present species to *Mimosella*; and it is similar to the arrangement which has been described above in *M. verticillata*, from which the species differs in the uniserial disposition of the zooecia, in the greater slenderness of all parts of the zoarium and in the greater length of the internodes.

The mode of branching of the stolon is represented in fig. 11. The primary internode is itself somewhat cruciform and is not marked off proximally by a diaphragm. A distal diaphragm is, however, present; and the internode gives off a short, narrow, tubular portion from its frontal surface, a short distance on the proximal side of the diaphragm. This tubular portion, which resembles the similar parts in *M. verticillata*, acts as the support of a zooecium. The branches pass off nearly at right angles from the sides of the internode, and are slender and somewhat elongated, being terminated distally by a diaphragm, giving off the base of a zooecium in the same manner as in the primary internode, and sometimes producing lateral branches of a new order. The peduncle of the zooecium is variable in its length but is usually much longer than in *M. verticillata*. The zooecia are relatively much more elongated, in proportion to their width, than in that species, but otherwise resemble them in structure.

The following are the measurements, in μ, of the zooecium shown in fig. 14: — total length, 1040; greatest width, 90; length of peduncle, 360. The peduncle of the specimen shown in fig. 12 is only 250 μ long. The stolon is about 10 μ in diameter.

The unnamed species of *Mimosella* described by WATERS (t. cit.) from Chuaka, Zanzibar, has considerable resemblances to the present species, but the base of the zooecium is said to be "rounded like that of a *Bowerbankia*". The *Farrella atlantica* described in the same place has the muscles of a *Mimosella* and it is indeed identified by WATERS with *Hippuraria verticillata* Hincks (non Heller). It appears to me to be clearly distinct from *F. atlantica* Busk.

Fam. BUSKIIDAE Hincks.

Buskiidae Hincks, 1880, "Hist. Brit. Mar. Pol.", p. 531.

The diagnosis of the Family given by HINCKS runs as follows: —

"Zooecia contracted below, not continuous with the creeping stolon, with an aperture "on the ventral surface".

In the form which I refer doubtfully to *Buskia nitens*, I have not been able to convince myself of the existence of the "aperture".

Buskia Alder.

Buskia Alder, 1856, "Cat. Zooph. North. and Durham", Trans. Tyneside Nat. Field Club, III, Pt 2, p. 156, (sep. 66).
Buskia Alder, 1857, Rep. 26th Meet. Brit. Ass. Cheltenham, 1856, Notices and Abstr., p. 91; and Quart. J. Micr. Sci., V, "Zoophytology", p. 24.
Buskia Hincks, 1880, "Hist. Brit. Mar. Pol.", p. 531.
Buskia Waters, 1910, "Rep. Mar. Biol. Sud. Red Sea", "Bry. II", J. Linn. Soc. Zool., XXXI, p. 241.
(nec *Buskia* Reuss, 1865, "Fauna d. deutsch. Oberoligocäns, 2. Abth., Sitzb. k. Akad. Wiss., math. naturw. Cl., L, I Abth., Jahrg. 1864, p. 677). (sep., p. 64).
(nec *Buskia* Tenison-Woods, 1877, Papers and Proc. and Rep. Roy. Soc. Tasmania for 1876, p. 115).
(nec *Buskea* Heller, 1867, "Bry. adriat. Meeres", Verh. k. k. zool.-bot. Ges., XVII, p. 89).

Mr WATERS (t. cit.) states that *B. socialis* Hincks possesses a gizzard and that it cannot be included in *Buskia* (of which the genotype is *B. nitens*). But if I am right in believing that both *B. nitens* and *B. setigera* possess a gizzard, the subdivision of the genus indicated by WATERS does not appear necessary.

1. *Buskia nitens* Alder (?). (Pl. V, figs 14—17).

Buskia nitens Alder, 1856, t. cit., p. 156, Pl. VII, figs 1, 2 (sep., p. 66, Pl. V, figs 1, 2).
Buskia nitens Alder, 1857, Rep. Brit. Ass. t. cit., p. 91.
Buskia nitens Alder, 1857, Quart. J. Micr. Sci., t. cit., p. 24, Pl. XIII, figs 1, 2.
Buskia nitens Hincks, 1880, t. cit., p. 532, text-fig. on p. 533, Pl. LXXII, figs 6, 7, 7*a*.
Buskia nitens Hincks, 1884, "Pol. Q. Charlotte Islands", Ann. Mag. Nat. Hist. (5) XIII, p. 208.
Buskia nitens Levinsen, 1894, "Zool. Dan.", IX, "Mosdyr", p. 83, Pl. VIII, figs 12, 13.
Buskia nitens Waters, 1914, "Mar. Faun. Brit. E. Afr.", "Bry. Cycl. . . .", Proc. Zool. Soc., p. 854.

307. B. Stat. 273. Off Pulu Jedan, E. coast of Aru Islands, 13 Metres; sand and shells.
451. C. Stat. 64. Kambaragi Bay, Tanah Djampeah, 0—32 Metres; coral, coral-sand. (On slide 451. B.[1], *Victorella sibogae*).

Zooecia very minute, with an attached base, spinous at its edge, and a short erect peristome. Stolon not continuous with the proximal end of the zooecium, very slender, bifurcating at intervals, the branches usually given off in the interspaces between the zooecia; with a few transverse diaphragms. Polypide with a gizzard. Collar apparently absent. Tentacles 8.

In its general appearance the present form has a close resemblance to the British species figured by ALDER and HINCKS. The latter author has, however, described an "aperture", or flat membranous region on the side of the peristome facing the stolon. ALDER has, moreover, described a well developed collar. As I have been unable to find certain evidence of HINCKS' aperture and of ALDER's collar, I am not certain that the reference of the 'Siboga' specimens to the British species is correct. The species is, however, represented by so small an amount of material (307. B., one colony; 451. C., two or three zooecia) that I hesitate to describe it as distinct. It is possible that I have overlooked the parts in question; or that the specimens observed are to be regarded as a variety in which they are really absent. In view of its minute size it is not impossible that some of the features ordinarily present are not here developed. HINCKS leaves the existence of a gizzard doubtful; but I have no doubt of its presence in the 'Siboga' material.

It is not easy to be positive with regard to the mode of attachment of the zooecium to the stolon. At first sight it might be supposed that a narrow, pointed, proximal end of the zooecium was connected with the stolon. But a more careful examination seems to show that the pointed end (fig. 16) is merely one of the spines developed from the margin of the zooecium, the real attachment of which is somewhere near the middle of the adnate portion. This region is flattened and is provided with a few spinous processes on one side only, instead of on both sides, as in British specimens. The stolon generally runs along the attached part of the zooecium, in close contact with it, on the side opposite to that which bears the spines. The diaphragms of the stolon do not seem to be constant in position.

In one case (fig. 17) the tentacles are protruded, and eight can be counted. In the same zooecium there is a small emargination on one side of the zooecium, close to the base of the kamptoderm. This may represent the "aperture"; but I have not been able to find it in other zooecia. The peristome is usually marked by a number of fine circular striae, and the orifice is more or less square.

The zooecium shown in fig. 15 is 290 μ long, and 140 μ in greatest breadth. The longest zooecium in fig. 14 is 360 μ long.

Buskia australis Jullien [1]) seems to be an allied species; but it has a well developed aperture. No figure is given in the original account. *B. socialis* Hincks [2]) is another form allied to *B. nitens*, from which it is said to differ in its much larger size, as well as by its erect habit and by other characters.

It might be suggested that this species should be referred to *Arachnidium*, but its mode of branching seems to exclude this possibility. The cruciform arrangement is not found here, and the branches of the stolon do not correspond with the bases of the zooecia. It has, however, some resemblance to *Arachnidium simplex*, described by HINCKS from Barents Sea [3]).

1) JULLIEN, J., 1888, p. 22.
2) HINCKS, T., 1887. "Pol. Adriatic", Ann. Mag. Nat. Hist. (5) XIX, p. 310, Pl. IX, figs 7—7 *b*.
3) Ibid., 1880, "Hydr. Pol. Barents Sea", Ann. Mag. Nat. Hist., (5) VI. p. 284. Pl. XV, figs 10. 11.

2. *Buskia setigera* Hincks. (Pl. V, figs 8—10).

Buskia setigera Hincks, 1887, "Pol. Hydr. Mergui Arch.", J. Linn. Soc. Zool., XXI, p. 127, Pl. XII, figs 9—13.
Buskia setigera Kirkpatrick, 1890, "Hydr. Pol. China Sea", Ann. Mag. Nat. Hist. (6), V, p. 17 (Tizard Bank, 27 fathoms).
Buskia setigera Kirkpatrick, 1890, "Hydr. Pol. Torres Str.", Proc. R. Dublin Soc. (N. S.) VI, p. 612.
Buskia setigera Thornely, 1905, "HERDMAN's "Rep. Pearl Oyster Fish. G. of Manaar", Suppl. Rep. XXVI, "Polyzoa". Publ. by the Roy. Soc., p. 128.

380. F. Stat. 47. Bay of Bima, 55 Metres; mud with patches of fine coral-sand.
322. D. Stat. 50. Bay of Badjo, W. coast of Flores, 0—40 Metres; mud, sand and shells. (On slide 325. M., *Valkeria atlantica*).
339. B. Stat. 71. Makassar, 0—32 Metres; mud, sand with mud, coral (mostly on Hydroids).
38. K. Stat. 77. Borneo Bank, 3° 27' S., 117° 36' E., 59 Metres; fine grey coral-sand.
130. N. / 133. E. / 505. D. } Stat. 164. 1° 42'.5 S., 130° 47'.5 E., 32 Metres; sand, small stones and shells (on Hydroids, *Bugula*, etc.).
144. D. Stat. 166. 2° 28'.5 S., 131° 3'.3 E., 118 Metres; hard coarse sand (on a Hydroid: — *Cellepora* slides 144. C.[1], 144. C.[2]).
296. D. Stat. 273. Off Pulu Jedan, E. coast of Aru Islands, 13 Metres; sand and shells (on *Catenicella*, slide 296. B.[1]).
also from Torres Straits (Mus. Zool., Cambridge), A. C. HADDON Coll., Reg. Feb 24, 1898.

Zooecia relatively large. Stolon well chitinised, forming slight expansions separated by internodes which vary in length. A diaphragm is developed immediately on the distal side of each internode, and another on each side. From each of the regions corresponding with a lateral diaphragm a branch is given off, the two branches being nearly always exactly opposite one another, and standing at right angles to the main stem. Each lateral branch gives rise to an internode, which may be formed close to the parent-stem. When this is the case in both lateral branches (fig. 8) the zooecia appear paired, their principal axis being parallel to the main stolon. In other cases the first node of a lateral branch may be at a greater distance from the main stolon. The lateral branches do not usually give off new branches; but each is prolonged beyond the first node (*a*) as a short barren stolon; (*b*) as a continuation of the branch forming a new internode which bears a single zooecium and is often prolonged as a barren stolon; (*c*) as a stolon which branches like the main stem. The zooecia are almost entirely erect, broader basally than distally, and with a small attachment to the internode. One aspect of the zooecium is convex, while the opposite side is flattened and forms a membranous "aperture". The basal end of the zooecium gives off a varying number of spines, which may be used to give a firmer attachment. One of these commonly lies on the stolon, to which it is fastened along its whole length, in such a way as to form a buttress supporting the base of the zooecium. A pair of spines, near the proximal end, may be more developed than the others and are directed in an oblique direction. At its distal end the zooecium bears several spines, in most cases four in number, arranged at equal distances round the region of the orifice. Each of these spines consists of a short basal segment followed by an elongated, slender, pointed spine. Collar greatly developed, its supporting ribs at first spirally arranged and then becoming straight (fig. 9). Polypide with a gizzard, and apparently with 8 tentacles.

Recorded by Hincks from the Mergui Archipelago (W. of the Malay Peninsula); by Kirkpatrick from the Tizard Bank (between the Philippine Is and Cochin China) and Torres Straits, and by Miss Thornely from Ceylon.

This species is obviously a common Ctenostome in the region investigated by the 'Siboga', as is evident from the list of localities given. It has been well described and figured by Hincks, to whose account I have little to add. The number of spines at the distal end of the zooecium is nearly always four, the number recorded by Hincks. But in one case (38. K.) I find a larger number in some of the zooecia, indicated by their basal segments, which may be as many as eight. Hincks has given a "correction" (op. cit., foot-note on p. 127) of the position of the spines shown in two of his figures; stating that these originate from the margin of the distal end of the zooecium. The 'Siboga' specimens show, however, that there was no inaccuracy in the figures in question, but that the spines may appear to originate from the margin or more proximally, according to the state of protrusion of the kamptoderm.

Hincks has described a peculiar arrangement, which I can confirm, of the supporting ribs of the collar. These are spirally disposed in the proximal part of the structure (fig. 9), but become straight distally. By focussing down through the spiral part it can be seen that the ribs of the opposite side cross those of the side which is uppermost; indicating that the direction of the spiral is the same all round the collar.

Hincks has stated that that the polypide is "small, and of very simple structure"; and further that "there seems to be no trace of a gizzard". I cannot agree with either of these statements. The polypide is not simpler in its structure than is that of other Ctenostomes. The vestibule is of great length (fig. 10), in correlation with the great development of the collar; and it is retracted by strong parieto-vaginal muscles. The tentacles are bent in retraction; and the oesophagus in this position passes distally, being, moreover, of considerable length. At its distal end, this limb of the alimentary canal passes proximally and forms a well marked gizzard before opening into the stomach. It need hardly be remarked that these relations would be altered in the protruded condition of the polypide.

The membranous "aperture" varies in length. In the specimen shown in fig. 10 it is shorter than usual; and three groups of parietal muscles are visible, on each side; their fibres being inserted into the membrane of the aperture, the function of which is thus, as might have been expected, to permit the protrusion of the polypide.

The zooecia are usually from 480 μ to 550 μ long, and as much as 180 μ in greatest breadth. The collar shown in fig. 9 is 460 μ long and 130 μ broad at its distal end.

The species which has been described by Osburn[1]) as *Hippuraria armata* (= *Vesicularia armata* Verrill, 1874), from the Woods Hole Region, Mass., appears to me to be a *Buskia* and to be nearly related to *B. setigera*. It may be noted that Osburn describes a distinct gizzard. It is pointed out below (p. 90) that Busk's original account of *Hippuraria* was based on a misconception, and that there is no reason for separating that genus from *Triticella*.

1. Osburn, R. C., 1912, "Bry. Woods Hole Region", Bull. Bureau Fisheries (Washington), XXX, p. 256, Pl. XXIX, figs 84, 84*b*.

3. *Buskia pilosa* n. sp. (Pl. V, figs 11—13).

Type. 501. E. Stat. 163. Near Seget, W. entrance Selee (Galewo) Strait, 29 Metres; sand and stone, mixed with mud (on rootlets of *Caberea lata*).

Also from Torres Straits (Mus. Zool., Cambridge), A. C. HADDON Coll., Reg. Feb. 24, 1898 (on a Hydroid).

Zooecia very large, more or less plano-convex in shape, attached by a flattened base, which is generally at least two thirds of the entire length of the zooecium. The basal wall is thin and membranous, and is continued along one surface of the free portion as far as the orifice. Frontal and lateral surfaces very convex, covered with a thick cuticle, all parts of which give off a profusion of spines, which are of several kinds. Stolon slender, very irregular and frequently geniculate; dilating at intervals into slight expansions, from which branches are given off, as in *B. setigera*.

The zooecia are all dead and empty; and there is thus no certain proof that the organism here described is a Polyzoon. But I think there can be no doubt of this; and the species has sufficient resemblance to *B. setigera* to justify its reference to the same genus. The cuticle of the free surface is very thick and stout; since in the Torres Straits specimen, which is a dry mount, the zooecia show no noticeable shrinkage, and agree precisely in form with the 'Siboga' specimens mounted in glycerine or Canada balsam. The continuation of the flat, membranous base as far as the orifice indicates that an aperture is represented, as in typical species of *Buskia*. The spines are a specially characteristic feature of this form, and the following kinds may be distinguished: — (*a*) those of the greater part of the free surface, which are relatively short, pointed and curved; (*b*) a tuft of much longer spines, which appear to correspond with the oral spines of *B. setigera*: they are, however, much more numerous than in that species and are not jointed: while they usually have a sinuous outline; (*c*) those of the edge of the convex portion of the zooecium, which are commonly bifurcate and are used for attachment to the object on which the colony is growing.

The distal region of the zooecium is free, and forms a short "peristome", the orifice being no doubt terminal and surrounded by the oral spines; though the orifice cannot actually be demonstrated except so far as it is indicated in fig. 13. None of the details of the internal anatomy can be made out; as the zooecia are quite empty, with the exception of one or two which contain a multinucleated mass which looks like an encysted (intrusive) Protozoon.

The stolon has a close resemblance to that of *B. setigera*; the swellings from which branches are given off being much like those of that species. But the stolon of the present species is very irregular in outline and is frequently angulated. It is of considerably smaller diameter than the *Caberea*-rootlets (fig. 11, *r*) over which it creeps.

The zooecium shown in fig. 13 measures 600 μ in length without its spines: and is 260 μ in greatest diameter, without the spines. The finer stolon-threads are 10 μ in diameter, while the width of the *Caberea*-rootlets is about 50 μ.

Fam. Triticellidae G. O. Sars.

Tritellidae (misprint for Triticellidae), Sars, 1874, "Om en . . maerk. Slaegtstype af Polyzoer", Forh. Vid.-Selsk. Christiania, Aar 1873, p. 397 (sep., p. 13).
Triticellidae Hincks, 1880, "Hist. Brit. Mar. Pol.", p. 541.

This Family is not represented in the collection here reported on; but as the distribution of *Triticella boeckii* noted below gives some reason for supposing that it is not unlikely to occur in the Malay region, a few notes on this species may not be out of place.

Triticella Dalyell.

Triticella Dalyell, 1848, "Rare and remark. An. Scotland", II, p. 66.
Cordyle Boeck, 1862, "Forelob. Bemaerkn. Pol.", Forh. Vid.-Selsk. Christiania f. 1861, p. 49.
Triticella G. O. Sars, 1874, l. cit.
Hippuraria Busk, 1874, "Not. New Pol.", Proc. Zool. Soc., p. 29.
Triticella Hincks, 1880, t. cit., p. 542.
Triticella Duerden 1893, "New and rare Irish Pol.", Proc. R. Irish Acad. (3) III, p. 129.

1. *Triticella boeckii* G. O. Sars.

Triticella boeckii Sars, 1874, t. cit., pp. 387, 397 (sep., 3, 13), Pl. VIII.
Triticella boeckii Carus, 1889, "Prodr. Faun. Med.", II, p. 51 [Mediterranean].
Triticella boeckii Duerden, 1893, t. cit., p. 131.
Triticella boeckii Duerden, 1895, "Surv. Fishing Grounds, W. Coast Ireland", "Hydr. and Pol.", Proc. R. Dublin Soc. (N. S.) VIII, p. 334.
Triticella boeckii Ostroumoff, 1896, "Otchet Exp. 'Selianik'", Bull. Ac. Imp. St. Pétersb. (5) V, pp. 37, 66 (on *Geryon tridens*, Sea of Marmara).
Hippuraria egertoni Busk, 1874, l. c.

The genotype of *Triticella* is *T. flava* Dalyell. A species of this genus had previously been recorded by Gros [1]), under the name of *Plumatella familiaris*, from Ostende and Havre; and this specific name has been adopted by Smitt [2]), for one of the species of the genus, apparently identical with *T. korenii* Sars.

Mr Waters [3]) has made the following statement: — "*Hippuraria*, Busk, has a delicate "rhizome, from which groups of zooecia arise. In the only specimen (which is now in the British "Museum) it is growing upon the stalk of a seaweed, and this was mistaken for the stem of "*Hippuraria*. There is, therefore, now absolutely no reason for separating *Hippuraria* from "*Triticella*".

I agree with Mr Waters in his general conclusion, but from an examination of the type-specimen (73.11.21.1) of *H. egertoni*, to which he alludes, I have come to a different conclusion with regard to certain details. The slide had suffered from the drying up of the medium in which the specimen had been mounted; and it has been re-mounted by Mr Kirkpatrick since Mr Waters examined it. It is now quite clear that the description "delicate rhizome" is

1) Gros, G., 1840, "Fragm. d'Helminthologie", Bull. Soc. Imp. Nat. Moscou, XXII, p. 567, Pl. VI, figs G, 1—10.
2) Smitt, F. A., 1866, "Krit. fort. Skand. Hafs-Bry.", II, Ofv. K. Vet.-Ak. Forh., 1866, pp. 502, 524, Pl. XIII, fig. 36.
3) Waters, A. W., 1910, p. 241, note.

unsuitable. The specimen consists of several groups of zooecia, each of which arises from an isolated base completely surrounding the jointed tubular object which Busk mistook for the stem of the *Hippuraria*. The base is of precisely the same nature as that described as a "continuous crust" by Duerden (1893), in *Triticella boeckii* and other species. The zooecia show the gibbous "dorsal" outline which is so characteristic of that species; and agree with it in the position and general development of the curved chitinous thickening of the ectocyst described by Duerden as the "frenaculum". The comparison of Busk's specimen of *Hippuraria egertoni* with undoubted specimens of *T. boeckii* leads me, in fact, to the conclusion that the two forms are identical.

The label of Busk's slide states that the specimens was "Attached to eye of *Gonoplax angulatus*". An examination of the supposed stem of the Polyzoon shows that it is a jointed structure, bearing rings of minute spines at the joints. Mr Waters regarded it as a seaweed, but it appears to me nearly certain that it is really a fragment of the flagellum of the antenna of the *Gonoplax*. Dr W. T. Calman, whose opinion I asked, agrees with this conclusion. The base of the antenna lies close to that of the eye in *Gonoplax*, as may readily be seen by examining a specimen of the crab. When it is remembered that Busk mistook the antenna for part of the *Hippuraria*, the statement that the Polyzoon was attached to the eye of the crab becomes readily intelligible.

In order to obtain further evidence with regard to the nature of *Hippuraria* I asked Dr Calman to select specimens of *Gonoplax* which seemed likely to bear this interesting form. He was kind enough to send me specimens, from the collection in the British Museum, on several of which there was no difficulty in finding perfectly typical specimens of *Triticella boeckii*. All the crabs are labelled *Gonoplax rhomboides* Linn., with which, as Dr Calman informs me, *G. angulata* Fabr. is generally regarded as synonymous. The specimens on which *T. boeckii* was found are as follows: —

(1) 98. 5. 7. 251—252. Bay of Biscay, "Porcupine", 1870, Coll. Norman; on 5 specimens, attached principally to the bases of the walking legs, particularly on the dorsal side, in the angles between the legs and the carapace.

(2) 1911. 11. 8. 34. Off Valentia, Ireland, "Porcupine", 1869, Stat. 6, 90 faths, Coll. Norman; on 1 specimen.

(3) 1911. 11. 8. 31. Cadiz Harbour, Coll. Norman; on 1 specimen.

(4) 1911. 11. 8. 35—38. Off Cape Sagres [Portugal], 45 faths, "Porcupine", 1870, Coll. Norman; on 1 specimen.

(5) 1910. 2. 4. 180—182. Same locality; on 1 specimen.

(6) 96. 5. 195—198. Algoa Bay, H. A. Spencer; on 4 specimens, growing on the bases of the legs and great chelae; also on the third maxillipedes, and on the edges of the abdomen.

(7) Crab not determined (*Gonoplax* sp.), 16 miles N. E. of Bird Is [Algoa Bay], 40 faths, F. Toppin 1905; on 1 specimen, growing on the bases of the walking legs; on the second and third maxillipedes; on the "front", close to the antennae; in the orbits; on the back of the carapace; and on the abdomen.

The localities given for *T. boeckii* by Duerden (1893) are Berehaven, S. W. Ireland (which, it may be noted, is the locality from which BUSK's *Hippuraria egertoni* was obtained), on *Portunus depurator*; and SARS' record from Christiania, on *Geryon tridens*. In 1895 DUERDEN mentions the occurrence of the same species, from another Irish locality, on *Gonoplax angulata*, in special abundance on the antennae. The list which I have given above shows that it is of common occurrence in more southern localities; and in particular on *Gonoplax* from Portugal, Spain and Algoa Bay. The last locality suggests that an examination of the Crabs and other Crustacea from the Malay region might be expected to result in the discovery of specimens of *Triticella*. It may be noted that ANNANDALE [1]) has recorded *T. korenii* from *Squilla fasciata* obtained off Japan.

If *Hippuraria* is a synonym of *Triticella*, it follows that the species placed in the former genus by previous authors must find a place elsewhere. I have cited *H. verticillata* Hincks, and *H. armata* Osburn under *Mimosella verticillata* and *Buskia setigera* respectively. *H. elongata* Osburn (t. cit., p. 256) appears to be a *Triticella*.

Distribution of ENTOPROCTA and CTENOSTOMATA.

STATION	DEPTH IN METRES	ENTOPROCTA	CTENOSTOMATA
?	?	. . . .	*Bowerbankia imbricata* (?). *Mimosella bigeminata.*
7	0—15	*Barentsia gracilis.*	*Amathia distans.* *Valkeria atlantica.*
43	0—36	*Loxosoma circulare* (*Retepora*).	
47	55	*Barentsia laxa.*	*Nolella annectens.* *Valkeria atlantica.* *Buskia setigera.*
50	0—40	*Loxosoma troglodytes* (*Lepralia*). *Barentsia gracilis.*	*Nolella papuensis.* *Amathia distans.* *Bowerbankia imbricata* (?). *Valkeria atlantica.* *Buskia setigera.*
53	0—36	*Loxosoma circulare* (*Retepora*). *Loxosoma velatum* (*Retepora*). *Loxosoma annulatum* (*Retepora*). *Barentsia gracilis.*	*Mimosella tenuis.*
58	0—27	. . . .	*Amathia distans.*
60, 303	0—36	*Loxosoma loricatum* (*Cauda*). *Barentsia gracilis.*	
64	0—32	*Loxocalyx lineatus* (*Halichondria*).	*Victorella sibogae.* *Bowerbankia imbricata* (?). *Valkeria tuberosa.* *Buskia nitens.*
71	0—32	*Loxosoma cirriferum* (*Retepora*). *Barentsia gracilis.* *Barentsia discreta.*	*Victorella sibogae.* *Nolella papuensis.* *Arachnoidea protecta.* *Bowerbankia imbricata* (?).

1) ANNANDALE, N., 1912. "Pol. Indo-Pacific Stomatopods", Rec. Ind. Mus. VII, p. 124.

STATION	DEPTH IN METRES	ENTOPROCTA	CTENOSTOMATA
71	0—32	. . . .	*Valkeria atlantica.*
			Buskia setigera.
77	59	*Barentsia gracilis.*	*Mimosella bigeminata.*
			Mimosella verticillata.
			Buskia setigera.
80	40—50	. . . .	*Nolella papuensis.*
		. . . .	*Valkeria tuberosa.*
91	0—54	. . . .	*Nolella papuensis.*
99	16—23	. . . .	*Amathia convoluta* (?).
105	275	*Loxosoma sluiteri.*	
115	Reef	*Barentsia laxa.*	*Nolella papuensis.*
116	72	*Loxosoma* sp. (*Retepora*).	
117	80	. . . .	*Valkeria atlantica.*
133	0—36	. . . .	*Valkeria atlantica.*
			Valkeria tuberosa.
144	45	*Loxosoma loricatum* (*Canda*).	*Nolella papuensis.*
		Loxosoma pusillum (*Retepora*).	*Valkeria atlantica.*
		Loxosoma sp. (*Retepora*).	
		Barentsia gracilis.	
156	469	*Loxosoma cocciforme* (*Siphonicytara*).	
162	18	. . . .	*Nolella papuensis.*
			Valkeria atlantica.
			Mimosella bigeminata.
163	29	. . . .	*Valkeria atlantica.*
			Buskia pilosa.
164	32	*Loxosoma annulatum* (*Retepora*).	*Nolella papuensis.*
		Loxosoma pusillum (*Retepora*).	*Amathia convoluta.*
		Loxosoma breve (*Schizoporella*).	*Bowerbankia imbricata* (?).
		Loxosoma troglodytes (*Lepralia*).	*Valkeria atlantica.*
		Barentsia discreta.	*Valkeria tuberosa.*
			Mimosella bigeminata.
			Mimosella verticillata.
			Mimosella (? gen. & sp.).
			Buskia setigera.
166	118	. . . .	*Buskia setigera.*
181 & 231	36—54	. . . .	*Valkeria atlantica.*
204	75—94	*Loxocalyx leptoclini* (*Cephalodiscus*).	*Nolella papuensis.*
		Loxosoma sp. (*Retepora*).	
213	0—36	*Barentsia gracilis.*	*Arachnidium irregulare.*
		Barentsia discreta.	*Nolella papuensis.*
			Valkeria atlantica.
240	9—45	*Loxosoma circulare* (?) (*Retepora*).	*Valkeria tuberosa.*
		Barentsia gracilis.	*Mimosella bigeminata.*
250	20—45	*Loxosoma loricatum* (*Canda*).	*Nolella papuensis.*
257	0—52	*Loxosoma loricatum* (*Canda*).	
273	13	*Loxosoma cirriferum* (*Retepora*).	*Vesicularia papuensis.*
		Pedicellina compacta.	*Amathia convoluta.*
		Barentsia gracilis.	*Amathia distans.*
			Valkeria atlantica.
			Buskia nitens.
			Buskia setigera.

STATION	DEPTH IN METRES	ENTOPROCTA	CTENOSTOMATA
274	57	*Loxosoma annulatum* (*Retepora*). *Loxosoma cirriferum* (*Retepora*). *Loxosoma pusillum* (*Retepora*). *Barentsia discreta*.	*Nolella papuensis*. *Amathia convoluta*.
282	27—54	*Loxosoma loricatum* (*Cauda*).	
285	34	*Loxosoma* sp. (*Retepora*).	
305	113	*Loxosoma* sp. (*Retepora*). *Loxosoma loricatum* (*Cauda*).	
310	73	*Loxosoma annulatum* (*Retepora*).	
311	0—36	. . . .	*Valkeria tuberosa*.
318	88	*Loxosoma subsessile* (*Conescharellina*). *Barentsia gracilis*.	*Valkeria atlantica*.
319	82	*Barentsia gracilis*. *Barentsia geniculata*.	
320	82	*Barentsia gracilis*.	
321	82	*Loxosoma annulatum* (*Schizoporella*).	

The preceding list gives a complete statement of all the specimens of Entoprocta and Ctenostomata which I have found among the 'Siboga' dredgings. It may be remarked, in the first place, that the conditions which are favourable for the occurrence of either of these groups appear to be favourable for that of the other; — since Entoprocta and Ctenostomata were found in company in a considerable number (17) of the Stations. Only 42 of the Stations have yielded both groups or one of them, out of a total of about 135 Stations at which Polyzoa were obtained. Entoprocta are represented at 30 Stations, and Ctenostomata at 29 Stations.

So far as the Loxosomatidae are concerned, the distribution is no doubt affected by that of the animal on which they are found. *Loxosoma cocciforme* was discovered in the material from Stat. 156, at a depth of 469 Metres. I believe this to be the greatest depth from which any species of this genus has been obtained; but it seems natural to suppose that this exceptional depth depends largely on the fact that *Siphonicytara*, the Cheilostome Polyzoon on which the *Loxosoma* was found, is in some way adapted for an abyssal existence. *Loxosoma sluiteri*, on *Phascolion*, was obtained from Stat. 105, 275 Metres. With these exceptions, only one of the above Stations exceeds 100 Metres; namely Stat. 166 (118 Metres), at which a single Ctenostome, *Buskia setigera*, was found. *Nolella papuensis* and two species of Loxosomatidae occurred at Stat. 204 (75—94 Metres); while *Valkeria atlantica* is recorded from Stat. 117 (80 Metres) and, in company with two Entoprocta, from Stat. 318 (88 Metres). All the rest of the Ctenostomata were found at depths of less than 60 Metres, and most of them in still shallower water.

The majority of the Entoprocta similarly come from depths of less than 60 Metres. Those from greater depths, in addition to the records indicated in the preceding paragraph, are: — Stations 319, 320 (82 Metres), two species of *Barentsia*; Stat. 318 (88 Metres) one *Barentsia*, and one *Loxosoma* on a Cheilostome (*Conescharellina*). The remaining records exceeding 60 Metres consist entirely of species of *Loxosoma* growing on Cheilostomes, and are as follows: — Stat. 116 (72 Metres), one species, on *Retepora*; Stat. 305 (113 Metres), two species, on *Retepora* and *Canda* respectively; Stat. 310 (73 Metres), one species, on *Retepora*; and Stat. 321 (82 Metres), one species, on *Schizoporella*.

It is thus clear that the Entoprocta and Ctenostomata of the Malay Region, as in other parts of the world, are in the main shallow water forms. Of the former group, with the exception of two abyssal species of *Loxosoma* (469, 275 Metres) and of others from 73 to 113 Metres, whose distribution may be considered to be affected by that of their "host", *Barentsia* seems to descend to a slightly greater depth than the Loxosomatidae.

The distribution of Entoprocta and Ctenostomata in the Archipelago, as revealed by these records, is curiously unequal. Thus from the whole series of Stations (93—109) from the Sulu Sea, the only member of either group was *Amathia convoluta* (? sp.), from Stat. 99 (16—23 Metres), although this particular Station was rich in Polyzoa generally, and was, moreover, well within the limits of depth at which the two groups were found to flourish in other regions.

Ctenostomata were obtained principally in two well marked groups of Stations: — (I) off the N. W. extremity of New Guinea, including the region from the Aru Islands to the S. coast of Ceram, and the S. point of Halmaheira (Djilolo); (II) off the chain of Islands stretching from Java to Flores, in the Straits of Makassar and on the other coasts of Celebes, and just extending to the Sulu Sea. Only one Station (133, Talaut Is) at which Ctenostomes were found falls outside these limits. The map published by Prof. MAX WEBER in his preliminary account [1]) of the Expedition shows that the two principal areas correspond with two relatively shallow water plateaux separated by deep water. One of these extends from the N. coast of Australia to New Guinea, and the other from Borneo through Java and other Islands to Flores, and, in other directions, to Celebes and the Sulu Sea. It is noteworthy that the coast of Timor, which is separated from Flores by deep water, has yielded no Ctenostomes, though *Elzerina blainvillii* was recorded by LAMOUROUX from Timor.

The individual Stations from which Ctenostomes were obtained in greatest abundance were: — from area (I), Stat. 164, W. of the N. end of New Guinea (9 species) and Stat. 273, Aru Is (6 species): — and from area (II), Stat. 50, W. end of Flores (5 species); Stat. 64, Tanah Djampeah, N. of Flores (4 species); and Stat. 71, Makassar (6 species). The depth of none of these dredgings exceeded 40 Metres. At all these Stations a considerable number of other Polyzoa were obtained, Stat. 164 being specially rich in these animals. It has been pointed out by Prof. WEBER [2]) that Stations 164 and 273 were characterised by the richness of their fauna in general.

A careful tabulation of the occurrences of the individual species has failed to reveal anything that could be held to justify the division of the entire area covered by the 'Siboga' dredgings into sub-regions. Omitting the two species (*Alcyonidium polyoum* and *Elzerina blainvillii*) which were obtained from Torres Straits, outside the 'Siboga' area, 18 species of Ctenostomata are described in the present Report. Of these, 14 occur in the first of the large areas indicated above, and 13 in the other area. The two species found in the rather isolated

1) WEBER, M., 1900, "Die Niederländ. 'Siboga' Exped.". PETERMANN's Geogr. Mitth., Heft VIII, p. 3 (sep.).
2) WEBER, M., 1902, Monogr. I. "Introd. et Descr. de l'Exped., pp. 72, 124—126.

Station 133 occur in both the large areas. The species which were obtained most frequently are scattered throughout the region from which Ctenostomes were obtained. This is the case, for instance, with *Valkeria atlantica*, which was found at 14 of the 29 Stations at which the group was represented; while *Nolella papuensis* occurred at 12 Stations, *Buskia setigera* at 7, and *Valkeria tuberosa* at 6. It may be noted, however, that *Arachnidium irregulare*, *Arachnoidea protecta* and *Victorella sibogae* were only found at Stations 64, 71 and 213, three localities lying close together off the S. end of Celebes. But as the first two of these species were each obtained at only one Station, and the third at only two Stations, the number of records is insufficient to prove much.

There is perhaps sufficient evidence to warrant the general conclusion that Ctenostomes do not flourish where they are exposed to the full force of the open ocean. The headquarters of this group in the Archipelago seem to be, as has already been pointed out, round the W. end of New Guinea and from Celebes to the Islands from Java to Flores. Their absence from the more exposed S. coast of Timor, and the fact that there is only one record of their occurrence in the Sulu Sea; — in both of which localities a considerable number of dredgings were made; — may be significant. It is probable that the distribution of the group depends more on the nature of the locality (depth, character of bottom, etc.) than on any Geographical considerations which are perceptible in the area investigated.

It has been pointed out above that the distribution of the Entoprocta conforms in general to that of the Ctenostomata. It may be remarked, however, that three species of this group were obtained off the coast of Timor (Stations 60, 282, 285) and that none were found in the Sulu Sea.

Sub-Order II. CYCLOSTOMATA Busk.

Cyclostomata Busk, 1852, J. MACGILLIVRAY's "Voy. 'Rattlesnake'", I, p. 346.
Cyclostomata Busk, 1859, "Monogr. Foss. Pol. Crag", Palaeont. Soc., p. 9.

Fam. CRISIIDAE Johnston.

Crisiadae (pars), Johnston, 1838, "Hist. Brit. Zooph.", Ed. 1, p. 260.
Crisiadae Johnston, 1847, Ibid., Ed. 2, p. 282.

Crisia Lamx.

Crisia (pars), Lamouroux, 1812, "Mém. class. Pol. coralligènes", Nouv. Bull. Sci. Soc. Philomat., III, p. 183.
Crisia (pars), Lamouroux, 1816, "Hist. Pol. Cor. Flex.", p. 136.
Crisia (pars), Lamouroux, 1821, "Exp. Méthod.", p. 6.
Crisia (pars), Lamouroux, 1824, "Encycl. Méthod.", "Zoophytes", p. 224.

1. *Crisia elongata* Milne Edwards. (Pl VIII, figs 1—8).

Crisia elongata Milne Edwards, 1838, "Mém. Crisies", Ann. Sci. Nat., Zool., (2) IX, p. 203, Pl. VII, fig. 2 (Red Sea).

Crisia elongata Busk, 1875, "Cat. Mar. Pol. Brit. Mus.", III, p. 5, Pl. IV, figs 5, 6 (Algoa Bay).

Crisia elongata Waters, 1879, "Bry. Naples", Ann. Mag. Nat. Hist. (5) III, p. 269, Pl. XXIII, fig. 1 (Naples, 40 fathoms).

Crisia elongata Busk, 1886, Challenger Rep., Pt L, p. 5, Pl. I, figs 3, 3*a* (W. of Fiji Islands, 1450 fathoms).

Crisia elongata Kirkpatrick, 1890, "Hydr. Pol. China Sea", Ann. Mag. Nat. Hist. (6) V, p. 17 (Tizard Bank, 27 fathoms).

Crisia elongata Waters, 1914, "Mar. Faun. Brit. E. Afr.", "Bry. Cyclost.", Proc. Zool. Soc., p. 838, Pl. I, figs 3, 4; Pl. IV, fig. 6.

? *Crisia sinensis* D'Orbigny, 1850—1852, "Pal. Franç. Terr. Cret.", V, p. 599 (China Sea, recent). Mr Waters (1905, "Recent Bry. D'Orbigny's Coll." Ann. Mag. Nat. Hist. (7) XV, p. 13) was unable to refer the fragments in D'Orbigny's Collection to any other species.

? *Crisia punctifera* Haswell, 1879, "Cycl. Pol. Port Jackson", Proc. Linn. Soc. N. S. Wales, IV, p. 355.

Crisia terrae-reginae, Haswell, 1880, "Pol. Queensland", Proc. Linn. Soc. N. S. Wales, V, p. 35, Pl. I, fig. 1.

Crisia nigrijuncta Ortmann, 1889, "Japan. Bry.", Arch. f. Naturg. LVI, I, p. 58, Pl. IV, fig. 19.

Crisia denticulata Philipps, 1899, Willey's "Zool. Res.", Pt IV, pp. 441, 449 (Lifu, Loyalty Islands).

Crisia denticulata Waters, 1910, "Rep. Mar. Biol. Sud. Red Sea", "Bry. II", J. Linn. Soc., Zool., XXXI, p. 232, Pl. XXIV, figs 1—3, Pl. XXV, fig. 11.

? *Crisia denticulata* var. *gracilis* Busk, 1886, Challenger Rep., Pt L, p. 5, Pl. I, figs 4—4*d* (Philippine Islands).

Crisia acropora MacGillivray, 1895 (nec Busk), "Monogr. Tert. Pol. Vict.", Trans. R. Soc. Vict., IV, p. 118, Pl. XVI, figs 2, 8, 9. (The characters of the internode and the form of the ovicell make this identification probable.)

Crisia holdsworthii Thornely, 1905 (nec Busk), Herdman's "Rep. Pearl Oyster Fisheries G. of Manaar", Suppl. Rep. XXVI, Publ. by the Roy. Soc., p. 127.

? *Crisia margaritacea* Busk, 1875, "Cat. Mar. Pol. Brit. Mus.", III, p. 6, Pl. VI. B, fig. 1 (Australia).

427. C. {Stat. 60, Stat. 303}. Haingsisi, Samau Island, Timor, 0—36 Metres; Lithothamnion.

(? sp.) 37. R., (? sp.) 37. U. } Stat. 77. Borneo Bank, 3° 27' S., 117° 36' E., 59 Metres; fine grey coral-sand.

57. L. Stat. 80. Borneo Bank, 2° 25' S., 117° 43' E., 40—50 Metres; fine coral-sand.

459. G. Stat. 81. Pulu Sebangkatan, Borneo Bank, 34 Metres; coral-bottom and Lithothamnion.

475. A. Stat. 105. 6° 8' N., 121° 19' E., 275 Metres; coral-bottom.

101. B. Stat. 133. Anchorage off Lirung, Salibabu Island, 0—36 Metres; mud and hard sand.

107. B. Stat. 144. Anchorage N. of Salomakiee (Damar) Island, 45 Metres; coral-bottom and Lithothamnion.

117. B. Stat. 164. 1° 42'.5 S., 130° 47'.5 E., 32 Metres; sand, small stones and shells.

343. A. Stat. 213. Saleyer, 0—36 Metres; coral-reefs, mud, and mud with sand.

350. B. Stat. 240. Banda anchorage, 9—45 Metres; black sand, coral.

541. C. Stat. 257. Du-roa Strait, Kei Islands, 0—52 Metres; coral.

313. A., 544. B. } Stat. 273. Anchorage off Pulu Jedan, Aru Islands, 13 Metres; sand and shells.

194. C. Stat. 274. 5° 28'.2 S., 134° 53'.9 E., 57 Metres; sand and shells, stones.

208. B. Stat. 282. Anchorage between Nusa Besi and the N.E. point of Timor, 27—54 Metres; sand, coral and Lithothamnion.

244. A., 250. F. } Stat. 310. 8° 30' S., 119° 7'.5 E., 73 Metres; sand with a few pieces of dead coral.

253. A. Stat. 315. Anchorage E. of Sailus Besar, Paternoster Islands, 0—36 Metres; coral and Lithothamnion.

I refer the following specimens, in the collection of the University Museum of Zoology, Cambridge, to the present species: —

Torres Straits, A. C. HADDON Coll., Reg. Feb. 24, 1898 (Slides 10, 26, 96, 158).
Ceylon, Miss L. R. THORNELY, Reg. Apr. 25, 1906, 70 (determined by Miss THORNELY as *C. holdsworthii*).
Port Denison, Queensland, Miss E. C. JELLY, Reg. May 24, 1895 (3 slides).
Port Denison, Queensland, Australian Museum, Sydney, Reg. Oct. 23, 1899.
Lifu, Loyalty Islands, A. WILLEY Coll., Reg. Mar. 1, 1898 (determined by Miss PHILIPPS as *C. denticulata*).
Japan, found among rooting spicules of *Euplectella marshalli*, Prof. K. MITSUKURI, Reg. Sept. 23, 1896.
Red Sea, T. HINCKS Coll., Reg. May 13, 1899 (determined by Mr HINCKS as *C. elongata*).
Off Fiji, Stat. 176, Challenger Coll., 1450 fathoms, Reg. Nov. 18, 1899.

Zoarium relatively large, well branched. Internodes narrow in the proximal parts of the colony; becoming broad more distally, and then commonly with a sigmoid flexure. The frontal surface of the internode has a broad, slightly convex region in which the outlines of the zooecia are hardly visible. At the edges of the branch, the individual zooecia become distinct, terminating in a short peristome which is abruptly bent frontally, the lateral outer margin of the zooecium being often slightly carinate, the keel occasionally produced at its distal end into a point which occurs at the base of the peristome. The number of zooecia in an internode may be even or odd and is extremely variable; in elongated internodes reaching a high figure. Branches given off moderately high in the internode, seldom if ever from the lowest zooecium, usually not lower than the third of one side. Basis rami more or less wedged in between two zooecia. An ordinary internode may give off either one or two branches. A fertile internode typically bears the ovicell near the middle of its length and gives off three branches, one on the proximal side of the ovicell, the other two just distally to it. Ovicells with very numerous pores; greatly dilated distally, the most prominent part being near the distal end. Ooeciostome [1]) not developed. Ooeciopore [1]) a transverse slit in the distal wall of the ovicell, close to the point where it joins the frontal surface of the branch. Spines wanting. Joints black. Rootlets arising principally from the proximal internodes, black-jointed; occasionally terminating in a curved segment of the form shown in fig. 2 [2]).

The present species belongs to a group characterised by the considerable breadth of the internodes; a feature which is due to the fact that the proximal ends of the zooecia extend along the median sides of their predecessors, thus giving rise to the appearance of a broad region, in the middle of the frontal side of the branch, between the distal parts of the preceding zooecia. A number of species with the same general appearance have been described as Tertiary fossils, as for instance *C. hörnesii* Reuss [3]) and *C. subaequalis* Reuss [4]). The fossil forms occur

1) Ooeciostome = the tube by which the larvae escape from the ovicell; ooeciopore = its external orifice (HARMER, 1898. "Dev. *Tubulipora*", Quart. J. Micr. Sci., XLI, p. 81).

2) Rootlets of this type have been described by BUSK (1875, p. 6) in *C. acropora*; and also, if I understand the description correctly, by LEVINSEN (1912. "Stud. Cycl. Operculata", Kgl. Danske Selsk. Skr. (7) Naturv. og Math. Afd., X. 1, p. 16, note), in a species mentioned, but not described, as *C. hamifera* n. sp., found at some distance to the West of the Southern part of the United States.

3) REUSS, A. E., 1847, "Foss. Polyparien Wiener Tertiärbeckens", HAIDINGER's Naturw. Abhandl., II, p. 54, Pl. VII, fig. 21.

4) Ibid., 1869, "Pal. Stud. ält. Tertiärschichten Alpen", II, "Foss. Anth. u. Bry. Crosara", Denkschr. k. Akad. Wiss. Wien, Math.-Naturw. Cl., XXIX, 1 Abth., p. 270, Pl. XXXIV, fig. 8.

as isolated internodes, in which ovicells are seldom present; and it seems to me unsafe, in most cases, to attempt to identify them with recent species. It may, however, be noted that *C. elongata* has been recorded in the fossil condition [1]).

Among recent species the present form has considerable resemblance, in its broad internodes, its general mode of branching, and its black joints to the well known *C. denticulata*, from which it appears to differ in the more inflated shape of its ovicell, in the position of this structure near the middle of the length of the internode and in the greater profuseness with which branches are developed in the fertile internode.

Miss A. ROBERTSON has called attention to the importance of the mode of branching in the fertile internodes [2]); and this seems to be really a character which can be used with advantage in the discrimination of the species. These internodes may be regarded as the parts of the colony in which the definitive characters of the species find their fullest expression; the more proximal parts of the zoarium frequently showing characters which are nearly uniform in several distinct species.

The erect stems of a *Crisia* colony, like those of some of the more delicate branching Cheilostomes to which I shall have occasion to refer in the later parts of this Report, commonly arise as branches given off by adnate rootlets [3]). The present species has been found to furnish definite evidence in favour of this view. In its basal region the internodes of the erect branch consist of a very small number of zooecia, and have at first a diameter which is little greater than that of the rootlet. In tracing the branch upwards the internodes are found to become both broader and longer; the number of their zooecia increasing to a corresponding degree. It is only when growth has gone on for some time that the definitive characters of the species become marked. It thus follows that young branches, or the proximal parts of older ones, have an appearance entirely different from that of fully grown specimens; and in the absence of other evidence might easily be referred to different species (cf. figs 3, 5). This is of course true of the genus and not merely of the present species. As I have pointed out in an earlier paper [4]), the presence of ovicells is highly desirable, if not essential, in order to arrive at a definite conclusion with regard to the determination of a specimen. It is fortunate that ovicells are well developed in much of the 'Siboga' material.

The axis of a branch is usually sinuous, the convexities following one another in regular alternate order, and each one typically giving rise to a new branch. The branches, like the convexities of the stem, are thus alternately arranged. The form of the internode depends to a large extent on the frequency with which transverse joints are developed. This is a very variable character; and it accordingly follows that the internodes themselves are also variable in length and in the extent to which they produce branches.

Fig. 1 represents a portion of a colony in which the specific characters are fully developed. Joints are not numerous and the internodes are thus very long. The longer internodes have

1) NEVIANI, A., 1891, "Contr. Conosc. Bri. Foss. Ital.", "Bri. postpliocenici Livorno", Boll. soc. geol. ital., X, fasc. II. p. 133 (sep., p. 37); and elsewhere.

2) ROBERTSON, A., 1910, p. 230.

3) Cf. WATERS, 1910, t. cit., p. 239.

4) HARMER, S. F., 1891, p. 128; cf. also A. ROBERTSON, t. cit., p. 225.

the sigmoid curve strongly marked, with a branch arising from each convexity. In the first internode shown, there are 24 zooecia, a branch originating on the right side from the fourth zooecium of that side, and a second branch much higher from the tenth zooecium of the left side. At about the middle of its length the fertile internode bears an ovicell, which is the modified fifth zooecium of the left or inner side. The zooecium which immediately follows the ovicell, on the same side, is displaced by the growth of the ovicell, as is usual in *Crisia*; and has a specially long peristome, which is seen, on the left margin of the internode, just distally to the ovicell. The peristome in question is distinctly narrower than the ordinary peristomes; a feature which I have found commonly, but not universally, in the present species. The fertile internode has the arrangement which I regard as typical of such internodes in the present species, and as distinguishing it from *C. denticulata*; a proximal branch being developed from the outer side of the internode, and two others, on either side, from the region of the distal part of the ovicell.

Using the notation which I have employed in my previous paper, the part of the zoarium shown in fig. 1 may be represented by the formula [1]: —

(*a*) Slide 107. B.[2] — $(24 + r_4 + 10^l) + (18 + r_4 + 8^l + x)$
$\qquad\qquad\qquad\qquad|$
$\qquad\qquad(9 + Ov. - 15 + r_3 + r_7 + 7^l + x)$

the full number of zooecia being stated for the second main internode, which is only partially represented in the figure.

The colony of which a part is here shown is remarkable for the facts; — that most of the internodes are of great length, the number of zooecia varying from 22 to 32; that most of them have an even number of zooecia; and that they usually give rise to two branches.

The examination of other specimens shows, however, that these relations are by no means universal. This is brought out by the following formulae:

(*b*) Slide 107. B.[2] (another branch) — $(19 + 7^l) - (21 + r_7) + (19 + 7^l) - (19 + r_7)$
(*c*) Slide 107. B.[2] (another branch) — $(11 + r_5) - (24 + 4^l - r_{10}) + (15 + 5^l)$
(*d*) Slide 313. A. . . . . — $(5 + 2^l) + (7 - r_2) + (9 + 4^l) + (9 + r_3) + (9 + 2^l) + (11 + r_4)$
$\qquad\qquad\qquad\qquad|$
$\qquad\qquad(11 + 2^l + r_3) +$

In these formulae most of the internodes have a single branch and an odd number of zooecia; but in (*c*) one of them agrees with (*a*) in having two branches and an even number. This seems to be the general rule, but it is not universal, as is shown by (*d*), where an odd-numbered internode bears two branches.

When only a single branch occurs, its position varies, usually from the 2nd to the 7th zooecium of its own side. The formula (*d*) represents a main stem, attached by rootlets at its base. It illustrates the tendency which has already been pointed out of forming at first short internodes with few zooecia and the branch arising as low as the 2nd zooecium. These small

1) The limits of the internodes are indicated by the brackets. The numerals denote the number of the zooecia in an internode: *Ov* = ovicell: x = growing point: r_4 = a branch given off by the 4th right zooecium: 10^l = a branch from the tenth left zooecium. JULLIEN and CALVET (1903, p. 109) consider this a useless method of notation; but it appears to me a convenient method of recording some of the characteristic features of the species.

internodes are of a form entirely different from that of the younger internodes; being narrow and with the peristomes hardly developed: — which may, however, indicate that the projecting portions have been lost with the atrophy of the corresponding polypides. But the reference to the present species is justified by the fact that the more peripheral internodes of the same stem take on a broad form and may become fertile internodes bearing ovicells of the typical character. The number of zooecia in the internode remains low in this colony, even in the peripheral parts.

The ovicell [1]) of the present species has the form shown in figs 1, 7. Its inflated part begins very suddenly, and the most prominent region is situated near its distal end. The ooeciopore is of the form found in *C. denticulata*, and is a small transverse slit, visible only when the ovicell is seen from its distal end (fig. 6). In a single case I have found twin-ovicells (fig. 8), similar to those described by D'ORBIGNY [2]) in *C. patagonica*. In rare cases, apparently where the growth is not very vigorous, the ovicell is less inflated distally, and may be simply pear-shaped.

The number of branches borne by the fertile internodes is typically three, as shown in fig. 1; but one of these may be suppressed; and in a single instance (fig. 4) I have found four branches.

I have referred the specimens from Stat. 77 with some doubt to the present species. In slide 37. R.[1] the ovicells are delicate and pear-shaped, not specially inflated. This may be due to the fact that they have been formed in parts of the erect stems, near their origin from rootlets, which are still slender and have not assumed the adult characters. The specimens in question have a considerable resemblance to *C. denticulata*, var. *gracilis*, described by BUSK from the Philippine Islands [3]).

The following notes may be added with regard to the specimens, recorded above, which are not from the 'Siboga' Collection. They serve, in some cases, as a justification of the synonymy, where references to the Memoirs cited will be found.

The specimens from Torres Straits agree in all essential respects, including the characters of the ovicells, with the 'Siboga' material.

The same may be said of the Queensland specimens. The material obtained from the Australian Museum consisted of unsorted fragments which were part of the remains of the Collection described by Prof. HASWELL. There is thus a strong presumption that the *Crisia* belongs to the species described by that author as *C. terrae-reginae*. In his account of this species HASWELL gives the number of the zooecia in an internode as 16—22, the complete internode figured having 18. The occurrence of an even number of zooecia is somewhat unusual [4]) in *Crisia*. HASWELL further states that the branches arise from the 8th to the 13th zooecium (i. e. from the 4th to the 7th of one side); and that the joints are black. It may be noted, in

1) It is uncertain to what extent the absence of ovicells indicates that a colony is of the male sex. Miss ROBERTSON (1903, "Embr. *Crisia*", Univ. Calif. Publ. Zool. I, p. 116) states that *C. eburnea* (= *C. occidentalis* Trask, cf. ROBERTSON, 1910, p. 239), is "certainly dioecious", though this did not appear to be the case in all the species investigated.

2) D'ORBIGNY, A., 1839, "Voy. Amér. Merid.", T. V, 4^e Partie, "Zooph.", Pl. I, fig. 1: — see also Pl. XII, fig. 13 in my paper on *Crisia*, already referred to.

3) BUSK, G., 1886, l. cit.

4) In *C. cribraria* Osburn (1912, p. 216) describes the internodes as normally constituted of an even number of zooecia.

this connexion, that in the original account of *C. elongata*, the only complete internode figured by MILNE EDWARDS has 20 zooecia. The specimens described by that author are believed to have come from the Red Sea.

The specimen from Lifu recorded by Miss PHILIPPS as *C. denticulata* has no ovicell, but in other respects appears to agree with the present form.

The Japanese specimen has no ovicells, but is referred with some doubt to the present species. *C. nigrijuncta* was described by ORTMANN from Japan; and, as its name indicates, it possesses black joints.

The 'Challenger' specimen, from off Fiji, has no ovicells, but in other respects agrees closely with the 'Siboga' material. The internodes have a pronounced sigmoid curvature, and some of them have two branches and an even number of zooecia, in one case rising as high as 36. The joints are brown; but it may be noted that this specimen differs from others recorded in coming from much deeper water (1450 fathoms).

The specimens from the Red Sea determined by Mr HINCKS as *C. elongata* are mere fragments; and although the determination appears to be probable, I cannot be confident about it.

I have not examined specimens from the Sudanese Red Sea; but there can be little doubt that the form recorded by Mr WATERS as *C. denticulata* is the present species. I have found the "thin oval spot" recorded by that author in Canada balsam preparations ('Siboga', N° 253. A.[2]; Queensland). It occurs, in the position shown by WATERS in Pl. XXV, fig. 11, on the frontal side of the zooecium, just where the peristome turns frontally to become free. I have not been able to make out its significance, but it is possible that it may be a result of the sudden bending of the wall of the zooecium at this point. The "narrow tube from the distal base of the ovicell" described by WATERS (p. 233, Pl. XXIV, figs 1, 2) is clearly the modified peristome of the zooecium which next succeeds the ovicell, as described above, p. 100, and shown in fig. 1.

In his most recent paper (1914) WATERS records both *C. denticulata* and *C. elongata* from the neighbourhood of Zanzibar; and both are said to have the "small mark" at the base of the peristome. *C. elongata* is described as having only one branch on each internode, springing from the 6th to the 10th zooecium of one side. I have shown above that the number of branches is variable in the 'Siboga' material; and I think it not improbable that the two forms recorded by WATERS really belong to one species. This author states that ovicells are not known in *C. elongata*.

Measurements, in μ, of 'Siboga' specimens: —

Diameter of orifices, 50—75;
From centre of orifice to centre of the next orifice, on the same side of the branch, 275;
Width of branch, 250—300;
Length of ovicell, measured from the distal end of the preceding zooecium, on the same side of the branch, 500—750;
Width of ovicell, 500—575.

2. *Crisia cuneata* Mapl. (Pl. VIII, figs 13—17).

Crisia cuneata Maplestone, 1905, "Lord Howe Island Pol.", Proc. R. Soc. Vict. (N. S.) XVII, p. 390, Pl. XXIX, fig. 12.
? *Crisia cylindrica* Ortmann, 1889 (nec Busk), "Japan. Bry.", Arch. f. Naturg. LVI, I. p. 58, Pl. IV, fig. 17.
Crisia circinata Waters, 1914, "Mar. Fauna Brit. E. Afr.", "Bry. Cycl.", Proc. Zool. Soc., p. 840, Pl. I, figs 7—9.

120. B. Stat. 164. 1°42'.5 S., 130°47'.5 E., 32 Metres; sand, small stones and shells.
and (Mus. Zool., Cambridge), Japan, off Tokyo, 40 fathoms, A. Owston Coll., Reg. June 23, 1902, Slide 5. AM. (Now transferred to the British Museum).

Zoarium small and delicate. Margin of branches strongly serrate, owing to the marked projection of the zooecia, the peristomes of which are directed obliquely outwards. The zooecia of each pair are in contact in the middle line of the branch. Internodes variable in length, sometimes consisting of 5 or 7 zooecia, but commonly more elongated. Branching rather irregular, the branches arising at variable heights in the internode.

(Japanese specimens) Ovicell projecting strongly in a direction at right angles to the branch, with a relatively long, curved ooeciostome arising not far from the point where it becomes free.

I have found only minute fragments, without ovicells, in the 'Siboga' Collection; and they were unfortunately damaged after being mounted. I should not have ventured to record the species if it had not been for the evidence of a Japanese specimen in the Cambridge Collection, agreeing well in zooecial characters with the fragments from Stat. 164, except in being more robust: and bearing ovicells of the remarkable type shown in figs 15—17.

C. cuneata was described by Maplestone from Lord Howe Island, E. of New South Wales. The ovicells described and figured in the original account are of the type figured in the present Report, but they are said to have "a flattened distal end on which is an oval aperture". This appears to indicate that the calcification of the ovicell was not complete; and that the ooeciostome is not described in the original account.

The ovicells of the Japanese specimens (figs 15—17) are remarkably prominent, their distal extremity being in the form of a cylinder terminated by a rounded or conical end, the elongated being at right angles to the surface of the branch. The ooeciostome is a conspicuous tube, of slightly curved form; and it originates, in the usual position, not far from the point where the ovicell becomes free. Ovicells of a similar shape have been described in other species of *Crisia* and particularly in the forms referred by Busk respectively to *C. edwardsiana* d'Orb. [1]) and *C. biciliata* MacGill. [2]), and in *C. inflata* Waters [3]); but in these cases the ooeciostome is given off near the end of the produced part of the ovicell; while in the first two species the zooecia bear spines.

A portion of the zoarium of the 'Siboga' material is shown in fig. 13. It is unfortunately too incomplete to enable any positive statements to be made with regard to the mode of

1) Busk, G., 1875, Pl. II, fig. 7. See also Miss A. Robertson, 1910, p. 237, Pl. XIX, fig. 10.
2) Ibid., 1886, Challenger Rep., Pt L. Pl. I, fig. 1*c*.
3) Waters, A. W., 1914, Pl. I, fig. 2.

branching. It was, however, noticed before the specimen was damaged that branches were given off from the 2nd or 3rd zooecium of one side, or higher in the internode; and that two branches might be given off by the same internode, on the same or opposite sides. The basis rami is short, usually not reaching the zooecium on the proximal side of the one with which it is connected. The internode is narrow, the two zooecia of a pair being in contact with one another medianly along the whole length of their "immersed" part. The peristome is of some length, and is directed somewhat obliquely, so that the outline of the internode appears strongly serrate.

The proximal part of the colony in the Japanese specimen (fig. 14) has so close a resemblance to the 'Siboga' specimen that there is good reason for referring it to the same species. The zooecia are, however, larger, and the basis rami is long enough to reach the preceding zooecium. The specimen shown in this figure is an incomplete internode, which bears two branches on the left side, followed by a third branch on the right side. An ovicell is commencing to develop at the distal end of the principal internode. The remainder of the Japanese specimens consist of isolated internodes, some of which are fertile. In one case three branches arise from one side of an internode; and some of the internodes cannot have had less than 30 zooecia. When seen in side view (fig. 16) the zooecia are observed to overlap one another to a considerable extent, and in a way very different from that characteristic of *C. elongata*. In the latter a zooecium does not overlap its predecessor on its basal side, but it extends for a considerable distance on its inner side down the middle of the branch. The internode is thus broad as well as being flattened. In *C. cuneata* the branch is of considerable fronto-basal depth, and it appears narrow when seen in frontal view, in consequence of the way in which the zooecia overlap. In some of the internodes of the Japanese material, obviously belonging to the peripheral parts of a colony, the peristomes are much elongated.

C. cylindrica was originally described by Busk [1]) from Tristan da Cunha. The present species agrees with it in its narrow branches and in the median contact of the zooecia of the same pair when seen in frontal view. The elongated internodes and the mode of branching seem also to be very similar in the specimens from the three localities under consideration. It thus appears possible that the 'Siboga' specimen and that from Japan should be referred to *C. cylindrica*. But in the absence of ovicells in Busk's figures, and taking into consideration the distance which separates Tristan da Cunha from the localities considered in this Report, I think it would be unsafe to assume that the specimens here described belong to Busk's species. I have therefore referred them to *C. cuneata*, in which the ovicell has been described, even though imperfectly, and which comes from a nearer locality. The Japanese form referred by Ortmann to *C. cylindrica* is insufficiently described and figured; but in view of the practical identity of locality in the two cases, the Japanese specimens in the Cambridge Collection may fairly be considered to belong to the same species as Ortmann's. Waters [2]) has recorded *C. cylindrica*, though with some hesitation, from the Sudanese Red Sea; and I should have been inclined to regard this as belonging to the same species as the Japanese form if it had not

1) Busk, G., 1886, p. 7, Pl. II, figs 2, 2*a*, 4, 4*a*.
2) Waters, A. W., 1910, p. 235, Pl. XXV, figs 14, 15.

been for the account of the ovicells, which are said to be "shortly pyriform". WATERS' figure (Pl. XXV, fig. 15) gives little indication of the remarkable elongation of the ovicell which is so characteristic a feature of the Japanese specimens.

Mr WATERS [1]) has just described, under the name of *C. circinata*, a species from Zanzibar which he thinks may be identical with *C. cuneata* Mapl. It appears to me probable that this form and those here recorded belong to the same species, as is shown particularly by the form of the ovicell and of the ooeciostome.

Measurements, in μ: —

Diameter of orifices, 90 ('Siboga'); 120 (Japan);
Distance apart of zooecia of the same side of the branch, 300 ('Siboga'); 240—400 (Japan);
Width of branch, 145—200 ('Siboga'); 200—250 (Japan);
Length of ovicell (projection from frontal surface of branch), 650—700 (Japan);
Diameter of ovicell, 350 (Japan).

3. *Crisia kerguelensis* Busk. (Pl. VIII, figs 9—11).

Crisia kerguelensis Busk, 1876, "Descr. Pol. Kerguelen's Island", Ann. Mag. Nat. Hist. (4) XVII, p. 117.
Crisia kerguelensis Busk, 1879, "Zool. Coll. Kerguelen's Land", "Pol.", Phil. Trans. CLXVIII, p. 197, Pl. X, figs 17, 18.
Crisia kerguelensis Studer, 1879, "Fauna Kerguelensland", Arch. f. Naturg. Jahrg. XLV, Bd I, pp. 124, 133.
Crisia kerguelensis Studer, 1889, "Forschungsreise Gazelle", III Theil, pp. 140, 145, 158.
? *Crisia eburnea*, var. *laxa* Busk, 1886, Challenger Rep., L, p. 4, Pl. II, figs 1, 1*a* (Kerguelen).

37. S. Stat. 77. Borneo Bank, 3° 27' S., 117° 36' E., 59 Metres; fine grey coral-sand (fragments).
416. K. Stat. 321. 6° 5'.5 S., 113° 30' E., 82 Metres; fine grey mud (one fragment).

Zoarium delicate, the branches narrow and the zooecia of the same pair in lateral contact with one another on the frontal side of the internode. Lower internodes consisting of a single zooecium, the number increasing from the proximal end of the colony and becoming fairly large in the peripheral internodes. Internodes with an odd or even number of zooecia, a branch commonly given off by the lowest zooecium, and another, on the opposite side of the branch, from the second zooecium of that side. Basis rami very short, not nearly reaching the preceding node or zooecium. Peristomes long, abruptly bent frontally at their base. Ovicell with its inflated region entirely free and set at an acute angle to the surface of the branch; the ooeciostome near the distal end, on the side facing the fertile internode.

One ovicell is present (fig. 11) on the specimen from Stat. 77. It agrees with those described by BUSK sufficiently well to make the determination probable.

At the proximal end the present form has considerable resemblance to *C. geniculata*, a species which *C. kerguelensis* was said to resemble by BUSK. This is shown in fig. 9, where the first five internodes consist each of a single zooecium. The next two internodes in the same

1) WATERS, A. W., 1914: see synonymy.

specimen consist of three zooecia each, and the number then rises to a much larger one. The formula of this fragment is as follows: —

$$(1) + (1) + (1) + (1) + (1) + (3) + (3 + 1r) + (11 + r_1 + 2r + r_3 + x).$$

Another, on the same slide, is: —

$$(3) + (5 + 1r + r_1) + (6 + r_1 + 2r) + (2 + r_1 + x).$$

In fig. 10 it will be noticed that two of the internodes have an even number of zooecia (4), and that the first of these two has no branch, while the second produces a branch from its lowest zooecium. One of these internodes shows the elongated peristomes, angulated at their base, which seem to be characteristic of the present species. The formula of the fragment from Stat. 321 is: —

$$(6 + 1r + r_2) + (6 + 1r + r_2) + (6 + 1r + r_2) + (1 + 1r + x)$$
$$(9 + 2r) + (3) \qquad (5 + 2r + x) \qquad (x)$$
$$(6 + r_2) + (x) \qquad (2 + x)$$

The single ovicell (fig. 11) is of the same general type as in *C. cuneata*, but it is considerably smaller. It is seen from the side, a position which shows the free character of its inflated region to advantage. The ooeciostome is short but distinct, and it is produced into a point beyond the ooeciopore.

Measurements, in μ: —

Diameter of orifices, 60;
Distance apart of zooecia, of the same side of the branch, 300—400;
Width of branch, 100—150;
Length of ovicell (projection from frontal side of branch), 335;
Width of ovicell, 170.

4. *Crisia geniculata* Milne Edwards. (Pl. VIII, fig. 12).

Crisia geniculata Milne Edwards, 1838, "Mém. Crisies", Ann. Sci. Nat., Zool., (2) IX, p. 197, Pl. VI, figs 1—1*c*.
Crisia geniculata Harmer, 1891, "Brit. Spp. *Crisia*", Quart. J. Micr. Sci., XXXII, p. 172, Pl. XII, figs 7, 8.
Crisia geniculata Duerden, 1893, "New and rare Irish Pol.", Proc. R. Irish Acad. (3) III, p. 126.
Crisia geniculata Jullien & Calvet, 1903, "Rés. Camp. Prince de Monaco", XXIII, p. 110.
Crisia geniculata Robertson, 1910, "Cycl. Bry. W. Coast N. America", Univ. Calif. Publ., Zool., VI, N° 12, p. 235, Pl. XVIII, figs 6, 7; Pl. XIX, fig. 8.
Filicrisia geniculata D'Orbigny, 1853, "Pal. Franç. Terr. Crét." V, p. 604.
Crisidia cornuta, var. *geniculata* Busk, 1875, "Cat. Mar. Pol. Brit. Mus.", III, p. 3, Pl. I, figs 1—4.
Crisia cornuta, var. *geniculata* Hincks, 1880, "Hist. Brit. Mar. Pol.", p. 419, Pl. LVI, fig. 4.
Crisia cornuta, var. *geniculata* Calvet, 1902, "Bry. mar. Cette", Trav. Inst. Zool. Montpellier, (2) Mém. 11, p. 71.

(Mus. Zool., Cambridge.) Torres Straits, 88, A. C. HADDON Coll., Reg. Feb. 24, 1898 (now transferred to the British Museum).

Zoarium delicate. Internodes consisting of one, two or three zooecia, giving off a branch on one or both sides. Peristomes very long and delicate, not much less than half the length of the entire zooecium. Ovicells wanting.

The specimen described is from Torres Straits, and I have not found this species in the 'Siboga' Collection. In its zooecial characters it agrees closely with European specimens, except that the peristomes are perhaps rather longer. In the absence of ovicells the determination cannot be regarded as certain.

By most authors *C. geniculata* has been regarded as a form of *C. cornuta*. I have attempted, in an earlier paper [1]), to show that this view is incorrect, and that the species is characterised by the relations of the ovicell [2]), which is not free distally but is adnate on its basal surface to one or two zooecia. As no ovicells are present in the Torres Straits specimen it is impossible to say whether the form here considered would have been found to agree with European specimens in the characters of the ovicell.

The zooecial characters are illustrated by fig. 12. The internodes commonly consist of a single zooecium, though two zooecia may occur, and the internode at the upper end of the left side of the figure has three, the largest number observed. An internode may give off one or two lateral branches, in the latter case not quite at the same level, even in internodes consisting of a single zooecium. The basis rami is short and does not reach the preceding joint. An axial joint is formed in such a way as to leave the proximal part of the zooecium across which the joint runs as a sort of basis rami which is situated in the angle between the two diverging peristomes of the distal zooecia (where the internode consists of more than a single zooecium), as shown in the lowest internode of the figure. The peristomes are of great length and are curved both in a frontal and in a lateral direction.

Measurements, in μ: —

Length of zooecia, 700—950;

Width of zooecia, 50—60.

Fam. ENTALOPHORIDAE Reuss.

Entalophoridea (pars), Reuss, 1869, "Pal. Stud. ält. Tertiarsch. Alpen", II, Denkschr. k. Akad. Wiss. Wien, math.-naturw. Cl., XXIX, p. 285.

Entalophoridae Pergens & Meunier, 1887, "Faune Bry. Garumniens Faxe", Ann. Soc. Roy. Malacol. Belg. XXI, Ann. 1886, p. 19 = 201.

Entalophoridae Gregory, 1896, "Cat. Foss. Bry. Brit. Mus.", "Jurassic. Bry.", p. 137.

Pustuliporidae auctt.

Idmoneidae (pars), auctt.

Entalophora Lamx.

Entalophora Lamouroux, 1821, "Exp. Méthod.", p. 81.

Entalophora Lamouroux, 1824, "Encycl. Méthod.", "Zooph.", p. 322.

1) l. cit.

2) Miss ROBERTSON, t. cit., p. 234, describes a transverse septum passing across the ovicell in its proximal half, in this and certain other species of *Crisia*.

Entalophora Gregory, 1896, t. cit., p. 137.
Pustulopora and *Pustulipora* auctt.

Busk and others have used *Pustulopora* or *Pustulipora* in place of *Entalophora*. It has, however, been pointed out by Gregory (l. cit.) that *Pustulopora*, as originally introduced by de Blainville [1]) was a synonym of *Spiropora* Lamouroux, 1821.

The genus *Entalophora* includes a number of recent and fossil species in which the zoarium is erect and the peristomes open irregularly on all sides of the stems. A key to the Cretaceous forms has been published by Lang [2]). Gregory (t. c., p. 217) considers that the Entalophoridae are nearly allied to the Diastoporidae, partly on the evidence of a specimen of *Entalophora* in which the erect stem grows from a *Berenicea*-like encrusting portion. Some of the names have been used for both recent and fossil species; but it is extremely difficult to decide how far this procedure is justifiable.

1. *Entalophora proboscidea* M. Edw. (Pl. X, fig. 12).

Pustulopora proboscidea H. Milne Edwards, 1838, "Mém. Crisies", Ann. Sci. Nat. (2) IX, p. 219, Pl. XII, fig. 2 (recent, Mediterranean).
Pustulopora proboscidea Busk, 1875, "Cat. Mar. Pol. Brit. Mus.", III, p. 21.
Pustulopora proboscidea Haswell, 1879, "Cycl. Pol. Port Jackson", Proc. Linn. Soc. N. S. Wales, IV, p. 352.
Pustulopora proboscidea Busk, 1886, Challenger Rep. [3]), L, p. 19, Pl. IV, figs 1—1*b*. (Heard Island, Prince Edward Island, S. Indian Ocean).
Pustulipora proboscidea Haswell, 1880, "Pol. Queensland", Proc. Linn. Soc. N. S. Wales, V, p. 35 (no description).
Entalophora proboscidea Gregory, 1899, "Cat. Foss. Bry. Brit. Mus.", "Cret. Bry.", I, p. 221 (Naples, recent).
Entalophora proboscidea Waters, 1904, "Rés. Voy. Belgica", "Bry.", pp. 9, 91, Pl. IX, figs 4*a*, 4*b* (Antarctic and Cosmopolitan).
Entalophora proboscidea Norman, 1909, "Pol. Madeira", J. Linn. Soc. Zool., XXX, p. 280, Pl. XXXV, figs 1—3.
Entalophora proboscidea Thornely, 1912, "Mar. Pol. Ind. Ocean", Trans. Linn. Soc. (2) Zool., XV, p. 156 (Amirante and Seychelles Islands; no description).
? *Entalophora indica* D'Orbigny, 1853, "Pal. Franç. Terr. Crét.", V, p. 781 (Straits of Malacca).

This list of synonyms might be greatly extended, but most of the references would be very doubtful. A number are given by Miss Jelly [4]). Gregory, t. cit., p. 219, includes many of the citations of *E. proboscidea* under *E. virgula*, a Cretaceous species which he regards as nearly related to the recent *E. proboscidea* (pp. 217, 221).

329. A. Stat. 64. Kambaragi Bay, Tanah Djampeah, 0—32 Metres; coral, coral-sand.
239. A. Stat. 310. 8° 30' S., 119° 7'.5 E., 73 Metres; sand with a few pieces of dead coral.
(? sp.) 449. B. Stat. 59. W. entrance Samau Strait, 390 Metres; coarse coral-sand with small stones.
251. H.[1] Stat. 315. Anchorage E. of Sailus Besar, Paternoster Islands, 0—36 Metres; coral and Lithothamnion.

1) de Blainville, H. M. D., 1830, Dict. Sci. Nat. LX, p. 382: and 1834, "Man. d'Actinol.", p. 418 (*Pustulipora* in Index, p. 601).
2) Lang, W. D., 1906, "Key publ. Figures Cret. *Entalophora*", Geol. Mag. (N. S.), Dec. V, III, p. 462.
3) In the synonymy here given Busk states that the [right hand] figure on "Pl. XVIII, A" (*errore*, for XVII, A.) of the British Museum Catalogue does not belong to Milne Edwards' species, and implies that it was taken from a Shetland specimen.
4) Jelly, E. C., 1889, "Syn. Cat. Rec. Mar. Bry.", p. 89 (under *E. varipora*).

Also (Mus. Zool., Cambridge): —

Torres Straits, 195, A. C. HADDON Collection, Reg. Feb. 24, 1898.
Queensland, Port Denison, Miss E. C. JELLY, Reg. May 24, 1895.
Queensland, Port Denison and Holborn Island, Australian Museum, Sydney, Reg. Oct. 23, 1899 (from remains of the Collection described by Prof. W. A. HASWELL).

Zoarium consisting of a few coarse, irregularly arranged branches which bifurcate rather seldom and do not keep in one plane. Zooecia few and large, often with greatly produced peristomes. Ovicell occurring at a bifurcation, variable in form, but extending some way up one of the branches thus formed. Ooeciostome terminal, meeting the rest of the ovicell at an angle, and when fully developed with a transversely elongated ooeciopore, bounded by well developed lips.

The present species is distinguished from the other forms dredged by the 'Siboga' by its more robust zooecia, and by the characters of its ovicell. Its growth is very irregular, the branches not keeping in the same plane, and varying in thickness. The largest colony examined (239. A.) is about 20 mm. in greatest length, and consists of two main lobes, which diverge from one another close to the base of the colony at an angle of nearly 180°. Not more than three or four bifurcations are present in any branch, so that the colony does not attain much complexity of growth.

The zooecia, while maintaining a practical uniformity in their sectional area, vary much in other respects. The peristome is either short or long; and it may continue the direction of the proximal part of the zooecium in a uniform curve, or it may leave that part at a distinct angle. The direction of its growth may be uniform or irregular, an alteration of the curve being frequently visible at some point in its length. It is frequently marked by circular lines of growth. As will be seen from fig. 12, the number of zooecia present in any transverse section of a branch is small compared with that found in some other species. This character depends, however, on the degree of vigour in the growth of the branches, some of which may be slenderer than in the portion figured; while in other parts, particularly in the region immediately preceding a bifurcation, the number of zooecia present at the same level may be increased.

The ovicell of the specimen figured (fig. 12) commences at a bifurcation and extends along only one of the branches so formed. This fertile branch shortly bifurcates again, although one of the branches has been broken off. With the first bifurcation placed in the plane of the drawing the ovicell is seen from the side; but if the bifurcation which occurs at about the middle of the ovicell had been in that plane it is obvious that the ovicell would have been seen in frontal view. This is a consideration which has to be borne in mind in comparing this specimens with others. At the point where the second bifurcation was formed there has been an interruption in the continuity of the growth of the ovicell, as is shown by the persistence of part of the margin of the growing end of the branch as the ridge which is seen crossing the ovicell. The remainder of the roof of the ovicell has been formed by a calcareous lamina developed slightly within this edge. Another sudden change in the direction of growth is indicated by a kind of collar present near the base of the ooeciostome.

The ooeciostome is a wide tube which leaves the ovicell at its distal end; and it is directed somewhat frontally, with a distinct angle at its junction with the ovicell. The ooeciopore is transversely elongated and it is bounded by fairly distinct lips.

The ovicells of the specimens referred to the present species differ from one another; but this appears to depend largely on the nature of the growth of the fertile branch. In another specimen (230. A.[1]) from the same Station the ovicell is developed from a short thick branch, which shows only a slight indication of bifurcating in the region of the ovicell, which is thus considerably wider at its distal end than in the specimen shown in fig. 12 (the ovicell having shared in the general widening of the branch which has taken place in this region). The ooeciostome has, however, the same terminal position, although it is not quite so well developed as in the branch figured.

In the specimens from Queensland three ovicells are present, all of a more elongated type than in fig. 12. One of these begins at a bifurcation and extends for some distance up the inner side of one of the branches so formed. The branch in question is a slender one, and the ovicell is correspondingly narrow. The other two ovicells begin before the bifurcation and extend along one of the branches. In one of them the ovicell is on the side of the branch facing the other branch, and is accordingly seen in side view with the bifurcation in the plane of the slide. The other ovicell is quite similar, except that it is seen in frontal view with the bifurcation in the same position. In all these cases the ooeciostome is terminal and is set at an angle to the rest of the ovicell.

The other specimens recorded above have no ovicells; but, from their zooecial characters, 329. A. and the specimen from Torres Straits may be placed with the present species with some confidence; while 251. H.[1] is probably correctly determined and 449. B. — a fragment in poor condition — is doubtful. Two specimens dredged by the 'Challenger' off the Marion Islands, in the Cambridge Collection, and referred to *E. proboscidioides*, have some resemblance to the 'Siboga' specimens; but their stems are more regularly cylindrical; and in the absence of ovicells it would be unsafe to assume that they belong to the present species.

Measurements, in μ:

Width of branch, at lower end of fig. 12, 850;
Length of longest peristome, fig. 12, 1,400; diameter, 220—250;
Length of ovicell, fig. 12, 2,280;
Width of ovicell, at proximal end, fig. 12, 780;
Width of ooeciostome, fig. 12, 250;
Diameter of orifices, fig. 12, 150—200.

Gregory (t. cit., p. 222) gives the diameter of the orifices of a recent specimen from Naples as 210 μ.

2. *Entalophora delicatula* Busk. (Pl. X, fig. 11).

Pustulopora delicatula Busk, 1875, "Cat. Mar. Pol. Brit. Mus.", III, p. 20, Pl. VI.B, fig. 3 (Queensland).
? *Pustulipora delicatula* Haswell, 1880, "Pol. Queensland", Proc. Linn. Soc. N.S. Wales, V, p. 35.

? *Entalophora delicatula* Ortmann, 1889, "Japan. Bryozoenfauna", Arch. f. Naturg., Jahrg. LVI, Bd I, p. 61, Pl. IV, figs 28*a*, 28*b*.

Entalophora delicatula Philipps, 1899, WILLEY's "Zool. Res.", Pt IV, pp. 441, 449 (Lifu).

? *Pustulipora fragilis* Haswell, 1880, t. cit., p. 35, Pl. I, fig. 2.

? *Entalophora fragilis* Waters, 1887, "Bry. N. S. Wales", III, Ann. Mag. Nat. Hist. (5) XX, p. 259.

Entalophora deflexa Smitt (nec auctt.), 1872, "Floridan Bry.", I, K. Svensk. Handl., X, N⁰ 11, p. 11, Pl. V, figs 28—30 (fide WATERS).

Entalophora wasinensis Waters, 1914, "Mar. Bry. B. E. Afr.", "Bry. Cycl.", Proc. Zool. Soc., p. 840, Pl. II, figs 1—4, 9; text-fig., p. 841 (Zanzibar, etc., 10 fathoms; Florida, SMITT).

376. L. Stat. 213. Saleyer Anchorage and surroundings, 0—36 Metres; coral-reefs, mud and mud with sand.

298. B. Stat. 273. Anchorage off Pulu Jedan, E. coast of Aru Islands, 13 Metres; sand and shells (on 298. A., *Amathia convoluta* Lamx).

217. A. Stat. 301. Pepela Bay, E. coast of Rotti Island, 10°38' S., 123°25'.2 E., 22 Metres; mud, coral and Lithothamnion.

(sp. incert.) 57. X. Stat. 80. Borneo Bank, 2°25' S., 117°43' E., 40—50 Metres; fine coral-sand.

The following specimens, in the Collection of the University Museum of Zoology, Cambridge, are referred, somewhat doubtfully, to the same species:

Japan, from rooting spicules of *Euplectella marshalli*, Prof. K. MITSUKURI, Reg. Sep. 23, 1896.

Queensland, Port Denison (two slides), Miss E. C. JELLY, Reg. May 24, 1895.

Queensland, Port Denison, from remains of the Collection described by Prof. W. A. HASWELL, Australian Museum, Sydney, Reg. Oct. 23, 1899.

Lifu, Loyalty Islands, A. WILLEY Collection, Reg. Mar. 1, 1898 (determined by Miss PHILIPPS as *E. delicatula* Busk).

Torres Straits, 132, 190. A. C. HADDON Coll., Reg. Feb. 24, 1898.

Zoarium consisting of delicate branches. Zooecia small, the peristomes long and prominent; usually about four series visible in one half of the branch. Ovicell more or less pyriform; if present at a bifurcation extending into one of the branches only; its roof not traversed by zooecia. Ooeciostome terminal, with a transversely elongated ooeciopore, bounded by lips which are variable in their development.

If the specimens of which a list is given above are correctly referred to one species, there is a considerable amount of variation in the characters. The branches and the zooecia are much slenderer than those of *E. proboscidea*, as is seen by comparing fig. 11 with fig. 12 (both drawn to the same scale). In one or two cases, particularly in the specimens from Queensland, some of the branches are very straight; and, except for the projection of the peristomes, cylindrical in form [1]). In others, as in 376. L., these features are not so pronounced. The peristomes are usually long and slender. The ovicell differs from that of the species next to be described in not having its roof traversed by zooecia; although some of the peristomes at its sides may be laterally adnate to its roof.

The ovicell, although variable in shape and in its position with relation to a bifurcation, appears to have some features which are fairly constant. If developed in the region of a bifurcation, it does not divide with the branch, but extends into only one of the branches (fig. 11).

1) These specimens appear to resemble *Pustulipora fragilis* Haswell (l. cit.).

As is usual in Cyclostomes, its pores are more numerous than those of the zooecia; and they are also distinctly larger. The ooeciostome is terminal. In the specimen figured it is seen sideways; although, as a second bifurcation is formed at its level, it would have been seen in frontal view if the branch had been arranged with the plane of the second bifurcation horizontal. In other specimens in which no second bifurcation of the fertile branch takes place, the ooeciostome is situated symmetrically with regard to the proximal end of the ovicell, which is more or less pyriform. In fig. 11 the distal lip of the ooeciostome is seen to be curved over the ooeciopore, as a sort of hood, thus resembling the ooeciostome of *Tubulipora phalangea*; and its proximal lip is hardly developed. In some of the other specimens the distal lip does not have this hood-like character; and the ooeciopore is transversely oval, with its proximal and distal lips about equally developed. The type-specimens (Brit. Mus. 75. 5. 29. 30) of *Pustulopora delicatula* Busk show ovicells of the general character of those here described in two of the branches.

Measurements, in μ:

Width of branch at lower end of fig. 11, 250; of left branch, fig. 11, 400;

Length of part of ovicell visible in the same figure, measured in a straight line, 1,950;

Greatest width of ovicell, as seen in the same figure, 450;

Diameter of zooecia, fig. 11, 75—100; of orifices, 80.

The specimens here described appear to agree closely with *E. wasinensis*, which Mr Waters regards as including *E. deflexa* Smitt, 1872 (nec Couch). The agreement is manifested in the form of the zoarium, in the measurements of the various parts, and particularly in the characters of the ovicell and of the ooeciostome. Waters particularly comments on the fact that none of the zooecia pass through the ovicell.

3. *Entalophora intricaria* Busk (? sp.). (Pl. X, figs 13, 14).

Pustulopora intricaria Busk, 1875, "Cat. Mar. Pol. Brit. Mus.", III, p. 22, Pl. X, figs 1, 4 (South Australia).

Pustulopora intricaria Haswell, 1879, "Cycl. Pol. Port Jackson", Proc. Linn. Soc. N. S. Wales, IV, p. 352.

Entalophora intricaria Waters, 1914, "Mar. Fauna Brit. E. Afr.", "Bry. Cycl.", Proc. Zool. Soc., p. 842.

135. F. / 506. B. } Stat. 164. 1°42.5 S., 130°47.5 E., 32 Metres; sand, small stones and shells.

202. D. Stat. 282. Anchorage between Nusa Besi and the N. E. point of Timor, 27—54 Metres; sand, coral and Lithothamnion.

(? sp.) 106. A. Stat. 144. Anchorage N. of Salomakiee (Damar) Island, 45 Metres; coral-bottom and Lithothamnion.

(? sp.) 351. A. Stat. 240. Banda Anchorage, 9—45 Metres; black sand, coral, Lithothamnion-bank in 18—36 Metres.

(? sp.) 254. F. Stat. 315. Anchorage E. of Sailus Besar, Paternoster Islands, 0—36 Metres; coral and Lithothamnion.

The following specimens, in the Collection of the University Museum of Zoology, Cambridge, may belong to the present species: —

Torres Straits, 45, 90, A. C. Haddon Coll., Reg. Febr. 24, 1898.

Zoarium rather more robust than that of *E. delicatula*, and the zooecia slightly larger; their immersed portions sometimes very long. Ovicell not bifurcating with a branch: its roof pierced by isolated peristomes, and its ooeciostome not terminal.

The present species is slightly coarser than *E. delicatula*, and its zooecia are somewhat larger. In some of the specimens referred to it, the zooecia have a very long portion immersed in the general substance of the branch, before they give off their free peristomes [1]) The feature which specially distinguishes this form is the ovicell, which has the character shown in fig. 14. In this specimen the ovicell is rather broad, with a gently convex frontal surface, which descends very steeply into the lateral walls of the branch. It is "simple" in character, not bifurcating with the branch. In the fact that its roof is traversed by zooecial peristomes (usually isolated) it differs from the other 'Siboga' specimens. The ooeciostome (if this structure has been correctly identified) is situated at a long distance from the distal end of the ovicell, instead of being terminal, as in the other two species. In fig. 14 it seems to be the opening which is adnate to an ordinary peristome, not far from the proximal end of the ovicell; and it is not unlike an ordinary orifice in shape. Ovicells of a similar type are present in 202. D., in which the ooeciostomes also have the character shown in the figured branch. One of the Torres Straits specimens (90) has ovicells in which the roof is traversed by zooecia, although the ooeciostomes cannot be seen with certainty. The remaining specimens in the above list have no ovicells; and the determinations must be regarded as doubtful.

All the specimens described are small fragments.

Measurements, in μ (fig. 14):

Width of branch, at lower end, 580;
Length of inflated part of ovicell, 1,820;
Greatest width of inflated part of ovicell, 1,000;
Diameter of peristomes, 130—150;
Diameter of orifices, 100.

Mr Waters (l. cit.) has stated that in *E. intricaria* the zooecia pass through the ovicell. This is the principal justification for the determination of the 'Siboga' specimens, which are, however, more delicate than those described by Busk and may belong to a distinct species. Their fragmentary condition does not permit any statement to be made as to the character of the zoarium: which, according to Busk's original description, should form "dense intricate masses of considerable size".

Fam. Diastoporidae Busk.

Diastoporidae Busk, 1859, "Monogr. Foss. Pol. Crag", Palaeont. Soc., pp. 91, 113.
Diastoporidae Smitt, 1866, "Krit. fort. Skand. Hafs-Bry.", II, Öfv. K. Vet.-Ak. Forh. XXIII, p. 395.

I use the Family Diastoporidae in the sense in which it was understood by Busk and

1) The greatly elongated zooecia seen in some of the specimens (fig. 13) have not been found in fertile branches: and it is possible, though not very probable, that they may not belong to the same species as the fertile branches.

SMITT, for adnate or foliaceous forms in which the zooecia are to a large extent immersed, forming a continuous sheet, and in which the peristomes are relatively little developed. The ovicells differ in the various species, sometimes being but little expanded, and not unlike those of *Crisia*, and sometimes being considerably broadened in a transverse direction, so as to form conspicuous inflations on the surface of the colony. It appears to be characteristic of this Family that zooecia with functional polypides are restricted to the periphery of the colony, the more centrally placed zooecia becoming occluded by a calcareous covering, the form of which may serve to distinguish the species. By many authors the Diastoporidae are regarded as falling within the Tubuliporidae.

Berenicea Lamx.

Berenicea Lamouroux, 1821, "Exp. Method.", p. 80.
Berenicea Lamouroux, 1824, "Encycl. Méthod.", "Zooph.", p. 140.
Berenicea Gray, 1848, "List Brit. An. Brit. Mus.", I, p. 142.
Berenicea Reuss, 1867, "Bry. Braunen Jura Balin", Denkschr. K. Ak. Wiss. Wien, math.-naturw. Cl. XXVII, I Abth., p. 4.
Berenicea Novák, 1877, "Bry. Böhm. Kreideform.", Ibid., XXXVII, II Abth., p. 96.
Berenicea Gregory, 1896, "Cat. Foss. Bry. Brit. Mus.", "Jurassic Bry.", p. 76.
Diastopora Waters, 1914, "Mar. Fauna Brit. E. Africa", "Bry. Cycl.", Proc. Zool. Soc., p. 835.
Diastopora auctt. (nec Lamouroux, 1821, p. 42).

By most writers on recent Polyzoa the genus *Berenicea* has been suppressed in favour of *Diastopora*. LAMOUROUX used the former for encrusting species, and the latter for foliaceous forms. The history of the genera was explained by REUSS (1867), who pointed out that the distinction between them was somewhat arbitrary. GREGORY (1896) argues in favour of retaining the distinction made by LAMOUROUX, on the ground of convenience. CANU [1]) considered that *Berenicea* was inseparable from *Diastopora*, placing the species described by him in *Diastopora*. In a later paper [2]) he uses *Berenicea* in preference to the other generic name. NORMAN [3]) maintained that *Berenicea prominens* Lamx was really identical with the Cheilostome *Chorizopora brongniartii* Aud.; although in a later paper [4]) he stated that *B. prominens* was mentioned by him in error, and that *B. annulata* was the species he intended to refer to. I am in agreement with WATERS [5]) in thinking that LAMOUROUX' *Berenicea* probably referred to the Cyclostomatous species which have been placed in it by other authors, and not to *Chorizopora*.

1. *Berenicea sarniensis* Norman. (Pl. XI, figs 4, 5).

Diastopora sarniensis Norman, 1864, "Undescr. Brit. Hydr. Act. Pol.", Ann. Mag. Nat. Hist. (3) XIII, p. 89, Pl. XI, figs 4—6 (Guernsey & Jersey).
Diastopora sarniensis Busk, 1875, "Cat. Mar. Pol. Brit. Mus.", III, Pl. XXXIV, fig. 5.
Diastopora sarniensis Hincks, 1880, "Hist. Brit. Mar. Pol.", p. 463, text-fig. on p. 461, Pl. LXVI, figs 7—9.

1) CANU, F., 1898, "Et. Ovicelles Bry. Bathonien", Bull. Soc. Géol. France, (3) XXVI, p. 265.
2) Ibid., 1913, "Contr. Ét. Bry. Foss.", Ibid., (4) XIII, pp. 268—.
3) NORMAN, A. M., 1903, "Notes Nat. Hist. E. Finmark", Ann. Mag. Nat. Hist. (7) XI, p. 569.
4) Ibid., 1909, "Pol. Madeira", J. Linn. Soc., Zool., XXX, p. 299, note.
5) WATERS, A. W., 1904, "Bry. Fr.-Josef Land", II, Ibid., XXIX, p. 172.

Diastopora sarniensis Hincks, 1884, "Pol. Queen Charlotte Islands", Ann. Mag. Nat. Hist. (5) XIII, p. 206.
Diastopora sarniensis Hincks, 1887, "Pol. Adriatic", Ibid. (5) XIX, p. 308.
Diastopora sarniensis MacGillivray, 1887, McCoy's "Prodr. Zool. Vict.", Dec. XV, p. 181, Pl. CXLVII, figs 4—4 *b*.
Diastopora sarniensis Kirkpatrick, 1890, "Hydr. Pol. China Sea", Ann. Mag. Nat. Hist. (6) V, pp. 17, 22.
Diastopora sarniensis Calvet, 1902, "Bry. Mar. Corse", Trav. Inst. Zool. Montpellier, (2) Mém. 12, p. 42.
Diastopora sarniensis Jullien and Calvet, 1903, Res. Camp. Prince de Monaco, XXIII, p. 117.
Diastopora sarniensis Calvet, 1907, "Bryozoaires", Exp. Sci. Travailleur et Talisman, VIII, p. 465.

Mr Waters (1887, "Tert. Cycl. Bry. New Zealand", Q. J. Geol. Soc., XLIII, p. 342) has recorded *Diastopora sarniensis*, var. *perangusta* from New Zealand, both recent and fossil; but he states that the zooecia are only about half the size of those of typical *D. sarniensis* from Guernsey.

81. F. Stat. 105. 6° 8' N., 121° 19' E., 275 Metres; coral-bottom.
566. F. Stat. 204. Between Islands of Wowoni and Buton, N. entrance of Buton Strait, 75—94 Metres; sand with dead shells.
551. C. Stat. 310. 8° 30' S., 119° 7'.5 E., 73 Metres; sand with a few pieces of dead coral.

And (Mus. Zool., Cambridge): —

Japan, Uraga Channel, off Tokyo, 80 fathoms; A. Owston Coll., 28. H., Reg. June 23, 1902.

Zoarium somewhat irregular in form, sometimes flabellate. Marginal lamina variable. Zooecia quincuncial, not in radiating series, peristomes free. Occlusion of the orifices partial, in the form of a transverse calcareous plate from which rises a short, narrow tube which remains open at its free end. Ovicells not forming a continuous ring; not broader than long, or not much broader than long. Ooeciostome centrally placed, near the distal end, but looking somewhat proximally.

The present species, which I am unable to distinguish from the European *B. sarniensis*, originally described by Norman from Guernsey and Jersey, is represented by only a few specimens in the 'Siboga' Collection. In its young state (566. F.) the colony may commence with a narrow *Stomatopora*-like portion, which after a time bifurcates, at right angles, into two lobes, at an angle of 180° to one another. In the specimen described, one of these lobes has hardly developed, while the other remains quite flabellate (fig. 5). In a later stage of growth (fig. 4) the colony is more discoidal, but with an irregular outline. The zooecia show none of the radial arrangement which characterises *B. lineata*, but are arranged quincuncially. Their proximal parts are depressed, as in the other species; but their distal parts rise into free peristomes, which do not become connate. In the 'Siboga' specimens, very few of the orifices are occluded, and the marginal lamina remains narrow. In the specimen from Japan, all the centrally placed zooecia are occluded: and, in correlation with this fact, the marginal lamina is broad, no doubt indicating a rapid production of new zooecia to take the place of those which are being occluded.

The "closure" of the zooecia takes the form which is well known in British specimens: a calcareous plate being formed across the orifice, and giving off a short, open tube, of small diameter. Two such "closures" are seen in fig. 5. The small tube is generally given off from the distal half of the calcareous plate.

The ovicells (fig. 4) are not so broad as those of *B. lineata*; and they show no disposition to form a continuous ring. They are very distinctly outlined, as their inflated part commences suddenly, even on the proximal side. In one of the colonies on slide 551. C., the roof of the ovicell has been broken; permitting the observation to be made that the ovicell has a round hole in its proximal wall, of the same diameter as a zooecium. This no doubt indicates the region where the ovigerous zooecium dilated suddenly into an ovicell. The floor of this ovicell is complete, the subjacent zooecia being covered by a calcareous film which conceals their outlines. The ooeciostome is placed at the middle of the ovicell, near its distal border. It is not terminal, as it is in *B. suborbicularis*; and it slopes a little proximally (see left ovicell in fig. 4). The ooeciostome is a short tube which is terminated by a nearly circular ooeciopore. Several ovicells may be present in the same colony.

The Japanese specimen agrees in all respects with those from the 'Siboga' Collection, except for the difference, which has already been pointed out, of having all its central zooecia occluded; but the form of the "closure" is as in the other specimens.

Measurements, in μ:

Greatest diameter of colony, fig. 4, 3.400;
Width of ovicells, fig. 4, 500, 525, 700;
Diameter of ooeciopore, 50;
Diameter of orifices, 70.

2. *Berenicea lineata* MacGill. (Pl. XI, figs 6, 7).

Diastopora lineata MacGillivray, 1885, "Descr. New Pol.", VII, Trans. Proc. R. Soc. Vict., XXI, p. 96, Pl. III, fig. 1.
Liripora lineata MacGillivray, 1887, Ibid. XII, Trans. Proc. R. Soc. Vict., XXIII, p. 182.
Discotubigera? lineata Waters, 1887, "Bry. N. S. Wales", II, III, Ann. Mag. Nat. Hist. (5) XX, p. 260, Pl. VI, fig. 24.
Discotubigera? lineata Waters, 1889, "Ovicells Lichenoporae", J. Linn. Soc., Zool., XX, p. 284, Pl. XV, fig. 5 (ovicell).
? *Diastopora bicolor* MacGillivray, 1885, "Descr. New Pol.", VIII, Trans. Proc. R. Soc. Vict. XXI, p. 117, Pl. V, fig. 2.
? *Diastopora bicolor* MacGillivray, 1887, McCoy's "Prodr. Zool. Vict.", Dec. XV, p. 180, Pl. CXLVII, figs 3, 3*a*.
? *Liripora bicolor* MacGillivray, 1905, "Monogr. Tert. Pol. Vict.", Trans. R. Soc. Vict., IV, p. 131, Pl. XX, fig. 8; Hall, Ibid., Appendix, p. 138.
? *Diastopora prominens* Ortmann, 1889 (nec Lamouroux, 1821), "Japan. Bry.", Arch. f. Naturg. Jahrg. LVI, Bd I, p. 64, Pl. IV, fig. 38.

104. C. Stat. 139. 0°11 S., 127°25 E., 397 Metres; mud, stones and coral.
424. A. Stat. 240. Banda Anchorage, 9—45 Metres; black sand, coral; Lithothamnion-bank in 18—36 Metres.

Also (Mus. Zool., Cambridge): —

Singapore, New Harbour, 6 fathoms, Dr. R. HANITSCH, Reg. Apr. 10, 1900.
Japan, Uraga Channel, off Tokyo, 30 fathoms, A. OWSTON Coll., 7. X., Reg. June 23, 1902.

Each of the above localities is represented by a single specimen.

Zoarium circular, with a strongly developed marginal lamina, which may become free and cup-like. Zooecia with a pronounced radial arrangement, those of the central region with a depressed porous region passing into the projecting peristomial part. The peristomes are connate, in radial series; at first uniserial, but more peripherally becoming biserial or triserial. In fertile colonies the series of zooecia appear interrupted by the ovicells, but may bifurcate in that region, so that the number of series is greater on the peripheral side of the ovicells than in the central part of the colony. Outside the ovicells, the zooecia are usually in connate groups, which are two or three zooecia wide. Ovicells transversely elongated; when several are present, forming a ring which extends round almost the entire circumference of the colony. The more centrally placed zooecia are closed by a terminal or slightly depressed calcareous plate.

The genus *Liripora* was founded by MacGillivray (1887) for species which differ from *Diastopora* [*Berenicea*] in having the zooecia arranged in uniserial or multiserial radiating rows. It appears to me possible that *L. bicolor* of the same author is identical with *L. lineata*.

The bathymetrical range of this species is considerable (6 fathoms = 11 Metres, to 397 Metres), if the specimens here described are rightly referred to the same species. The largest colony is shown in fig. 7 (424. A.), and measures 4.4 mm. in diameter, a size which would have been slightly exceeded if the marginal lamina had been complete. The connate, radial arrangement of the zooecia appears to be very characteristic of this species; and this is a sufficient reason for distinguishing it from *B. patina* Lamk, which it resembles in several respects. The zooecia in these series are at first arranged in a single line, but become biserial even on the central side of the ovicell, while more peripherally they are in two or three series. The depressed parts, between the series, in the central region of the colony, are porous, and at first sight might be mistaken for parts of the ovicells. More careful examination shows, however, that these parts are divided by septal lines; and the specimen 104. C. (fig. 6) shows very distinctly that these are really the edges of the walls between the zooecia, which are accordingly depressed in the proximal part, becoming raised in their peristomial region into the constituents of the radiating ridges. Consecutive zooecia of a series may have their depressed part on the same side or on opposite sides of the peristomes; in the latter case an alternate disposition being indicated.

It appears to be characteristic of the present genus that the centrally placed zooecia cease to be functional at a relatively early stage. This is indicated by the fact that they are terminated by the well known calcareous "closure". The shape of this closing plate offers good characters for the discrimination of the species. In the present case the "closure" is of the type characteristic of *B. patina*: consisting of a nearly terminal plate provided with a few pores, but not raised into a tubular prolongation. It may safely be assumed that the formation of the terminal plate is a consequence of the degeneration of the polypide: and that the only zooecia which possess functional polypides are those which have no "closure" and are situated in the marginal region of the zoarium [1]). The great development of the marginal lamina which is so common in this genus is probably correlated with the fact that there is here an active growth of new zooecia to replace the more centrally placed occluded zooecia.

1) I have evidence, derived from a British specimen of *B. sarniensis*, that the central zooecia contain no functional polypides.

The inflated part of the ovicell (which has been figured by WATERS, 1889) commences very suddenly on its proximal side, and it is hardly possible to distinguish which zooecium has given rise to it. There is, however, every probability that, as in other Cyclostomes, the ovicell is at first a zooecium, the distal end of which becomes greatly enlarged and dilated as the result of the development of an egg into an embryo which gives rise to numerous larvae by a process of embryonic fission. In fig. 6 only a single ovicell is present; and it is thus easy to distinguish its lateral outlines. The ooeciostome is in this case a short tube which rises symmetrically from the middle of the distal border of the ovicell, terminating in a nearly circular ooeciopore which looks frontally.

In fig. 7 the ovicells form a ring which is quite complete except at one side, where the growth of the colony has no doubt been checked by some object on which it was growing. Four ooeciostomes can be distinguished, each of which lies near the proximal end of a pluriserial group of connate zooecia, representing the peripheral end of one of the series of zooecia which started near the centre of the colony. As these peripheral groups (about 26) are more numerous than the radial ridges (about 16) in the more central part of the colony, it may be concluded that some of the series have bifurcated, but that the point of bifurcation is concealed by the ovicell. The number of ooeciostomes present indicates that there are probably four ovicells in specimen 424. A.; but the lateral union of the ovicells is so intimate that their limits cannot be made out. It is not impossible that they have fused with one another laterally, so that the cavities have become confluent; but it cannot be ascertained whether this is the case or not without destroying the specimen.

424. A. was growing on a small Gasteropod shell, and the Japanese specimen was also on a shell. 104. C. is on the basal surface of a Retepore (104. B.), two or three of the fenestrae of which are obliterated by its marginal lamina.

Measurements, in μ: —

Greatest diameter of colony, fig. 7, 4,400;
Greatest diameter of ovicell-ring, fig. 7, 3,300;
Radial diameter of the same ovicells, 600—700;
Width of ovicell, fig. 6, 850;
Diameter of ooeciopore, 80;
Diameter of orifices, 100.

TUBULIPORIDAE Johnston.

Tubuliporidae (pars), Johnston, 1838, "Hist. Brit. Zooph.", Ed. 1, p. 267.
Tubuliporidae (pars), Johnston, 1847, Ibid., Ed. 2, p. 265.
Tubuliporidae (pars), Hincks, 1880, "Hist. Brit. Mar. Pol.", p. 424.
Tubuliporidae and *Idmoneidae* auctt.

The Family Tubuliporidae, as used by JOHNSTON in 1838, included the two genera *Tubulipora* and *Discopora*; the former comprising species of *Berenicea* (*Diastopora*) as well as species which have retained their place in *Tubulipora*. *Discopora* was represented by *D. hispida* only, a species which has been placed in *Lichenopora* by the majority of recent authors.

In the present Report the Family Tubuliporidae is understood to include the genera there placed by Hincks, with the exception of *Diastopora* and *Entalophora*; and to consist, therefore, of Cyclostomata in which the zooecia are restricted to one surface of the colony and are commonly arranged in connate alternating series. Cancelli are absent in the majority of the species. The ovicell is a modified zooecium which is usually much dilated in the region where the embryos undergo their development.

The study of recent Cyclostomata is greatly complicated by the fact that this Suborder is represented by an immense number of fossil forms, which have frequently been named from imperfect fragments; and by the fact that it has been investigated to a large extent independently by Palaeontologists and students of the recent species. The conclusions of these two sets of workers referring to nomenclature have often been very different; and there have been many divergences of opinion with regard to the propriety of identifying recent with fossil species. It must be remembered that the recent species constitute but a small fraction of the number of those known in a fossil condition. A satisfactory decision as to the limits and interrelationships of the genera must be based on a full consideration of the fossil forms. I do not feel myself competent to undertake this task; and I am aware of the fact that the conclusions drawn from a study of the recent forms alone must be subject to a considerable amount of revision at the hands of those who combine a knowledge of fossil and recent species.

Reptotubigera D'Orb.

Reptotubigera D'Orbigny, 1853, "Pal. Franç. Terr. Crét.", p. 751.
Stomatopora (pars), Hincks, 1880, "Hist. Brit. Mar. Pol.", p. 424.

The genus *Reptotubigera* was introduced by D'Orbigny for forms which are entirely adherent, having their zooecia arranged in series, as in typical species of "*Idmonea*". It was regarded by him as synonymous with *Obelia* Lamouroux [1]), preoccupied by *Obelia* Péron and Lesueur (Hydrozoa). Gregory [2]) regards it as a synonym of *Proboscina* [3]) Audouin.

Obelia tubulifera was described by Lamouroux from recent Mediterranean specimens, which it might be unnecessary to separate from *Tubulipora*. *Proboscina boryi* was named by Audouin from specimens, obtained in Egypt, which had been figured by Savigny. The figures show that these are also *Tubulipora*-like forms, with well developed peristomes, but having ovicells of an unusually simple character. It is not stated whether they came from the Mediterranean or the Red Sea coast. Most of the species figured by D'Orbigny, namely *R. neocomiensis* (Pl. 763, figs 1—3), *R. marginata* (Pl. 750, figs 19—21), *R. ramosa* (Pl. 751, figs 1—3), and *R. serpens* (Pl. 751, figs 4—7) are adnate forms in which the branches are linear or not much expanded, and in which the peristomes seem to be comparatively short. With this type the

1) Lamouroux, 1821, "Exp. Méthod.", p. 81 (nec *Obelia* Péron and Lesueur).
2) Gregory, J. W., 1896, "Cat. Foss. Bry. Brit. Mus.", "Jurassic Bry.", p. 59.
3) For a criticism of this genus, see Walford, 1889, "Bry. Inf. Oolite Shipton Gorge", I. Q. J. Geol. Soc. XLV, p. 565.

species described below agrees well; and it seems convenient to place it in D'ORBIGNY's genus. It might well have been placed in *Stomatopora*, as understood by HINCKS; but GREGORY (t. cit., p. 42) has given reasons for restricting this generic appellation to species in which the zooecia are uniserial, as in *S. granulata*.

1. *Reptotubigera philippsae* n. sp. (Pl. X, fig. 9).

Idmonea australis (pars), Philipps, 1899, WILLEY's Zool. Res., Pt. IV, "Polyzoa", pp. 441, 449.

I name this species after Miss E. G. PHILIPPS, who has recorded it from Lifu. It is probably allied to *Idmonea ramosa* Waters [1]).

250. A. Stat. 310. 8° 30' S., 119° 7'.5 E., 73 Metres; sand with a few pieces of dead coral. (On an Alcyonarian axis).

and (Mus. Zool. Cambridge, Reg. Mar. 1, 1898), *Idmonea australis* (so determined by Miss PHILIPPS), Lifu, Loyalty Islands, A. WILLEY Coll., Reg. Mar. 1, 1898.

Zoarium entirely adherent, formed by two or three elongated, strap-like lobes which may diverge from one another at an angle of nearly 180°; the edges of the lobes forming a basal lamina, marked by porous areas representing closed vestigial zooecia. Lobes nearly semicircular in transverse section, most raised in the middle, but without any angulation in that region. Zooecial series very close together, alternate in the more proximal parts, but becoming nearly opposite at the ends of the lobes. Number of zooecia in a series 3 or 4, less in the proximal parts of the lobes. The two or three zooecia nearest the middle of the lobe are connate, the outermost zooecium usually separate from the others. Peristomes short, completely connate or partially free; curved in the more proximal parts, straight and nearly at right angles to the surface of the branch at the distal ends of the lobes. Ovicells inflated, rather broad, but not very distinctly outlined. Ooeciostome a short tube, developed on the proximal side of one of the series of zooecia, near its median end. Ooeciopore directed frontally, elongated transversely and more or less oval.

The 'Siboga' Collection includes only two specimens of the present species; both from the same Station. The larger, which is represented in fig. 9, measures 9 mm. in total length, and consists of two strap-shaped lobes, closely adherent to the substratum, an Alcyonarian axis, and diverging from one another at an angle of almost 180°. In the oldest part of the colony the zooecia are somewhat smaller than in the more distal parts, and the full number of zooecia in a series is not attained. Some of the zooecia near the centre have long peristomes, which may be free. The series of zooecia are unusually close together. They are at first regularly alternate and the zooecia are curved; but, towards the end of the lobes, where ovicells are present, they become almost opposite; the zooecia being now straight and standing almost at right angles to the surface. The arrangement of the zooecia in the series has been indicated in the diagnosis. The middle of the branch is the most elevated part, but it is rounded and not angular.

1) WATERS, A. W. 1887. "Tert. Cycl. Bry. New Zealand". Q. J. Geol. Soc., XLIII, p. 339. Miss JELLY (1889, "Syn. Cat. Rec. Mar. Bry." p. 119) records recent specimens from Stewart Island.

Both lobes possess an ovicell near the distal extremity, and the longer lobe has a more proximal one as well. The ovicells are all alike, rather broad and moderately swollen, but not very distinctly outlined. The ooeciostome is in each case a very short tube, which rests against the two inner zooecia of a series, on their proximal side. The ooeciopore is transversely oval and is visible in the frontal view of the branch.

The basal surface of the lobes is prolonged into a well marked marginal lamina, which projects beyond the rest of the lobe and is closely adnate to the substratum. The marginal lamina shows a series of porous areas, which are represented in fig. 9 (*l*) on the right side, and are separated from one another by low but moderately broad ridges.

The Polyzoa belonging to Dr A. WILLEY's Collection from Lifu and other localities were described by Miss E. G. PHILIPPS, and are preserved in the University Museum of Zoology at Cambridge. Two slides mounted by Miss PHILIPPS were referred by her to *I. australis*; but they certainly do not belong to MACGILLIVRAY's species. Of these, one slide contains several young colonies, on sea-weed; showing the primitive disc, which is surrounded by fine denticulations, like those figured by BUSK [1]) in a form referred by him to *Tubulipora organisans* D'Orb. The marginal lamina of the specimens in question, instead of forming a broad zone round the branch, is hardly present, but it is represented by a number of short lateral projections which are separated from one another by rounded bays [2]). The zooecia have long, slender, curved peristomes, some of which are free and others connate. It is not impossible that these specimens belong to the same species as the 'Siboga' specimens: but, if so, it would have to be assumed that the entire colonies had not developed beyond the condition which is indicated in the central region of fig. 9 and that the projecting points of the marginal lamina represent the porous areas of the 'Siboga' specimens not yet closed. In the absence of any evidence as to the characters of the primitive disc of the 'Siboga' specimens, it would, however, be unsafe to assume that these Lifu colonies belong to the same species.

The second slide referred by Miss PHILIPPS to *I. australis* may, however, be placed without hesitation in the same species as the 'Siboga' specimens, with which it agrees closely in the form and arrangement of the zooecia, in the ovicells (of which two are present), in the ooeciostomes, and in the marginal lamina. The specimen throws considerable light on the morphology of the porous areas of the marginal lamina shown in fig. 9. The agreement with the 'Siboga' specimens is complete in the more central part; but, at the end of one of the two lobes present, the porous areas are represented by the open mouths of structures which exactly resemble the incompletely developed zooecia which are usually found at the growing margin of a Cyclostome colony. It is obvious from this specimen that the porous areas result from the closure of the imperfectly developed zooecia by calcareous plates, in which pores are developed. The ridges separating the porous areas are clearly seen to be the remains of the lateral walls of zooecia, the porous plates having been developed at a level slightly lower than the edges of the septal walls.

1) BUSK. G., 1879, "Pol. Kerguelen". Phil. Trans., CLXVIII (Trans. of Venus Exp.) p. 6 (sep.). Pl. X, figs 22—25.

2) It may be noted that the occurrence of fine denticulations round the primitive disc and of pointed lateral projections at the edges of the marginal lamina cannot be regarded as distinctive of any single species, since both characters are shown in Japanese specimens (OWSTON Coll., 40. F.), in the Cambridge Collection, the adult condition of which is of a flabellate type resembling *Tubulipora flabellaris*.

Measurements, in μ:

Length of the entire colony, fig. 9, measured in a straight line, 9,000;
Greatest diameter of right lobe, 1,330;
Width of the longer zooecial series, 360;
Longest diameter of orifices, about 100;
Width of ooeciopore, 110.

Tubulipora Lamarck.

Tubulipora Lamarck, 1816, "Hist. An. sans Vert.", Ed. 1, II, p. 161.
Tubulipora Lamouroux, 1821, "Exp. Méthod.", p. 1.
Tubulipora Harmer, 1898, "Dev. *Tubulipora*", Quart. J. Micr. Sci., XLI, p. 90.
Idmonea Lamouroux, 1821, "Exp. Méthod.", p. 80.

I have stated my conviction, on a former occasion [1]) that *Idmonea*, as commonly understood, is inseparable from *Tubulipora*. The first species given by LAMARCK is *T. transversa* [2]), which from his synonymy appears to be identical with the species described by most authors as *Idmonea serpens*, but which appeared to me to be more properly designated *T. liliacea* Pall. This species is usually adnate, although showing some tendency to become erect. In this latter form it has so marked a similarity to species like *Idmonea atlantica* auctt., that it is hardly possible to separate it generically from that species, and therefore from a number of other erect species which writers on recent Polyzoa are agreed in referring to *Idmonea*. It passes, on the other hand, through species like *T. phalangea* and *T. flabellaris* to the flabellate, adnate species which are usually regarded as constituting the genus *Tubulipora*. *T. phalangea* shows the serial arrangement of zooecia in as pronounced a form as in any species of *Idmonea*, while *T. flabellaris* may have a considerable proportion of its peristomes isolated, although others may be arranged serially. *T. aperta* Harm. was characterised as a species in which the peristomes are all isolated or in which the tendency to assume a serial disposition is only slightly marked. There seems thus to be a continuous succession, among recent species, from the erect "*Idmonea*" type, with strongly marked alternating series of zooecia, to the adnate, flabellate, "*Tubulipora*" type, in some species of which the serial arrangement is wanting.

While most writers on recent Polyzoa have distinguished *Idmonea* from *Tubulipora* by its erect habit, a different view is taken by some Palaeontologists. GREGORY [3]) considers that *I. triquetra*, the only species included by LAMOUROUX in *Idmonea*, and therefore indubitably the genotype, differs generically from "the erect forms attributed to *Idmonea*". He accordingly defines *Idmonea* as consisting entirely of adnate forms, and uses *Crisina* D'Orbigny for the erect forms which by most authors are placed in *Idmonea*. For the flabellate, adnate species referred by most authorities to *Tubulipora*, GREGORY employs *Phalangella* Gray [4]). I regret that I cannot follow him in this usage, on the ground that the only two species included by GRAY

1) HARMER, S. F., 1898 (see ref. on p. 124), p. 88.

2) This is the only species mentioned by LAMOUROUX (1821, p. 1): and, as pointed out by GREGORY (1899, "Cat. foss. Bry. Brit. Mus.", "Cret. Bry.", I, p. 157), it thus became the genotype of *Tubulipora*.

3) GREGORY, J. W., 1899, t. cit., p. 150.

4) GRAY, J. E., 1848, "List Brit. An. Brit. Mus.", I, pp. 130, 149.

in his genus are *P. phalangea* and *P. flabellaris*: — both of them species which appear to me congeneric with *Tubulipora liliacea* (= *T. transversa*, the genotype of *Tubulipora*). In view of the enormous size of the genus *Tubulipora*, as I understand it (including the numerous fossil forms) some subdivision may be desirable on practical grounds; but I am unable to see how the adnate and erect conditions can be used by themselves in subdividing the genus into genera or subgenera.

It may be noted that CANU[1]) has proposed to abandon the genus *Tubulipora*, on the ground that it has been used in so many different senses by various authors. For the adnate, flabellate species referred to this genus by HINCKS and others, he uses MACGILLIVRAY's genus *Liripora*[2]), which was, however, introduced for *Diastopora lineata* MacG. and *D. fasciculata* MacG.: — species which appear to belong to *Berenicea* rather than to *Tubulipora*.

I have accordingly referred most of the forms of Tubuliporidae obtained by the 'Siboga' to the genus *Tubulipora*. The species commonly known as *Idmonea radians* appears to me to deserve generic separation; and I have placed it in *Crisina* D'Orbigny. For one of the other species I have employed *Reptotubigera* D'Orbigny. I follow WATERS in referring species of "*Idmonea*" with "dorsal" ovicells to *Tervia* Jullien.

For the synonymy of species referred to these and other genera, NEVIANI's still incomplete "Monografia del Genera *Idmonea*"[3]) should be consulted. LANG[4]) has published a recent summary of the Cretaceous species of "Idmoniidae".

1. *Tubulipora concinna* MacG. (Pl. X, fig. 10).

Tubulipora concinna MacGillivray, 1885, "Descr. new Pol.", VII, Trans. Proc. R. Soc. Vict. XXI, p. 94, Pl. I, figs 10—10*b*.
? *Tubulipora lucida* MacGillivray, 1885, Ibid., VIII, t. cit., p. 116, Pl. V, fig. 1.

350. D. / 351. E. / 352. B. — Stat. 240. Banda Anchorage, 9—45 Metres; black sand, coral, Lithothamnion-bank in 18—36 Metres.
(? sp.) 57. Y. Stat. 80. Borneo Bank, 2°25' S., 117°43' E., 40—50 Metres; fine coral-sand.

Zoarium more or less flabellate, completely adnate. Primitive disc without denticulations. Zooecia at the commencement of the colony strongly reflexed, the younger zooecia with extremely long, delicate peristomes, which are mostly completely free in the centre of the colony, but may unite in the marginal regions, where series of connate zooecia, 2—4 in number, occur nearly at right angles to the edge. Ovicells of the typical *Tubulipora* form, with numerous pores. Ooeciostomes free, with a more or less everted lip. Ooeciopores elongated in one direction.

MACGILLIVRAY (l. cit., Part VII) has described three species of *Tubulipora* from Victoria, under the names *T. concinna*, *T. pulchra* and *T. connata*, all apparently nearly related to one

1) CANU, F., 1908, "Icon. Bry. Foss. Argentine", An. Mus. Nac. Buenos Aires, XVII, p. 310.
2) See above, p. 117.
3) NEVIANI, A., 1900, Parte I; Parte II, Cap. 1: 1901, Parte II, Cap. 2.
4) LANG, W. D., 1907, "Tab. view of Cret. Idmoniidae". Geol. Mag. (N. S.) Dec. V, Vol. IV, p. 122.

another. The present species agrees well, so far as I can judge, with the first of these three. In the arrangement of its zooecia, in the form of its ovicells, and particularly in the characters of its ooeciostomes, it resembles *T. aperta* Harmer[1]), from which it differs in the much smaller size of the zooecia. The peristomes are slender and of great length, being mostly free in the central parts of the colony and only united into series at the margin. The largest colony (fig. 10) measures about 4.5 mm. in longest diameter.

The roofs of the ovicells occur at the bases of the greatly elongated peristomes, and thus appear to lie at a low level. The outlines of the ovicells cannot be distinguished clearly in the specimen figured; but their number is indicated by the ooeciostomes, of which three are present. Each is a tube of some length, standing more or less at right angles to the roof of its ovicell, and completely free from the zooecia. The ooeciostome becomes compressed near its free end, so that the ooeciopore is elongated. The free lip of the ooeciostome is slightly everted.

350. D. and 351. E. were found on sea-weed; 352. B. on what appears to be a Chaetopod tube, perhaps a *Phyllochaetopterus*; and 57. Y. on an *Adeona* (57. C.). The last specimen has rather coarser tubes, and more nearly approaches *T. aperta* in this respect. It is possible that it does not belong to the same species as the specimens from Stat. 240, but it has no more than the commencements of ovicells.

Measurements, in μ:

Greatest diameter of colony, fig. 10, 4,500;
Diameter of zooecia, 95;
Diameter of ooeciopore, 110.

2. *Tubulipora atlantica* (Forbes, MSS.) Johnston. (Pl. X, figs 4, 5).

Idmonea atlantica (Forbes, MSS.) Johnston, 1847, "Hist. Brit. Zooph.", Ed. 2, p. 278, Pl. XLVIII, figs 3, 3.
Idmonea atlantica Busk, 1856, "Pol. Norway and Finmark", Ann. Mag. Nat. Hist. (2) XVIII, p. 34, Pl. I, figs *6a—c*.
Idmonea atlantica Busk, 1858, "Zoophytology", Q. J. Micr. Sci., VI, p. 128, Pl. XVIII, fig. 5 (Madeira).
Idmonea atlantica (pars) Busk, 1875, "Cat. Mar. Pol. Brit. Mus.", III, p. 11.
Idmonea atlantica Hincks, 1880, "Hist. Brit. Mar. Pol.", p. 451, Pl. LXV, figs 1—4.
Idmonea atlantica (pars) Busk, 1886, 'Challenger' Rep., L, p. 10.
Idmonea atlantica Ortmann, 1889, "Japan. Bry.", Arch. f. Naturg., Jahrg. LVI, Bd I, p. 58, Pl. IV, figs 20*a*, *b* (var. *disticha* Ortm.).
Idmonea atlantica Levinsen, 1894, "Zool. Danica", 4 Bd, 1 Afd., "Mosdyr", p. 76, Pl. VII, figs 4, 5.
Idmonea atlantica (det. R. Kirkpatrick), Thurston, 1895, "Rámésvaram Island and Fauna G. Manaar", Madras Gov. Mus., Bull. 3, p. 131.
Idmonea atlantica Neviani, 1900, "Monogr. Gen. *Idmonea*", Parte I, pp. 6, 49 (synonymy); 1901, Parte II, Cap. 2, p. 74.
Idmonea atlantica Jullien and Calvet, 1903, "Res. Camp. Sci. Prince de Monaco", XXIII, p. 113.
Idmonea atlantica Waters, 1904, "Bry. Fr.-Josef Land", II, J. Linn. Soc., Zool., XXIX, p. 166, Pl. XXI, figs 2, 3 (the ovicell here figured is unusually short).

1) Harmer, S. F., 1898, "Dev. *Tubulipora*", Quart. J. Micr. Sci., XLI, p. 101.

Idmonea atlantica Waters, 1904, "Rés. Voy. Belgica", "Bry.", p. 90, Pl. IX, fig. 5 (Antarctic).
Idmonea atlantica Nordgaard, 1906, "Bry. 2nd Fram Exp.", Rep. 2nd Norw. Arct. Exp., N° 8, p. 36.
Idmonea atlantica Calvet, 1907, "Bryozoaires", Exp. Sci. Travailleur et Talisman, VIII, p. 469.
Idmonea atlantica Calvet, 1909, "Exp. Antarct. Franç.", "Bry.", p. 41.
Idmonea atlantica Norman, 1909, "Pol. Madeira", J. Linn. Soc., Zool., XXX, p. 278, Pl. XXXIII, figs 1, 2.
Idmonea atlantica Thornely, 1912, "Mar. Pol. Ind. Ocean", Trans. Linn. Soc. (2) Zool., XV, p. 156.
Tubulipora atlantica Osburn, 1912, "Bry. Woods Hole", Bull. Bur. Fisheries, XXX, p. 217, Pl. XIX, figs 9, 9*a* (good figures of zoarium, ovicell and ooeciostome).
Tubulipora atlantica, forma *erecta* Smitt, 1866, "Krit. forteckn." II, Öfv. K. Vet. Ak. Förh. XXXIII, pp. 399, 434, Pl. III, figs. 6, 7; Pl. IV, figs 3—13 (ovicell figured).
Idmonea radians Van Beneden, 1849, "Rech. Bry. Mer du Nord" (suite), Bull. Ac. Roy. Belg. XVI, p. 646, Pl. I, figs 4—6.

The synonyms here given are only a small selection of the records of this species, which is believed to be cosmopolitan in its occurrence, extending from the Arctic to the Antarctic Ocean [1]).

26. A. Stat. 53. Bay of Nangamessi, Sumba, 0—36 Metres; coral-sand; near the shore, mud.
43. C. / 48. B. } Stat. 77. Borneo Bank, 3° 27′ S., 117° 36′ E., 59 Metres; fine grey coral-sand.
56. A. Stat. 80. Borneo Bank, 2° 25′ S., 117° 43′ E., 40—50 Metres; fine coral-sand.
394. J. Stat. 144. Anchorage North of Salomakiëe (Damar) Island, 45 Metres; coral-bottom and Lithothamnion.
353. F. Stat. 240. Banda Anchorage, 9—45 Metres; black sand, coral, Lithothamnion-bank in 18—36 Metres.
165. B. Stat. 248. Anchorage off Rumah Lusi, N. point of Tiur Island, 0—54 Metres; dredge and reef-exploration.
371. D. Stat. 273. Anchorage off Pulu Jedan, E. coast of Aru Islands, 13 Metres; sand and shells.
(? sp.) 459. H. Stat. 81. Pulu Sebangkatan, Borneo Bank, 34 Metres; coral-bottom and Lithothamnion; dredge and shore-exploration.
(? sp.) 394. O. Stat. 144. Anchorage North of Salomakiëe (Damar) Island, 45 Metres; coral-bottom and Lithothamnion.
(? sp.) 414. B. Stat. 315. Anchorage North of Sailus Besar, Paternoster Islands, 0—36 Metres; coral and Lithothamnion.
(Mus. Zool., Cambridge) Torres Straits, 131, A. C. HADDON Coll., Reg. Feb. 24, 1898.

Zoarium delicate, somewhat resembling that of *Crisina radians*, but the ramification less profuse and the branches slightly reflexed, not usually becoming parallel. Basal surface narrow and strap-like, marked off by sharp edges in the younger branches, generally slightly concave and (in most of the 'Siboga' specimens) bearing ripple-like lines of growth, along which the pores tend to be arranged in single transverse rows. Middle of the frontal surface elevated; the zooecia in alternating series, usually consisting of four zooecia, but sometimes of five, three or even two. The median zooecium, or the first two from the middle, longer than the outer zooecia. Ovicell a modified median zooecium, commonly beginning shortly before a bifurcation and forking with the branch; usually as long as many series of zooecia, in most

1) MACGILLIVRAY (1882, McCOY's 'Prodr. Zool. Vict.', Dec. VII, p. 30), in describing *I. australis*, suggested that it might prove to be a form of *I. atlantica*. It appears to me quite distinct, after comparing specimens of the two forms in the British Museum.

cases with a zigzag keel on its frontal surface. Ooeciostome in contact with a median zooecium, which it resembles; the ooeciopore not differing much from a zooecial orifice and facing more or less distally. The stalk of the colony becomes cylindrical by the development of a secondary cancellated growth on its basal surface.

This delicate species has a considerable resemblance to *Crisina radians* in external appearance; but differs from it in many important characters. The younger branches are narrow and strap-like, as seen in basal view; and are without cancelli. In nearly all the specimens referred to this species, the basal surface is marked by ripple-like lines of growth (fig. 4). The ripple, which is slightly elevated, is convex distally, and the pores of this surface of the branch are generally arranged in a single series along the projecting part. This character is somewhat variable, but in several of the specimens it is an extremely pronounced feature. The basal surface is nearly flat, but is usually slightly concave; and it is separated from the lateral surfaces of the branch by a sharply marked edge. In the main stalk of the colony this arrangement becomes modified by the superposition, on the original basal surface, of a secondary thickening, which grows in a distal direction, but does not extend far up the colony. This thickening, which has a cancellated structure and is shown in fig. 4, corresponds with the "canaux de renforcement" which have been described by PERGENS [1]) in species of *Idmonea*.

The frontal surface of the branch is most elevated at its middle, owing to the fact that the more median zooecia are much the most prominent. The zooecia, which are closely connate in each series, are usually four in a series, but sometimes five or even three or two. The median zooecium may project beyond its neighbour, and thus have a free peristome. The orifices are nearly circular. The colony may commence with one or two alternating single zooecia; a bi-zooecial condition next following and the full number being quickly acquired.

The ovicell constitutes a specially characteristic feature of the present species. Its length varies with the degree of vigour in the growth of the colony. In most cases it is very long, corresponding in length with as many as 12 series of zooecia of one side. Near its frontal part it is somewhat compressed, in such a way as to form a zigzag keel, giving off a branch to each series of zooecia, as indicated in fig. 5. Evidence that it is morphologically a modified median zooecium is given by two facts: — (I) it commences proximally with a narrow portion which occupies the position of a median zooecium; (II) the ooeciostome (fig. 5, *o*) occurs on the median side of one of the series of zooecia in the course of the ovicell. From the fact that the ooeciostome has a considerable resemblance to an ordinary peristome it is not very conspicuous; and since only one ooeciostome occurs in each ovicell, the inner edge of a number of series may have to be examined before it is discovered. The carinate condition of the ovicell is usually well marked, but in some specimens it is hardly apparent. The ovicell generally commences a short distance on the proximal side of a bifurcation, and forks with the branch; sometimes bifurcating a second time when the branch divides.

The specimens 459. H. and 394. O. are rather more robust than the others. The basal surface has rounded edges and the pores are uniformly scattered, without being confined to

1) PERGENS, E., 1890. "Rev. Bry. Cretace", Bull. Soc. Belge Géol., III, p. 311. text-fig. 5 (p. 312); cf. also KIRKPATRICK, 1888. "Pol. Mauritius", Ann. Mag. Nat. Hist. (6) I, Pl. X. fig. 2 *b* (*Idmonea tortuosa*).

ripple-like lines of growth. In the absence of ovicells it is hardly possible to say what they are; and I think it not improbable that they may belong to some other species.

414. B. is a fragment which may belong to the present species.

Measurements, in μ:

Width of right hand branch, fig. 4, 400;
Breadth of the longest series of zooecia, fig. 5, 600;
Greatest length of the ovicell in fig. 5, measured in a straight line, (to end of left lobe) 2,800;
Diameter of zooecia, fig. 5, 100;
Diameter of orifices, fig. 5, up to 100.

2*a*. *Tubulipora atlantica* (Forbes, MSS.) Johnst., var. *flexuosa* Pourt. (Pl. X, figs 1—3).

Idmonea flexuosa Pourtales, 1867, "Contr. Fauna Gulf Stream", Bull. Mus. Harvard, I, p. 111 (off Havana, 270 fathoms).
Idmonea flexuosa Smitt, 1872, "Flor. Bry.", I, K. Svensk. Handl., X, N° 11, p. 6, Pl. II, figs 7, 8.
Idmonea atlantica, var. *tenuis* Busk, 1875, "Cat. Mar. Pol. Brit. Mus.", III, p. 11, Pl. IX (Cf. Busk, 1886).
Idmonea atlantica, var. *tenuis* Busk, 1886, Challenger Rep., L, p. 10.
Idmonea atlantica, var. *tenuis* Hincks, 1880, "Hist. Brit. Mar. Pol.", p. 452.
Idmonea atlantica, var. *tenuis* MacGillivray, 1887, "Descr. New. Pol.", XII, Trans. Proc. R. Soc. Vict., XXIII, p. 181.
Idmonea tenella Ortmann, 1889, "Jap. Bry.", Arch. f. Naturg., Jahrg. LVI, Bd I, p. 59, Pl. III, figs 3*a*, 3*b*.

80. A. } 477. A. } Stat. 105. 6° 8' N., 121° 19' E., 275 Metres; coral-bottom.
111. D. Stat. 156. 0° 29'.2 S., 130° 5'.3 E., 469 Metres; coarse sand and broken shells.

Zoarium delicate, the branches diverging, sometimes of considerable length before bifurcating. Basal surface narrow, without sharply marked edges, the longitudinal septal lines very distinct, but without transverse ridges. Branches sub-triangular in transverse section, the median zooecia the most prominent. Zooecial series usually with two zooecia, of which the median one is the longer, often considerably longer than the other. The zooecia may be completely connate, but both may develop a free peristome. Ovicells short, dilating gradually from their narrow proximal portion, then becoming considerably inflated, but without ridges on the frontal surface. Ooeciostomes?

The longest fragment (111. D.) is only 15 mm. in length. This specimen and 80. A. have branches which reach a length of about 8 mm. before bifurcating, but the unbranched regions of 477. A. are shorter. The whole colony is very delicate, and the branches are narrow and without sharp edges separating the basal from the lateral surfaces. The basal surface is somewhat convex, and it appears to be characteristic of this form that the longitudinal septal lines are here very distinct, and that the "back" is smooth and without ridges. The lateral surfaces slope fairly steeply to the middle of the frontal surface. The series are bi-zooecial in most cases, though three zooecia occur rarely. The median zooecium is usually distinctly longer than the outer one.

The ovicell is not unlike that of a typical *Crisia* in its general proportions, and in the fact that the narrow proximal part expands gradually into the inflated part. In length the ovicell corresponds with $2^1/_2$ to 3 zooecial series of one side. It usually occurs at about the middle of the unbranched part of a branch, but it may be found just on the proximal side of a bifurcation. Other ovicells may be developed on the distal side of the first one. Thus in 111.D. the fertile part of the branch bifurcates in one instance, and of the two branches thus formed one has an ovicell in the middle of its length, and the other has formed a new bifurcation, one of the branches of which bears another ovicell. In all cases observed the ovicell is simple, not bifurcating with the branch.

Most of the ovicells are either incomplete or broken; and I have not been able to distinguish the ooeciostome with certainty. In fig. 1 it is perhaps the second opening from the middle of the series of four tubes which constitute the second zooecial series from the proximal end, on the right side of the figure.

Two specimens from Japan, in the Collection of the University Museum of Zoology at Cambridge, show considerable resemblance to the present form in their zooecial characters. But there are differences in the ovicells, particularly in the existence of a long ooeciostome projecting laterally on one side of the ovicell and curving distally, which make it doubtful whether they should be referred to the same species or not.

Measurements, in μ:

Width of branch, fig. 2, 300;
Width of branch, just before bifurcation, fig. 3, 500;
Length of ovicell, fig. 1, 1,300;
Diameter of orifices, about 100.

The specimens here considered are both from deep water (275—469 Metres), and may represent an abyssal form of the species from shallower water which I have referred to *T. atlantica*. The description, unaccompanied by a figure, which was given by POURTALES would have been insufficient by itself for identification; but the specimens figured by SMITT, who regarded *I. flexuosa* as a form of *I. atlantica*, have a close resemblance to those dredged by the 'Siboga'. BUSK's var. *tenuis* of the same species seems indistinguishable from SMITT's form. In the biserial character of their zooecia the 'Siboga' specimens resemble *I. gracillima* Busk [1]) (nec Ortmann). BUSK states that the outer zooecia are the longer; but, from the examination of the slide labelled "Adventure Bank, Porcupine, 92 fathoms", in the British Museum I do not feel convinced that this is correct. The specimen consists of two minute fragments which are probably more or less worn. The median zooecia are much more distant from the basal surface than the outer zooecia, as in *T. atlantica*. It is to this assemblage of species, in which the median zooecia are at the same time the most raised and the longest, that BUSK's specimen seems to me to belong.

From the locality in which they were found, the 'Siboga' specimens might be supposed

1) BUSK, G., 1875, p. 14, Pl. VII, figs 5, 6. *I. gracillima* Busk is antedated by *I. gracillima* Reuss, 1869, "Pal. Stud. ält. Tertiärsch. Alpen". II. Denkschr. Ak. Wiss. Wien, math.-naturw. Cl. XXIX, p. 282.

to be identical with *I. tuberosa* D'Orbigny [1]) from Basilan Island (Philippines). But this species, although delicate and with biserial zooecia, is said to have the series "peu distinctes", and the two zooecia in each series are "écartées". It is further described as being everywhere wrinkled.

T. tenella was described by Ortmann, from Sagami Bay, Japan, 70—100 fathoms. The branches are described as very thin ("fadendünn"). The zooecia are usually 2—3-serial, most often biserial. Ovicells are not mentioned. No measurements are given in the text, but fig. 3*b* is said to be × 10. This gives a diameter of the branches, between the series of zooecia, of 600 μ; which is twice as much as the width of the 'Siboga' specimen indicated above.

3. *Tubulipora pulcherrima* Kirkp. (Pl. IX, figs 1—5).

Idmonea pulcherrima Kirkpatrick, 1890, "Hydr. Pol. China Sea", Ann. Mag. Nat. Hist. (6), V, p. 22, Pl. IV, figs 6—6*b* (Tizard Reef, 6 fathoms).

Idmonea interjuncta Waters, 1887, "Bry. N. S. Wales", I, II, III, Ibid., (5) XX, Pl. VI, fig. 29, pp. 84, 256.

Idmonea interjuncta Philipps, 1899, Willey's "Zool. Res.", Pt 4, "Polyzoa", pp. 441, 449 (Lifu, Loyalty Islands).

Idmonea interjuncta Waters, 1914, "Mar. Fauna Brit. E. Afr.". "Bry. Cycl.", Proc. Zool. Soc., p. 846, Pl. II, fig. 5.

? *Idmonea milneana* Haswell, 1880, "Pol. Queensland", Proc. Linn. Soc. N. S. Wales, V, p. 35.

Idmonea milneana (pars), Neviani, 1900, "Monogr. Gen. *Idmonea*", Parte I, p. 23.

Idmonea milneana Thornely, 1905, Herdman's "Rep. Pearl Oyster Fisheries", Suppl. Rep. XXVI, Polyzoa, p. 127 (Ceylon).

? *Idmonea radicata* Kirkpatrick, 1888, "Pol. Mauritius", Ann. Mag. Nat. Hist. (6) I, p. 83, Pl. IX, figs 2, 2*a*.

449. A. Stat. 59. Western Entrance Samau Strait, 390 Metres; coarse coral-sand with small stones.

269. D. {Stat. 60, Stat. 303} Haingsisi, Samau Island, Timor, 0—36 Metres; Lithothamnion.

47. A. Stat. 77. Borneo Bank, 3°27' S., 117°36' E., 59 Metres: fine grey coral-sand.

57. N. Stat. 80. Borneo Bank, 2°25' S., 117°43' E., 40—50 Metres; fine coral-sand.

(? sp.) 62. M. Stat. 99. Anchorage off North Ubian, 16—23 Metres; Lithothamnion-bottom.

84. A. Stat. 105. 6°8' N., 121°19' E., 275 Metres; coral-bottom.

482. B. Stat. 116. West of Kwandang Bay, entrance, 72 Metres (chart); fine sand with mud.

92. H. Stat. 117. Kwandang Bay, entrance, 80 Metres (chart); sand and coral.

99. A. Stat. 129. Anchorage off Kawio and Kamboling Islands, Karkaralong group, 23—31 Metres; sand.

108. L. Stat. 144. Anchorage North of Salomakiee (Damar) Island, 45 Metres; coral-bottom and Lithothamnion.

505. A. Stat. 164. 1°42'.5 S., 130°47'.5 E. 32 Metres; sand, small stones and shells.

350. C., 352. A. } Stat. 240. Banda Anchorage, 9—45 Metres; black sand, coral, Lithothamnion-bank in 18—36 Metres.

425. A. Stat. ?, Banda Sea (on sea-weed).

165. A. Stat. 248. Anchorage off Rumah Lusi, N. point of Tiur Island, 0—54 Metres.

276. D. Stat. 250. Anchorage off Kilsuin, W. coast of Kur Island, 20—45 Metres; coral and Lithothamnion.

168. B., 172. A. } Stat. 251. 5°28'.4 S., 132°0'.2 E., 204 Metres; hard coral-sand.

1) D'Orbigny, A., 1853, "Pal. Franç. Terr. Crét.", V, p. 732.

177. I. Stat. 257. In Du-roa Strait, Kei Islands, 0—52 Metres; coral.
208. F. Stat. 282. Anchorage between Nusa Besi and the N. E. point of Timor, 27—54 Metres; sand, coral and Lithothamnion.
223. A. Stat. 305. Mid-channel in Solor Strait, off Kampong Menanga, 113 Metres; stony bottom.
412. A. Stat. 310. 8° 30' S., 119° 7.5 E., 73 Metres; sand with a few pieces of dead coral.

Also, in the Collection of the University Museum of Zoology, Cambridge: —

Torres Straits, 194. A. C. HADDON Coll., Reg. Feb. 24, 1898.
Singapore, 5—10 fathoms, F. P. BEDFORD Coll., Reg. Nov. 11, 1899.
Ceylon, L. R. THORNELY Coll., Reg. Apr. 25, 1906 (determined by Miss THORNELY as *Idmonea milneana*).
Lifu, Loyalty Islands, A. WILLEY Coll., Reg. Mar. 1, 1898 (determined by Miss PHILIPPS as *I. interjuncta*).
Port Denison, Queensland, Miss E. C. JELLY, Reg. May 24, 1895.
Japan, Uraga Channel, off Tokyo, 30 fathoms, A. OWSTON Coll., 49. K, 7. S + 15. B, Reg. June 23, 1902.

Zoarium large, reaching a diameter of at least 45 mm. (412. A.); its branches commonly in one layer, often nearly in one plane, but sometimes variously curved. In the majority of cases the zoarium is more or less reticulate, owing to the existence of cross-connexions between the branches. Stout rooting processes, consisting of a bundle of parallel kenozooecia [1]), are usually given off, here and there, from the middle of the basal surface of the branches. Basal surface not limited by sharp edges, flat or gently convex, the longitudinal septal lines distinct; usually without transverse lines of growth. Frontal surface of branch nearly flat, without a median ridge. Series consisting of 2—3 zooecia, rarely 4, the outer zooecia the longest. Some of the median peristomes are commonly somewhat separated from their neighbours of the same series, and appear more or less isolated in the middle of the branch. Ovicell variable, either simple or bifurcating with the branch, the frontal surface only slightly convex. Ooeciostome typically single, with a much inflated basal portion, of an urn-like shape. Accessory ooeciostomes are rarely present, and may be of simpler structure than the principal ooeciostome.

This species is represented by a number of specimens in the 'Siboga' dredgings. As in the case of so many other Cyclostomes, there is a considerable amount of variation in size, arrangement of zooecia and other characters. These variations may depend on the general vigour of growth. Thus the ovicells shown in fig. 4 are developed in the course of branches of a large reticulate colony; while in fig. 1 the ovicell is formed in a very small colony whose zooecia had not attained the typical adult arrangement at the time when the ovicell commenced to develop.

In well branched colonies the zooecia have the disposition shown in those parts of fig. 4 where an ovicell is not present. The rather flat frontal surface of the branch is associated with the fact that the median zooecia are not specially raised. The alternating series consist most commonly of two or three zooecia, or alternately of two and three; the outer zooecia being the longest and often having their peristomes much prolonged. The median peristomes are frequently separated from their next neighbours by a distinct interval, as shown in the

1) This term was introduced by LEVINSEN (1902, "Studies on Bryozoa", Vidensk. Medd. Naturh. Foren. Kjøbenhavn, p. 3) for zooecia "which lack both a polypide and an orifice".

lower part of the left hand branch in fig. 4; and thus appear as isolated, nearly vertical units which lie in the middle of the branch. In the older parts of the colonies each "series" may be reduced to a single zooecium, as shown in the proximal part of fig. 1; the normal disposition being attained in younger parts of the same branch. Minute calcareous teeth commonly project into the peristomes.

One of the most characteristic features of the 'Siboga' specimens is the presence of cross-connexions between the branches, as shown in figs 4 and 5. These vary greatly in their degree of development, even in different parts of the same colony. Thus in specimen 99. A., from which the figures just referred to are taken, the following conditions were observed: —

(I) A tube (kenozooecium) which has all the relations of the outermost zooecium of its series grows across to the next branch, with some part of which it unites firmly, leaving a suture between itself and the branch with which it has united (figs 4, 5). The kenozooecium develops no orifice;

(II) the connexions may be widely separated from one another, giving rise to elongated meshes, or two may develop close together; sometimes, as in fig. 5, one from each of the participating branches;

(III) the connexion may be two zooecia wide, and orifices may develop on the zooecia which take part in its formation (fig. 4, middle of figure);

(IV) a stouter connexion may be formed, by a bundle of several kenozooecia which develop no orifices;

(V) if the next branch does not lie in a suitable position the connexion may run across it, without meeting it, and may unite with the branch next but one to that from which it has taken origin.

In addition to these formations a considerable proportion of the specimens develop long, straight, rooting columns [1]) (fig. 3), formed of a bundle of as many as 8 kenozooecia, which diverge when they reach the substratum, sometimes separating from one another to form irregular attaching processes. These may give rise to isolated, free peristomes, which reach a considerable length (350. C.[2]).

The largest specimen found (412. A.) consists of a colony about 45 mm. in diameter. It is completely overgrown by, and embedded in a Sponge, so that its form cannot be made out. On isolating one or two branches of this colony by means of Eau de Javelle, it was found that the peristomes were of unusual length, and that they were to a considerable extent discrete; — probably as a result of an attempt to keep pace with the growth of the including Sponge.

The ovicells are generally about as long as three series of zooecia of each side (fig. 4); their frontal surface being only slightly convex. In some colonies, as shown in the figure referred to, they are "simple"; i. e., not extending into a bifurcation. The ovicell appears to be a modification of a median zooecium. Its ooecistome, when typically developed, is a beautiful urn-shaped structure, with its basal region much dilated and porous; then contracting slightly,

1) As in *Idmonea radicata* Kirkpatrick (1888, p. 83, Pl. IX, fig. 2), with which this species may be identical. Similar rooting columns have also been described, in *I. pedata*, by NORMAN (1909. "Pol. Madeira". J. Linn. Soc. Zool., XXX. p. 279. Pl. XXXIII. figs 6, 8).

and finally expanding to form an everted lip which surrounds the ooeciopore. In the majority of cases the ooeciopore is transversely elongated and looks frontally and distally; but rarely it faces in a proximal direction. It is usually symmetrically situated, near the middle line of the ovicell.

The development of the lip of the ooeciostome is variable. In fig. 1 it is wider than in fig. 4; and in some cases it is wider still. In other colonies, on the contrary, the lip is hardly, or only slightly developed; and even the basal dilatation may be absent. But the same colony may show one or two ooeciostomes of the typical form, even though other ovicells have this structure in what may be considered the reduced form above described.

In nearly all cases, each ovicell has a single ooeciostome, even when it bifurcates with the branch. But in specimen 350. C., where the ovicell may bifurcate once or even twice, several accessory ooeciostomes are present. One or more of these may have the typical form; but they are usually simpler in character. A case of this kind is represented in fig. 2, where the ovicell has two main branches, each of which shows the indication of a second bifurcation. Each of the principal branches has three ooeciostomes (*o*) facing in various directions. The most proximal ooeciostome in the branch of the left side is more or less of the typical form, although not fully developed and without an everted lip; and this is perhaps the normal ooeciostome of the ovicell. The other five are less like what I have described as the typical ooeciostome of the species.

The form described by KIRKPATRICK as *Idmonea pulcherrima* (see synonomy) agrees closely with 'Siboga' specimens (e. g. 99. A.), as I have convinced myself by an examination of the type-specimen (89. 8. 21. 73) in the British Museum, in the form of the colony, in its reticulate arrangement, in its zooecial characters, and in its ovicells and ooeciostomes. The description given by that author makes no reference to the occurrence of more than one ooeciostome in an ovicell; but his fig. 6*a* shows an ovicell with two ooeciostomes of the typical form. I have previously called attention to the occurrence of accessory ooeciostomes in *Tubulipora aperta* [1]), from Norway.

The polypides have the loop of their alimentary canal unbent during retraction: — a character which seems to be general in Cyclostomes, and is probably associated with the long and narrow shape of their zooecia. The distal ends of the tentacles include a considerable number of the "excretory vesicles" which I have described in other species of *Tubulipora* [2]); and similar structures appear to occur in the embryos. The retractor muscles diverge from a single point on the wall of the zooecium, which is situated at some distance on the distal side of the apex of the caecum of the stomach (in the retracted polypide).

The primitive disc of the colony has no marginal denticulations.

The present species appears to be closely related to *T. milneana* D'Orb. [3]) and *T. interjuncta* MacGill. [4]), if indeed it is not identical with one or both of those forms. If these

1) HARMER, S. F., 1898, "Dev. *Tubulipora*", Quart. J. Micr. Sci., XLI, pp. 101, 104. Pl. VIII, fig. 2.
2) l. cit., p. 113.
3) D'ORBIGNY, A., 1846. "Voy. Am. Merid.", V, 4e Partie. "Zoophytes", p. 20 (as *Idmonea milneana*). Pl. IX, figs 17—21.
4) MACGILLIVRAY, P. H., 1886, "Descr. new Pol.", IX, Tr. Pr. R. Soc. Vict., XXII, p. 137 (as *Idmonea interjuncta*).

species are distinct from one another it is probable that they have often been confused by other writers.

D'ORBIGNY's specimens were obtained in the Falkland Islands, and his description and figures represent a form which is much coarser in its habit than the 'Siboga' specimens, the series consisting of 3—4 zooecia. The basal surface of the branches appears to be very convex; and there is no indication of cross-connexions or of rooting columns [1]). A specimen obtained by Mr DARWIN, during the 'Beagle' Voyage, at the Albrolhos Islands, Brazil, and now in the Collection of the University Museum of Zoology at Cambridge, agrees well with D'ORBIGNY's account. The branches are robust, the zooecia being usually 4 in each of the alternating series. When an ovicell is formed the branch widens greatly, and the number of zooecia in one series rises to 6 or 7; represented, as in the 'Siboga' specimens, by peristomes isolated from one another by the roof of the ovicell. A similar enlargement of the branch may occur at a bifurcation, without the formation of an ovicell. The only ooeciostome which is satisfactorily seen is much compressed, with a narrow ooeciopore, much elongated in one direction, looking directly frontally and placed obliquely. The much coarser habit, with the absence of connexions between the branches, together with the characters of the zooecial series and of the ovicell, appear to me to point to the fact that the 'Siboga' specimens do not belong to D'ORBIGNY's species. The basal surface of Mr DARWIN's specimen is very broad, nearly flat in the middle, and shows distinct longitudinal septal lines and a certain number of transverse lines of growth.

T. interjuncta was described, but not figured, by MACGILLIVRAY from Victorian specimens. In the existence of connexions between the branches and of rooting columns from their basal surfaces, it obviously comes very near the Malay specimens. But although MACGILLIVRAY describes it as resembling a slender form of *T. milneana*, the evidence of Victorian specimens in the Cambridge Collection shows that it is a more robust form than those from the 'Siboga' dredgings. The Victorian material alluded to includes only a single ovicell; which possesses a marked rounded swelling in the middle line. On the proximal side, this swelling opens by an ooeciostome which is hardly represented by more than a greatly compressed, slit-like ooeciopore, opening almost directly from the swelling in a vertical plane, and facing proximally. The long axis of the ooeciopore is transverse, and is convex proximally, the slit being vertical and accordingly only visible when the ooeciostome is looked at from the proximal end of the branch. The zooecia are usually 3—4 in a series, and are distinctly larger than those of the 'Siboga' specimens. I do not feel convinced that these are identical with MACGILLIVRAY's species.

WATERS [2]) has compared *T. milneana* and *T. interjuncta* from Port Jackson; but I do not feel sure that his determination of *T. interjuncta* is correct. The characters of the ooeciostome in WATERS' specimens appear to show that these belong to the same species as the 'Siboga' material; and that they are hence not identical with MACGILLIVRAY's species. The ovicell of a Mediterranean specimen (Capri) which has been described as *I. milneana* and figured by WATERS [3])

1) These structures may, however, occur in this species (WATERS, A. W., 1905, "Bry. Cape Horn", J. Linn. Soc., Zool., XXIX, p. 249).

2) WATERS, A. W., 1887. "Bry. N. S. Wales", Pts II. III, Ann. Mag. Nat. Hist. (5) XX, Pl. VI. fig. 29: pp. 256. 257.

3) Ibid., 1889, "Ovicells Cycl.", J. Linn. Soc., XX, p. 279, Pl. XIV, fig. 8.

has not much bearing on the question at issue if, as I think, the determination of the species is uncertain.

It may be admitted that the synonymy of this species is doubtful. I have preferred to describe the 'Siboga' specimens as *T. pulcherrima*, as I am quite satisfied that they belong to the species so named by KIRKPATRICK in 1890. But it is not impossible that it should with more propriety be referred to *T. interjuncta* MacGillivray, 1886 or to *T. radicata* Kirkpatrick, 1888.

The following notes may be added with regard to the specimens in the Cambridge Collection which are considered to belong to the present species: —

Torres Straits. — Ovicells are not present. The zooecia are robust, and the branches show no cross-connexions. Basal rooting columns are present.

Singapore. — A very typical specimen, with cross-connexions and rooting columns. Ovicells, resembling those shown in fig. 4, are present, but they have produced no ooeciostomes. It may be inferred that development of the embryos had not proceeded normally.

Ceylon (determined by Miss THORNELY as *I. milneana*). — Two small fragments with ovicells. The ooeciostomes, of which two are visible, do not show the urn-like shape of those of the 'Siboga' Collection. A basal rooting column is present, but no cross-connexions are visible.

Lifu, Loyalty Is (determined by Miss PHILIPPS as *I. interjuncta*). — 4 slides, one of which shows ovicells and typical cross-connexions. The ooeciostomes are intermediate in character between those of the 'Siboga' specimens and those from Ceylon. Basal rooting columns occur.

Queensland. — Fragments, without cross-connexions, rooting columns or ovicells, but probably belonging to the present species.

Japan, OWSTON Collection (49. K., 7. S. + 15. B.). — Fragments, with ovicells showing urn-shaped ooeciostomes precisely like those of the 'Siboga' specimens. Rooting columns are present, but no cross-connexions.

Measurements, in μ: —

Diameter of left branch, fig. 4, on the proximal side of the ovicell, 700;
Diameter of left branch, fig. 4, on the distal side of the same ovicell, 500;
Diameter of the distal end of the same ovicell, 1,100;
Length of its inflated part, 2,000;
Diameter of the inflated part of its ooeciostome, 210;
Diameter of the ooeciopore, 255;
Diameter of the zooecia, 180—200;
Diameter of the orifices, about 180;
Greatest width of the branch, between the zooecia, fig. 5, 1,000;
Greatest width of the ovicell, fig. 2, 3,200;
Width of the ooeciopore, fig. 1, 280;
Width of the rooting column, near its origin, fig. 3, 220;
Length of the same rooting column, 3,400;

4. *Tubulipora cassiformis* [1]) n. sp. (Pl. IX, figs 6—10).

Type. 94. A. Stat. 119. 1° 33'.5 N., 124° 41' E., 1901 Metres; stony bottom.
112. A. Stat. 156. 0° 29'.2 S., 130° 5'.3 E., 469 Metres; coarse sand and broken shells.

Zoarium reticulate, with the branches arranged in one plane. Strong rooting columns, formed of a bundle of kenozooecia given off occasionally from the basal side of the colony. The branches are commonly parallel to one another, and the cross-connexions are often arranged at the same level in adjacent branches, thus giving rise to elongated, narrow meshes of uniform size. In other parts the meshes may be more irregular. Basal surface smooth, porous, the zooecial outlines indistinct. The branch is subtriquetrous in transverse section, the middle of the frontal surface being the part which is most prominent. This portion is occupied by an alternating series of zooecia, the peristomes of which are somewhat compressed and bend outwards, the orifice being oval and the part of the distal end of the zooecium which faces outwards being flattened. Each "series" of zooecia is thus reduced to a single member, although the outer members are represented by kenozooecia which form the lateral parts of the branch and from which the transverse connexions are developed. Ovicells elongated, usually corresponding in length with about three zooecial series on each side; considerably inflated, the swollen part beginning suddenly at the proximal end. The ovicell encircles the median zooecia on their outer sides, and is here produced into an angular ridge. Ooeciostome short, the ooeciopore being a wide aperture, near the distal end of the ovicell.

This very characteristic deep-water species is represented in two of the 'Siboga' dredgings, in each case by a small amount of material. The specimens arrived broken, so that it is not possible to decide what was the form of the complete colony. The longest fragment measured about 19 mm. in length. The species is distinguished by its reticulate character, by the reduction of each "series" to a single complete median zooecium and an outer kenozooecium, and by the narrow inflated ovicell.

The fragments are all flat, the branches being arranged in a single plane. Those from Stat. 119 have elongated meshes, with parallel sides, as shown in fig. 8, a basal view. The connexions between adjacent branches are formed by subcylindrical bundles of kenozooecia, several of which constitute each bundle. In this specimen most of the connexions are developed at the same level in neighbouring branches, so that a very regular disposition of the meshes results. The connexions may be quite transverse, or somewhat oblique; and they are formed from one or both branches. Both these conditions are shown in fig. 8; the region where the bundle of kenozooecia meets the other branch or a similar bundle developed from it being distinctly indicated by a suture. Since each bundle dilates as it approaches the suture, a transverse or oblique ridge is formed where two bundles unite. The connecting bundles may have a compressed shape, as shown in fig. 10. A massive column of kenozooecia may be given off by the basal surface of a branch, and no doubt indicates an attaching arrangement.

The specimens from Stat. 156 may have belonged to two colonies, as there are well

1) From *cassis*, a net or cobweb.

marked differences between them. One of them consists of branches of the type described in the other specimen, except that the meshes are more irregular in size. The other has branches which are rather more divergent and less parallel. In this specimen the zooecia agree with those of the colony from Stat. 119; but in the other piece, which has parallel branches, the zooecia exhibit the curious modification which is illustrated by figs 6 and 9. The median part of the wall of the peristome is here prolonged into a flat, shield-like portion which almost or entirely conceals the orifice, in a frontal view of the branch. In a side view (fig. 9) it is seen that the terminal portion of the peristome comes off at right angles from the shield-like part, which is prolonged beyond it. The same specimen has the lateral edges of the basal wall of its branches distinctly serrate (figs 6, 9, 10), the projecting parts being transverse and joining the rest of the branch at right angles distally, and sloping gradually in the proximal direction into the side of the branch. The occurrence of septal lines outlining these serrated portions (fig. 9) indicates that the parts in question are really kenozooecia and are thus outer zooecia which develop no orifices. It may be concluded that the zooecial series consist of two zooecia, of which the median one possesses an orifice and is a complete zooecium, while the outer one is reduced to a kenozooecium. This serrated condition has not been found in the other specimens, in which, however, the lateral parts of the branches appear to be similarly constituted of kenozooecia, which do not project in the way just described. Since the transverse connexions between the branches are produced from these lateral regions, it may be concluded that some of the lateral zooecia have been modified into kenozooecia which unite in bundles to form the cross-connexions. These facts seem to indicate that the present species is comparable with other species of *Tubulipora* in which several zooecia unite laterally to form the alternating series. The complete zooecia always have the outer parts of the distal portion flattened.

The ovicells are "simple", in the sense that they are dilatations which do not bifurcate with the branch. Their form is shown in fig. 7, where it will be seen that the ovicell, although much inflated, is not much wider than the branch. The inflated part of the ovicell commences abruptly at its proximal end. The ovicell extends round the zooecia which occur in its region, on their outer sides; and an angular ridge is formed at the side of it, distally to each complete zooecium, and sometimes elsewhere. In all the specimens in which an ooeciostome occurs, this structure is found at the distal end of the ovicell, on one side. It appears as a wide tube, the ooeciopore of which looks frontally (see the right side of the distal end of the ovicell in fig. 7); but I am not sure that the ooeciostome is fully formed in any of the ovicells present.

Measurements, in μ: —

Width of branches, between the cross-connexions, fig. 8, 340—410;
Diameter of cross-connexions, fig. 8, 190—210;
Length of inflated part of ovicell, fig. 7, 1,700;
Greatest width of proximal part of ovicell, fig. 7, 635;
Greatest diameter of orifices, up to 175;
Diameter of zooecia, fig. 6, 150.

Crisina D'Orbigny.

Crisina D'Orbigny, 1850, "Prodr. Pal. Stratigr.", II, p. 265 (nomen nudum).
Crisina D'Orbigny, 1853, "Pal. Franç. Terr. Cret.", V, pp. 912, 728.
Crisina Neviani, 1900, "Monogr. Gen. *Idmonea*", Parte II, Cap. 1, p. 65.
(nec *Crisina* Gregory, 1899, "Cat. Foss. Bry. Brit. Mus.", "Cret. Bry.", I, p. 159.)

Crisina, as I use it in this Report, differs from the erect species of *Tubulipora* (*Idmonea* auctt.) in the development of cancelli, specially in longitudinal lines along the basal surfaces of the branches. These cancelli are developed in the earliest stages of the growth of the branch in the recent *C. radians*, the ovicells of which differ from those of typical "*Idmonea*" in possessing curious lateral porous windows.

The history of the generic names *Crisina* and *Crisisina* has been given by Gregory (t. cit., p. 159, note); but I do not find myself able to agree with him in his conclusions. Gregory considers that D'Orbigny used *Crisina* and *Crisisina* indiscriminately, and that the employment of the latter term was probably due to a misprint. I think, on the contrary, that there is clear evidence that D'Orbigny meant to distinguish the two genera, and that there is reason for accepting *Crisina* as he defined it.

In the "Prodrome", Vol. II, p. 175, D'Orbigny defines *Crisisina* as follows: — "C'est une *Idmonea*, dont les branches sont libres au lieu d'ètre fixes". *Crisina* occurs on p. 265 of the same volume, five species being mentioned. No diagnosis is given; and *Crisina* thus appears to be a nomen nudum, so far as this publication is concerned. Gregory is perfectly correct in stating that the species of both genera occur under *Crisisina* in the Index of the work (Vol. III, 1852, p. 51); but a careful examination of this index shows that there are several other mistakes in it, so that too much stress need not be laid on the omission of *Crisina*. That D'Orbigny intended, even in this work, to keep the two genera distinct is indicated by the fact that *Crisisina* and *Crisina* appear with two separate generic headings on p. 265 of Vol. II.

In his larger work ("Pal. Franç.", p. 728) D'Orbigny states that he had given the name *Crisina* to the species with erect branches, when he would have been more accurate in stating that *Crisisina* was the name referred to; while on Plate 612 he uses *Crisisina* in one place where the text shows that he meant *Crisina*. But his real meaning may be inferred by noticing that in this work he entirely suppresses *Crisisina*, placing species referred to it in the smaller work under *Idmonea*, and stating specifically (p. 728) that he now places species with free branches and without inferior pores in *Idmonea*, and that he retains *Crisina* for species "dont la face inférieure est criblée de pores spéciaux".

A comparison of D'Orbigny's two works with regard to the treatment of the five species of *Crisina* mentioned in the "Prodrome" confirms the above conclusions. The facts are as follows: —

"Prodrome". Vol. II.	"Pal. Franç. Terr. Cret.". Vol. V.
Crisina unipora p. 265.	*Idmonea unipora* p. 737, Pl. 613, figs 1—10.
Crisina ramosa p. 266.	*Idmonea ramosa* p. 736, Pl. 611, figs 11—15.
Crisina Normaniana p. 265.	*Crisina Normaniana* p. 914, Pl. 612, figs. 1—5.
Crisina subgradata p. 266.	*Crisina subgradata* p. 914, Pl. 612, figs 6—10.
Crisina triangularis p. 266.	*Crisina triangularis* p. 915, Pl. 612, figs 11—15; Pl. 614, figs 11—15; Pl. 769, figs 11—14.

The names on the Plates do not, however, agree completely with those used in the text.

It should be noted that the three species retained in *Crisina* in the "Paléontologie Française" have porous backs, and thus agree with the definition of *Crisina* given in that work. Of the others (as shown by the figures) *I. unipora* has no pores on its basal surface; and it is stated in the text (p. 736) that the appearance of pores in that position in *I. ramosa* is due to the fact that the specimens are worn.

GREGORY further objects (p. 160) that on Pl. 614 of the larger work D'ORBIGNY figures three species marked as *Crisina*, and that of these *C. cenomana* shows pores on the basal surface. But D'ORBIGNY expressly states in his text (p. 733) that the appearance of these pores is due to wear. *C. cenomana* (p. 732) was accordingly placed by D'ORBIGNY in *Idmonea*, to which genus the second species, *C. subgracilis*, a form with an imperforate back (p. 738), was also referred. The only species left on this Plate is there called *Crisina Ligeriensis*, which is treated in the text as a synonym of *C. triangularis*. GREGORY's statement that *C. cenomana* is "the only species amongst those originally included in *Crisina* which is available as a member "of that genus" is invalidated by the fact that in the "Prodrome" (Vol. II, p. 175) *C. cenomana* is referred to *Crisisina*, and not to *Crisina*. I have indicated above that *Crisina* as used in the "Prodrome" appears to be a nomen nudum; but even if its validity in that work is admitted, it may be pointed out that three of the five species originally included in it are retained by D'ORBIGNY in *Crisina* in his larger work; in which, in fact, he rejects *Crisisina* but retains *Crisina*.

GREGORY uses *Crisina* (p. 160) for the erect species which most writers on recent Polyzoa refer to *Idmonea*. The above considerations appear to show that this procedure is inadmissible; though it would have been open to him to have used *Crisisina* in the sense in which he actually used *Crisina*.

The peculiarities of the recent "*Idmonea*" *radians* appear to be sufficiently marked to justify its separation from most of the recent species of "*Idmonea*", and as it agrees exactly, in its porous basal surface, with the feature emphasised by D'ORBIGNY in defining *Crisina*, there seems to be every reason for placing it in that genus. The basal surface of *C. radians* has the closest resemblance to that of *C. triangularis*, as shown by D'ORBIGNY in his Pl. 769, fig. 13. As I show below, in my account of *C. radians*, this feature is pronounced from the earliest stages in the growth of the branches, and thus differs from the arrangement found in other species here described (cf. *Tubulipora atlantica*, p. 126), in which the stalk of the colony becomes thickened by secondarily developed calcareous tubes, the "canaux de renforcement" of PERGENS.

I cannot find sufficient evidence of the characters of the ovicells of fossil species which fall within *Crisina* in D'ORBIGNY's sense. MACGILLIVRAY [1]) has described the ovicell of a Tertiary Victorian form referred by him to *C. hochstetteriana* Stoliczka, as being dorsal in position. WATERS [2]), who regards STOLICZKA's species as identical with *C. radians*, considers that the form described by MACGILLIVRAY is *Hornera fissurata* Busk. I am not quite convinced that this

1) MACGILLIVRAY, P. H., 1895, "Monogr. Tert. Pol. Vict.", Trans. R. Soc. Vict. IV, p. 121, Pl. XVI, fig. 14.
2) WATERS, A. W., 1914, "Mar. Fauna Brit. E. Afr.", "Bry. Cycl.", Proc. Zool. Soc., p. 845.

latter identification is certain; since MACGILLIVRAY's figures, both of the unfertile branches and of the ovicell, show a considerable resemblance to *C. radians*. It is just possible, therefore, that *Crisina* may have ovicells of the *C. radians* type indifferently on the frontal or the basal surface of the branch.

1. *Crisina radians* Lamk. (Pl. X, figs 6—8).

Retepora radians Lamk, 1816, "Hist. Nat. An. s. Vert.", II, p. 183 (Nouvelle-Hollande).
Retepora radians Lamk, 1836, Ibid., 2 Éd., II, p. 279.
Idmonea radians H. Milne Edw., 1838, "Mem. Crisies", Ann. Sci. Nat. Zool. (2) IX, pp. 214, 217, Pl. XII, figs 4—4*b* (from one of LAMARCK's specimens).
Idmonea radians Busk, 1856, "Pol. Norway and Finmark", Ann. Mag. Nat. Hist. (2) XVIII, p. 34 (compared with *I. atlantica* and distinguished from it).
Idmonea radians Busk, 1875, "Cat. Mar. Pol. Brit. Mus.", III, p. 11, Pl. VII, figs 1—4 (characteristic figures). (Australia, New Zealand).
Idmonea radians Haswell, 1879, "Cycl. Pol. Port Jackson", Proc. Linn. Soc. N. S. Wales, IV, p. 350 (Sydney).
Idmonea radians Haswell, 1880, "Pol. Queensland", Ibid., V, p. 35.
Idmonea radians MacGillivray, 1882, McCOY's "Prodr. Zool. Vict.", Dec. VII, p. 30, Pl. LXVIII, figs 3—3*b* (ovicells figured).
Idmonea radians Maplestone, 1882, "Obs. Living Pol.", Trans. Proc. R. Soc. Vict., XVIII, p. 51 (colour French grey; 8 tentacles).
Idmonea radians Waters, 1884, "Foss. Cycl. Bry. Australia", Quart. J. Geol. Soc., XL, p. 676 (describes lateral windows of ovicells).
Idmonea radians Busk, 1886, "Challenger Rep.", L, p. 10 (Tongatabu, Honolulu).
Idmonea radians Waters, 1887, "Bry. N. S. Wales", II, III, Ann. Mag. Nat. Hist. (5) XX, pp. 203, 255, Pl. VI, figs 27, 28 (figures the lateral windows).
Idmonea radians Kirkpatrick, 1890, "Hydr. Pol. Torres Straits", Proc. R. Dublin Soc., (N. S.) VI, p. 612 (Torres Straits).
Idmonea radians MacGillivray, 1895, "Monogr. Tert. Pol. Vict.", Trans. R. Soc. Vict., IV, p. 121, Pl. XVI, figs 18—18*c*.
Idmonea radians Philipps, 1899, "Polyzoa", WILLEY's Zool. Res. IV, pp. 441, 449 (Lifu, Loyalty Islands).
Idmonea radians Neviani, 1900, "Monogr. Gen. *Idmonea*", Parte I, pp. 26, 41, 46.
Idmonea radians Waters, 1907, "*Tubucellaria*", J. Linn. Soc. Zool., XXX, p. 129 [ovicell compound, "containing a group of larvae in each of the four to six divisions"].
Idmonea radians Thornely, 1912, "Mar. Pol. Ind. Ocean", Trans. Linn. Soc. (2) Zool. XV, p. 156 (Seychelles, Amirante Islands).
Idmonea radians Waters, 1914, "Mar. Fauna Brit. E. Afr.", "Bry. Cycl.", Proc. Zool. Soc., p. 844, Pl. II, figs 6, 7, 8, 10.

336. A. } 441. A. } Stat. 37. Sailus Ketjil, Paternoster Islands, 0—27 Metres; coral and coral-sand.
251. J. Stat. 315. Anchorage E. of Sailus Besar, Paternoster Islands, 0—36 Metres; coral and Lithothamnion.

Also, in the Collection of the Univ. Museum of Zoology, Cambridge: —

Torres Straits (46, 47, 89), A. C. HADDON Coll., Reg. Feb. 24, 1898.
Port Denison, Queensland, Miss E. C. JELLY, Reg. May 24, 1895.
Port Denison, Queensland, from Coll. described by W. A. HASWELL, Australian Mus., Sydney, Reg. Oct. 23, 1899.
Victoria, Port Phillip Heads, Miss E. C. JELLY, Reg. May 24, 1895.
Lifu, Loyalty Islands, A. WILLEY Coll., Reg. Mar. 1, 1898.

Zoarium saucer-shaped, attached by a thick short stem, which bifurcates repeatedly to form a number of narrow branches, of nearly uniform width. The angle between two branches of a bifurcation is acute. In specimens which have grown vigorously, the two branches formed by a bifurcation are more or less parallel, and resemble the prongs of a tuning-fork. Branches subtriquetrous in transverse section, the basal surface slightly convex and the two lateral surfaces sloping upwards to meet one another in a rounded ridge which runs along the middle of the frontal surface and unites the peristomes of the median zooecia. In basal view the branches appear narrow and strap-like, with sharply marked, parallel, straight or slightly sinuous lateral edges, each of which is formed by the outermost of a series of ridges which occur on this surface of the branch. These ridges, which are usually about 6—8 in number, run longitudinally along the basal surface. At the growing ends (fig. 8) they appear as longitudinal carinae on the basal surfaces of the young zooecia. In the interzooecial grooves thus formed are the ordinary zooecial pores. By the subdivision of the grooves the pores become included in a longitudinal series of cancelli, each of which contains one or more of the pores. In the older parts of the branches the openings of the cancelli appear as a single series of moderately large pores, corresponding with each of the original interzooecial grooves, which are now .separated from one another by ridges with rounded sides. A similar set of cancelli are developed on the fronto-lateral sides of the branch and on the ovicells. Series of zooecia oblique, regularly alternating on the two sides of the branch; 3 or 2 zooecia in each series, the innermost zooecium much the most prominent, and the outermost one with its orifice not or hardly raised above the level of the surface of the branch. Ovicells developed just before or at a bifurcation, commonly simple, but occasionally bifurcating with the branch. The frontal surface of the ovicell is much raised and is covered with conspicuous cancelli, at the bottom of which are pores of the usual type. The ovicell corresponds in length with several of the oblique series of zooecia. Between each two series the wall of the ovicell, on each side, is composed of a flat, thin plate which is thickly covered with pores; thus forming a series of lateral porous windows, the number ol which corresponds with that of the intervals between the series of zooecia which are involved in the ovicell. These porous windows develop no cancelli. Each ovicell has a single ooeciostome, which occurs at either the proximal or the distal margin of one of the lateral windows, and has the form of a convex hood overarching the window and bearing the slit-like ooeciopore on its inner side.

This very beautiful species has frequently been described and is characterised by an unusual number of distinctive features. It seems to be always more or less saucer-shaped, and to be attached by a central or sub-central stalk. Its branches are arranged in a single tier (subject to occasional irregularities of growth); and from their narrow form and the acute angles formed by their bifurcations, a large number of branches can be accommodated in the space available. The tuning-fork-like mode of bifurcation (fig. 8) is very characteristic of well grown colonies. The largest colony observed measures 18 mm. in greatest length; but this measurement is really a radius of the colony, which may be estimated to have been something like 36 mm. in diameter when complete. The specimens recorded above from Victoria are much smaller, the diameter of the largest being only 7 mm., and most of them being not more than 4 or

5 mm. in that measurement. In all essential respects, including the characteristic ovicells, these specimens agree completely with those belonging to the 'Siboga' Collection.

The profuse development of cancelli is another very distinctive feature, especially as this character is not ordinarily found in species of "*Idmonea*". They are present in all parts of the zoarium except on the peristomes of the zooecia and on the porous lateral windows of the ovicells. Both on the basal and on the fronto-lateral surfaces they originate by the subdivision of the interzooecial grooves. Examination of the growing ends of the branches shows that a cancellus commonly includes several pores.

The feature which is, however, specially distinctive of the present species is the occurrence of thin lateral regions in the wall of the ovicell, which have been alluded to above as the lateral porous windows [1]). The pores are here much more numerous than in any other part of the colony; and they are indeed arranged so closely that there is very little interval between any two pores. In the 'Siboga' material the ovicell commonly corresponds in length with four of the oblique series of zooecia on each side (fig. 7). In these cases it follows that there will be three porous windows (*w*) on each side of the ovicell; but in ovicells which correspond with a smaller number of zooecial series, the number of windows is smaller in proportion. If an ovicell extends into the bifurcation of a branch, a distal window is generally present, in addition to the lateral ones. The windows, which are longest in the fronto-basal direction, are usually quite distinct from one another, as shown in figs 6 and 7; and the series of zooecia then extend along the sides of the ovicell without any obvious modification. In a few cases I have found that the lateral windows may be confluent along their basal portions; and the zooecial series are then interrupted; a median zooecium occurring in its usual place, the middle zooecium of the series being suppressed, and the outermost zooecium being found on the basal side of the confluent part of the windows, separated by a considerable interval from the median zooecium of the same series.

The lateral windows of the ovicells of this species have already been described by WATERS (1887; see synonymy); and the ooeciostomes have been described by the same author in a recent paper (1914). One ooeciostome is present in each ovicell, corresponding with one of the lateral windows, either on the inner or on the outer side (as determined by the relation of the ovicell to the preceding bifurcation of the branch). Where three lateral windows are present on one side I have generally found the ooeciostome on the distal window; less commonly on the middle window; and very rarely on the proximal window. The thin perforated plate is surrounded by a slightly raised margin, and part of the more frontal portion of this margin is produced into a convex hood (fig. 7, *o*), which constitutes the ooeciostome. In the majority of cases this structure is developed from the proximal side of the window, and is directed distally, as in fig. 7; but in a smaller proportion of cases it is developed from the distal side of its window and looks proximally. The back of the hood of the ooeciostome rests against the adjacent zooecium, usually the middle one of the series. The ooeciopore is completely concealed in a frontal view of the branch; but it can be found by arranging the ovicell so as to be able

1) These structures are stated by WATERS (1914, p. 845) to be absent in specimens from Zanzibar.

to look into the mouth of the ooeciostome, when it is found to be a narrow slit, elongated transversely. The ooeciostome is thus very similar to that of *Tubulipora phalangea*, as described by me in an earlier paper [1]).

During the development of the ovicell the lateral windows are the parts which calcify last. The cancellate frontal wall is thus completely formed while the windows are closed merely by an uncalcified membrane. I have not obtained specimens in which the complete development of the normal ovicell can be traced; but in a specimen from Torres Straits, in which an abortive attempt to produce an ovicell has been made, two of the median zooecia on one side and three on the other have each developed a spoon-shaped process which passes towards the middle line of the branch, at a level considerably raised above that of the general surface of the branch. The processes have not met one another; but this case may give some indication of the way in which the roof of the ovicell is normally formed. In this instance one of the branches immediately beyond the next bifurcation has developed a normal ovicell; but in other cases the production of an ovicell seems to exhaust the energy of growth, in this respect; no second ovicell being formed on any branch.

I find comparatively little variation in the present species, but there is some variation in the form of the orifices. The typical number of zooecia in a series is three; but two are not infrequent and four are occasionally observed. The orifices are usually oval, corresponding with some compression in the peristomes; the longer axis of the oval being in the direction of the row of orifices of the series. The median peristome is usually long; and those of opposite sides diverge from one another. The orifice of this zooecium is frequently pointed on its median side, so that it is not a true oval; and the peristome is often produced into a distinct point on the same side, in such a way as to resemble a quill-pen. Its outer margin is less often produced into a point. The next peristome is distinctly shorter than the median one, and in some cases is produced into a marked point on its outer side, the orifice being then pointed on that side. The outermost orifice is usually level with the surface of the branch, and no peristome is present. The middle line of the frontal surface of the branch is generally occupied by a pronounced thickening band of calcareous matter, from which the median peristomes diverge. The outer margin of the basal surface of the branch may be slightly serrate, particularly in young branches.

Measurements, in μ: —

Width of branch, lower part of fig. 8, 500;
Width of branch, upper part of fig. 8, 350;
Length of ovicell, fig. 6, 1,300;
Longest diameter of proximal lateral window of ovicell, fig. 6, 250;
Longest diameter of ooeciostome, fig. 7, 100;
Longest diameter of orifices of zooecia, up to 100.

1) Harmer, S. F., 1898. "Dev. *Tubulipora*", Quart. J. Micr. Sci., XLI, p. 94, Pl. VIII, figs. 5, 6.

Tervia Jullien.

Tervia Jullien, 1883, "Drag. du Travailleur", "Bry.", Bull. Soc. Zool. France, VII, p. 500 (sep., p. 4).
Idmonea (pars) auctt.
Filisparsa (pars) auctt. (nec D'Orbigny).

The history of the species which have been referred to *Tervia* is somewhat involved. The genus was founded by JULLIEN, in 1883, for four species dredged in the Atlantic. Two of these species, *T. solida* and *T. discreta* have been regarded by NORMAN [1]) as forms of *T. irregularis* Meneghini. In 1903 JULLIEN and CALVET [2]) admitted that *T. folini*, one of the species which had been included in the genus by JULLIEN in the original account was a synonym of *T. irregularis*.

In 1853 D'ORBIGNY [3]) founded the genus *Filisparsa* for several fossil and recent species, of somewhat varied appearance; and his name has been accepted by certain later writers, as by GREGORY [4]) and PERGENS [5]).

The character by which *Tervia* was distinguished from *Idmonea* in the original account was that some of the zooecia are "isolées, disposées sans ordre sur le milieu des branches, entre les séries latérales". This character by itself might not be considered a sufficient reason for establishing the genus; but it has been pointed out by WATERS [6]), in several places, that the ovicell of *Tervia irregularis* is "dorsal" in position, while that of *Hornera violacea*, var. *tubulosa*, or *H. tubulosa* Busk [7]), which he refers to *Filisparsa*, is situated on the front of the branch. The "dorsal" ovicell of *Tervia* has been figured by WATERS [8]), NEVIANI [9]) and JULLIEN and CALVET [10]).

1. *Tervia jellyae* n. sp. (Pl. XI, figs 1—3).

Idmonea irregularis Haswell, 1880, "Pol. Queensland", Proc. Linn. Soc. N. S. Wales, V, p. 35.
Idmonea ? *irregularis* (pars) Waters, 1887, "Bry. N. S. Wales", III, Ann. Mag. Nat. Hist. (5) XX, p. 255 (the specimens from Holborn Island, Queensland).
(nec *Idmonea irregularis* Meneghini).

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1) NORMAN, A. M., 1909, "Pol. Madeira", J. Linn. Soc., Zool., XXX, p. 280.

2) JULLIEN, J. and CALVET, L., 1903, "Bryozoaires", Rés. Camp. Prince de Monaco, XXIII, p. 114.

3) D'ORBIGNY, A., 1853, "Pal. Franç. Terr. Cret.", V, p. 814.

4) GREGORY, J. W., 1899, "Cat. Foss. Bry. Brit. Mus.", "Cret. Bry.", I, p. 66 (admitted provisionally).

5) PERGENS, E., 1890, "Rev. Bry. Crét.", Bull. Soc. Belge Géol., III, p. 350.

6) WATERS, A. W., 1884, "Foss. Cycl. Bry. Australia", Q. J. Geol. Soc., XL, p. 687: 1888, "Ovicells Cycl. Bry.", J. Linn. Soc., Zool., XX, p. 279: 1910, "Mar. Biol. Sud. Red Sea", "Bry. II", Ibid., XXXI, p. 236: 1914, "Mar. Fauna Brit. E. Afr.", "Bry. Cycl.", Proc. Zool. Soc., p. 843.

7) BUSK, G., 1875, "Cat. Mar. Pol. Brit. Mus.", III, p. 19, Pl. XVIII, figs 2—4. The specimen in question, believed to have come from the North Atlantic, is preserved in the British Museum (75. 5. 29. 29). The oeciostomes, of which two are well shown, have a considerable resemblance to those of *Tubulipora aperta*; and the widely open ooeciopores, facing frontally, are also like those of that species. The zoarium is, however, composed of narrow, bifurcating branches, in which the zooecia are mostly scattered, with but little indication of the formation of transverse series. It seems to me by no means improbable that the form which I described as *Tubulipora aperta* is merely an adnate phase of *Hornera tubulosa* Busk: although the characters of the ovicell show that the latter cannot be placed in the genus to which BUSK referred it.

8) WATERS, A. W., 1888, Pl. XIV, figs 5, 6.

9) NEVIANI, A., 1891, "Bri. postplioc. Livorno", Boll. Soc. geol. Ital., X, Pl. IV, fig. 21; 1905, "Bri. foss. Carrubare", Ibid., XXIII, text-fig. 17 on pag. 547.

10) JULLIEN, J. and CALVET, L., 1903, Pl. XIV, fig. 7.

? *Tervia irregularis* Waters, 1914, "Mar. Fauna Brit. E. Afr.", "Bry. Cycl.", Proc. Zool. Soc., p. 843, Pl. IV, fig. 8.

285. A. } Stat. 51. Madura Bay, S. point of Molo Strait, 69—91 Metres; fine grey sand, coarse
560. A. } sand with shells and stones.

Also, in the Collection of the University Museum of Zoology, Cambridge: —

Torres Straits, 191. A., A. C. HADDON Coll., Reg. Feb. 24, 1898.
Queensland, Holborn Island, Miss E. C. JELLY, Reg. May 24, 1895 (now transferred to the British Museum).

The following specimens, in the *Stomatopora*-condition, may be noticed in this place. One or more of them may be the encrusting bases of the present species, but it is probable that several species are represented, belonging to *Entalophora* and *Tubulipora* as well as to *Tervia*: —

17. T. Stat. 49a. Sapeh Strait, 69 Metres; coral and shells (on *Smittia* slide, 17. K.).
62. N. Stat. 99. Anchorage off N. Ubian, 16—23 Metres; Lithothamnion-bottom.
249. H. Stat. 310. 8° 30' S., 119° 7'.5 E., 73 Metres; sand with a few pieces of dead coral.
(Cambridge Coll.) Torres Straits, 193, A. C. HADDON Coll., Reg. Feb. 24, 1898.

Zoarium commencing with a "*Stomatopora*"-like base, giving off erect stems which are oval or nearly circular in transverse section. The basal surface of the erect branches is at first flat, but later becomes covered by a layer of longitudinally disposed kenozooecia which make this surface convex. Zooecia not arranged regularly in two alternating series, those of opposite sides being often continuous across the middle line of the frontal surface of the branch. At the outer ends of the rows, the zooecia are partly or entirely connate and here resemble the series of a typical *Tubulipora*. Ovicell developed on the basal surface of the branch, extending into a bifurcation, in the angle of which is situated a short ooeciostome which may be visible in frontal view.

I name this species in honour of Miss E. C. JELLY, from whom I obtained the ovicell-bearing specimen here figured, and whose excellent "Synonymic Catalogue of the Recent Marine Bryozoa" (1889) has been so invaluable an aid to students of recent Polyzoa. It appears to have been referred to by HASWELL and WATERS, under the name of *Idmonea* or *Tervia irregularis*, but I think I am justified in separating it from the Mediterranean and Atlantic forms to which MENEGHINI's specific name properly belongs. The ovicell of *T. jellyae* has much resemblance to that of an Italian fossil ascribed by NEVIANI, 1891 [1]), to *Filisparsa varians* Reuss; but I do not think there is sufficient reason for placing the specimens here described under REUSS' species.

The present species is represented only by small fragments. The specimen 285. A. consists of the base, which is adnate to a small Gasteropod shell inhabited by a Hermit-crab; and of two erect stems of short length. The base by itself might well have been referred to *Reptotubigera* or *Stomatopora* [2]), consisting, as it does, of completely adnate lobes growing over the shell. These lobes are very irregular in their arrangement, and to some extent confluent with

1) l. cit.
2) Cf. WATERS, A. W., t. cit., p. 844.

one another. The zooecia here show no uniformity in position. Part of one lobe is formed of two successive pairs of connate zooecia, which have the relations of those of typical *Reptotubigera*. Most of the zooecia of the adnate part are, however, alternate; a median zooecium having one other on each side of it, but at a different level in the length of the lobe. Towards the end of one of the adnate lobes, the zooecia are assuming the serial arrangement seen in the erect stems. The margins of the lobes may give off kenozooecia, of about the same diameter as the complete zooecia, which fix the lobe firmly to the shell. Where an erect stem is developed, some of these kenozooecia [1]) pass longitudinally up the basal surface of the stem, which, however, grows more rapidly than the bundle of basal kenozooecia. The branches thus have a flattened basal surface near their distal ends, but more proximally the kenozooecia grow up the back of the branch, so as to give this surface a convex shape. The pores are very numerous on all parts, including the free peristomes. The zooecia of the erect stems are similar to those of the Queensland specimen represented in fig. 1; but many of them have free peristomes, some of moderate length.

The specimen represented in figs 1, 2 is from a Queensland slide which formerly belonged to Miss JELLY. It is one of four fragments which consist of erect stems, of a nearly cylindrical shape; and there can be no reasonable doubt that they belong to the same species as the 'Siboga' specimen above described. The branches bifurcate several times, sometimes at an acute angle, sometimes at an angle of nearly 90°. The basal surface is convex and is marked by distinct longitudinal septal lines, which project as slight ridges, between which the surface of the zooecia is very gently concave. From the evidence afforded by 285. A. it may be assumed that this appearance is due to the kenozooecia which have grown up the back of the branches from the proximal end of the colony. On the frontal surface the zooecia are arranged in series, usually with no break in the middle line. In the second series from the distal end seen, towards the upper end of the figure, in the left hand branch, the transverse row of zooecia extends in a spiral way across the whole width of the branch, and is completed by the zooecium projecting to the right; this zooecium being separated by an interval from its nearest neighbour. In the series next on its proximal side an interruption in continuity occurs nearer the middle line of the branch, and in such a position that two of its zooecia appear to belong to the left side and four to the right side. There is in fact a good deal of irregularity in the disposition of the series, which have a tendency, however, to extend across the whole width of the branch, in such a way as to form a curve which is convex towards the proximal end. At the outer ends of the series, two or more of the zooecia are commonly connate distally, the peristomes not showing much tendency in this specimen to become free.

Three of the fragments on this slide possess ovicells, of the type represented in figs 1, 2. The greater part of the ovicell belongs to the basal surface of the branch (fig. 2), where it occupies the length of about four zooecial series. At its proximal end the ovicell is no wider than a zooecium; but it then expands in a pear-shaped way, until it reaches its broadest part,

1) The "canaux de renforcement" of PERGENS (1890).

which is situated in the emargination of the bifurcation. The basal surface of the ovicell is only slightly convex; and therefore projects but little beyond the general level of the basal surface of the branch. It is covered by very numerous pores; which, as is usual in Cyclostomes, are more numerous than those of other parts of the colony. In the frontal view (fig. 1) the distal end of the ovicell appears in the emargination of the branch. Its ooeciostome is a very short tube, which stands vertically, so that the ooeciopore is easily seen in this view. This opening may be described as circular, with one part of the circumference flattened. On its distal side the ooeciostome is in close contact with the peristome of the outermost zooecium of the series next beyond the bifurcation on the left side. In the other ovicells, the ooeciopore is concealed by the corresponding peristome and is thus not visible in frontal view; and it is less circular than in the specimen figured. The ovicell appears to be a modification of one of the kenozooecia of the basal surface of the branch.

The ovicells of *Tervia irregularis* have been figured by WATERS[1]). One of the figures (fig. 5) given by this author, and stated by him to be the normal ovicell of the species, is elongated, and is not unlike that shown in fig. 2 of this Report, except that it commences just on the proximal side of a bifurcation and belongs mainly to one of the branches thus formed. The other (fig. 6) is described as "a short abnormal one"; and is hardly longer than broad; but it has the same relation to the bifurcation that is shown in my own figure. In both cases the ooeciostome appears to be visible in basal view. A similar short ovicell is figured by JULLIEN and CALVET, 1903 (t. cit.).

I have compared the forms described in the present Report with specimens of *T. irregularis* Menegh., in the Cambridge and British Museum Collections. Ovicells are not present; but while the general arrangement of the zooecia is similar to that found in the Oriental and Australian forms, the specimens differ in having their lateral zooecia developed into strongly projecting wing-like outgrowths of the sides of the branch; each such outgrowth being formed of several (as many as four or five) zooecia, which are in the main connate, but have some of their constituent peristomes free at their ends. The pores are less numerous than in the specimens here referred to the present species. The differences, both of the ovicells and of the zooecia, seem to be sufficient to justify the separation of the forms described in this Report from the Mediterranean species.

Measurements, in μ:

Width of the branch, at the proximal end of fig. 1, 700;

Width of the same branch, immediately distally to a row of zooecia which runs transversely across the entire branch, just before the bifurcation, 1,550;

Diameter of the ooeciopore, 175;

Diameter of the zooecia, 150—200;

Diameter of the orifices, 150;

Length of the part of the ovicell shown in fig. 2, 2,550;

Width of the ovicell, at its distal end, 750.

1) WATERS, A. W., 1888, t. cit., Pl. XIV, figs 5, 6.

Fam. Horneridae Smitt.

Horneridae Smitt, 1866, "Krit. förteckn. Skand. Hafs-Bry.", II. Öfv. K. Vet.-Ak. Forh., XXIII, p. 404.

Hornera Lamx.

Hornera Lamouroux, 1821, "Exp. Meth.", p. 41.
Hornera Lamouroux, 1827, "Encycl. Method.", "Zooph.", p. 460.

1. *Hornera spinigera* Kirkp. (Pl. XI, figs 8—13).

Hornera spinigera Kirkpatrick, 1888, "Pol. Mauritius", Ann. Mag., Nat. Hist. (6) I, p. 83, Pl. X, figs 1—1 *b*.
Hornera spinigera Philipps, 1899, "Polyzoa", Willey's "Zool. Res.", Pt IV, pp. 441, 449 (Lifu).

470. B. Stat. 97. 5° 48'.7 N., 119° 49'.6 E., 564 Metres; coarse coral-sand.
82. A. Stat. 105. 6° 8' N., 121° 19' E., 275 Metres; coral-bottom.
483. B. Stat. 117. Kwandang Bay, entrance, 80 Metres (chart); sand and coral.
112. B. Stat. 156. 0° 29'.2 S., 130° 5 .3 E., 469 Metres; coarse sand and broken shells.

Also (Univ. Mus. Zool., Cambridge): —

Lifu, Loyalty Islands, A. Willey Coll., Reg. Mar. 1, 1898 (determined by Miss E. G. Philipps).

Zoarium usually branching in one plane, the branches numerous and close together, alternate or nearly or quite opposite. Spines developed on many parts, including the peristomes. Basal surface of the young branches with strong longitudinal ridges, between which the surface is concave and bears a row of pores. In the older branches the ridges become confluent, more numerous and less regular, the pores being still distinguishable. On the frontal surface the zooecia are arranged in *Tubulipora*-like alternate series, each of which consists of 2 or 3 zooecia, the outermost the most prominent. Peristomes spinous, some of the spines radiating inwards towards the centre of the orifice. The spines are most developed on the outer zooecia, and a pair of specially long ones are often produced by the distal margin of the peristome, and a large spine by the middle of the proximal border. This suboral spine may be greatly developed, and is sometimes as long as the peristome. Ovicells on the basal surface, extending along the region of two consecutive branches, their basal surface reticulato-punctate and more or less strongly carinate. Ooeciostome visible in the frontal view, situated in the axil of a branch.

This very beautiful and characteristic species has been well described by Kirkpatrick from specimens found at Mauritius; and it has also been recorded from Lifu by Miss Philipps. It is specially characterised by the serial arrangement of its zooecia and by the spines which occur on various parts, particularly on the peristomes. In the 'Siboga' specimens the series are usually bizooecial; but in that from Lifu three zooecia generally occur in a series. The outer peristome is long and free, while the inner zooecium has its orifice almost level with the surface of the branch.

The branches of this species are developed very freely, succeeding one another with but small intervals between them. They are given off by both sides of an older branch and may be alternate, opposite or nearly opposite one another. Most of the branches are in one plane.

At the growing tips (fig. 9) the zooecia are very distinct. Their frontal surface is here flat or gently concave, its plane being placed in such a way as to project most on the median side, and falling away towards the outer side of the branch. This flat surface is bordered by a longitudinal ridge on each side; and these ridges are recognizable as longitudinal ridges some way down the branch. A few pores occur on the flat surfaces. In the older branches (fig. 12) a considerable amount of thickening is found to have taken place. The middle line of the branch is the most projecting part; but the ridges have become less regular and more numerous, and are wider than at first, with evenly rounded summits. Pores are visible in the intervals between the ridges, and the external opening of the pore is commonly longitudinally slit-like. A few sharp spines are developed, here and there, on the frontal surfaces of the zooecia, principally on the ridges. On the basal surface the spines may be numerous, but are shorter and conical.

The greatest development of the spines occurs, however, on the peristomes, both of the inner and of the outer zooecia. They may be regarded as due partly to the splitting of the peristome, at its free end, into a certain number of sharp spines, of which two on the distal border and a stronger, median, suboral spine are usually the largest (fig. 10). The peristome bears other spines, as well as these, and some of them radiate into the orifice, as has been pointed out by KIRKPATRICK.

The shape of the outer peristomes is variable. In some cases (fig. 9) the peristome does not widen at its distal end, and the spines are more or less equally developed all round, although even in these zooecia the suboral spine is generally distinguishable. 112. B. included two specimens, of very different appearance. In one of these (fig. 12) most of the outer peristomes widen considerably at their distal end, where there is a marked calcareous collar round most of the orifice, being specially developed proximally and laterally. The suboral spine is produced from the middle line of this collar, and may be strengthened by a longitudinal buttress running down the frontal surface of the zooecium. The collar forms a concave shelf-like surface, starting from the inner aspect of the suboral spine and passing to the sides of the orifice. In the other specimen (figs 8, 10) from the same dredging the peristomes of the outer zooecia are greatly compressed; and they are further remarkable for the enormous development of the suboral spine, which is compressed and finely denticulate, and may be as long as the peristome itself. A similar suboral spine may be found on the inner zooecia as well.

In the basal view of young zooecia (fig. 11) a strong longitudinal ridge is generally discernible along each edge of this surface. Where the two distal spines are large, one of these ridges is seen to pass into each spine; and the ridges themselves may be plate-like and very high, so that each lateral border of the basal surface bears a high flange. The basal ridges of the terminal zooecium of the branch can be traced into the two ridges which run longitudinally along the back of the young branch (fig. 11). These ridges become joined by others which belong to the more proximally situated zooecia, and the number is thus increased. In the older branches the basal ridges are not so regularly longitudinal and they have a more rounded surface, between them occurring the pores, each of which generally lies in a somewhat lozenge-shaped depression (upper part of fig. 11), of the kind so frequently seen in species of *Hornera*. The outer ends of the pores are generally longitudinally slit-like.

Three ovicells are present in the 'Siboga' specimens; one on 112. B. (figs 11, 12) and the other two on 483. B. They are of the type characteristic of the genus, occurring on the basal side of a main branch, and belonging to the region of two lateral branches, one on either side of the main stem (fig. 11). The ovicell is considerably longer than broad and it is marked by a distinct longitudinal carina which runs obliquely, in the direction of the longest axis of the organ. From this carina its sides fall off, becoming convex and joining the branch in such a way that the ovicell is sharply marked off from the neighbouring parts. The whole surface, with the exception of the carina, is reticulato-punctate; the pores being situated at the bottom of fairly deep pits, one of which surrounds each pore. This ovicell is bifid distally, although this character is not found in the other two. On viewing the branch from the frontal side (fig. 12), it is seen that the ooeciostome occurs in the proximal axil, and is visible from this aspect. The tube is not developed on the side towards the axil; but on the opposite side it is raised and hood-like. The ooeciopore is subtriangular, the apex of the triangle being directed towards the axil. The ovicells of 483. B. are essentially similar. Both are borne by one small fragment, and have their ooeciostomes in a corresponding position. The tube of the ooeciostome is, however, indicated on the axillary side, and the ooeciopore is more rounded. These ovicells are considerably broader proximally than distally. One of them sends a lobe along the back of the proximal branch; and its carina, which is much less developed than in 112. B., gives off a branch, nearly at right angles, extending along this lobe. The other ovicell shows the same features in a less marked manner.

Measurements, in μ:

Diameter of main branch, fig. 11, 700—750;
Diameter of left lateral branch, fig. 11, 400;
Length of ovicell, fig. 11, 1,900;
Diameter of ovicell, at proximal end, fig. 11, 1,200;
Length of longest peristome, without spines, fig. 10, 425;
Length of longest suboral spine, fig. 8, 525;
Diameter of expanded part of peristome, close to orifice, fig. 12. 150.
Diameter of ooeciopore, fig. 12, 120.

2. *Hornera caespitosa* Busk. (Pl. XI, fig. 13).

Hornera caespitosa Busk, 1875, "Cat. Mar. Pol. Brit. Mus.", III, p. 17, Pl. XV, figs 1—3.

82. B. Stat. 105. 6°8' N., 121°19' E., 275 Metres; coral-bottom.

Zoarium with branches which are curved towards the frontal surface, some of them showing a lateral curvature. Basal surface very convex, the ridges neither regular not prominent, each bearing a series of granulations. Frontal surface not showing regular longitudinal ridges, even in young branches; with pores in depressions separated by obscure curved ridges. Zooecia not arranged in series, their orifices quincuncial. Most of the peristomes are not raised, but the outer peristomes may be somewhat prolonged and then project at the sides of the branches. Ovicells wanting.

The present species is represented by a single fragment; obtained, with *H. spinigera*, from Station 105. It may be described as a very typical form of its genus, but the material is hardly sufficient to enable it to be determined with certainty. It is probable, however, that it belongs to *H. caespitosa*, described by BUSK from Cape Capricorn, Queensland. The ovicells of a form from near Marseilles referred to *H. caespitosa* have been described by CALVET [1]; although it seems not improbable that the specimens figured really belonged to *H. frondiculata*.

Measurements, in μ:

Diameter of branch, at lower part of fig. 13, 1,020;
Diameter of branch, at left side of the same, 600;
Diameter of orifices, 75—100.

Fam. CYTISIDAE D'ORBIGNY.

Cytisidae D'Orbigny, 1854, "Pal. Franç. Terr. Cret.", V, p. 1042.
Cytisidae Pergens, 1890, "Rev. Bry. Cret. figurés par D'ORBIGNY", Bull. Soc. Belge Géol., III, p. 384.

The Family Cytisidae, as defined by PERGENS, consists of species in which the colony consists of free branches or is discoidal, having the orifices placed in groups on one of its surfaces. The peristomes are not prominent, and accessory pores are present. The ovicells are rounded swellings placed on the oral surface.

The only species corresponding with this definition which was found among the 'Siboga' dredgings may be referred to *Supercytis* D'Orb.: — a type which, according to PERGENS, is assumed by young colonies of forms referable to other genera, in which the branches are not yet much developed. The occurrence of ovicells in the specimens described below seems to show, however, that the adult features of the species are more or less developed in a form which has the *Supercytis*-characters. A number of fossil species of this type are known to Palaeontologists; and much difference of opinion exists as to their classification. The material at my disposal is not sufficient to enable me to attempt to reconcile these differences; but for a critical discussion of the subject I may refer to GREGORY's work [2] published in 1909.

Supercytis D'Orb.

Supercytis D'Orbigny, 1854, t. cit., p. 1060.
Supercytis? Waters, 1884, "Foss. Cycl. Bry. Australia", Q. J. Geol. Soc. XL, p. 692.
Supercytis (pars) Busk, 1886, Challenger Rep., L, p. 28.
Supercytis Waters, 1914, "Mar. Faun. Brit. E. Afr.", "Bry. Cycl.", Proc. Zool. Soc., p. 837.
Fasciculipora (pars) Busk, 1875, "Cat. Mar. Pol. Brit. Mus.", III, p. 37.

As defined by D'ORBIGNY, this genus consists of pedunculate forms, spreading out above and giving rise to simple or bifurcate branches diverging horizontally but united at their bases.

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1) CALVET, L., 1907. "Bryozoaires", Exp. Sci. Travailleur et Talisman, VIII, p. 478, Pl. XXX, figs 11, 12.
2) GREGORY, J. W., 1909. "Cat. Foss. Bry. Brit. Mus.", "Cret. Bry.", II, pp. XXIV—XLI.

The lower surface is covered by a thin epitheca, while the upper surface bears oblique zooecia. Ovicells, one or two, more or less inflated, occur in the middle of the upper surface of the colony.

WATERS (1914) points out that *S. tubigera* Busk is not correctly placed in this genus.

1. *Supercytis watersi* n. sp. (Pl. XII, fig. 1).

Supercytis? digitata Waters, 1884, t. cit., p. 692, Pl. XXXI, figs 22, 26, 27 (fossil, Murray Cliffs, S. Australia).

Type. 400. A. Stat. 164. 1°42'.5 S., 130°47'.5 E., 32 Metres; sand, small stones and shells.
348. I. Stat. 213. Saleyer Anchorage and surroundings, 0—36 Metres; coral-reefs, mud and mud with sand.

Zoarium consisting of a nearly cylindrical stalk, expanding into a wide, shallow saucer, the edges of which are produced into rays. Stalk porous externally, marked by numerous circular lines of growth. Rays having the same structure as the stalk basally, but on their frontal surface, corresponding with the concavity of the saucer, honeycomb-like, the smaller openings being perhaps cancelli. Ovicell central, its roof flat, very porous and distinctly outlined; traversed by several rows of discrete zooecia, the peristomes of which are short and disposed vertically. Ooeciostome apparently resembling one of these peristomes.

I name this species in honour of Mr A. W. WATERS, who has contributed so much to our knowledge of recent and fossil Polyzoa, and has apparently described it from an Australian fossil.

The present species is represented by only two specimens, one from each of two shallow water dredgings. The older specimen is shown in fig. 1, and consists of a massive stalk expanding distally into a shallow saucer, the edges of which are produced into seven rays. The base of the colony is not quite complete. The outer surface of the stalk is traversed by several longitudinal grooves, which separate a corresponding number of rounded elevations from one another. The surface is further marked by numerous circular lines of growth, some of which occur in the expanded distal part of the colony. The whole of this surface bears numerous pores. In the other specimen (348. I.) the longitudinal grooves are absent. This colony is in a younger state of growth, and longitudinal septal lines are visible; about 5 zooecia being seen in the exposed half. The zooecia which thus form the outer part of the stalk appear to extend throughout its entire length, each opening by one of the orifices seen in the cavity of the distal saucer-like part of the colony.

In both specimens, practically the entire frontal surface, with the exception of the central region, where an ovicell is present, is composed of a honeycomb-like arrangement of calcareous walls. The larger openings thus delimited are no doubt the orifices of zooecia. The smaller ones are either the proximal ends of young zooecia or are cancelli, similar to those found in *Lichenopora*.

In both colonies the central region is occupied by an ovicell, the roof of which is a nearly flat calcareous lamina, thickly covered by pores. Through this roof extend the peristomes of a certain number of zooecia, either singly or, as seen towards the right of the figure, two together. These isolated peristomes are short but distinct, and stand vertically. In the specimen figured they occur in about four rows, with three or four peristomes in each row. At the margin of the roof of the ovicell a few peristomes are outlined on their central side, where they project into the region of the ovicell; while peripherally they are continuous with the honeycomb-like arrangement of prismatic spaces which is seen in the rays. Between these partially isolated zooecia runs a sharply marked, but low calcareous ridge, by which the ovicell is outlined. In the interval between two rays seen opposite the left half of the upper border of the ovicell in fig. 1, the honeycomb has been closed by the development of a porous calcareous plate across the opening of each tube. In all other parts of this specimen the ovicell is in contact, peripherally, with the system of open tubes which form the frontal surface of the colony, including its rays.

The ooeciostome cannot be distinguished with certainty; but I believe this to be due to the fact that it has a close resemblance to one of the isolated peristomes of the central region. The lowest member of the middle vertical row of zooecia, in fig. 1, is probably the ooeciostome.

The ovicell of the younger specimen (348. I.) is similar to the one already described, but the calcification of its roof is not quite complete. The whole of the rest of the frontal surface of the colony is honeycomb-like; and the rays are only just commencing to be indicated.

Measurements, in μ;

Greatest diameter of the colony, fig. 1, 5,500;
Width of the two broadest lobes, 1,300, 1,100;
Width of ovicell, 1,850;
Diameter of orifices, 145.

Supercytis digitata was described by D'ORBIGNY[1]) from Cretaceous material. The recent form to which BUSK[2]) gave the same specific name (as *Fasciculipora digitata*), apparently by an undesigned coincidence, has usually been regarded as identical with D'ORBIGNY's species, although I am not sure that this view is correct. D'ORBIGNY's fig. 8 represents a colony with two distinct ovicells. One of these (right of figure) has lost its roof; and, as D'ORBIGNY pointed out, it shows "en dedans un canal qui communique avec l'intérieur de la colonie". This clearly indicates that the ovicell is to be regarded as a modified zooecium: the aperture shown by D'ORBIGNY being the point where the dilated part of the ovicell communicates with its proximal undilated part. The other ovicell is said to be complete. If this was really the case, it may be concluded that the ovicell in the Cretaceous form is developed in such a way as not to include any zooecia. This fact, and perhaps the existence of two ovicells, may be taken as a sufficient reason for distinguishing the recent species from its Cretaceous ally.

The specimen (Brit. Mus. 75. 5. 29. 60) described by BUSK in 1875 from Cape Capricorn, Queensland, seems to be distinct from the 'Siboga' specimens: while the figure given by the same author, in the 'Challenger' Report (1886) of "*Supercytis digitata*" appears to show that that specimen has an ovicell of a different type, and that it cannot be referred either to *S.*

1) D'ORBIGNY, 1854, t. cit., p. 1060, Pl. 798, figs. 6—9.
2) BUSK, G., 1875, t. cit., p. 37, Pl. XXXIII, fig. 1.

digitata or to *S. watersi.* Mr WATERS [1]) has described a New Zealand fossil which he considers "undoubtedly the same as the recent forms found by the 'Challenger'".

The Japanese Cyclostome described by ORTMANN [2]) as *Hypocytis asteriscus* has a close general resemblance to the present species. The genus was distinguished from *Supercytis* by the fact that the zooecia open at the ends of the rays and on their 'Unterseite'. As ORTMANN describes the entire colony as expanding 'oberwärts' into a disc prolonged into rays, I take this to mean that the orifices are borne on that surface of the rays which I have described as basal in the 'Siboga' specimens. The surface is said to be "gestreift". Fig. 19*b* shows distinctly outlined zooecia radiating from the centre of the colony, with orifices situated in the peripheral parts of the rays. It presumably represents a view of the basal surface of the rays; in which case a small circular area indicated in the middle of the figure probably represents either the foreshortened stalk or the broken attachment of the stalk to the expanded terminal part of the colony. If ORTMANN's account has been correctly understood, it is hardly possible to regard the Japanese species as a member of the genus *Supercytis*.

The *Supercytis digitata* of MACGILLIVRAY and HALL [3]) is said to have its orifices "on the lower and not on the upper side"; and in this respect it agrees with *Hypocytis*.

In its zoarial form, *S. watersi* has a considerable resemblance to *Defrancia lucernaria* M. Sars, as shown by the figures given by BUSK (1875, Pl. XXXIII, fig. 3). It appears to differ from that species in the characters of the ovicells, those of *D. lucernaria* being described by SMITT [4]) as swollen vesicles between the zooecial series, elongated in a radial direction.

Fam. LICHENOPORIDAE Smitt.

Lichenoporidae Smitt, 1866, "Krit. fört. Skand. Hafs-Bry.", II, Öfv. K. Vet.-Ak. Förh. XXIII, p. 405.
Lichenoporidae Pergens, 1890, "Rev. Bry. Cret. figures par D'ORBIGNY", Bull. Soc. Belge Géol., III, p. 378.
Caveidae (pars) D'Orbigny, 1853, "Pal. Franç. Terr. Cret.", V, p. 922.
Galeidae Jullien, 1888, "Bryozoaires", Miss. Sci. Cap Horn, VI, Zool., pp. 8, 82.

As defined by SMITT, this Family consists of discoidal Cyclostomata, with a marginal budding zone and zooecia radiating from a cancellated central region. For D'ORBIGNY's genera included in this Family, reference may be made to PERGENS' work, cited above.

Lichenopora Defrance.

Lichenopora Defrance, 1823, "Dict. Sci. Nat. XXVI, p. 256.
Lichenopora Hincks, 1880, "Hist. Brit. Mar. Pol.", p. 471.
Disporella Gray, 1848, "List Brit. An. Brit. Mus.", I, p. 138.
Discoporella Busk, 1859, "Crag Pol.", Palaeont. Soc., p. 115.
Discoporella Smitt, l. c.

1) WATERS, A. W., 1887, "Tert. Cycl. Bry. New Zealand". Q. J. Geol. Soc., XLIII, p. 344.
2) ORTMANN, A., 1889, "Japan. Bry.", Arch. f. Naturg., Jahrg. LVI, Bd I, p. 66, Pl. II, figs 19*a*, 19*b*.
3) MACGILLIVRAY, P. H., 1895, "Monogr. Tert. Pol. Vict.", Trans. R. Soc. Vict. IV, p. 134, Pl. XXII, figs. 1, 2; Appendix, by T. S. HALL, p. 145.
4) SMITT, F. A., 1866, "Krit. forteckn." II, Öfv. K. Vet.-Ak. Forh., XXIII, p. 494.

GREGORY [1]) has criticized the reference of recent species to the genus *Lichenopora*. He points out that of the three species originally included in *Lichenopora* by DEFRANCE, *L. turbinata* [2]), an Eocene species, was definitely selected as the genotype by D'ORBIGNY [3]), and that in this species the orifices are "in elliptical radial bundles, and not in single radial lines". Recent species which have the latter arrangement are thus wrongly referred to *Lichenopora*, and should be placed in *Discocavea* D'Orbigny; or perhaps (p. 233) in *Melobesia* Lamx or *Disporella* Gray, altered by BUSK to *Discoporella*. PERGENS [4]), on the other hand, considers that recent species agree in their general characters with *L. turbinata*, the genotype of *Lichenopora*.

I do not feel convinced that the arrangement of the zooecia in radial lines or otherwise can be adopted conveniently for the generic separation of recent species. These are greatly in need of further revision; but the number of species considered in this Report is insufficient for that purpose. It may, however, be pointed out that of the three species here described, the first has its zooecia in strongly marked radial lines, which have either uniserial or biserial zooecia; the second has most of its zooecia disposed quincuncially; while in the third the zooecia might be described as being arranged in biserial elliptical groups. These facts may indicate that more than one genus is represented; but I do not feel able to attempt to arrange the recent species according to this character. It appears to me probable that a comparative study of the ovicells might give better generic distinctions; and I may refer in particular to the great difference, indicated below, between *L. verrucaria* and *L. novae-zelandiae* in the mode of development of the ovicells. It seems to me best, therefore, to leave the recent species provisionally in *Lichenopora*, until some satisfactory method of grouping them can be shown to exist.

The following notes may be added with regard to the generic names which, according to GREGORY, are available for the recent species: —

(1) *Melobesia* Lamx, 1812. — Although, as GREGORY points out (p. 233) *L. radiata* was referred to *Melobesia* by AUDOUIN in describing SAVIGNY's figures, it is clear from the descriptions and figures given by LAMOUROUX that *M. pustulosa* [5]) was a Calcareous Alga; and indeed LAMOUROUX gives *Corallina* as a synonym of *Melobesia*.

(2) *Disporella* Gray, 1848 [6]). — The only species included in this sub-genus was *Discopora hispida* Fleming, a common British species which is generally included in *Lichenopora* by writers on recent Polyzoa. It is true that *Disporella* was given by GRAY as a subdivision of *Tubulipora*; but GREGORY's criticism (p. 234) that it was not used in a generic or subgeneric sense does not seem to me convincing. *Disporella* might thus be available if *D. hispida* and its allies should be proved to deserve generic separation.

1) GREGORY, J. W., 1909. "Cat. Foss. Bry. Brit. Mus.", "Cret. Bry", II, pp. 247, 233.

2) DEFRANCE. t. cit., p. 257, Atlas, Pl. XLVI. figs 4—4*b* (reproduced in DE BLAINVILLE, 1834, "Man. d'Actinol.", Pl. LXVIII, figs 4—4*b*. The zoarium of *L. turbinata* has the form of a funnel, attached by its stalk-like narrow end, and terminated by a discoidal surface bearing the serially arranged orifices and numerous cancelli.

3) D'ORBIGNY, 1853, t. cit. p. 063.

4) PERGENS, E., 1889, t. cit., p. 370.

5) LAMOUROUX, 1816, "Hist. Pol. Cor. Flex.". p. 315. Pl. XII. fig. 2; better figured in 1821, "Exp. Method.". p. 46. Pl. LXXIII. figs 17, 18.

6) GRAY, J. E., 1848, l. cit.

(3) *Discoporella* Busk, 1859[1]), given by Busk as "*Discoporella* Gray". — It is not clear whether this was a deliberate emendation of Gray's name or an accidental misquotation; but, as has already been remarked by Jullien[2]), the form adopted by Busk is not valid, as D'Orbigny[3]) had previously introduced *Discoporella* for *Lunulites umbellata* Defrance (now usually placed in *Cupularia*), and two other species. The use of *Discoporella* in this sense prevents it from being retained for any member of the Lichenoporidae.

(4) *Defrancia* Bronn, 1825. — As pointed out by Gregory[4]), the only species mentioned by Bronn in the original introduction of the genus is *D.* (*Pelagia*) *clypeata* Lamx. *Defrancia* and *Pelagia* Lamx, 1821 (preoccupied by *Pelagia* Pér. and Les.), are thus both synonyms of *Apsendesia* Lamx, 1821, if Gregory is right in stating[5]) that *Pelagia clypeata* is the young condition of *Apsendesia cristata* Lamx, 1821.

(5) *Discocavea* D'Orbigny, 1853[6]). — This genus is distinguished by D'Orbigny from other genera of his Fam. Caveidae by having its zooecia in uniserial radiating lines; — a character which does not apply to all recent species usually referred to *Lichenopora*.

1. *Lichenopora novae-zelandiae* Busk. (Pl. XII, figs 6—11).

Discoporella novae-zelandiae Busk, 1875, "Cat. Mar. Pol. Brit. Mus.", III, p. 32, Pl. XXX, fig. 2 (New Zealand).
Discoporella novae-zelandiae Haswell, 1879, "Cycl. Pol. Port Jackson", Proc. Linn. Soc. N. S. Wales, IV, p. 353.
Lichenopora novae-zealandiae Hincks, 1884, "Contr. Gen. Hist. Mar. Pol.", XII, Ann. Mag. Nat. Hist. (5) XIII, p. 362 (Mergui Archipelago, Burma; no description).
Lichenopora novae-zelandiae Ortmann, 1889, "Japan. Bry.", Arch. f. Naturg., Jahrg. LVI, Bd I, p. 65, Pl. II, fig. 10.
Lichenopora novae-zelandiae Thornely, 1905, Herdman's "Rep. Pearl Oyster Fish.", XXVI, "Pol.", publ. by the Roy. Soc., p. 127.
Lichenopora victoriensis Waters, 1889, "Ovicells Lichenoporae", J. Linn. Soc., Zool., XX, p. 284, Pl. XV, fig. 4.
Discoporella holdsworthii Busk, 1875, t. cit., p. 33, Pl. XXX, fig. 4.
Lichenopora holdsworthii Waters, 1889, t. cit., p. 285, Pl. XV, figs 7, 8.
Lichenopora holdsworthii Thornely, 1912, "Mar. Pol. Ind. Ocean", Trans. Linn. Soc., Zool., XV, p. 157.

364. H. Stat. 71. Makassar and surroundings, 0—32 Metres; mud, mud with sand, coral. 1 colony.
568. B. Stat. 105. 6° 8' N., 121° 19' E., 275 Metres; coral-bottom. 4 colonies.
108. AB. } Stat. 144. Anchorage N. of Salomakiee (Damar) Island, 45 Metres; coral-bottom
394. I. } and Lithothamnion. 8 colonies.
514. A. Stat. 172. Gisser, anchorage between this Island and Ceram-Laut, 18 Metres; coral and Lithothamnion-bottom. 1 colony.
354. A. Stat. 240. Banda anchorage, 9—45 Metres; black sand, coral; Lithothamnion-bank in 18—36 Metres. 9 colonies.

1) Busk, G., 1859, l. cit.
2) Jullien, J., 1888, t. cit., p. 83; cf. also Waters, 1888, "Ovicells Lichenoporae", J. Linn. Soc., Zool., XX, p. 280.
3) D'Orbigny, A., 1852, t. cit., p. 472.
4) Gregory, J. W., 1909, t. cit., p. 247.
5) Ibid., 1896, "Cat. Foss. Bry. Brit. Mus.", "Jurassic Bry.", p. 171.
6) D'Orbigny, 1853, t. cit., pp. 925, 957. The genotype, selected by Gregory, 1909, p. 233, is *D.* [illegible] D'Orb.

208\. C. Stat. 282. Anchorage between Nusa Besi and the N. E. point of Timor, 27—54 Metres; sand, coral and Lithothamnion. 1 colony.

202\. B. Stat. 282. do, do; reef. 2 colonies.

268\. B. Stat. 303 and 60. Haingsisi, Samau Island, 0—36 Metres; Lithothamnion. 1 colony.

239\. B. Stat. 310. 8° 30' S., 119° 7'.5 E., 73 Metres; sand with a few pieces of dead coral. 1 very young colony, growing on a peristome of *Entalophora proboscidea* (on *Entalophora*-slide, 239. A.[1]).

(? sp.) 251. M. Stat. 315. Anchorage E. of Sailus Besar, Paternoster Islands, 0—36 Metres; coral and Lithothamnion. 1 colony.

Also (Mus. Zool., Cambridge): —

Torres Straits, 192, A. C. HADDON Coll., Reg. Feb. 24, 1898. 1 colony.

Ceylon, determined by Miss THORNELY as *L. novae-zelandiae*, Miss L. R. THORNELY, Reg. Apr. 25, 1906, 72. 1 colony.

Japan, Okinose, off Tokyo, 40 fathoms, A. OWSTON Coll., 5. AN., Reg. June 23, 1902. Many colonies.

Japan, Tosa, Shikoku Island, T. MITZOBUCHI, Reg. Sept. 19, 1901. 4 colonies.

New Zealand, determined by Mr T. HINCKS as *L. novae-zealandiae*; HINCKS Coll., Reg. May 13, 1899. Several colonies.

Zoarium reaching a diameter of 8.5 mm. in large specimens, but usually smaller. Zooecia in well marked radial rows, the more median zooecia commonly with much elongated peristomes. The rays are usually composed of a single series of zooecia, but may be biserial at their median ends or more rarely throughout their length. Ovicells with a cavity which is continuous from the first; sending prolongations into the intervals between the series of zooecia; with a porous roof, covered by large cancelli. Ooeciostome a short simple tube, with a nearly circular ooeciopore. Cancelli large, sometimes partially occluded by a cryptocyst-like lamina, and with numerous pin-like spines radiating into their cavity.

The zoarium varies in form, being sometimes plano-convex, with its marginal lamina completely adherent to the substratum; or saucer-shaped, with a free marginal lamina. Its central region may be depressed (in colonies without ovicells), or this may be the thickest part. In some cases the colony forms a short cylinder, the free end of which is occupied mostly by a cancellated region, while the zooecial rays descend the sides of the cylinder. The number of rays may be at least 40, but new rays are added between the older ones, from time to time as the growth of the colony proceeds.

The specimens referred to the present species vary greatly in their appearance: as for instance in the prominence of the peristomes, in the form of the ovicells and in the size of the openings of the cancelli. The particular form assumed appears to depend largely on the age of the colony and on the presence or absence of ovicells. I have previously shown [1]) that in *L. verrucaria* the ovicell is usually developed at an extremely early stage in the growth of the colony, and indeed in many cases from the oldest zooecium but one; that its further growth is associated with the breaking down of the calcareous septa between the „alveoli" or cancelli which occur at the bases of the peristomes; and (p. 132) that secondary ovicells may develop in old colonies. In the species at present under consideration I have no evidence

1) HARMER, S. F., 1896, "Dev. *Lichenopora*", Quart. J. Micr. Sci., XXXIX, pp. 98 et seq.

that ovicells are formed so precociously as in *L. verrucaria*; and it seems probable that they are not as a rule produced until relatively late in the development of the colony, and that in some cases they do not appear at all. There is here no indication of the extension of the cavity of the ovicell by the addition of alveoli to its growing margin; and the cavity is from the first a continuous space, as shown in fig. 6. The present species agrees with *L. verrucaria*, on the other hand, in its capacity for developing secondary ovicells, at a late stage in its growth.

The variability in the appearance of the colonies appears to depend also on the extent of the production of ovicells; but it is greatly affected by the varying development of the cancelli. In colonies which have produced no ovicell, the central region is depressed; while in fertile colonies this is usually the thickest part.

The extent to which the radiating series of zooecia project is further a variable character. In some cases, as in fig. 8, the rays are extremely prominent at their central ends, where they may be biserial, with the peristomes of the two series diverging from one another and to a considerable extent free. The more marginally situated zooecia diminish rapidly in height to the outer border of the colony. In other cases, as in fig. 11, the rays project but little; even the central zooecia being but slightly prolonged, and all the zooecia being arranged in a single radial series. The extreme modifications are so different from one another that, in the absence of other evidence, the specimens might well be referred to two species. But, on the other hand, colonies from the same dredging may show both these extremes, with other individuals which are intermediate. I have been unable to make any satisfactory division of the specimens on the basis of the difference between the projection of the peristomes; and it appears to be necessary to regard this character as one which is really very variable. The zooecia are commonly compressed, the peristomes having a corresponding form, and being often produced into a point on the marginal and on the central side.

The form of the roof of the ovicell is another feature which is subject to variation. Fig. 9 shows a colony in which the roof has probably been broken. The floor is thus exposed and is seen to be composed of a smooth calcareous film which has overspread the underlying cancelli; a few pores, not represented in the figure, leading through the floor of the ovicell into the cancelli. The part of the roof which is complete is seen to be composed of two very convex lobes which are thickly covered by pores. These lobes are seen through the openings of large cancelli which have been developed superficially to the roof of the ovicell.

Fig. 11 shows a very different condition; the lobes of the ovicell being here roofed by a nearly flat calcareous lamina, which is covered by pores. This specimen, taken by itself, might well be regarded as a distinct species; but those shown respectively in fig. 6 and fig. 8 are from the same dredging and agree closely with one another in other characters; while they show the two conditions of the roof of the ovicell which have just been indicated. The younger specimen (fig. 6) has two distinct ovicells, of which the one on the lower side of the figure has at present no roof, but its floor is similar to that of the specimen shown in fig. 9 and already described. The ovicell of the upper side has a roof which consists of a narrow, flat, perforated lamina, which is not unlike that of fig. 11. In fig. 8, from the same Station, the growth of the ovicell is nearly complete; but its roof, seen through the widely open cancelli, consists of broad, convex, porous lobes which are similar to those of fig. 9. Fig. 8 is a colony in which the central zooecia of the rays are specially elongated and have a very distinctly biserial arrangement. But in fig. 10, representing a specimen which agrees with fig. 11 in its uniserial, slightly prominent zooecial rays, the lobes of the ovicell are not flat-roofed, as in that specimen, but are just as convex as in fig. 9.

It does not seem easy to give any other explanation of these differences than the assumption that the form of the ovicell is variable. It appears probable, however, that the ovicell has to adapt its form to the space which is available. Thus the colony shown in fig. 11 has a very small projection of its zooecial rays; while it is growing on the convex surface of a cylindrical Coral-branch of less diameter than itself. Owing to the latter reason, the basal surface of the colony is very concave, the edges of the *Lichenopora* being reflected round the Coral. This position would naturally result in some stretching of the central region of the colony, and would thus tend to prevent it from increasing greatly in thickness. The slight projection of the zooecial rays would operate in the same direction by not allowing much vertical room for the growth of the ovicell; and it is perhaps owing to the combination of these two conditions that the roof of the ovicell is unusually flat. In fig. 8 the conditions are very different. Although this colony too is growing on a cylindrical object of less diameter than its own, its basal lamina is for the most part free; being only attached along a narrow line to its substratum. There is thus no interference with the growth of the colony in vertical height. As the peristomes are, moreover, unusually long, there is plenty of room for the ovicell to attain a greater vertical height than in the other case; and the roof is accordingly very convex, with a correspondingly large perforated surface.

In some cases there is evidence of the development of what I have previously termed secondary ovicells; that is, ovicells which are formed at a late stage in the growth of the colony. Thus on slide 108. AB., one of the colonies has a normal ovicell in its central region; and, in addition, a much smaller ovicell, with an ooeciostome which has developed, in a more superficial position, between the outer ends of two or three of the zooecial rays. The ovicell shown in fig. 9 may also be regarded as a secondary one, since it is being developed in a colony which has already reached a considerable vertical thickness.

The ooeciostome varies little in form, although its position is not constant. In fig. 8 two ooeciostomes (*o*) are seen, at two points on the margin of the ovicells, of which it may be assumed that at least two are present. Each is a short, simple tube, terminated by a nearly circular ooeciopore. It is usually circular in section, but is occasionally compressed. In most cases the ooeciostome is found on the central side of one of the zooecial rays, or between the central ends of two of them. The number of ovicells is apparently always small (not more than two or three); but the development of cancelli generally prevents the line of junction of two contiguous ovicells from being visible; and the number of ovicells has to be inferred from that of the ooeciostomes.

Certain colonies are found to have reached a large size without showing any trace of an ovicell. A specimen of this kind, on slide 354. A., has a diameter of 3.2 mm. Its central region is depressed, and the entire surface which is not occupied by zooecial rays is covered by large, open cancelli through which no trace of ovicell can be seen. It is not impossible that colonies of this type have developed male sexual organs only, though I have no evidence on this subject. The majority of the colonies are, however, fertile.

The marginal lamina is generally broad: — an indication of the fact that growth is not complete. In some instances, as in certain specimens growing on shells, it is closely adnate to its substratum. An incidental advantage of this arrangement is well seen on slide 568. B.[1], where a colony is growing over an area occupied by an encrusting Cheilostome. Its marginal lamina has overspread the Cheilostome, occluding its orifices, and thus removing the competition of what might have been an inconveniently near neighbour. In one or two cases, however, the marginal lamina and some of the peripheral zooecia have been covered by an encrusting calcareous Alga.

In many other instances the marginal lamina has become completely free from the substratum; and it may then grow into the saucer-shaped edge which is also found in other species of the genus.

The cancelli are occupied; — or at least some of them in each colony; — by the well known radiating, pin-like spines, as shown in fig. 7. Examined with a sufficiently high power, the head of the pin is found to be minutely denticulated, or aster-like. In many cases the cancelli remain widely open; but in others a cryptocyst-like calcareous lamina develops in an iris-like way at a level slightly lower than the edges of the cancellus. The orifice of the cancellus may be reduced in this manner to a very small opening; and colonies in which this process has taken place may at first sight look very different from those with open cancelli. But even in these cases the cancelli may be seen to have the normal size, since their original edges still project as slight ridges above the level of the iris-like cryptocyst. In some of the specimens from Japan (5. AX) the ridges separating the cancelli are specially high and may be produced into spinous projections at their nodal points (where the walls of several adjacent cancelli unite). In some of these specimens the marginal side of the orifices may be produced into a sharp point; while in some of those from New Zealand the central side of the orifices may be prolonged into one or two points, in addition to that on the marginal side. These specimens, from Japan and New Zealand, are so similar to the 'Siboga' specimens in the characters of the ovicells that their reference to the same species seems fairly certain.

Some of the 'Siboga' specimens show distinct indications of regeneration of the entire colony: — a process which is known to occur in other species of the genus [1]). This is specially well seen in some large colonies (as much as 8.5 mm. in diameter) mounted on slide 568. B[2]. In one or two of these colonies, a smaller disc has developed from a part of a larger zoarium; and the regenerated disc is produced from one side of the older part of the colony in such a way that it is not in the least concentric with it, but leaves part of the old surface exposed, while the remainder is covered by the regenerated, excentric disc.

The specimen 251. M. is very doubtfully referred to the present species. Its rays are rather more biserial than usual, and more nearly approach the centre of the colony. The characters

1) Cf. PERGENS, E., 1890, "Rev. Bry. Cret. figures par D'ORBIGNY", Bull. Soc. Belge Géol. III. p. 319.

of the ovicell, ooeciostome and cancelli are, however, much as in other specimens which are believed to belong to the present species.

Measurements, in μ: —

Greatest diameter of the largest colony, 568. B.[2], 8,500;
Greatest diameter of the colony, fig. 11, 4,600;
Greatest diameter of the colony, fig. 10, 2,900;
Greatest diameter of the colony, fig. 9, 3,200;
Length of longest peristome, fig. 8, 1,000;
Greatest diameter of ovicell, fig. 11, 1,850;
Length of longest zooecial series, fig. 11, 1,200;
Width of zooecial series, fig. 11, 80;
Average diameter of openings of larger cancelli, fig. 10, 130;
Diameter of ooeciopore, fig. 8, 75.

The determination of the species of *Lichenopora* is admittedly very difficult; and it is probable that the present species has been described under several specific names. Forms like the colony shown in fig. 8 have a considerable resemblance to *L. radiata*, originally described by AUDOUIN [1]) as *Melobesia radiata*, on the basis of SAVIGNY's excellent figures [2]). In these figures the rays are represented as being uniserial, with the central zooecia greatly elevated, and longer than those which occur nearer the margin. The existence of an ovicell or ovicells is clearly indicated in SAVIGNY's fig. 3^4; but it appears from the figures that the cancelli are smaller than in *L. novae-zelandiae*, from which it is probably distinct.

Mr WATERS [3]) has figured the ovicell of a form referred by him to *L. novae-zelandiae*, which differs greatly from the ovicells described in the present Report. A central smooth region, not covered by cancelli, is represented as being surrounded by a sharply marked calcareous ridge. This has some resemblance to the ovicells of specimens from Ceylon described by BUSK as *Discoporella holdsworthii* (see below).

L. novae-zelandiae has been recorded from the Azores by JULLIEN and CALVET [4]) but in the absence of figures it is perhaps permissible to doubt the correctness of the reference.

In his paper on the ovicells of Lichenoporae, WATERS [5]) describes an ovicell which corresponds closely with those found in the 'Siboga' specimens; but he refers the specimens to *L. victoriensis*, a new name for *L. reticulata* MacGillivray, preoccupied. It appears to me probable that this is really *L. novae-zelandiae*.

The ovicell figured by WATERS [6]), in the same paper, as that of *L. echinata* MacG. develops in the same manner as that represented in my own fig. 6; but MACGILLIVRAY's species,

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1) AUDOUIN, V., "Explication", "Pol.", 1826, p. 235: Ed. 2. 1828, p. 60. The specimen (Brit. Mus. 90. 3. 24. 54) from Torres Straits referred by Mr KIRKPATRICK (1890[2], p. 612) to *Lichenopora radiata* has strongly marked radial ridges composed of 2—3 series of connate zooecia, and has much resemblance to *Radiopora cristata* Busk (1875, p. 35).
2) SAVIGNY, J. C., "Descr. Egypte", Pl. VI, figs 3^1—3^4.
3) WATERS, A. W., 1887, "Bry. N. S. Wales", III, Ann. Mag. Nat. Hist. (5) XX, p. 261, Pl. VII, fig. 8.
4) JULLIEN, J., and CALVET, L., 1903. "Bry.", Res. Camp. Prince de Monaco, XXIII. p. 164.
5) WATERS, A. W., 1889, t. cit., p. 284, Pl. XV, fig. 4.
6) Ibid., 1889, t. cit., p. 282. Pl. XV. fig. 6.

which bears numerous fine spines, seems to be distinct from *L. novae-zelandiae*. The specimen referred by WATERS to *L. californica* [1]) has, on the other hand, an ovicell which closely resembles that shown in my own fig. 11. Whether Mr WATERS' specimen really belongs to *L. californica* may be regarded as doubtful. It agrees with the form so named by BUSK [2]) in having biserial or even triserial rays; but it should be noted that the *Unicavea californica* of D'ORBIGNY was described as a member of a genus characterised by having uniserial rays. The form recorded by Miss ROBERTSON [3]) under the same name has also pluriserial rays, but it does not seem to correspond in the characters of its ovicell with the specimen figured by WATERS. The uniserial arrangement of the zooecia in the 'Siboga' colony is a reason for not referring the specimen shown in fig. 11 to the species described by BUSK, WATERS and Miss ROBERTSON as *L. californica*. *L. holdsworthii* Busk, described from Ceylon, has, on the other hand, a close resemblance to some of the 'Siboga' specimens referred by me to *L. novae-zelandiae*. In the original description [4]) of "*Discoporella holdsworthii*", BUSK makes no reference to ovicells, although these structures are present in two of the colonies from Ceylon on a slide (Brit. Mus., 75. 5. 29. 48*) belonging to the collection on which his Catalogue was based. In one of these colonies the ovicell occupies a central, much depressed region, surrounded by a high circular ridge formed by zooecia and cancelli. Its porous roof is flat and has a close general resemblance to that shown in my own fig. 11. Five main lobes, two of which divide into secondary lobes by a single bifurcation, are separated by central prolongations of the cancellated region. An ooeciostome, with a large, nearly circular ooeciopore, occurs among the cancelli just outside the flattened porous roof. In the raised circular ridge surrounding the central depression occurs a secondary ovicell of the same general type. The other fertile colony has a cylindrico-truncate form, terminated by a flat region containing one or perhaps two ovicell-roofs of the same general character as in the other colony.

Taken by themselves BUSK's specimens would suggest that *L. holdsworthii* is distinct from *L. novae-zelandiae*; but the study of the material considered in this Report indicates that this is probably not the case, and that the differences between the two types are due to variation in the extent to which the cancelli cover the ovicell. It may be remarked that pin-spines are well developed in BUSK's specimens.

2. *Lichenopora buski* n. sp. (Pl. XII, figs 4, 5).

Discoporella ciliata Busk, 1875, "Cat. Mar. Pol. Brit. Mus.", III, p. 31, Pl. XXX, fig. 6; Pl. XXXIII, fig. 4.

(nec *Discopora ciliata* Busk, 1855, "Zoophytology", Q. J. Micr. Sci., III, p. 256.)

Discoporella ciliata Haswell, 1879, "Cycl. Pol. Port Jackson", Proc. Linn. Soc. N. S. Wales, IV, p. 354.

Lichenopora ciliata Waters, 1887, "Bry. N. S. Wales", III, Ann. Mag. Nat. Hist. (5) XX, p. 263, Pl. VII, fig. 5.

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1) WATERS, A. W., 1889, t. cit., p. 282, Pl. XV, fig. 1.
2) BUSK, G., 1875, t. cit., p. 32, Pl. XXX, fig. 5.
3) ROBERTSON, A., 1910, "Cycl. Bry. W. coast N. America", Univ. Calif. Publ. Zool., VI, p. 261, Pl. XXV, fig. 48.
4) BUSK, G., 1875, t. cit., p. 33, Pl. XXX, fig. 4.

Lichenopora ciliata Waters, 1889, "Ovicells Lichenoporae", J. Linn. Soc. Zool., XX, p. 283.
Lichenopora ciliata, *L. hispida* and *L. verrucaria* Philipps, 1899, WILLEY's Zool. Res., Pt IV, p. 441.

394. P. Stat. 144. Anchorage N. of Salomakiëe (Damar) Island, 45 Metres; coral-bottom and Lithothamnion. 1 colony.
(? sp.) 568. E. Stat. 105. 6° 8' N., 121° 19' E., 275 Metres; coral-bottom. 1 colony.

Also (Univ. Mus. Zool., Cambridge): —

Torres Straits, A. C. HADDON Coll., 6, Reg. Feb. 24, 1898. 1 colony.
Torres Straits, A. C. HADDON Coll., 81, Reg. Feb. 24, 1898. 1 colony.
Japan, Uraga Channel, 30 fathoms, A. OWSTON Coll., 7. Q., Reg. June 23, 1902. 3 colonies.
Japan, Tosa, Shikoku Island, T. MITZOBUCHI, Reg. Feb. 1, 1901. 1 colony.
Japan, from rooting spicules of *Euplectella marshalli*, Prof. K. MITSUKURI, Reg. Sept. 23, 1896. 1 colony.
Lifu, Loyalty Islands, A. WILLEY Coll., Reg. Mar. 1, 1898. Determined by Miss PHILIPPS as *L. ciliata*. 1 colony.
Lifu, Loyalty Islands, A. WILLEY Coll., Reg. Mar. 1, 1898. Determined by Miss PHILIPPS as *L. hispida*. 1 colony.
Lifu, Loyalty Islands, A. WILLEY Coll., Reg. Mar. 1, 1898. Determined by Miss PHILIPPS as *L. verrucaria*. Two slides, 1 colony on each.

Zoarium reaching a diameter of 3.9 mm. Zooecia quincuncially arranged in the marginal part of the colony, sometimes in uniserial rays centrally; the orifices of those situated in the rays sometimes separated by one or two small cancelli. Peristomes produced on their central sides, pointed like the nib of a pen, or truncate, or fringed into several fine spines. Small pointed spines may also occur on the outer sides of the peristomes or, more rarely, on the septa between the cancelli. Ovicells usually small, their roof porous and covered with irregular ridges, but not by typical cancelli. Ooeciostome a simple tube, terminating in a large, nearly circular ooeciopore. Cancelli not usually separated by narrow, angular septa, their openings variable in size and often much reduced by the development of a cryptocyst; pin-like spines absent.

Two colonies from the 'Siboga' Collection are included in the list given above. Of these, 568. E. is in poor condition and is very doubtfully referred to the present species. The remaining specimens in the list form a fairly uniform series, in which, however, a certain amount of variation is shown, particularly in the form of the peristomes and in their tendency to become united into rays near the central part of the colony.

The present species seems to be characterised by having its more marginal zooecia isolated and arranged quincuncially, without any attempt to form radial rows. In the more central part of the colony a few zooecia may be united to form definite uniserial rays, although successive peristomes are usually separated from one another by a small cancellus or more commonly by a pair of these structures. This condition is shown by both the 'Siboga' specimens. In 394. P. (fig. 4) the central border of the peristome is usually elevated into a single point, resembling the nib of a pen, though some of them have the corresponding part of the peristome truncated, with a tendency to develop a short spine from each angle of the truncated end. From this raised central part, the lateral edges of the peristomes slope down to the general level of the surface of the colony, so that the marginal border is not at all raised. A few sharp spines, of no great length, are developed from various parts of the outer wall of the peristomes. The marginal cancelli are fairly large, and are at first separated from one another by narrow septa with sharp edges. In the more central regions the cancelli cease to be separated by angular septa, and their openings are reduced by the development of a concave iris-like cryptocyst. No ovicell seems to be present in this specimen.

Of the specimens from Torres Straits, N° 6 has nearly all its zooecia isolated and quincuncial, only one or two near the centre showing some disposition to assume a radial arrangement. Their peristomes are greatly elevated centrally, but fall off sharply laterally, so that the orifices have practically no lateral or distal raised wall. The central raised part of the peristome is either truncated, the edge forming a segment of a circle without spines; or its edge is fringed out into from three to five long delicate spines. The cancelli have their openings much reduced throughout the colony. Spinules are borne by the outer walls of the peristomes, as in 394. P. The marginal lamina is in this case free and upturned at its edge, so as to form a saucer; and, as has been noticed in some of the other specimens, its surface has a finely granular texture. In the other Torres Straits specimen (81) it is for the most part closely adherent to its substratum.

The specimen from Tosa, Japan, has a close resemblance, in most respects, to N° 6 from Torres Straits. The internal edge of the cryptocyst of the cancelli may be very finely denticulate; a feature which is barely indicated in 394. P. ('Siboga'), but is well marked in several of the other specimens. None of the colonies show any of the pin-like spines which are so conspicuous a feature of *L. novae-zelandiae*. The Tosa colony shows a well marked ovicell (fig. 5), which has some resemblance, in form, to that of certain species of *Berenicea*, being transversely elongated and giving off an ooeciostome (*o*) from the middle of its marginal border. The ooeciostome is a simple tube, which at first runs horizontally, but soon curves, so that its simple, nearly circular ooeciopore faces directly frontally. The ovicell, which exhihits no tendency to run into lobes between the zooecia, is more or less outlined by a series of ordinary cancelli, but its roof is not covered by typical cancelli. This part of the ovicell is, however, traversed by irregular, low ridges, between which are a moderate number of pores, each pore being as a rule sunk at the bottom of a slight depression. The roof of the ovicell is more convex than the adjacent part of the zoarium. The remainder of the central part of the colony is occupied by a somewhat similar convex surface, which is, however, simply granular and does not seem to be porous. I cannot distinguish an ooeciostome in connexion with this part, and I am unable to decide whether it represents a second ovicell or not. There is nothing to show whether its cavity is continuous with the ovicell, which has a porous roof; but it is not impossible that it my be merely a part of that ovicell.

Of the three specimens on the Japanese slide 7. Q, one has no ovicell; but in each of the others the central part of the colony is occupied by an ovicell of the type already described, except that it sends out short lobes, peripherally, between the more centrally placed zooecia. In one of these colonies the ooeciostome is very distinct; and in the same colony the ridges on the roof of the ovicell are produced, here and there, into spinous projections. The cancelli in these specimens have their openings hardly reduced by cryptocyst. Some of the zooecia are arranged in uniserial rays, the zooecia of which may be contiguous.

The remaining Japanese specimen (Prof. MITSUKURI) has the openings of its cancelli greatly reduced by cryptocyst.

Several of the specimens from Dr WILLEY'S Lifu Collection seem to be referable to the present species. The colony determined by Miss PHILIPPS as *L. ciliata* has some of its zooecia arranged in well marked uniserial rays, although the more peripheral zooecia are, as usual, quincuncial. Many of these are fringed out into spines at their free ends; and an ovicell, with an ooeciostome, both of the type found in the Japanese specimens, are present.

A colony, from the same Collection, referred by Miss PHILIPPS to *L. hispida*, and two colonies referred by her to *L. verrucaria* seem to belong to the same species.

Measurements, in μ:

Greatest diameter of colony, fig. 5, 3,900;
Greatest diameter of colony, fig. 4, 3,500;
Diameter of peristomes, fig. 5, 100;
Diameter of openings of cancelli, fig. 4, 50—60.

The species here considered appears to be identical with *Discoporella ciliata* Busk, 1875, (Cape of Good Hope, New Zealand); and with the form described under the same specific name by other authors. It does not seem to have been noticed, even by BUSK himself, that the specific name is pre-occupied by *Discopora ciliata* Busk, 1855 (see synonymy), a Northern form clearly referable to *Lichenopora* and perhaps a form of *L. verrucaria*. It seems necessary, therefore, to introduce a new designation, and I have accordingly named it in honour of BUSK; the type-specimen being the slide from the Cape of Good Hope preserved in the British Museum under the Register-number 99. 7. 1. 519. Mr WATERS (1887) has indeed suggested that *L. ciliata* Busk, (1875) may be identical with *L. verrucaria*; but the account which he gives of its ovicell shows clearly, I think, that this view cannot be maintained; and in any case the ovicell of the specimens described in the present Report is widely different from that of *L. verrucaria*.

3. *Lichenopora ? mediterranea* Mich. (Pl. XII, figs 2, 3).

Lichenopora mediterranea Michelin, 1840—1847, "Iconogr. Zoophytol.", p. 68, Pl. XIV, figs 5*a*, 5*b*.
Discoporella mediterranea Busk, 1875, "Cat. Mar. Pol. Brit. Mus.", III, p. 33, Pl. XXXIV, fig. 4.
(nec *Lichenopora mediterranea* (nomen nudum), Blainville, 1834, "Man. d'Actinol." p. 407.)
? *Discoporella porosa* Haswell, 1879, "Cycl. Pol. Port Jackson", Proc. Linn. Soc. N. S. Wales, IV, p. 354.
? *Lichenopora wanganuiensis* Waters, 1887, "Tert. Cycl. Bry. New Zealand", Q. J. Geol. Soc., XLIII, p. 346 (with text-fig.).

565. A. Stat. 125. Anchorage off Sawan, Siau Islands, 27 Metres; stone and some Lithothamnion. 1 colony.
568. C. Stat. 105. 6° 8' N., 121° 19' E., 275 Metres; coral-bottom. 2 colonies.
(? sp.) 568. D. Do. 1 colony.

Of the specimens above indicated, 565. A. is a colony in poor condition. It is represented in fig. 3; and, while agreeing with *L. novae-zelandiae* in the serial arrangement of its zooecia, it differs from that species in having the rays biserial throughout, and in the form of its cancelli. The rays do not project much and the zooecia are completely connate. It is quite possible, however, that their length was really greater than is indicated by the present condition of the specimen and that their distal parts have been worn off. The rays are disposed in much the same manner as the septa of a Madreporarian Coral; larger primary rays alternating with smaller secondary rays. The cancelli are conspicuous and have rounded openings, separated from one another by thick septa which are not angular at their edges as in *L. novae-zelandiae*. The nodal points of these septa have a tendency to be raised into short rounded tubercles. Pin-like spines project into the cancelli (fig. 2), as in the other species. Ovicells cannot be distinguished.

The slide 568. C. contains two worn colonies, the larger of which has a marked biserial arrangement of its very prominent zooecial rays [1]), which are, however, more massive than in 565. A. The cancelli resemble those of that specimen. The other colony is probably a younger condition of the same species. One of the rays is biserial and massive; another is biserial but narrower; and the others are uniserial.

568. D. is a young colony, in better condition, but it has a uniserial arrangement of its zooecia. The cancelli are like those of the other specimens but their cavity is constricted by an iris-like cryptocyst, lying at a deep level. In this specimen some of the septa between the cancelli are prolonged up the zooecia as longitudinal ridges.

Measurements, in μ:

Greatest diameter of colony, fig. 3, 3,000;
Length of longest zooecial series, fig. 3, 9,50;
Width of zooecial series, fig. 3, 150—180;
Average diameter of openings of larger cancelli, fig. 2, 100.

Busk gives this species as *Discoporella mediterranea* Blainville; but a reference to the "Manuel d'Actinologie" shows that de Blainville's name was a nomen nudum, as no diagnosis of any kind is given, though the species is said to occur, living, in the Mediterranean. The generic characters as formulated by de Blainville included the statement that the "cellules" are irregularly scattered; which is by no means in accordance with the strongly marked serial arrangement shown by Busk. De Blainville even expresses the conviction that the *Lichenopora* of Defrance are merely the young stages of a form like "*Retepora reticulata*", which, as shown by his synonymy (p. 406), is *Frondipora verrucosa*. As the name given by this author is a nomen nudum, it makes no difference what was intended; and Michelin's name may be considered valid. It is not clear whether Michelin's figures are taken from a recent or a fossil specimen.

I refer the 'Siboga' specimens with considerable hesitation to Michelin's species, which seems to be the same as that figured by Busk.

1) As in *L. imperialis* Ortmann, 1889 ("Japan. Bry.", Arch. f. Naturg., Jahrg. LVI, Bd I, p. 64, Pl. IV, fig. 25), although in this species the rays appear to be uniserial.

Distribution of Cyclostomata.

STATION	DEPTH IN METRES	SPECIES
37	0—27	*Crisina radians.*
49[a]	69	(Undetermined, in *Stomatopora*-condition).
51	69—91	*Tervia jellyae.*
53	0—36	*Tubulipora atlantica.*
59	390	*Entalophora proboscidea* (?).
		Tubulipora pulcherrima.
60 & 303	0—36	*Crisia elongata.*
		Tubulipora pulcherrima.
		Lichenopora novae-zelandiae.
64	0—32	*Entalophora proboscidea.*
71	0—32	*Lichenopora novae-zelandiae.*
77	59	*Crisia elongata.*
		Crisia kerguelensis.
		Tubulipora atlantica.
		Tubulipora pulcherrima.
80	40—50	*Crisia elongata.*
		Entalophora delicatula (?).
		Tubulipora concinna.
		Tubulipora atlantica.
		Tubulipora pulcherrima.
81	34	*Crisia elongata.*
		Tubulipora atlantica (?).
97	564	*Hornera spinigera.*
99	16—23	*Tubulipora pulcherrima* (?).
		(Undetermined, in *Stomatopora*-condition).
105	275	*Crisia elongata.*
		Berenicea sarniensis.
		Tubulipora atlantica, var. *flexuosa.*
		Tubulipora pulcherrima.
		Hornera spinigera.
		Hornera caespitosa.
		Lichenopora novae-zelandiae.
		Lichenopora buski (?).
		Lichenopora mediterranea (?).
116	72	*Tubulipora pulcherrima.*
117	80	*Tubulipora pulcherrima.*
		Hornera spinigera.
119	1901	*Tubulipora cassiformis.*
125	27	*Lichenopora mediterranea* (?).
129	23—31	*Tubulipora pulcherrima.*
133	0—36	*Crisia elongata.*
139	397	*Berenicea lineata.*
144	45	*Crisia elongata.*
		Entalophora intricaria (?).
		Tubulipora atlantica.
		Tubulipora pulcherrima.
		Lichenopora novae-zelandiae.
		Lichenopora buski.

STATION	DEPTH IN METRES	SPECIES
156	469	*Tubulipora atlantica*, var. *flexuosa*.
		Tubulipora cassiformis.
		Hornera spinigera.
164	32	*Crisia elongata*.
		Crisia cuneata.
		Entalophora intricaria (?).
		Tubulipora pulcherrima.
		Supercytis watersi.
172	18	*Lichenopora novae-zelandiae*.
204	75—94	*Berenicea sarniensis*.
213	0—36	*Crisia elongata*.
		Entalophora delicatula.
		Supercytis watersi.
240	9—45	*Crisia elongata*.
		Entalophora intricaria (?).
		Berenicea lineata.
		Tubulipora concinna.
		Tubulipora atlantica.
		Tubulipora pulcherrima.
		Lichenopora novae-zelandiae.
248	0—54	*Tubulipora atlantica*.
		Tubulipora pulcherrima.
250	20—45	*Tubulipora pulcherrima*.
251	204	*Tubulipora pulcherrima*.
257	0—52	*Crisia elongata*.
		Tubulipora pulcherrima.
273	13	*Crisia elongata*.
		Entalophora delicatula.
		Tubulipora atlantica.
274	57	*Crisia elongata*.
282	27—54	*Crisia elongata*.
		Entalophora intricaria (?).
		Tubulipora pulcherrima.
		Lichenopora novae-zelandiae.
301	22	*Entalophora delicatula*.
305	113	*Tubulipora pulcherrima*.
310	73	*Crisia elongata*.
		Entalophora proboscidea.
		Berenicea sarniensis.
		Reptotubigera philippsae.
		Tubulipora pulcherrima.
		Lichenopora novae-zelandiae.
		(Undetermined, in *Stomatopora*-condition).
315	0—36	*Crisia elongata*.
		Entalophora proboscidea.
		Entalophora intricaria (?).
		Tubulipora atlantica (?).
		Crisina radians.
		Lichenopora novae-zelandiae (?).
321	82	*Crisia kerguelensis*.

The preceding list gives a complete statement of all the specimens of Cyclostomata which I have found among the 'Siboga' dredgings. It will be seen that members of this group have been discovered in 40 Stations out of about 135 Stations at which Polyzoa were obtained; or almost the same as the number (42) at which either Entoprocta or Ctenostomata, or both these groups together, were found (cf. pp. 92—94). It exceeds the total for either group separately; Entoprocta having been found at 30 Stations, and Ctenostomata at 29. Cyclostomata were recorded in company with Entoprocta at 21 Stations; and with Ctenostomata at 16 Stations. Of these sixteen, none yielded less than 13 species of Polyzoa (mostly Cheilostomata); while at each of the other ten Stations more than 30 species of Polyzoa were discovered.

These facts are further elucidated by the following table; in which are set out all the Stations at which Cyclostomata were found in company with Entoprocta or with Ctenostomata,

Stations at which Cyclostomata were found with Entoprocta and Ctenostomata.

Station.	Depth. in Metres.	Entoprocta.	Ctenostomata.	Cyclostomata.	Species of Polyzoa in general (including Cheilostomata).
53	0—36	4	1	1	15
60 & 303	0—36	2	—	3	42
64	0—32	1	4	1	14
71	0—32	3	6	1	37
77	59	1	3	4	65
80	40—50	—	2	5	31
99	16—23	—	1	2	52
105	275	1	—	9	31
116	72	1	—	1	6
117	80	—	1	2	17
133	0—36	—	2	1	17
144	45	3	2	6	54
156	469	1	—	3	23
164	32	5	9	5	87
204	75—94	2	1	1	13
213	0—36	2	3	3	44
240	9—45	2	2	7	38
250	20—45	1	1	1	15
257	0—52	1	—	2	24
273	13	3	6	3	65
274	57	4	2	1	40
282	27—54	1	—	4	26
305	113	2	—	1	18
310	73	1	—	7	55
321	82	1	—	1	12

The last column in the above table indicates the total number of species of Polyzoa found at the respective Stations; and it therefore includes the numbers given in the preceding three columns, in addition to that of the Cheilostomata, which are throughout more numerous than the other three groups together. As the revision of the Cheilostomata has not yet been completed, the numbers in the last column are probably not quite accurate.

or with both these groups; with the total number of species, in each of the three groups, found at each Station, followed by the total numbers of species of Polyzoa recorded. The table includes those Stations which were most productive for Polyzoa in general; the highest figures being reached by Stat. 164, with 87 species, and Stations 77 and 273, with 65 species each. It will be seen, by a simple process of subtraction, that the Cheilostomata are, in all these cases, in excess — and usually largely in excess — of the other three groups together. The percentage of Cyclostomata to the total number is, however, by no means uniform; ranging from 2.5 p.c. at Stat. 274 (57 M.) to 29 p.c. at Stat. 105 (275 M.). This indicates that the conditions at the various Stations are not equally favourable for the growth of Cyclostomata, although it is not obvious why some are better than others. There is some reason to think that the Cyclostomata are, on the average, better adapted for deep water than the Cheilostomata; and this is brought out by the following Stations, not included in the table under consideration: — Stat. 119 (1901 M.), with 50 p.c. of Cyclostomata (Cycl. 1, Cheil. 1); Stat. 97 (564 M.), with the same numbers; Stat. 139 (397 M.), with 33.3 p.c. (Cycl. 1, Cheil. 2); and Stat. 59 (390 M.), with 25 p.c. (Cycl. 2, Cheil. 6). But these numbers are too small to prove much; and it may be noted that Stat. 251 (204 M.) yielded only 6.6 p.c. of Cyclostomata (Cycl. 1, Cheil. 14); while another from shallow water (Stat. 315, 0—36 M.) gave the high proportion of 23 p.c. of Cyclostomata (Cycl. 6, Cheil. 20).

The table on p. 168 reveals certain marked differences between the Cyclostomata and the Ctenostomata; but this is not surprising, in view of the fact that the Cyclostomata are strongly calcified, whereas the Ctenostomata are non-calcareous. The largest number of Cyclostomata (9) was yielded by Stat. 105 (275 M.), where no Ctenostomata were found. Stat. 310 (73 M), similarly characterised by the absence of Ctenostomes, provided 7 Cyclostomes. Stat. 240 (9—45 M.) had 7 Cyclostomes and 2 Ctenostomes. In certain other cases the advantage was with the Ctenostomes, as at Stat. 164, 32 M. (Cycl. 5, Cten. 9); Stat. 273, 13 M. (3,6); Stat. 71, 0—32 M. (1,6); and Stat. 64, 0—32 M. (1,4).

Cyclostomata occurred with Entoprocta in a larger number of Stations than with Ctenostomata; but it will be seen by the table on pp. 92—94 that a considerable proportion of the records of Entoprocta are of species of *Loxosoma* which live on *Retepora* and other calcareous Cheilostomes. The table on p. 168 shows that the various Stations are not equally favourable for the occurrence of Cyclostomata and Entoprocta. This may be illustrated by Stat. 105, 275 M. (Cycl. 9, Ent. 1), Stat. 282, 27—54 M. (4,1), Stat. 274, 57 M. and Stat. 53, 0—36 M. (1,4) and Stat. 164, 32 M. (5,5). Here again, no satisfactory explanation of the differences can be given.

The majority of the Cyclostomes obtained came from shallow water. Two thirds of the records (65 out of a total of 98) were from depths less than 60 Metres. Of the remaining 33 specimens, 14 were dredged in depths from 69 to 94 M.; 1 from 113 M.; and 18 from 204 to 1901 M. The greatest depth (Stat. 119, 1901 M.) at which Cyclostomes were obtained yielded only one species, *Tubulipora cassiformis*, obtained also at Stat. 156, 469 M. This may accordingly be regarded as an abyssal form. *Hornera spinigera* was obtained in three deep dredgings (Stations 97, 156, 105; 564, 469, 275 M.) but also at Stat. 117, 80 Metres. The single fragment of *H. caespitosa* came from Stat. 105, 275 M.; and the genus *Hornera* is thus almost confined to deep water, so far as the 'Siboga' dredgings are concerned. *Tubulipora atlantica*, var. *flexuosa* was obtained only at Stations 156 and 105, 469 and 275 M. Of the two species of *Berenicea*, *B. lineata* was obtained once at Stat. 139, 397 M., but once at only 9—45 M. (Stat. 240); while *B. sarniensis* occurred at Stations 105, 204 and 310, (275, 75—94 and 73 M.). *Entalophora proboscidea* ranged from 390 M. to some depth less than 32 M., the determination of the deep water specimen being doubtful. The specimens referred to *Tubulipora pulcherrima* were numerous, and are recorded from 390 M. to the shallowest dredgings; four of the records being, however, from more than 100 M., and three from more than 200 M. *Crisia elongata* and three species of *Lichenopora* are each recorded from Stat. 105, 275 M., although all the other occurrences were from less than 95 M. None of the other Cyclostomes found were from depths exceeding 91 M.

If the determinations made are correct, it thus appears that several of the species range from quite shallow water to depths that can be considered abyssal. But it is not impossible that this apparently wide range may be due to incorrect determinations of the specimens from deep water.

With regard to the Geographical Distribution of the species in the Archipelago, it may be pointed out that the Stations where Cyclostomes were found are distributed over the whole of the area investigated. The Sulu Sea, which yielded no Entoprocta and only one Ctenostome, has furnished 9 Cyclostomes. *Crisina radians* was found only at two Stations (37, 315), close together, off the Paternoster Islands; but *Crisia elongata* and *Tubulipora pulcherrima*, the species of which the records are most numerous, were widely distributed in the Archipelago. It thus appears that the area investigated by the 'Siboga' cannot be divided into distinct sub-regions, on the evidence of the Cyclostomata, any more than was the case with the Entoprocta or the Ctenostomata.

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INDEX.

EXPLANATION OF THE PLATES.

PLATE I.

ENTOPROCTA.

Loxocalyx, Loxosoma.

(All the figures are magnified to the same scale: — Zeiss, C. Obj., afterwards reduced $^{2}/_{3}$. The scale, in μ, is indicated at the foot of the Plate.)

Fig. 1. *Loxocalyx leptoclini* Harmer (p. 8). — 402. D., Stat. 204. Female, with two embryos (*emb.*).
Fig. 2. *Loxosoma annulatum* n. sp. (p. 11). — 195. D.^{1}, Stat. 274. Young individual.
Fig. 3. „ „ „ — 247. E.^{2}, Stat. 310. Older, with bud.
Fig. 4. „ „ „ — 195. D.^{2}, Stat. 274. Bud somewhat older.
Fig. 5. „ „ „ — „ „ „ . Bud still older.
Fig. 6. „ „ „ — 24. E., Stat. 53. Young individual.
Fig. 7. *Loxosoma sluiteri* n. sp. (p. 9). — 373. A.^{2}., Stat. 105. Oral view.
Fig. 8. *Loxosoma velatum* n. sp. (p. 13). — 24. D.^{2}, Stat. 53. Male, young.
Fig. 9. „ „ „ — „ „ „ Male, younger.
Fig. 10. „ „ „ — „ „ „ Male, old.
Fig. 11. *Loxosoma cirriferum* n. sp. (p. 14). — 337. J.^{2}, Stat. 71. Female, old: *emb.*, embryo.
Fig. 12. „ „ „ — „ „ „ Female, old: *b.*, buds; *emb.*, embryo (on slide 337. C.^{2}, *Retepora*).
Fig. 13. „ „ „ — „ „ „ Male, young.
Fig. 14. *Loxosoma circulare* n. sp. (p. 16). — 24. B.^{2}, Stat. 53. Female, with two embryos (*emb.*).
Fig. 15. „ „ „ — „ „ „ Male, with three buds.
Fig. 16. „ „ „ — „ „ „ Individual with three buds.
Fig. 17. *Loxosoma troglodytes* n. sp. (p. 17). — 131. T.^{1}, Stat. 164. Individual with two buds.
Fig. 18. „ „ „ — 142. D., „ „ Two individuals, seen in situ, in the compensation-sac of *Lepralia celleporoides*, of which the operculum (*op.*) and the ascopore (*asc.*) are shown (on slide 142 A., *L. celleporoides*).
Fig. 19. *Loxosoma pusillum* n. sp. (p. 16). — 133. G., Stat. 164. Specimen with four buds.
Fig. 20. „ „ „ — „ „ „ Young individual.
Fig. 21. *Loxosoma loricatum* n. sp. (p. 21). — 177. N.^{1}, Stat. 257. Oral view.
Fig. 22. „ „ „ — „ „ „ Side view.
Fig. 23. „ „ „ — „ „ „ Aboral view.
Fig. 24. „ „ „ — „ „ „ Aboral view, with old bud.
Fig. 25. „ „ „ — „ „ „ Individual, in situ, on *Canda*: *sc.*, scutum of the *Canda*; *set.*, its seta; *Vib.*, its vibraculum.
Fig. 26. *Loxosoma cocciforme* n. sp. (p. 22). — 112. D.^{3}, Stat. 156. Aboral view: *b.*, bud; *st.*, stalk.
Fig. 27. „ „ „ — „ „ „ Oral view: *st.*, stalk.
Fig. 28. „ „ „ — „ „ „ Oral view of an individual with embryos (*emb.*); *st.*, stalk.
Fig. 29. *Loxosoma breve* n. sp. (p. 19). — 131. U. Stat. 164. Two individuals, attached to the operculum (*op.*) of *Schizoporella*. This and the next two figures are from slide 131. B.^{3}, *Schizoporella*.
Fig. 30. „ „ „ — „ „ „ Another individual, on an operculum (*op.*).
Fig. 31. „ „ „ — „ „ „ A larger specimen, on an operculum (*op.*).
Fig. 32. *Loxosoma subsessile* n. sp. (p. 19). — 260. G., Stat. 318. This and the following figure are from slide 260. D.^{1}, *Conescharellina*.
Fig. 33. „ „ „ — „ „ „ Older individual, with two buds (*b.*); *st.*, stalk.

S. F. Harmer del.

ENTOPROCTA.

Fa. P. W. M. Trap impr.

PLATE II.

ENTOPROCTA.

Loxocalyx, Loxosoma, Pedicellina, Barentsia.

(All the figures are magnified to the same scale: — Zeiss, C. Obj., afterwards reduced $^1/_2$. The scale, in μ. is indicated at the foot of the Plate.)

Fig. 1. *Loxocalyx lineatus* n. sp. (p. 6). — 332. C.[1], Stat. 64. Aboral view.
Fig. 2. „ „ „ — „ „ „ Oral view.
Fig. 3. „ „ „ — „ „ „ Oral view.
Fig. 4. *Loxosoma lanchesteri* n. sp. (p. 8). — Singapore, slide B (not 'Siboga'-Expedition). Aboral view.
Fig. 5. „ „ „ — Singapore, slide B (not 'Siboga'-Expedition). Calyx and part of stalk, aboral view.
Fig. 6. *Barentsia geniculata* n. sp. (p. 33). — 260. E., Stat. 318. Side view.
Fig. 7. „ „ „ — „ „ „ Stalk-joint.
Fig. 8. *Barentsia discreta* Busk (p. 29). — 195. B.[1], Stat. 274. Base of stalk, with stolons, one of which is producing a young individual.
Fig. 9. „ „ „ — „ „ „ Old individual: an incipient joint is seen at the middle of the stem; *B*, part of body-wall of stalk.
Fig. 10. *Barentsia laxa* Kirkpatrick (p. 32). — 380. D.[1], Stat. 47. Base (*b.*) of stalk (*st.*), with appendages (*app.*).
Fig. 11. „ „ „ — 88. A., Stat. 115. Old individual.
Fig. 12. *Barentsia gracilis* M. Sars (p. 27). — 262. F. Stat. 319. Side view of one individual.
Fig. 13. *Pedicellina compacta* n. sp. (p. 24). — 293. B.[3], Stat. 273. Side view, with parts of stolons.
Fig. 14. „ „ „ — „ „ „ Young individual, with stolons.

S. F. Harmer del.

ENTOPROCTA.

Fa. P. W. M. Trap impr.

PLATE III.

CTENOSTOMATA.

Alcyonidium, Elzerina, Victorella, Arachnidium, Arachnoidea.

(Figs 1 and 10 were drawn with a Zeiss C Obj.; figs 2—9, 11, 14 and 15 with a Zeiss A Obj.; and figs 12 and 13 with a Ross 2-inch Obj. All the figures were afterwards reduced $^1/_2$. The scales, in μ, are indicated at the foot of the Plate.)

Fig. 1. *Alcyonidium polyoum* Hassall (p. 37). — Torres Straits (not 'Siboga'-Expedition). Six zooecia, growing on *Euthyris obtecta*, the zooecia of which are seen through the *Alcyonidium*.

Fig. 2. *Elzerina blainvillii* Lamx (p. 38). — Torres Straits (not 'Siboga'-Expedition). Distal end of a branch.

Fig. 3. *Arachnidium irregulare* n. sp. (p. 48). — 376. B.[4], Stat. 213. Zooecium.

Fig. 4. „ „ „ — „ „ „ Two zooecia, the lower one with the kamptoderm everted.

Fig. 5. „ „ „ — „ „ „ Zooecium, with embryo in ovisac: basal view.

Fig. 6. „ „ „ — 376. B.[2], „ „ Another zooecium, with polypide: basal view.

Fig. 7. *Arachnoidea protecta* n. sp. (p. 50). — 378. E.[2], Stat. 71. Zooecium with collar partially protruded.

Fig. 8. „ „ „ — „ „ „ Two zooecia in side view. Part of the collar, in its retracted position, is seen in the right hand zooecium.

Fig. 9. „ „ „ — „ „ „ Zooecium with its collar protruded.

Fig. 10. „ „ „ — „ „ „ Collar of the same specimen, more highly magnified.

Fig. 11. „ „ „ — „ „ „ Another zooecium, with short peristome.

Fig. 12. *Victorella sibogae* n. sp. (p. 45). — 451. B.[2], Stat. 64. A group of old zooecia.

Fig. 13. „ „ „ — „ „ „ A group of young zooecia.

Fig. 14. „ „ „ — „ „ „ An old zooecium, with degenerated polypide; more highly magnified.

Fig. 15. „ „ „ — „ „ „ An old zooecium, with functional polypide: magnification as in fig. 14.

S. F. Harmer del. Fa. P. W. M. Trap impr.

CTENOSTOMATA.

PLATE IV.

CTENOSTOMATA.

Nolella (= *Cylindroecium* auctt.).

(Figs 1—18 and 20 were drawn with a Zeiss A Obj., Fig. 19 with a Zeiss C Obj. All the figures were afterwards reduced $^1/_2$. The scales, in μ, are indicated at the foot of the Plate.)

Fig. 1. *Nolella annectens* n. sp. (p. 57). — 380. I.[1], Stat. 47. A young and much elongated zooecium.
Fig. 2. „ „ „ — „ „ „ Growing end of a branch. The dilated part represents the commencement of a zooecium, and already shows a young polypide-bud.
Fig. 3. „ „ „ — „ „ „ Zooecium with long peristome. The retracted collar is seen in the vestibule.
Fig. 4. „ „ „ — „ „ „ Zooecium with shorter peristome, showing the polypide, the retracted collar and the muscles.
Fig. 5. „ „ „ — „ „ „ A similar specimen, in side view.
Fig. 6. „ „ „ — „ „ „ A zooecium with shorter peristome, showing the retracted collar.
Fig. 7. „ „ „ — „ „ „ A similar zooecium in side view.
Fig. 8. „ „ „ — „ „ „ A zooecium with very short peristome, in side view.
Fig. 9. „ „ „ — „ „ „ Distal end of a zooecium with protruded collar.
Fig. 10. *Nolella papuensis* Busk (p. 53). — 337. G.[2], Stat. 71. Zooecium with regenerated distal end, in which are seen two embryos. An egg occurs close to the distal end of the old part.
Fig. 11. „ „ „ — „ „ „ Part of a similar zooecium, containing distally an embryo and, near the proximal end of the regenerated part, one or two eggs. The outline is irregular in this region, indicating that larvae have probably escaped here.
Fig. 12. „ „ „ — „ „ „ Distal end of a zooecium with three embryos.
Fig. 13. „ „ „ — „ „ „ Proximal end of a zooecium, showing branches.
Fig. 14. „ „ „ — 130. H.[3], Stat. 164. Young zooecium, with branches.
Fig. 15. „ „ „ — 276. A., Stat. 250. A long and slender zooecium.
Fig. 16. „ „ „ — 130. H.[3], Stat. 164. An elongated zooecium.
Fig. 17. „ „ „ — 337. G.[2], Stat. 71. A similar zooecium, showing, near the middle of its length, two embryos which appear to be about to escape.
Fig. 18. „ „ „ — „ „ „ An old and much shortened zooecium.
Fig. 19. „ „ (? sp.). — 108. P. Stat. 144. A zooecium, more highly magnified, showing several rounded bodies, possibly eggs, in the vestibule.
Fig. 20. „ „ „ — „ „ „ Several zooecia, from the same slide, magnified to the same extent as figs 1—18.

S. F. Harmer del.

CTENOSTOMATA.

Fa. P. W. M. Trap impr.

PLATE V.

CTENOSTOMATA.

Amathia, Buskia.

(Figs 1 and 7 were drawn with a Ross 2-inch Obj.; figs 2—4, 6, 8, 12 and 14 with a Zeiss A Obj.; and figs 5, 9—11, 13 and 15—17 with a Zeiss C Obj. All the figures were afterwards reduced ½. The scales, in μ, are indicated at the foot of the Plate.)

Fig. 1. *Amathia convoluta* Lamx (p. 64). — 298. A.[4], Stat. 273. Part of the zoarium.
Fig. 2. " " " — 298. A.[5], " " Zooecia in various conditions.
Fig. 3. " " " — 298. A.[4], " " A single group of zooecia.
Fig. 4. " " " — 198. A.[7], Stat. 274. Part of the stem, with attachments of zooecia.
Fig. 5. " " " — 298. A.[2], Stat. 273. Part of the stem, with young zooecia.
Fig. 6. *Amathia distans* Busk (p. 68). — 371. C.[2], Stat. 273. Part of the stem, with a single group of zooecia.
Fig. 7. " " " — " " " Part of zoarium, less highly magnified.
Fig. 8. *Buskia setigera* Hincks (p. 87). — 339. B.[2], Stat. 71. Group of zooecia.
Fig. 9. " " " — 38. K.[4], Stat. 77. Distal end of a zooecium, with protruded collar (more highly magnified).
Fig. 10. " " " — " " " Zooecium, attached to a Hydroid.
Fig. 11. *Buskia pilosa* n. sp. (p. 89). — 501. E.[2], Stat. 163. Part of stolon (*st.*), attached to the rootlets (*r.*) of *Caberea*.
Fig. 12. " " " — " " " A zooecium, side view.
Fig. 13. " " " — " " " A zooecium, more highly magnified, frontal view.
Fig. 14. *Buskia nitens* Alder (p. 85). — 307. B., Stat. 273. Part of zoarium.
Fig. 15. " " " — 451. B.[1], Stat. 64. Stolon and zooecium, on a zooecium of *Victorella sibogae*.
Fig. 16. " " " — 307. B., Stat. 273. Zooecium, side view.
Fig. 17. " " " — " " " Stolon and zooecium with protruded tentacles.

S. F. Harmer del.

CTENOSTOMATA.

Fa. P. W. M. Trap impr.

PLATE VI.

CTENOSTOMATA.

Vesicularia, Valkeria.

(Figs 1, 2, 8, 9, 13—15, 17—20 were drawn with a Zeiss A Obj.; figs 3—7, 10—12 and 16 with a Zeiss C Obj. All the figures were afterwards reduced $^{1}/_{2}$. The scales, in μ, are indicated at the foot of the Plate.)

Fig. 1. *Vesicularia papuensis* Busk (p. 61). — 307. A.^{6}, Stat. 273. Part of the main stem, with branches.
Fig. 2. „ „ „ — „ „ „ Terminal branches, with zooecia.
Fig. 3. „ „ „ — „ „ „ Tentacles, protruded.
Fig. 4. „ „ „ — „ „ „ Part of a branch, with two zooecia; *g.*, gizzard.
Fig. 5. *Valkeria atlantica* Busk (p. 73). — 337. B.^{2}, Stat. 71. Part of stolon, with zooecia, mostly old.
Fig. 6. „ „ „ — „ „ „ Another part of the stolon, with a young (left) and an old (right) zooecium.
Fig. 7. „ „ „ — „ „ „ Group of zooecia.
Fig. 8. „ „ „ — „ „ „ Part of zoarium, less magnified.
Fig. 9. „ „ „ — 393. C.^{1}, Stat. 133. Part of zoarium, with zooecia elongated at their proximal ends.
Fig. 10. „ „ „ — „ „ „ Zooecium of the same form.
Fig. 11. „ „ „ — „ „ „ Another zooecium of the same type.
Fig. 12. „ „ „ — „ „ „ Part of stolon, with a similar zooecium.
Fig. 13. *Valkeria tuberosa* Heller (p. 76). — 130. G., Stat. 164. Old group of zooecia, drawn from an unmounted specimen.
Fig. 14. „ „ „ — „ „ „ Young group of zooecia, unmounted.
Fig. 15. „ „ „ — 130. G.^{3}, „ „ Stolon from the basal side, showing the mode of origin of a group of zooecia.
Fig. 16. „ „ „ — 130. G.^{2}, „ „ Two zooecia, more highly magnified.
Fig. 17. „ „ „ — 130. G.^{5}, „ „ Zooecium with kamptoderm and collar protruded.
Fig. 18. „ „ „ — „ „ „ Distal end of zooecium with protruded collar.
Fig. 19. „ „ „ — „ „ „ Distal end of zooecium with degenerated polypide.
Fig. 20. „ „ „ — „ „ „ A similar zooecium, more contracted.

S. F. Harmer del.

Fa. P. W. M. Trap impr.

CTENOSTOMATA.

PLATE VII.

CTENOSTOMATA.

Bowerbankia, Mimosella.

(Figs 1—4, 6—9, 11—14 and 16 were drawn with a Zeiss C Obj.; figs 5, 10 and 15 were drawn with a Zeiss A Obj. All the figures were afterwards reduced $^1/_2$. The scales, in μ, are indicated at the foot of the Plate.)

Fig. 1. *Mimosella bigeminata* Waters (p. 79). — 38. M.[4], Stat. 77. Distal end of colony, with young zooecia.
Fig. 2. „ „ „ — „ „ „ Part of the same, seen from the opposite side.
Fig. 3. „ „ „ — „ „ „ Part of the stem, with zooecia.
Fig. 4. „ „ „ — „ „ „ Three stem-internodes.
Fig. 5. „ „ „ — „ „ „ The greater part of a stem, with its zooecia. 15 stem-internodes have been omitted in the region just below the persisting zooecia.
Fig. 6. „ „ „ — „ „ „ Part of the adnate stolon: *i.*[1], the primary internode, giving off, on the opposite side, *s.*, the base of an erect stem; *i.*[2], second internode of the main stolon; *l. i.*[1], *l. i.*[2], successive internodes of a lateral branch; *r.*[1], main rootlet; *r.*[2], lateral rootlet.
Fig. 7. „ „ „ — „ „ „ single zooecium, showing the polypide.
Fig. 8. *Mimosella verticillata* Heller (p. 81). — 139. D.[2], Stat. 164. A single zooecium, with the base of another.
Fig. 9. „ „ „ — „ „ „ Part of the adnate stolon, with the primary internode (*i.*) and the branches to which it gives rise. The proximal ends of five of the zooecia are indicated.
Fig. 10. „ „ „ — „ „ „ Part of the adnate stolon, with five groups of zooecia.
Fig. 11. *Mimosella tenuis* n. sp. (p. 84). — 31. H.[2], Stat. 53. Part of the adnate stolon, with two young zooecia.
Fig. 12. „ „ „ — „ „ „ A single zooecium.
Fig. 13. „ „ „ — 24. C.[3], „ „ A single zooecium.
Fig. 14. „ „ „ — „ „ „ A single zooecium.
Fig. 15. *Bowerbankia imbricata* Adams (? sp.) (p. 70). — 374. K. *Loc. incert.* Group of zooecia.
Fig. 16. „ „ „ „ — „ „ „ Portion of stem, with a zooecium and parts of several others.

S. F. Harmer del.

CTENOSTOMATA.

P. W. M. Trap impr.

PLATE VIII.

CYCLOSTOMATA.

Crisia.

(All the figures are magnified to the same scale: — Ross, 1-inch Obj., afterwards reduced $^{7}/_{12}$. The scale, in μ, is indicated at the foot of the Plate.)

Fig. 1. *Crisia elongata* M.Edw. (p. 96). — 107. B.², Stat. 144. Part of zoarium, with ovicell.
Fig. 2. „ „ „ — „ „ „ Part of branch, with rootlet.
Fig. 3. „ „ „ — 208. B.², Stat. 282. Proximal internodes.
Fig. 4. „ „ „ — 253. A.², Stat. 315. Basal view of internodes, with ovicell.
Fig. 5. „ „ „ — 107. B.², Stat. 144. Proximal internodes.
Fig. 6. „ „ „ — „ „ „ Distal view of internode, with ovicell, showing ooeciopore.
Fig. 7. „ „ „ — „ „ „ Internodes, with ovicell.
Fig. 8. „ „ „ — 313. A., Stat. 273. Internodes, with twin-ovicells.
Fig. 9. *Crisia kerguelensis* Busk (p. 105). — 37. S., Stat. 77. Proximal part of zoarium.
Fig. 10. „ „ „ — „ „ „ Distal part of zoarium.
Fig. 11. „ „ „ — „ „ „ Part of internode, with ovicell.
Fig. 12. *Crisia geniculata* M.Edw. (p. 106). — Torres Straits, 88 (not 'Siboga'-Expedition). Part of zoarium.
Fig. 13. *Crisia cuneata* Mapl. (p. 103). — 120. B., Stat. 164. Part of zoarium.
Fig. 14. „ „ „ — Japan, 5 AM. (not 'Siboga'-Expedition). Part of zoarium.
Fig. 15. „ „ „ — „ „ (not 'Siboga'-Expedition). Internode, with ovicell.
Fig. 16. „ „ „ — „ „ (not 'Siboga'-Expedition). Internode, with ovicell.
Fig. 17. „ „ „ — „ „ (not 'Siboga'-Expedition). Internode, with ovicell.

S. F. Harmer del. Ed. P. W. M. Trap impr.

CYCLOSTOMATA.

PLATE IX.

CYCLOSTOMATA.

Tubulipora.

(All the figures are magnified to the same scale: — Ross, 1-inch Obj., afterwards reduced $^1/_2$. The scale, in μ, is indicated below the middle of the Plate.)

Fig. 1. *Tubulipora pulcherrima* Kirkp. (p. 129). — 92. H., Stat. 117. Part of a small zoarium, with ovicell: *o.*, ooeciostome.

Fig. 2. „ „ „ — 350. C.[2], Stat. 240. Branch with an ovicell bearing six ooeciostomes (*o.*).

Fig. 3. „ „ „ — 99. A.[1], Stat. 129. Fragment of a branch, with rooting processes (*r.*).

Fig. 4. „ „ „ — „ „ „ Part of a reticulate colony, with two ovicells: *o.*, ooeciostomes.

Fig. 5. „ „ „ — „ „ „ Basal surface of two branches, showing connecting kenozooecia (*k.*).

Fig. 6. *Tubulipora cassiformis* n. sp. (p. 135). — 112. A.[1], Stat. 156. Parts of three branches, with connecting kenozooecia (*k.*); *s.*, shield-like portions of zooecia concealing the orifices.

Fig. 7. „ „ „ — 94. A.[2], Stat. 119. Part of a colony, with ovicell and connecting kenozooecia (*k.*); *o.*, ooeciostome.

Fig. 8. „ „ „ — „ „ „ Basal surface of three branches, with connecting kenozooecia (*k.*).

Fig. 9. „ „ „ — 112. A.[1], Stat. 156. Side view of part of a branch, showing the remarkable shields (*s.*) which overlap the orifices (*or.*); *k.*, kenozooecia of edge of branch.

Fig. 10. „ „ „ — „ „ „ Basal view of branches, with connecting kenozooecia (*k.*).

S. F. Harmer del

CYCLOSTOMATA.

Fa. P. W. M. Trap impr.

PLATE X.

CYCLOSTOMATA.

Entalophora, Reptotubigera, Tubulipora, Crisina.

(All the figures are magnified to the same scale: — Ross, 1-inch Obj., afterwards reduced $^1/_2$. The scale, in μ, is indicated at the foot of the Plate.)

Fig. 1. *Tubulipora atlantica* (Forbes, MSS.), Johnst., var. *flexuosa*, Pourt. (p. 127). — 111. D.[1], Stat. 156. Part of a branch, with ovicell.

Fig. 2. „ „ „ „ „ „ „ „ — 111. D.[1], Stat. 156. Basal view of branch.

Fig. 3. „ „ „ „ „ „ „ „ — 111. D.[1], Stat. 156. Branch, with part of ovicell.

Fig. 4. *Tubulipora atlantica* (Forbes, MSS.), Johnst. (p. 124). — 165. B.[1], Stat. 248. Basal view of branch, showing secondary thickening.

Fig. 5. „ „ „ „ „ — „ „ „ Part of colony, with ovicell: *o.*, ooeciostome.

Fig. 6. *Crisina radians* Lamk (p. 139). — 336. A.[2], Stat. 37. Branch with ovicell: *w.*, porous lateral windows of ovicell.

Fig. 7. „ „ „ — „ „ „ Side view of fertile branch, showing *w.*, lateral windows of ovicell, and *o.*, ooeciostome.

Fig. 8. „ „ „ — „ „ „ Basal view of branches.

Fig. 9. *Reptotubigera philippsae* n. sp. (p. 120). — 250. A.[1], Stat. 310. Complete colony, with three ovicells: *l.*, marginal lamina with pore-areas; *o.*, ooeciostomes.

Fig. 10. *Tubulipora concinna* MacGill. (p. 123). — 350. D., Stat. 240. Complete colony, with ovicells; *o.*, ooeciostomes.

Fig. 11. *Entalophora delicatula* Busk (p. 110). — 376. L., Stat. 213. Branches with ovicell: *o.*, ooeciostome.

Fig. 12. *Entalophora proboscidea* M.Edw. (p. 108). — 239. A.[2], Stat. 310. Branches, with ovicell: *o.*, ooeciostome.

Fig. 13. *Entalophora intricaria* Busk (? sp.) (p. 112). — 135. F., Stat. 164. Branch without ovicell.

Fig. 14. „ „ „ „ — „ „ „ Branches, with ovicell: *o.*, ? ooeciostome.

S. F. Harmer del.

CYCLOSTOMATA.

Fa. P. W. M. Trap impr.

PLATE XI.

CYCLOSTOMATA.

Berenicea, Tervia, Hornera.

(Fig. 5 was drawn with a Zeiss A Obj., the other figures with a Ross 1-inch Obj.; all the figures were afterwards reduced $^1/_2$. The scales, in μ, are indicated near the middle and at the foot of the Plate.)

Fig. 1. *Tervia jellyae* n. sp. (p. 143). — Queensland (not 'Siboga'-Expedition). Frontal view, showing the distal end of an ovicell: *o.*, ooeciostome.

Fig. 2. „ „ „ — „ „ „ Basal view of the same branch, showing the ovicell.

Fig. 3. „ „ „ — 285. A., Stat. 51. Part of a branch, in frontal view.

Fig. 4. *Berenicea sarniensis* Norman (p. 114). — 551. C., Stat. 310. Colony with three ovicells: *o.*, ooeciostome.

Fig. 5. „ „ „ — „ „ „ Part of a younger colony, more highly magnified.

Fig. 6. *Berenicea lineata* MacGill. (p. 116). — 104. C., Stat. 139. Young colony, with ovicell: *o.*, ooeciostome.

Fig. 7. „ „ „ — 424. A., Stat. 240. Older colony, in which the ovicells form an almost complete ring: *o.*, ooeciostomes.

Fig. 8. *Hornera spinigera* Kirkpatrick (p. 147). — 112. B.^{1}, Stat. 156. Part of a branch in which the orifices are prolonged into specially long spines.

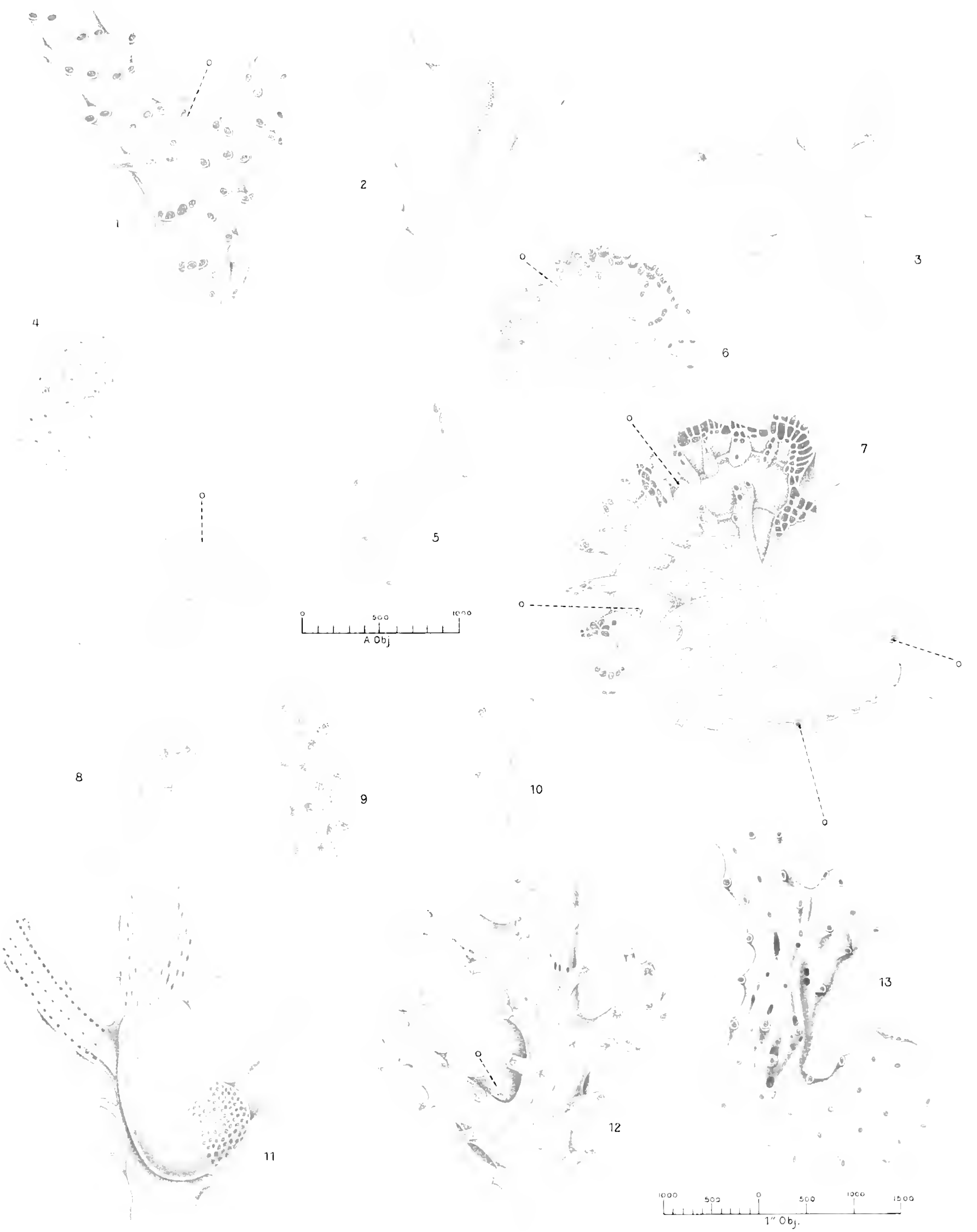
Fig. 9. „ „ „ — 82. A.^{2}, Stat. 105. End of a young branch, from another colony.

Fig. 10. „ „ „ — 112. B.^{1}, Stat. 156. Branch with spinous zooecia.

Fig. 11. „ „ „ — „ „ „ Basal view of several branches, showing an ovicell.

Fig. 12. „ „ „ — „ „ „ Frontal view of the same specimen: *o.*, ooeciostome.

Fig. 13. *Hornera caespitosa* Busk (p. 149). — 82. B., Stat. 105. Frontal view of several branches.



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CYCLOSTOMATA.

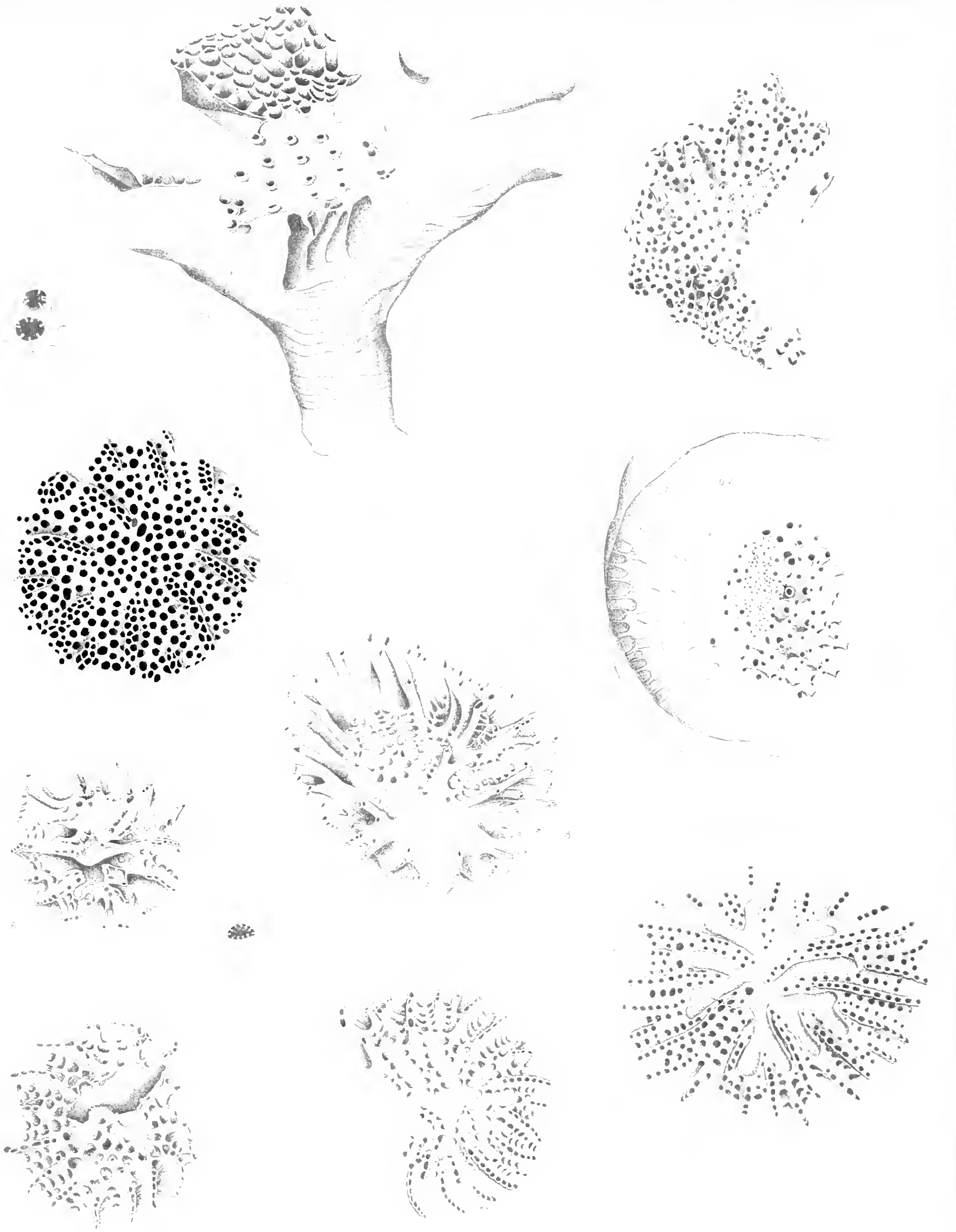
PLATE XII.

CYCLOSTOMATA.

Supercytis, Lichenopora.

(Figs 2 and 7 were drawn with a Zeiss B Obj., the other figures with a Ross 1-inch Obj.; all the figures were afterwards reduced 1/2. The scales, in μ, are indicated with figs 2 and 7 and at the foot of the Plate.)

Fig. 1. *Supercytis watersi* n. sp. (p. 151). — 400. A., Stat. 164. Complete colony, showing the ovicell (*ov.*).
Fig. 2. *Lichenopora mediterranea* Blainv. (? sp.) (p. 164). — 565. A., Stat. 125. Openings of cancelli, showing the pin-like spines.
Fig. 3. " " " " — " " The complete colony from which fig. 2 was drawn.
Fig. 4. *Lichenopora buski* n. sp. (p. 161). — 394. P., Stat. 144. Complete colony.
Fig. 5. " " " — Tosa, Japan (not 'Siboga'-Expedition). Complete colony, showing the roof of the ovicell (*ov.*): *o.*, ooeciostome.
Fig. 6. *Lichenopora novae-zelandiae* Busk (p. 155). — 202. B., Stat. 282. Colony with two young ovicells, the roofs of which are not completely formed: *o.*, ooeciostome.
Fig. 7. " " " — " " " Cancellus, with spines, more highly magnified (from the colony shown in fig. 8).
Fig. 8. " " " — " " " Colony with specially long peristomes: *o.*, ooeciostomes.
Fig. 9. " " " — 568. B.[1], Stat. 105. Colony, with incompletely formed or broken ovicell.
Fig. 10. " " " — 354. A., Stat. 240. Colony with short peristomes.
Fig. 11. " " " — 349. I., Stat. 144. Colony with short peristomes. The roof of the ovicell is not concealed by cancelli: *o.*, ooeciostome.



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Livr. LXXV.

RÉSULTATS DES EXPLORATIONS
ZOOLOGIQUES, BOTANIQUES, OCÉANOGRAPHIQUES ET GEOLOGIQUES
ENTREPRISES AUX
INDES NÉERLANDAISES ORIENTALES en 1899—1900,
à bord du SIBOGA
SOUS LE COMMANDEMENT DE
G. F. TYDEMAN
PUBLIÉS PAR
MAX WEBER
Chef de l'expédition.

Siboga-Expeditie

THE POLYZOA OF THE SIBOGA EXPEDITION

BY

SIDNEY F. HARMER, Sc.D., F.R.S.
Keeper of Zoology in the British Museum (Natural History), London

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ENTOPROCTA, CTENOSTOMATA AND CYCLOSTOMATA

With 12 plates

Monographe XXVIIIa of:

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verzameld in Nederlandsch Oost-Indië 1899—1900

aan boord H. M. Siboga onder commando van
Luitenant ter zee 1e kl. G. F. TYDEMAN

UITGEGEVEN DOOR

Dr. MAX WEBER
Prof. in Amsterdam, Leider der Expeditie

(met medewerking van de Maatschappij ter bevordering van het Natuurkundig Onderzoek der Nederlandsche Koloniën)

BOEKHANDEL EN DRUKKERIJ
VOORHEEN
E. J. BRILL
LEIDEN

Publié Octobre 1915

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