A REVISION OF THE MONAXONID SPECIES DESCRIBED AS NEW IN LENDENFELD'S "CATALOGUE OF THE SPONGES IN THE AUSTRALIAN MUSEUM." Part i.

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(Plates xv.-xxiv.)

Introduction.

In view of the many serious inaccuracies found by Mr. Whitelegge and myself in the portions, revised by us, of the "Catalogue of the Sponges in the Australian Museum," and my further discovery that, contrary to Mr. Whitelegge's assumption, the specimens standing as the types of the species therein described are not in every case to be relied upon as authentic, I have deemed it advisable to continue much further my investigations in regard to those species before proceeding with other work intended for publication on Australian sponges. The results of these investigations, in so far as they pertain to the Monaxonida, it is the purpose of the present paper to set forth.

The material upon which the revision has chiefly been based, consists of the reputedly original specimens preserved in the Australian Museum, and of sample-fragments of an incomplete duplicate set of specimens belonging to the British Museum. The correspondingly labelled specimens of the two sets, however, are not always in agreement; and among the latter are included examples of species which are not to be found in the existing collection of the Australian Museum. At the same time, a number of the Monaxonid species described in the Catalogue are unrepresented in either set of examples. In the case of the former specimens—all of which are labelled in Dr. Lendenfeld's own handwriting—the original labels, as a rule, bear only

"manuscript" names, and for the published equivalents of these dependence has mainly to be placed on a synonymic list (hereinafter referred to as the key-list) furnished by the author of the Catalogue at the request of the Museum Trustees some years after his departure from Australia: the specimens also have attached to them labels added by Mr. Whitelegge, indicating their correct names according to the key-list, and marking them to be the type-specimens.

The examination of portion of this material, undertaken in connection with my previous paper, disclosed that many of the specimens were altogether incompatible with the descriptions of the species they purported to represent; and that, as a rule, considerable disagreement existed between description and specimen even in those cases in which the latter had to be adjudged as beyond question correctly labelled. So far as the evidence then forthcoming enabled one to determine, however, the discrepancies observed were, with two exceptions, such as it seemed necessary to attribute either to inaccuracy of observation on Dr. Lendenfeld's part or to a mislabelling of the specimens; the exceptions —both of which I referred to in my previous paper—were in connection, firstly, with *Clathrissa arbuscula*—the figure given in illustration of which is in reality one of *Clathriodendron arbuscula*; and, secondly, with the two so-called varieties of *Thalassodendron rubens*, the descriptions of whose skeletal characters should be interchanged. The investigation of the remaining material, while proving the descriptions to be almost without exception faulty (often even to an extreme degree), has resulted in the discovery that errors of the kind last-mentioned are by no means of isolated occurrence in the Catalogue; in other words, that not a few of the figures are wrongly designated, and that in repeated instances the disparity between specimen and description is in consequence of the fact that the description is an account partly of the external features of one species and partly of the internal features of another. The former of these extraordinary errors were comparatively easy of detection, and are indubitable, since the actual specimens from which the figures were taken have been found; but those affecting the descriptions only

became apparent, at a late stage of the investigation, as a result of accumulated circumstantial evidence, and have been responsible for the chief difficulties which the task of revision has presented.

The alterations in nomenclature which have been found necessary in connection with the species revised are indicated in the lists given below. In the first list, the left-hand column gives the names under which the species were described or figured in the "Catalogue," and the right-hand the names of the species as now accepted. Where the original name is preceded by the sign †, it is intended to indicate that the species described by Whitelegge under that name was wrongly identified; the correct name of the latter species is given in the second synonymic list. In the case of each of the species whose name is followed by the sign + (only), there is good reason to believe that the original description was based upon two species, only one of which is with certainty known. The single asterisk(*) placed before several of the names indicates a doubt as to whether the specimen examined was a genuine example of the species—and, accordingly, a doubt as to whether the name is really correct. Finally, the double asterisk(**) is employed to denote that the species is known only from its description; and where in addition the name is enclosed within brackets, the description is regarded as insufficient, even if it be correct, to enable one to say positively to what genus the species belongs. Certain of the last-mentioned species were referred to in my previous paper, and assigned doubtfully to the genus *Wilsonella*; but I now consider it better to allow them to remain under their original names.

List A.—Synonymy of the Species, as far as revised by me, of Lendenfeld's "Catalogue."

Tethya multistella var. *megastella*	***Donatia lyncurium* (?) var. *multistella.*
Tethya multistella var. *microstella*	***Donatia lyncurium* (?) var. *microstella.*
Tethya corticata.	**Donatia ingalli* var. *lævis.*
Tethya fissurata	*Donatia fissurata.*
Tethya inflata	**Donatia ingalli* var. *lævis.*
Tethya phillipensis	*Donatia phillipensis.*
Tethya lævis	*Donatia ingalli* var. *lævis.*

Tethyorrhaphis lævis	*Tethyorrhaphis lævis.*
Tethyorrhaphis tuberculata	*Tethyorrhaphis lævis.*
Tethyorrhaphis gigantea	*Tethyorrhaphis lævis.*
Tethyorrhaphis conulosa	*Tethyorrhaphis lævis.*
Sollasella digitata	*Sollasella digitata.*
Spirastrella australis	*Spirastrella* (?) *australis.*
Papillina panis (descr.)	*Spirastrella papillosa* R. and D.+ *S. papillosa* v. *porosa* Dy.
Papillina panis (fig.1)	*Cliona* (*Papillissa*) *lutea*
Papillina panis (fig.2)	*Spirastrella* (?) *ramulosa.*
Papillina ramulosa	*Spirastrella* (?) *ramulosa.*
Raphyrus hixonii	*Cliona* (*Papillissa*) *hixoni.*
Papillissa lutea	*Cliona* (*Papillissa*) *lutea.*
Suberites domuncula	**Suberites* spp.
Plectodendron elegans	*Caulospongia elegans.*
Chondrosia collectrix	*Chondrosia* (?) *collectrix.*
Reniera collectrix	*Chondrosia* (?) *collectrix.*
†*Reniera australis*	*Reniera australis.*
Reniera megarrhaphea	*Amorphinopsis megarrhaphea*+.
Reniera pandœa	*Hemitedania anonyma* Crtr.+.
Reniera lobosa	***Reniera lobosa.*
Petrosia hebes	*Petrosia hebes.*
Halichondria rubra	*Hemitedania anonyma* Crtr.
Halichondria rubra var. *digitata* (descr.)	*Hemitedania anonyma* Crtr.
Halichondria rubra var. *digitata* (fig.)	*Raspailia agminata* sp.n.
†*Halichondria mammillata*	***Halichondria* (?) *mammillata.*
†*Halichondria clathriformis*	*Thrinacophora clathriformis.*
†*Reniochalina stalagmitis*	***Reniochalina stalagmitis.*
†*Reniochalina lamella*	***Axinosia* (?) *lamella* (?+).
Stylotella digitata	*Stylotella agminata* Ridl.
Stylotella polymastia (descr.)	*Ciocalypta* (?) *polymastia.*
Stylotella polymastia (fig.)	*Histoderma actinioides* sp. n.
Stylotella rigida	*Stylotella agminata* Ridl.
Stylotella aplysillioides	***Hymeniacidon aplysillioides.*
Rhizochalina ramsayi	*Phloeodictyon ramsayi.*
Rhizochalina petrosia	*Phloeodictyon petrosia.* +*Ciocalypta* (?) sp.
Gellius panis	***Gellius panis.*
Gellius raphidiophora	*Gellius raphidiophora.*
Tedania rubicunda	*T. digitata* var. *rubicunda.*
Tedania laxa	*Stylotella agminata* Ridl.
Tedania rubra	*Tedania digitata* var. *rubra.*
Tedania tenuispina	*Stylotella agminata* Ridl.+.

Sideroderma navicelligerum (descr.)	*Histoderma actinioides* sp. n.
Sideroderma navicelligerum (fig.)	*Polymastia zitteli.*
Sideroderma zittelii	*Polymastia zitteli.*
Esperella ridleyi v. *robusta*	*Mycale ridleyi.*
Esperella ridleyi var. *intermedia*	*Mycale ridleyi.*
Esperella serpens	*Mycale serpens.*
Esperella penicillium	*M.* (*Paresperella*) *penicillium.*
Myxilla jacksoniana	*Lissodendoryx jacksoniana.*
Clathriodendron arbuscula	*Clathriodendron arbuscula.*
Clathriodendron irregularis	***Clathriodendron* (?) *irregularis.*
Clathriodendron nigra	*Raspailia nigra.*
Kalykenteron elegans	*Echinodictyum bilamellatum* Lam.
Kalykenteron silex	*Echinodictyum bilamellatum* Lam.
Clathrissa arbuscula (descr.)	*Clathrissa arborescens* Ridl.
Clathrissa arbuscula (fig.)	*Clathriodendron arbuscula.*
Clathrissa elegans	***Clathrissa* (?) *elegans.*
Clathrissa pumila	*Crella incrustans* Crtr. v. *pumila.*
Clathrissa pumila v. *rubra*	*Crella incrustans* Crtr. v. *rubra.*
Echinonema anchoratum v. *ramosa*	***Echinonema* [*anchoratum*, var.] *ramosa*
Echinonema anchoratum v. *dura*	***Echinonema* [*anchoratum*, var.] *dura.*
Echinonema anchoratum v. *lamellosa*	***Echinonema* [*anchoratum*, var.] *lamellosa.*
Echinonema levis	*Crella incrustans* Cr. v. *levis*(?+).
Echinonema rubra	*Crella incrustans* Cr. v. *levis*(?+).
Clathria macropora	**Crella incrustans* var. *levis* (?+)
Clathria pyramida	*Wilsonella* (?) *pyramida.*
Clathria australis	*Crella incrustans* v. *arenacea* Cr. (?+).
Thalassodendron digitata	**(*Thalassodendron digitata*).
Thalassodendron typica	**(*Thalassodendron typica*).
Thalassodendron rubens v. *dura*	*Clathria rubens*+*Rhaphidophlus paucispinus.*
Thalassodendron rubens v. *lamella*	*Rhaphidophlus paucispinus* +*Clathria rubens.*
Thalassodendron paucispinus	*Rhaphidophlus paucispinus.*
Thalassodendron brevispina	*Rhaphidophlus typicus* Crtr. var. *brevispinus.*
Thalassodendron viminalis	*Ophlitaspongia hispida* Crtr. var. *viminalis.*
Plectispa elegans	***Echinoclathria* (?) *elegans.*

Plectispa arborea	*Echinoclathria arborea.*
Plectispa macropora	***(Plectispa macropora).*
Clathriopsamma lobosa	*Wilsonella australiensis*+.
Clathriopsamma reticulata	*Rhaphidophlus reticulatus.*
Aulena laxa	**Echinoclathria laxa.* (?=*E. gigantea*).
Aulena gigantea	*Echinoclathria gigantea.*
Axinella hispida v. *gracilis*	*Raspailia gracilis*+.
Axinella hispida v. *tenella*	*Raspailia tenella*+.
Axinella aurantiaca	*Axinella aurantiaca*
Axinella inflata	***(Axinella inflata).*
Axinella obtusa	***(Axinella obtusa).*
Spirophorella digitata	***Trachycladus digitatus* (=*Spirophora digitata* Ldf.)+.

List B.—Synonymy of Monaxonid Species wrongly identified by Whitelegge in his Revision of Lendenfeld's "Catalogue"—(omitting Chalininæ).

Reniera australis(53, p.324)	*Reniera* sp.
Halichondria mammillata(56, p.282)	*Siphonochalina* sp.
Halichondria clathriformis(56, p.282)	*Chalina finitima* Whtlg. (non Schmidt).
Reniochalina stalagmitis (56, p.283)	*Axiamon folium* g. et sp.n.
Reniochalina lamella(56,p.283)	*Axiamon folium* g. et sp.n.
Echinonema anchoratum var. *ramosa*(54, p.81)	*Clathriodendron arbuscula* Ldf.
Echinonema anchoratum var. *dura*(54, p.81)	*Clathria*(?) *indurata*, sp.n(18).
Echinonema anchoratum var. *lamellosa*(54, p.82)	*Clathria spicata*, sp.n (18)*
Thalassodendron typica (54,p. 86)	*Echinodictyum bilamellatum* Lamk.
Thalassodendron rubens var. *dura*(54, p.87)	*Rhaphidophlus paucispinus.*

*On one page of my former paper(p.211) I have inadvertently referred to this species as *C. diechinata*, a name merely which it was at first my intention to bestow on the species.

Thalassodendron viminalis(54, p.87)	*Echinochalina intermedia* Whtlg.
Plectispa elegans(54, p.90)	*Echinoclathria arborea* Ldf.
Plectispa arborea(54,p.89; 55, p.212)	*Clathria multipes*, sp.n.(18).
Plectispa macropora(54, p.89)	*Echinoclathria ramosa*, sp.n.(18).

New genera have been established as follows:—*Hemitedania*, for *Rhaphisia anonyma* Carter; *Axiamon*, for *Reniochalina lamella* Whitelegge (non Lendenfeld); *Pseudotrachya*, for *Sollasella hystrix* Topsent; *Stylissa*, for *Stylotella flabelliformis* Hentschel; and *Axinosia* (with *Axinella symbiotica* Whitelegge, as type) to include *Stylotella irregularis* Kirkpatrick. *Amorphinopsis* Carter and *Papillissa* Lendenfeld have been revived—the latter provisionally as a subgenus of *Cliona*. *Plectodendron* Lendenfeld, is found to be identical with the almost forgotten *Caulospongia* Kent, and *Strongylophora* Dendy, to be a synonym of *Petrosia*. The genera *Sollasella* and *Stylotella*(s.str.) are removed from the family Axinellidæ and placed in the Donatiidæ and Suberitidæ respectively.

For convenience of reference, I deal with the species in the same order and under the same names and family headings as in the Catalogue.

Revision of the Species.

Familia TETHYDÆ (= Donatiidæ).

Genus Tethya (= Donatia).

Of the difficulties which the identification of many of the species to be revised has presented, the greatest by far, from the point of view of the expenditure of time they have occasioned, have been those in connection with the several species of *Tethya* (i.e., *Donatia*). In the first place, it was found that the specimens labelled as the types of these species, excepting only *T. inflata*, comprise in each case examples of two or three species (or varieties)—among them, in the case of *T. corticata* and *T. lævis*, being examples even of the genus *Tethyorrhaphis* (which outwardly are hardly to be distinguished from the accompanying

specimens of *Donatia*). And, secondly, the examination of all these specimens (some thirty in number), as well as many other examples of the genus from Port Jackson and its vicinity, resulted in my failure to discover any which accorded at all satisfactorily with the description of any one of the species. As a consequence, since it is practically certain that, with the scarcely to be doubted exception of *T. multistella*, all the species in question are comprised amongst the specimens I have examined, I have deemed it best to regard definitely as the types of these species in each case—*T. multistella* excepted—those of the specimens labelled as representing them which best accord with their respective descriptions.

I have found the number of the rays of the spherasters to be very constant in specimens of the same species, and have, therefore, attached importance to it as a specific character. The precise number of the rays not being exactly determinable (owing to their distribution over the surface of a sphere), I have stated, in the following descriptions, only the number of them that can actually be seen and counted.

Tethya multistella.

The "types," labelled as from Port Jackson, comprise three distinct forms, which all resemble *Tethya multistella* in having the surface subdivided into polygonal areas by pore-grooves, but not one of which admits of being identified with either of the varieties into which Lendenfeld divides the species. Some further specimens, left by Lendenfeld and exhibiting a tessellated surface, occur in the collection, labelled (wrongly so far as the specific name is concerned) "*Tethya fissurata*, Port Molle"; and these likewise are unidentifiable with *T. multistella*. As Lendenfeld records the species from Port Jackson, Port Phillip, Port Chalmers, and the Chatham Islands, it accordingly seems probable that his description of it was based solely on specimens from one or other of the last-mentioned three localities, and that the specific identity of the Port Jackson specimens with these was merely assumed from their external resemblance thereto. It is not unlikely that the true types of *T. multistella* are in the

British Museum; though among the sponge-fragments which have been received from that Institution none labelled as *T. multistella* are included.

The following brief descriptions of the several forms above mentioned—which on account of their surface-tessellation and their spiculation, could, I suppose, be designated varieties of *Donatia lyncurium*—are intended merely for the purpose of indicating the chief reasons against the acceptance of any of them as an example of the species here in question.

i. This sponge, which is a common one in Port Jackson and adjacent localities in shallow water, is represented by a number of specimens. The spicules of the radial fibres are styli, which are generally sharp-pointed, and attain a size of about 1250 by 16 μ; the terminal spicules of the fibres project only a slight distance beyond the surface. Between the fibres in the outer region of the choanosome, fairly abundant radially directed slenderer megascleres occur, and in the spicular "nucleus" of the sponge are found comparatively short styli, some of which are less than 200 μ in length. Spherasters occur only in the cortex, and are comparatively very scarce even there; they are at most 45 μ in total diameter, and are provided with straight, conical, smooth rays, the length of which may attain to three-fourths the diameter of the centrum, and the number of which (actually countable) varies from 14 to 18. Tylasters are plentiful in all parts of the sponge, most abundant in the superficial layer of the cortex; they seldom exceed 15 μ in diameter and have the slightly expanded extremities of the rays minutely spined.

ii. A single specimen, labelled as from Port Jackson, is remarkable in having spherasters, the surface of the rays of many of which is roughened with incipient spines; occasionally a few of the spines are of considerable size. In other respects this sponge is very similar to the preceding; but the styli attain a stoutness of 20 μ, and the spherasters a diameter of 55 μ; the length of the rays of the latter may equal the diameter of their centrum; and the tylasters are rare in the choanosome, except in the immediate surrounding of canals.

iii. Another specimen, also labelled from Port Jackson, agrees with those of the two preceding forms in having chiefly stylote megascleres and asters of two kinds; but the spherasters are extremely abundant throughout the entire cortex and occur fairly plentifully also in the choanosome, decreasing in number, however, towards the centre of the sponge. Many of the megascleres are blunt-pointed, and an appreciable number of them approximate in form to (fusiform) strongyla; their maximum size is about 1520 by 22 μ. The spherasters, the largest of which measure 75 μ in total diameter, have from 13 to 17 (actually countable) rays; the rays vary from one-half to three-fourths the diameter of the centrum in length, and are often slightly curved, and occasionally forked, at the extremity. In the choanosome, spherasters of all sizes, from 20 μ in diameter upwards, are common. As regards the tylasters, the same remarks apply as to those of the preceding forms. Radially directed megascleres, lying between the fibres, are not so abundant in this as in the preceding forms, and the surface of the sponge is hispidated by far-projecting spicules.

iv. The specimens labelled "*Tethya fissurata*, Port Molle," differ from the foregoing, and agree with one another, in the following particulars: (1) the megascleres of the fibres, the maximum size of which somewhat exceeds 2000 by 40 μ, are invariably rounded at the apex and are usually almost or quite symmetrically-ended (fusiform strongyla); (2) the megascleres between the fibres are distinctly different from the fibre-spicules (being more or less sharp-pointed at the apex and of much smaller size than them); (3) the chiasters are of two kinds, tylasters and "oxyasters"; and (4) the spherasters have from 19 to 23 actually countable rays. As in the third-mentioned variety, the spherasters are closely packed throughout the entire cortex and occur also scattered in the choanosome. The tylasters, measuring at most 16 μ in diameter, have the ends of the rays slightly expanded and provided with minute spines. The asters of the third kind attain to 23 μ in diameter, and have comparatively slender rays which are not expanded at the extremities, and which usually are blunt-pointed and provided along their whole length with not

numerous minute tubercles or spines; a few, however, have the rays sharp-pointed and free from spines (oxyasters). In spite of their many points of resemblance, the specimens nevertheless exhibit certain decided differences, the most noteworthy of which is in regard to the size of the spherasters; these attain a diameter of 100 μ in one specimen, only 65 μ in another, and are of intermediate size in a third.

Tethya corticata.

According to its description, this species is characterised by an irregularly conulated surface (apparently not incised by pore-grooves), obtusely pointed styli of two sizes, the larger of which attain a size of 2000 by 13 μ, and microscleres of only two kinds, spherasters and tylasters, the former abundant in the cortex. The specimens indicated to be the types, however, as well as a fragment labelled *Tethya corticata* from the British Museum, while conforming fairly well with the description as regards external features, have mostly sharp-pointed styli, the largest of which measure 1600 by 28 μ, only moderately few spherasters, and, in addition to (chiefly cortical) tylasters, abundant choanosomal oxyasters, which are well distinguished from the tylasters both in shape and size. They are, in fact, examples of a variety of *Donatia ingalli*, differing in no essential respect from the specimens labelled (correctly, I feel sure) as the types of *Tethya lævis*, except that in several of the latter, apparently merely in consequence of individual variation, the megascleres which lie free in the choanosome are notably of smaller size than those which compose the fibres. One may, therefore, regard *T. corticata* as synonymous with *T. lævis*, and since the latter name rests on a more certain identification than the former, it should be preferred, and the sponge known as *Donatia ingalli* var. *lævis*.

Tethya fissurata. (Plate xv., fig.3).

In addition to the several specimens referred to above in connection with *Tethya multistella*, the "types" of *Tethya fissurata* comprise two specimens which are unquestionably to be identified with this species; yet, strangely, instead of being as the description states "irregularly spherical, more or less kidney-shaped

sponges, with a flat base," they are stipitate, with a spherical body (in each specimen about 40 mm. in diameter), and with a well-developed, fairly stout stalk which divides below into a number of root-like processes (Plate xv., fig.3). They correspond exactly with the description with respect to surface-features, as may be seen from the figure which I furnish of one of them; and they also show considerable agreement in other respects. The description, however, makes it appear as if only one form of aster, a small tylaster, was present in addition to spherasters, whereas an oxyaster is also present; but Lendenfeld mentions that "a great abundance of the young stages of the larger kind of stellate is to be found," and I, therefore, take it that he mistook the oxyasters for developmental forms of the spherasters. A more correct account of the spiculation is as follows :—

The spicules of the radial fibres are almost exclusively fusiform strongyla with one extremity (viz., the outwardly directed) somewhat narrower than the other, and attaining a maximum size of about 4000 by (rarely) 80 μ; the terminal spicules of the fibres, however, which project beyond the surface, are usually more or less sharp-pointed and are not so large as the others. Between the fibres, megascleres (styli and strongyla) of smaller size occur, but are rare.

The spherasters are incompletely differentiated into two kinds: (1) a relatively shorter-rayed, ranging in total diameter from about 45 μ to upwards of 160 μ, and having from 13 to 18 actually countable rays of length seldom exceeding (and when least, only about two-thirds) the diameter of the centrum—the number and relative length of the rays decreasing as the size of the spicule increases; and (2) a relatively longer-rayed, ranging in diameter from less than 75 μ up to 240 μ, and having from 10 to 14 countable rays, the length of which is greater than (and occasionally attains to twice) the diameter of the centrum. The former occur only in the cortex, and in some parts of it are abundant throughout its entire thickness; the latter are chiefly confined to the choanosome, where they are extremely abundant in the peripheral layer and gradually diminish in number towards the centre. Frequently in the case of the longer-rayed spherasters, and ex-

ceptionally in the case of the shorter-rayed, one to several of the rays are forked, or are once or (seldom) a few times branched, or, on the other hand, are truncated and rounded off at the extremity.

The tylasters, which form a dense layer in the superficial part of the cortex and are scattered sparsely through the choanosome, are at most 19 μ in diameter, and have short stout rays, about equal in length to the diameter of the centrum, with slightly expanded extremities tipped with numerous minute spines.

The oxyasters occur abundantly in all parts of the choanosome, but are absent from the cortex. They attain to 50 or 55 μ in diameter, and have only a very slightly developed centrum and from 6 to 8 slender, usually blunt-pointed rays, generally provided with a few minute spines or tubercles, especially towards their extremities.

Many large spherical embryos occur throughout the sponge, some of which are over 2·5 mm. in diameter. These have radially arranged stylote megascleres and, as microscleres, a very thin superficial layer of tylasters similar to those of the adult, and exceedingly minute developmental spherasters scattered sparsely in the cortex.

Lendenfeld records the species from Port Molle (Queensland), Port Jackson, and New Zealand. The specimens described by me are labelled as coming from Port Jackson.*

If this species is to be placed in the genus *Donatia*, as at present seems necessary, then the latter can no longer be defined as being "without highly specialised pore-bearing grooves."

The sponge described by Hentschel(19) from Shark's Bay (Western Australia) as *Donatia fissurata* var. *extensa*, is undoubtedly a distinct species from the above.

Tethya inflata.

According to description, this species has a smooth (*i.e.*, non-tessellated) surface with thread-shaped appendages, cylindrical

* The Federal trawling-steamer "Endeavour" has now obtained another specimen from Storm Bay, Tasmania.

stylote megascleres 2000 by 14 μ in size, and asters of two kinds —spherasters 50 μ in diameter and tylasters 12 μ in diameter— which are "particularly abundant in the skin"; the colour of spirit-specimens is stated to be light flesh-colour in the cortex, and dirty-yellow in the interior. In agreement with this description, the two specimens labelled as the types have a smooth surface—which in one case is quite even, in the other, slightly tuberculate—and although without filaments and without a pinkish tint (their colour being pale creamy on the surface and brownish-yellow in the interior), yet at any rate they are identical in all other respects with specimens in the collection which exhibit those features. But, contrary to the description, they have fusiform, usually blunt-pointed (occasionally strongyla-like) megascleres, the largest of which are 27 μ in stoutness and less than 1700 μ in length: the spherasters are (comparatively) scarce in the cortex and attain a diameter of 60 μ or more; the tylasters are usually not less than 15 μ (and at most are 20 μ) in diameter; and oxyasters are present. The specimens are, in fact, forms of *D. ingalli* var. *lævis*; and a fragment labelled *Tethya inflata*, from the British Museum, is another example of the same. As I do not think that any reliance can be placed upon the spicule-measurements given by Lendenfeld, or even upon the form which he ascribes to the megascleres, I would, therefore, have but slight hesitation in declaring *Tethya inflata* to be synonymous with *Tethya lævis*, were it not for the fact of the possession by these specimens of oxyasters, and of the comparative non-abundance of their spherasters. I might mention, however, that, in the larger of the two "type-specimens," the oxyasters are rather few in number, and in places are absent (or almost so) throughout considerable tracts; while, at the same time, they are rarely more than 30 μ in diameter, and usually are not very markedly different from the largest tylasters; and thus it is conceivable, in the case of such a specimen, that these spicules could, through hasty observation, be overlooked. Also I might mention that, in some specimens of *Tethya lævis*, the spherasters are abundant in the outermost layer of the cortex; and possibly it is only to the outermost layer of the cortex that Lendenfeld refers in speaking of

"the skin" of the sponge. Accordingly, taking everything into consideration, I think one is justified in regarding *Tethya inflata* (like *T. corticata*) as a synonym of *D. ingalli* var. *levis*.

Tethya phillipensis. (Plate xv., fig.4).

Two of the three specimens labelled as the types of *Tethya phillipensis*, although by no means closely in accord with the description of this species, yet exhibit so many analogies therewith as regards both external and skeletal features, that one is justified, I think, in accepting them as the types of the species. The third specimen, while perhaps more closely in agreement with the description in the matter of skeletal characters, differs from the other two in surface-features, and provisionally I do not regard it as belonging to the same species as they. The locality of all three is given as Port Phillip, and this is confirmed, as regards the two taken to be the types, by the occurrence of a similar sponge in a collection from Port Phillip presented to the Australian Museum by the late Mr. J. Bracebridge Wilson. The following brief description, based on the two type-specimens and the one last-mentioned, will be sufficient to show that *T. phillipensis* is well distinguished from any other of the forms of *Donatia* herein described: and, at present, I consider it to be an independent species. As contrasted with *D. ingalli*, to which it makes nearest approach in spiculation, its chief diagnostic features are the minute pattern of the surface, the presence of (a few) spheres in addition to asters of three kinds, and the plentiful occurrence of spherasters in the choanosome.

The sponge is of more or less globular shape, either sessile (and then at times somewhat depressed) or prolonged below into a short stalk-like portion (*i.e.*, somewhat pyriform). The oscula are conspicuous and several in number. The colour in alcohol varies from a pale creamy-white, with a tinge of pink, to a light salmon. The surface, which is fairly regularly tuberculate, shows over its entire extent a minute reticulation (just visible to the naked eye): the tubercles are usually much depressed, flattened, and the surface as a consequence presents a slightly tessellated appearance. The shallow and, for the most part, narrow grooves

separating the tubercles are not of the nature of specialised pore grooves; immediately underlying these grooves, however, and roofed over only by membrane, are narrow cleft-like spaces in the cortex, so that if a thin superficial layer of the sponge were pared off, the surface then would appear imperfectly divided into polygonal areas by discontinuous narrow cracks. The characteristic minute reticulation of the surface (Plate xv., fig.4) is found, on microscopical examination, to consist of polygonal or rounded meshes, averaging 150 μ in diameter, separated by narrow partitions in which are spherasters and megascleres, the latter—directed perpendicularly to, and slightly projecting beyond the surface—being the terminal spicules of the branches into which the radial skeletal fibres divide on entering the cortex. Superimposed upon this reticulation, and immediately external to it, is a finer reticulation with meshes about 25 μ in average diameter, which meshes are formed by pauciserial lines of tylasters and enclose each a single pore.

The spicules composing the radial fibres are styli, which, almost without exception, are more or less blunt-pointed—occasionally to such an extent as to approximate in form to strongyla; their maximum size in the several specimens varies from 1425 by 20 μ to 1600 by 24 μ. In the cortex, as the fibres approach nearer to the surface, their megascleres gradually diminish in size, and become cylindrical and abruptly sharp-pointed; the smallest of these terminal spicules are less than 240 μ in length. Between the fibres, in the choanosome, a fair abundance of radially directed megascleres occur, which are similar in form to those of the fibres, except that a few of them are slenderer and usually gradually sharp-pointed.

The microscleres are spherasters, spheres, tylasters, and oxyasters. The spherasters are abundant throughout the choanosome, and, in the cortex, occur chiefly in a broad superficial layer; they have rarely less than 13, and normally not less than 9, actually countable rays, and measure at most 65 μ in diameter; when, as occasionally happens, the number of rays is less than nine, it is because of the non-development of one or a few rays, and the spicule is then no longer centro-symmetrical. The

spheres, which are equal in size to the centrum of the spherasters, occur sporadically both in the choanosome and the cortex; though few in number, they are not so rare as to excuse their being overlooked; in rare instances, two or three spheres may occur fused together.

Although similar to one another in all the foregoing particulars, the specimens are nevertheless of two forms in respect of a number of other (spicular) characters. In one form, (i.) the rays of the spherasters are rarely or never as long as (and usually are somewhat less in length than two-thirds) the diameter of the centrum, and not infrequently one or a few of them are provided with a small spine or two (incipient branches), or are forked at the extremity; (ii.) the tylasters, which may attain to 19 μ in diameter, have short stout rays usually less in length than the diameter of the centrum and provided with a well-developed terminal knob densely covered with minute spines; and (iii.) the oxyasters, which vary from (seldom) 20 μ to 35 μ in diameter and are fairly abundant, have moderately stout rays (1·5 to 3 μ in diameter near their base) with the distal half of their length covered with well-developed tubercles. In the other form, (i.) the rays of the spherasters are generally as long as, or slightly longer than, the diameter of the centrum, and rarely (if ever) exhibit incipient branching; (ii.) the tylasters are at most 17 μ in diameter, and have comparatively slender rays, which are longer than the diameter of the centrum, and are usually only slightly knobbed, and which are provided with spines, not only around their extremity, but also for some short distance along their length; and (iii.) the oxyasters, which are of about the same diameter as those of the preceding form, have slender rays only sparsely provided with tubercles.

Remarks.— Among the fragments received from the British Museum, there is one labelled *Tethya phillipensis* which, in skeletal characters (excepting that the spherasters are at most only about 55 μ in diameter), is in various respects intermediate between the two above-described forms. Unfortunately this fragment was used up in the preparation of sections from it,

without a proper examination of its surface-features having been made; but if the specimen, from which it was taken, exhibits the characteristic dermal reticulation that would prove it to be also a form of *Donatia phillipensis*, then I would be inclined to say that a separation of these forms, as distinct varieties, is not feasible.

The specimen referred to in the opening paragraph, which I do not consider to belong to *D. phillipensis*, differs from the type-specimens of that species chiefly in the absence of a dermal reticulation and of subdermal clefts in the cortex, and in almost all respects is closely similar to *D. ingalli* var. *lævis*. In it, however, just as in *D. phillipensis*, spherasters are abundant in the choanosome and spheres are present. Concerning its megascleres, exactly the same remarks apply as to those of *D. phillipensis*, excepting that the largest attain a length of 1670 μ. The spherasters have from 9 to 13 countable rays, the length of which is less than the diameter of the centrum, and which rarely (if ever) exhibit any tendency to branch. Spherasters with one or more rays completely aborted were not observed. The tylasters are rarely more than 16·5 μ in total diameter, and their rays, which are shorter than the diameter of the centrum, have well-developed terminal knobs densely covered with minute spines; an extremely few, however, ranging in diameter from about 16 up to about 23 μ in diameter, have the rays less markedly knobbed, and provided with spines for some distance along their length. The oxyasters, which are abundant, occasionally attain to 43 μ in diameter, and have, as a rule, stout rays (2 to 4 μ in diameter at the base), the distal half of the length of which is covered with well-developed tubercles; some of the more slender-rayed spicules (? developmental forms), however, are without tubercles; in a small proportion of cases, the rays, which in such instances are usually stunted, are provided along their whole length with tubercles, and the spicule then often closely approaches in form to the oxyasters of *D. ingalli* as figured by Bowerbank (**3**, Pl. v., fig. 17). In no other example of *Donatia* examined by me, does the tuberculation of the rays of the oxyasters reach quite such a degree of development.

Tethya lævis.

The sponge, which I identify as *Tethya lævis*, is a common one in the neighbourhood of Port Jackson, and is represented in the Australian Museum by some dozens of examples. The specimens labelled as the types of *Tethya corticata* and *Tethya inflata*, as well as the fragments labelled with the same names from the British Museum, are, as already stated, examples of it; and it is represented (along with several examples of *Tethyorrhaphis lævis*) among the specimens labelled as the types of *Tethya lævis*. There can be no doubt, also, that the species is identical with the *Tethya ingalli* recorded from Port Jackson by Sollas(**36**); but as proof is yet lacking of its strict identity with Bowerbank's species of that name, the locality of which is Western Australia, I propose to regard it as a variety thereof, and to designate it *D. ingalli* var. *lævis*.

The sponge, which appears always to be more or less spherical in shape, and to grow attached to the substratum by root-like processes, is chiefly distinguished, so far as external features are concerned, by the entire absence of any sign whatsoever of surface-tessellation, and by the very small size of the oscula,—the latter being, as a rule, at any rate in the case of preserved (and contracted) specimens, almost or quite invisible. The pores are not discernible; and there is no perceptible minute reticulation of the surface as in *D. phillipensis*. The surface is mammillated, the elevations varying in shape in different specimens, or even in different parts of the same specimen, from low and dome-like to verruciform; in most specimens, a certain proportion of these elevations are provided apically with a thread-like process, at the extremity of which a bud is often to be observed.

The two previous accounts of the sponge are not quite full and accurate concerning its spiculation, more especially in regard to the megascleres. These spicules are imperfectly differentiated into three kinds, the typical representatives of each of which are distinguished not only by their form and size, but also by their different situation in the sponge. The spicules of one kind are chiefly or exclusively confined to the fibres and almost entirely compose them; these attain a maximum length varying between

1·5 and 1·9 mm., (but only in rare specimens exceeding 1·6 μ) and a maximum stoutness approximating to 30 μ. The spicules of the second kind, which are typically of much smaller size than the preceding, though connected with them by a perfect gradation, contribute to form a "nuclear" skeleton surrounding the centre from which the fibres radiate, and are found also in the cortex in the penicillately outspread terminations of the fibres; the smallest of them measure less than 275 by 10 μ. Those of the third kind occur between the fibres, chiefly in the more peripheral part of the choanosome, and they vary markedly in size and abundance in different specimens. All three kinds are alike styli, which gradually taper towards the basal end and usually exhibit a faint constriction just immediately above that end: but the first-mentioned, or chief fibral, spicules are fusiform, and almost invariably have the apical end more or less rounded off so as occasionally to approximate in form to strongyla; the second are nearly cylindrical in shape, and are more or less abruptly sharp-pointed; while those of the third kind taper gradually to a usually very fine point. As already stated, the last-mentioned spicules are subject to considerable variation in size and number. Thus in one specimen (which is to be regarded as strictly typical of the var. *lævis*) these spicules are very few in number and rarely exceed 600 by 6 μ in size; whereas in most of the specimens labelled by Lendenfeld as the types of *Tethya inflata* and *Tethya corticata*, they are, on the other hand, extremely abundant and about equal in size to the spicules composing the fibres. Other specimens which I have examined are less widely divergent in these respects, and at present (although further investigation is necessary in order to settle the point) I do not think that the differences in question are varietal, more especially as they do not appear to be associated with any constant differences in respect of other characters.

The spherasters are almost entirely confined to the more superficial part of the cortex, and to the outermost region of the choanosome adjoining the cortex; the largest have a maximum diameter varying in different specimens from 60 to 85 μ; the rays, which in length are about equal to the diameter of the

centrum, are rarely if ever bifurcate or branched, and their number (actually countable) varies (in the same specimen) from 9 to 13. The chiasters (tylasters) form a very thin layer at the surface of the sponge and are scattered through both the cortex and the choanosome – more abundantly in the former region, especially in the immediate surrounding of the canals traversing it; they measure from 10 or 11 μ up to from 17 to (rarely) over 20 μ in diameter, have from 6 to rarely more than 10 moderately stout rays, which are provided with a well-developed terminal knob covered with minute spines, and exhibit a fairly well-marked centrum, the diameter of which may equal or even slightly exceed the length of the rays. The oxyasters are entirely confined to the choanosome, are usually abundant, and vary in maximum diameter in different specimens from about 30 to slightly upwards of 40 μ; they have from 5 to 9 rays, which are provided over their distal moiety with tubercles, some of which are elongated so that the rays may appear branched.

Loc.—Port Jackson.

Genus Tethyorrhaphis.

According to their description, the four species, ascribed by Lendenfeld to this genus, are distinguished both by differences in the shape and degree of development of protuberances on the surface, and by a number of points of difference in spiculation. Thus, in the case of *T. lævis* and *T. gigantea*, the brushes, formed by the skeletal fibres on approaching the surface, are stated to be lacking in the shorter stylote spicules present in the other species; in the same two species and in *T. conulosa*, asters of two kinds, spherasters and chiasters, are mentioned as occurring, but in *T. tuberculata* only chiasters; and the peculiar microscleres characteristic of the genus are described as strongylote in *T. lævis*, simply as "diact" in *T. tuberculata*, and as oxeote in *T. gigantea* and *T. conulosa*. I have examined all available examples (some twenty in number) of the genus, including those labelled as the types of the several species; but I have failed to find any differences among them in spiculation, except as regards the size and relative abundance of the several kinds of micro-

scleres. Considerable diversity, indeed, exists among them in the character of their surface-elevations, these being either few or numerous, and either rounded (varying from wart-shaped to dome-like) or conical (and then sometimes prolonged each into a filament). But the various differences observed are apparently merely the outcome of individual variation.

The labelled specimens, excepting those purporting to represent *T. conulosa* and *T. tuberculata*, are in fair agreement with the description of the species whose name they bear, as regards outward characters, and it is beyond reasonable doubt that they are authentic examples of those species; while among the remaining specimens, there are some which exhibit the external features ascribed to *T. tuberculata*, and others, again, having the surface provided with tapering conical processes, which presumably are to be identified with *T. conulosa*. Accordingly, I look upon Lendenfeld's four species of *Tethyorrhaphis* as representing but a single species, which we may call *Tethyorrhaphis lævis*.

In every respect, *Tethyorrhaphis lævis* resembles a species of *Donatia* except in possessing, in addition to asters, microscleres in the form of small blunt-ended rods (microstrongyles) densely covered with minute spines, and along with these a number of forms variously intermediate between them and chiasters. Asexual propagation, by means of buds, occurs, and in the same way as in *Donatia*. The superficial appearance of the sponge, owing to the absence of any trace of pore-grooves, approaches at times very closely to that of *T. ingalli* var. *lævis*; and, in some cases, microscopical examination is necessary before one can say with certainty to which of the two species a given specimen belongs.

The spicules composing the radial fibres within the choanosome are blunt-pointed, fusiform styli, frequently almost or quite symmetrically ended (*i.e.*, strongyla); their maximum size varies in different specimens from 1850 by 30 μ to 2300 by 38 μ. Near the surface of the sponge, the fibres expand penicillately, and their fusiform spicules are there largely replaced by shorter, abruptly sharp-pointed, and more cylindrical styli of various lengths down to 280 μ or less. Spicules similar to the latter

occur also, abundantly, disposed concentrically around the centre from which the fibres radiate, forming a well-marked spherical "nucleus" to the sponge. Between the fibres elsewhere, megascleres are rare or absent. The spherasters are found chiefly in the outer region or the cortex, and in the peripheral layer of the choanosome close beneath the cortex; they are provided with, usually, from 11 to 15 actually countable rays, and vary in their maximum total diameter, in different specimens, from about 50 to 90 μ. It appears to be the rule that, in specimens in which the maximum diameter of the spherasters is less than 70 μ, the rays, for the most part, are shorter than the diameter of the centrum, and frequently are bifurcate at the extremity; whereas when the spicule is of greater diameter than 70 μ, the rays appear usually to be longer than the diameter of the centrum and to be only very rarely forked. The chiasters (which are almost entirely confined to the choanosome) are sometimes abundant, sometimes rather scarce; they usually have from 6 to 10 rays, the surface of which is minutely tuberculate. The diameter of the chiasters that occur in the cortex rarely exceeds 12 or 13 μ, while those within the choanosome range in diameter up to 18 or 20 μ; also, in the case of the smaller chiasters, whether in the cortex or the choanosome, the rays usually are slightly expanded at the tip, whereas the larger ones approach more closely in form to oxyasters, and, in addition, they occasionally exhibit a branching of their rays; there would thus appear to be an incipient differentiation of the chiasters into two forms, tylasters and oxyasters. As intermediates between the chiasters and the microstrongyles, somewhat plesiaster-like forms are commonly met with, in which the rays proceed, not from a common centre, but from a shorter or longer axis, and are usually also reduced in number. In addition to these, triradiate or Y-shaped forms are frequent, as well as bent rods derived from the latter through the loss of one ray. The microstrongyles occur in moderate abundance throughout the entire cortex and are densely aggregated to form a thin layer immediately below the surface; they are also scattered through the choanosome, gradually decreasing in numbers towards the centre of the sponge. They vary from 6 to (rarely) 20 μ in

length and up to 3 μ or slightly more in stoutness. In their earliest developmental stages, they have the form of very slender centrotylote amphioxea.

Loc.—Port Jackson.

Familia SOLLASELLIDÆ.

From the description given below, it will be seen that *Sollasella digitata*, the single species on which this family was founded, is unquestionably aberrant, and that it cannot with any justification be retained in the *Axinellidæ*, to which it is generally regarded as belonging. Nor can it be referred to any other of the recognised families as ordinarily defined. In some features, however, it shows a striking similarity to certain *Donatiidæ*. Thus its cortex appears to be exactly similar in character to that of the genera *Donatia* and *Xenospongia*; it further resembles *Xenospongia* and some species of *Donatia* in having inhalant pore-like apertures localised along lines; and, although not possessed of a typically radiate skeleton—being of ramose habit—is provided, externally to the core-region, with a system of fibres which run perpendicularly to the surface, and expand penicillately in the cortex. Accordingly, for the reception of the genus *Sollasella*, either the family *Sollasellidæ* will have to be retained, or the *Donatiidæ* defined in a broader sense; and of the two alternatives, I think the latter has most to recommend it. It is to be noted that, in *Donatia* itself, the skeleton is not completely radiate, since there is present a central core-region in which the spicules have a confused arrangement, and, besides this, the spicules lying between the radial fibres are not always radially directed.

Topsent(47) has referred, to the genus *Sollasella*, the species originally described by him as *Trachya hystrix*. As it now becomes evident that this is a markedly different type of sponge from *S. digitata*, I venture to propose for its reception a new genus, *Pseudotrachya*, to be placed provisionally in the *Axinellidæ*.

Sollasella Lendenfeld.

Donatiidæ(?), typically of ramose habit, with well-developed fibrous cortex and with linearly disposed inhalant openings leading

into chones. Microscleres absent. The megascleres are of two kinds—the larger, monactinal (typically subtylostrongyla); the smaller, diactinal (oxea). The skeleton of the interior, consisting chiefly of longitudinal spicule-bundles and variously oriented scattered spicules, is supplemented in the axial region by a reticulation of fibres composed of a sponginous substance, and in the extra-axial region by radiating spicule-fibres, which continue into the cortex.

Sollasella digitata. (Plate xv., figs.1,2; and text-fig.1).

The species is represented by the incomplete type-specimen (Pl. xv., fig 2), by a correctly labelled fragment from the British Museum, and by an entire specimen (Pl. xv., fig.1) from an unknown locality, probably obtained by the "Thetis" Expedition.

External features. — Sponge ramose, stipitate; stalk and branches short, stout and cylindrical, the latter extending upwards and outwards in various directions without anastomosis. Surface even, very sparsely hispid with singly dispersed long spicules that project 2 or 3 mm. beyond it, and conspicuously characterised by a polygonal areolation formed by lines of uniserially disposed, closely approximated, small shallow pits; these pits are terminated below by a microscopically cribriporal membrane, which roofs over an inhalant chone. The oscula are few, scattered, small; they measure up to 2 mm. in diameter. Consistency very firm, dense, and tough. Colour in alcohol brownish.

In one of the specimens (Pl. xv., fig.2), the surface-areolation is generally hexagonal, the areolæ average between 2 and 3 mm. in width, and the pore-pits, which are usually elliptical in outline, measure from 0·2 to 0·5 mm. in their longer diameter. In the other, the type-specimen, the areolæ are, as a rule, much elongated in the longitudinal direction of the branches, but are very variable in length, and measure only 1 to 2 mm. in width; while, at the same time, the pits are comparatively small, being rarely as much as 0·2 mm. in diameter. Neither of the specimens affords any particular justification for Lendenfeld's statement that the polygonal fields (areolæ) are "expressions of the terminations of the surface-tufts of the spicule-bundles"; nor do

they at all substantiate his statement that these fields "are divided from each other by sharply defined incisions" unless the word "incisions" is used in a quite unusual sense. The two specimens are of nearly the same height, viz., 120 mm., which is 20 mm. less than the maximum height recorded by Lendenfeld.

Internal structure.—A transverse section across a branch permits three regions to be distinguished with the naked eye: (i.) a pale-coloured external layer, or cortex, which, in different parts of the sponge, varies in width from about 0·8 to 1·5 mm.; (ii.) a deeply brownish-coloured subcortical layer, usually much wider than the cortex, but in width rather variable; and (iii.) a broad axial region or core, also brownish-coloured, distinguishable from (ii.) by reason of its being traversed longitudinally by numerous spicule-strands, the cut ends of which show clearly on the surface of the section. In the figure of the type-specimen (Pl. xv., fig. 2) a branch is seen in longitudinal section, showing the relative extents of these three regions. In this example, however, the subcortical tissue has mainly disappeared owing to maceration (which it undergoes more readily than do the other tissues), and, as a result, a system of fibres, crossing the subcortical layer and passing into the cortex, is brought into view. Owing to these fibres, the cortex cannot be peeled off separately, but, in its removal, drags with it most or all of the underlying layer. In a longitudinal section of a branch, ordinarily, the subcortical region is not recognisable as a layer distinct from the core-region (Lendenfeld includes them both under the term "pulpa"); but the demarcation between the subcortical layer and the cortex is well-pronounced, owing to their difference in colour, and to the presence, immediately beneath the latter, of a narrow zone of lacunæ and canals. Lendenfeld's statement that these lacunæ (and canals) form a "nearly continuous cavity" beneath the cortex, appears to be somewhat exaggerative.

On treatment with a macerating agent, such as caustic potash, the two outer layers of the sponge readily soften and come away, leaving intact the stout core, the thereby exposed surface of which bristles sparsely with long spicules projecting, nearly perpendicularly, 1 to 3 mm. beyond it. The core is very resistant

to maceration, but after prolonged treatment, aided by washings with a pipette, it becomes reduced to a reticulation of fibres composed of a substance much resembling spongin, entangled with which, and apparently for the most part independent of it, are numerous indifferently oriented oxea. Many of the apparently free spicules, however, prove, on close scrutiny, to be ensheathed, over portion at least of their length, with a thin layer of spongin continuous with that of the fibres; and the long spicules (subtylostrongyles) which project from the core, are likewise found to be held in position by a partial covering of spongin. The sponginous fibres are not provided with an axial core of longitudinally disposed spicules.

Skeleton.—The skeleton of the axial region consists, in addition to the spongin-reticulation and the irregularly disposed oxea, of ill-defined longitudinal strands of loosely associated oxea and subtylostrongyla. The reticulation of spongin-fibres is exceedingly irregular in pattern, and the fibres themselves are very variable in stoutness and uneven in their outlines. The spongin has a faintly brownish-yellow tint, and is of low refractive index, and is readily stainable.

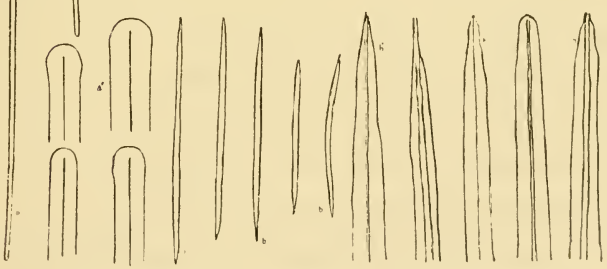

Fig. 1.—*Sollasella digitata.* *a*, Subtylostrongyla. *a'*, Basal extremities of ditto. *b*, Oxea. *b'*, Extremities of oxea.

Immediately surrounding the core-region, and forming the inner limit of the subcortical layer, is a narrow belt of longi-

tudinally disposed spicules, which are chiefly subtylostrongyla. This belt is crossed, at rather wide intervals in a radial direction, by single spongin-fibres, each ensheathing the basal portion of a subtylostrongyle; and immediately external to the belt, the already-mentioned radial fibres, composed of closely packed parallel oxea, take origin, each fibre having, as its axis, one of these radially directed long spicules. The remaining skeleton of the subcortical layer consists of abundant oxea arranged in an irregular, somewhat halichondroid, fashion, even if, for the most part, more or less longitudinally directed.

The radial fibres increase in stoutness on their way across the subcortical layer, and on their arrival at the cortex sometimes exceed 200 μ in diameter. On entering the cortex, each fibre spreads out into a widely divergent brush, the terminal spicules of which project slightly beyond the surface. Apart from the occasional long spicules which project from the surface, these spicule-brushes constitute the entire cortical skeleton.

Spicules.—(*a*) The oxea are very slightly fusiform, mostly straight, and nearly always irregularly ended, very frequently having abrupt, more or less mucronate, sharp points. They vary from about 340 to 760 μ, but are usually between 450 and 650 μ in length, and attain (rarely) to 15 or 16 μ in stoutness. (*b*) The so-called subtylostrongyla are usually only very faintly expanded at the basal end, and often are without any sign of such enlargement; occasionally, however, the phyma is so well developed that the spicule could be called a tylostrongyle. They are nearly always quite straight, taper slightly from base to apex, and vary from (rarely) less than 2 mm. to upwards of 4 mm. in length, and from 10 to 35 μ in diameter measured just above the base. Among the slenderest spicules, there are some which are gradually sharp-pointed at the apex, *i.e.*, are subtylostyli.

Histology. Rounded cells, about 12 μ in diameter, containing brownish granules, occur abundantly in all parts excepting the cortex. The flagellated chambers are confined to the axial region of the sponge, and are of rounded shape, measuring about 25 μ in diameter. The cortex consists of a dense fibrous tissue, resembling that of the cortex of *Donatia*.

Familia SPIRASTRELLIDÆ.

Of the five species of *Spirastrellidæ* described in the Catalogue, one, *Papillina panis*, is a *Spirastrella*, identical partly with *S. papillosa* R. and D., and partly with *S. papillosa* var. *porosa* Dendy; two, *Spirastrella australis* and *Papillina ramulosa*, are, in virtue of their outward form and spiculation, likewise referable to *Spirastrella*, yet exhibit a character apparently not possessed by any other species of the genus; and the remaining two, *Raphyrus hixonii* and *Papillissa lutea*, belong to the genus *Cliona* (*sens. ampl.*). Vosmaer recently(50), after a comprehensive study of the genus *Spirastrella* based on numerous specimens, including the types of many of its described species, has expressed the opinion that, of the thirty-four (excluding the insufficiently described) species known to him, which are referable to this genus, all but two are to be regarded as no more than forms or "tropi" of a single species, *S. purpurea*. Of the three species of *Spirastrella* indicated above, *S. australis* was dismissed by Vosmaer as insufficiently described to admit of an opinion regarding it, and *S. ramulosa* (probably thought by him to be a species of *Cliona*) he does not mention; while *S. papillosa* (more especially its variety *porosa*), although taken into account by him, seems not to have received due consideration. Accordingly, in dealing with these species, even while not intending to furnish a detailed description of them in this paper, it seemed to me necessary that I should attempt to determine, if possible, whether they admitted or not of being specifically distinguished from *S. purpurea* (*sens. ampl.*). At the outset, little hope was felt of arriving at a definite conclusion, inasmuch as Vosmaer allows, in the case of this species, exceedingly wide variation in almost every character that can be utilised for species-differentiation; but though it was found impossible to come to a decision regarding *S. papillosa*, it very soon became evident that *S. australis* and *S. ramulosa* are species quite of a distinct kind; and, indeed, it is only provisionally that I refer them to the genus.

The peculiar and distinctive feature of these two species is their possession of a skeleton consisting in part of a system of exceedingly stout "fibres" which remain intact when the sponge is

macerated by means of caustic potash, and which consist of closely packed spicules held together by what appears to be a kind of connective tissue. A skeleton of similar nature, though of very different conformation, is possessed also by *Cliona hixonii*; but I have so far met with nothing of a like kind in any other of the species of *Spirastrella* that I have examined, nor has such a skeleton been mentioned by Vosmaer.* It would seem not unlikely, therefore, that *S. australis* and *S. ramulosa* are more closely related to *Cliona* than to *Spirastrella*; and the question arises as to what particular features are to be regarded as essentially distinguishing the two genera. To this question, I do not think a satisfactory answer can, at present, be given. The distinction recognised by Vosmaer is summed up in his statement that, "whereas the latter (*Cliona*) begins its post-larval life by boring into calcareous matter, *Spirastrella* never does so"; but although this may ultimately prove of value as a basis for separating the two genera, the fact remains that the life-history of most of the species included in the genus *Spirastrella* is as yet unknown to us. At present, the practical difficulty which presents itself is how to determine, in a given case, whether a massive sponge seemingly a *Spirastrella* has or has not been in early life a boring sponge; and in striking illustration of this, is the fact that Vosmaer himself has confounded with *Spirastrella purpurea* a species that undoubtedly should be referred to *Cliona*. I refer to *Spirastrella areolata* Dendy, which in the areolation of its surface and in its possession of spined microxea (apparently overlooked by Vosmaer) shows so close an analogy with *Cliona hixonii* as to render unquestionable the close relationship of the two. There is a number of species also unreferred to by Vosmaer—concerning which it is an entirely open

* I think it is exceedingly probable, however, that *Spirastrella robusta* (Carter) Dendy(14)—which was regarded by Carter as a variety of *Spirastrella cuncatrix*—will be found to possess an analogous type of skeleton. I have seen only a thin section of this sponge—one presented to the Australian Museum by Prof. Dendy—and although this is insufficient to provide unmistakable evidence of the presence of such "fibres," nevertheless the structure of the skeleton, as displayed therein, exhibits, on the whole, a marked similarity to that of *S. australis*.

question whether they belong to *Spirastrella* or *Cliona*; one may mention, for example, *Cliona phallica* Leidy(25), and several species described by Verrill(49), viz., *Heterocliona cribraria*, *Spirastrella mollis*, and apparently also *Polymastia varia*.

Having examined an undoubted example of *Spirastrella fibrosa* Dendy(14), from the type-locality, I agree with Vosmaer that this species does not belong to *Spirastrella*; I find it to be congeneric with the species described by me(15) under the name *Latrunculia conulosa*.

Spirastrella australis. (Pl. xv., fig.5; Pl. xvii., fig.3).

The species is well represented in the collection, both by a number of the original specimens and by others more recently obtained; among the latter, there is a single small one which differs from the rest in being of submassive form. The chief distinguishing characters of the species are its typically compressed plate-like form, its smooth and even surface without tubercles or papillæ, and the density and compactness of its substance; in addition to these, but becoming manifest only when the sponge has been macerated, is the reticulation of stout cord-like "fibres" forming the main skeleton. An adequate idea of the conformation of this skeleton may be obtained from the figure (Pl. xvii., fig.3). Apart from being lamellar, the sponge is without definite habit; occasional specimens are more or less regularly flabelliform. Contrary to the description, apparently in no case do oscula occur on either of the flattened surfaces of the sponge, but only along its margin; and these are of minute size. Lendenfeld's description of the canal-system, also, appears to me to be quite without value.

In thin sections cut transversely through the entire thickness of the sponge, the naked eye can distinguish (i.) a less compact middle region within which are denser areas corresponding to transected "fibres," and, on either side of this, (ii.) a more compact superficial layer of mottled appearance (because not uniformly dense), which extends to the surface and has a width of 1-2 mm. Under the microscope, the demarcation between these regions is indistinct, and what difference there is, in their appearance,

seems mainly to be due to differences in the closeness of aggregation of the spicules, and particularly of the microscleres, the abundance of which, throughout all parts of the sponge, constitutes a marked characteristic of the species.

The tylostyli are straight non-fusiform spicules, very gradually tapering throughout the greater part of their length, and, as a rule, terminating in a sharp point; their length ranges from (rarely) less than 390 μ to 610 μ, while the stoutest of them are 11 μ or 12 μ in diameter. The spirasters are separable into two groups: (i.) those which occur in great abundance throughout the whole interior, and (ii.) those which are almost exclusively confined to a very thin superficial layer of the sponge. The former are stout, with a straight axis, and with close-set large spines, which are not uncommonly as much as 20 μ in length, and are frequently more or less curved in the manner of a rose-thorn; inclusive of spines, these spicules measure 35 μ to 60 μ in length, by 30 μ to 55 μ in breadth. The spirasters of the second group, which are usually of much smaller size than the preceding, are very variable in form, and perhaps are divisible into several kinds; of chief importance concerning them, however, is the fact that they include forms much resembling the "lophasters" of *Timea lophastræa* Hentschel(**19**), as well as forms intermediate between such and spirasters of more typical shape.

Loc.—Port Jackson.

Papillina panis.

In connection with this species, a difficulty presents itself which, in spite of the fact that over a dozen specimens (all labelled as *Papillina panis* by Lendenfeld) are at hand, cannot be solved until additional material is forthcoming. The specimens, while extremely alike in all other essential respects, are in some cases provided with small oscula, in others instead with one or several sieve-areas; in no observed instance do both oscula and sieve-areas occur in the same specimen. So far as I can see, if there is another difference between the two forms, it lies in this, that, generally speaking, the oscula-bearing specimens are rather of conical or wedge-shaped form, while the sieve-bearing

specimens are low and broad, or (less frequently) more or less compressed into plate-like form, and have a flattened upper surface. In both forms, the oscula or the sieve-areas, as the case may be, occur on the upper aspect of the sponge. There can scarcely be any doubt that the form with oscula is identical with *Spirastrella papillosa* Ridley and Dendy, although the oscula are very much smaller than in the type of that species; while it is equally certain that the form with sieve-areas is identical with *S. papillosa* var. *porosa* Dendy(14) from Port Phillip. What I cannot decide is whether we have to do with a single form or with two distinct forms.

The sieve-areas, which measure several square inches each in extent, are free from the tubercles that occur in other parts of the surface, and are usually slightly depressed below the level of the surrounding surface; they are perforated by close-set circular pores (measuring from 75 μ to 160 μ in diameter, and between 100 μ and 200 μ in distance apart), and thus present an appearance very much resembling that of the pore-bearing surface of certain polyporaceous fungi (e.g., *Polystictus*). Possibly it is to these sieve-areas that Lendenfeld refers, when he speaks of "movable membranes" by which "for the most part" the "vents" are covered; but it is strange that he makes no reference to their perforate or sieve-like character. The "perforated membranes," or "inhalant pore-sieves," which he mentions as occupying the depressions between the papillæ, are different, and correspond to what is described by Dendy (*loc. cit.*) as a "beautiful pore-bearing membrane" stretched between the "conuli." This membrane has a minutely reticulate appearance, which, in some specimens, is very distinct, in others scarcely perceptible; but it is not, to the naked eye or even with the aid of a lens, "perforate" or "porous" in the sense of "sieve-like."

As far as I know, oscular sieve-areas in the genus *Spirastrella* have been observed only in *S. papillosa* var. *porosa*. Vosmaer makes no mention of the occurrence of anything of the kind in any of the numerous forms of *Spirastrella* studied by him; nor, by the way, does he comment upon their occurrence in *S. papillosa* var. *porosa*—an omission difficult to account for, since he

quotes this sponge in support of his reasons for regarding *S. papillosa* and *S. cunctatrix* as identical. There is good reason to believe, therefore, that *S. papillosa* var. *porosa*—even though it should prove to be merely a variant of *S. papillosa* – belongs to a species quite distinct from any other that Vosmaer would include under *S. purpurea*: as we have yet no proof that it and *S. papillosa* are connected by intermediate forms, and as the distinction between the two seems so definite, I am inclined to regard it as at least an independent variety.

Seeing that Vosmaer considers that no importance can be attached to the presence or absence of papillæ as an indication of specific difference, I may mention that every specimen of *S. papillosa* and of its variety I have seen, is not only provided with papillæ, but these always have the same characteristic appearance, and are always distributed over all parts of the surface except in the neighbourhood of the oscula or upon the sieve-areas. There may be considerable variability in the degree of development of these papillæ as regards their size, but scarcely any as regards their relative number; when least pronounced, they resemble those of the specimen figured by Vosmaer (Pl.iii., fig.5). Besides *S. papillosa*, I am acquainted with at least five that I believe to be quite distinct species of *Spirastrella*, and, in the matter of papillæ, no specimen of these makes any approach to *S. papillosa*.

The character of the papillæ in *S. papillosa* is such as to suggest that they are morphologically related to the papillæ and areolæ of *Cliona* (*Papillissa*) *lutea* and its allies; because of this, I am inclined to attach importance to the fact that, in many specimens, both of *S. papillosa* and of its variety, I have found incorporated, pieces of shell and other calcareous fragments which, in every case, showed the characteristic perforations due to a boring sponge.

It remains to be mentioned that, in connection with the two figures given in the "Catalogue"(Pl. i., figs.1-2), which purport to be in illustration of *Papillina panis*, a serious mistake has been made: the first is unmistakably a figure of *Cliona* (*Papillissa*) *lutea*, and the second is one of *Spirastrella*(?) *ramulosa*.

Papillina ramulosa. (Pl. xxii., fig.5).

In addition to the type-specimens, five in number and well-preserved, another example of the species (correctly labelled) is included among the fragments received from the British Museum.

As I already have had occasion to mention, a figure of a specimen of *Spirastrella*(?) *ramulosa* is given in the Catalogue (Pl. i., fig.2), but is wrongly indicated as being one of *Papillina panis*. In regard to the external features of the species, the original description may stand without amendment, except in one particular: the small circular openings scattered over the surface are not oscula, as Lendenfeld has stated, but simply holes due to the presence, here and there beneath the surface, of symbiotic operculate Cirripedes. These openings, then, are of the same nature as those which Lendenfeld also described as oscula in the case of *Cliona lutea*. In view of such an error, indicative as it is of extremely superficial and hasty observation, one need scarcely remark how little is the value to be attached to the statements concerning the minuter details of the canal-system. As in *S. australis*, the whole interior of the sponge, quite to the surface, is very dense, and canals are few and of small size. The largest canals, which run in an ascending direction, are usually very much less than 1 mm. in diameter; they are always easily traceable to immediately beneath the surface of the upper parts of the sponge, and some of them, at least, can be seen to terminate in very minute oscula.

The peculiar "fibres" composing the main skeleton, as revealed in a macerated specimen, are arranged dendritically; owing to their mode of branching, they exhibit a tendency to become restricted in their disposition to a limited number of vertical planes of branching, or, in other words, to be arranged in flabellate systems. They are from more or less strap-shaped to cylindrical, and (in the only specimen in which they were examined, one measuring 120 mm. in height) measure about 1 mm. in stoutness at the base of the sponge, and about 0·5 mm. at its top. Anastomosis between the "fibres" occurs, but it is not very frequent, except in the older portions of the sponge.

Between the "fibres," megascleres are scattered in profusion and without apparent order. Spirasters likewise occur in all parts, but only in moderate abundance (as compared with those of *S. australis*) except at the surface, where they form a dense layer varying in width from about 100 μ to 450 μ.

The tylostyli are typically straight, and are usually more or less rounded off at the apex, so as occasionally to resemble tylostrongyla; the largest vary in length, in different specimens, from 440 μ to 560 μ and are about 11 μ in diameter. The spirasters are roughly divisible into two groups: (i.) those of larger size and more regular and typical form, provided with large spines, which comprise the majority of the microscleres scattered throughout the interior of the sponge; and (ii.) those of smaller size and variable form, with comparatively small spines, which chiefly compose the dermal crust. The largest of the former measure 45 by 8 μ, exclusive of spines; and their spines are, at most, 12 μ in length.

Remarks.—I have carefully examined many of the Cirripede-shells that occur in the specimens of this species, but in no case have I been able to detect (as in *Cliona lutea*) any sign of their perforation by the sponge.

Loc.—Port Jackson.

Raphyrus hixonii. (Pl. xvi., figs. 1, 2).

This species, so far known only in the free or raphyroid stage, is conspicuously characterised by a beautifully regular areolation of the surface (Pl. xvi., fig. 1), the areolæ being circular in outline, of diameter varying (gradually) over different parts of the surface from 3 to 6 μ, and placed at intervals apart of from 2 to 3·5 μ; the pattern of the areolation, when viewed from a distance, consequently appears hexagonal. Judging from the material at my disposal, which consists of some half-dozen large pieces of the original specimens (including the piece figured by Lendenfeld), and a small complete specimen obtained recently, the areolæ—except rarely and apparently abnormally—are situate on a level with the general surface, and are distinguishable to the eye only by reason of their difference in colour from the intervening areas;

only over a limited portion of the surface of one specimen are the areolæ at all depressed and pit-like. Accordingly, in conveying the impression that the reticulation of the surface is produced entirely by a "network . . . . of projecting lines" with "polygonal meshes" in which are "depressions about 4 or 5 mm. deep," the original description is quite misleading: one can see, indeed, from the figure in the "Catalogue" (Pl. i., fig. 3) how free from any pitted appearance is the portion of the surface therein shown.

The description is inaccurate also in several statements regarding the excurrent canal-system. We are told that vents are scattered over the surface and lead into short conic tubes, which are not oscula but præoscula; that these "short" (*sic*) tubes, which in the case of the original specimen are "nine in number and measure 250 mm. long by 20 mm. wide at the mouth," have their walls covered throughout by a reticulation similar to that of the exterior surface; and that proper oscula, 2 to 10 mm. in diameter, are scattered over the whole surface, including the sides of the conic tubes. After the most careful examination of the several specimens, I can find no reason to doubt (what, even at first sight, seemed most probable) that all the tubes referred to, including those leading from the so-called oscula, are nothing more than excavations made by crustaceans and other boring organisms, a considerable number of which are still present in most of the tubes; it is significant, also, that many of the smaller tubes are entirely filled with sand and mud. The tubular excavations are everywhere lined with a dense tough rind, often exceeding 1 mm. in thickness, composed almost entirely of closely packed megascleres; on no part of their wall, have I seen any trace of areolation.

If the soft tissues be removed by means of a macerating agent, there remain (Pl. xv., fig. 2) finally (i.) the rind-like cortical layer forming the outer surface; (ii.) the rind which lines the above-mentioned cavities; and (iii.) extending through the whole interior, a coarse network of somewhat flattened or strap-shaped trabeculæ, similarly constituted to the "fibres" of *Spirastrella australis* and *Spirastrella*(?) *ramulosa*, which are ordinarily 0·5 mm. to 1 mm. broad, and enclose meshes, on the average, several millimètres in

width. In reference to the pattern of this network, I need only mention here that, in the peripheral layer of the sponge, to a considerable distance below the surface, the trabeculæ are so arranged as to form incomplete boundaries between elongated "cells," the outer ends of which correspond in position with the areolæ of the surface, and the disposition of which, relatively to one another and to the exterior, is exactly similar to that of the cells of a honeycomb. In the case of the small specimen before me, the trabeculæ forming these cells still retain their separate individuality, thus enabling one clearly to distinguish between (i.) main ones, relatively few in number, running in the longitudinal direction of the cells, *i.e.*, perpendicularly to the surface, and (ii.) more numerous transverse or connecting ones; but in the large (and older) specimens, presumably as the result of the increase in width and gradual concrescence of the trabeculæ, and of the consequent reduction (even to the point of complete obliteration) of the intervening meshes, the condition is such that the cells are divided from one another by almost or quite comp'ete partitions, and thus bear a structural likeness to the cells of honeycomb, which is almost perfect.

The cortical rind, which is of very firm, dense, and fairly tough consistency, varies in thickness, in the different parts of the surface, from about 0·5 mm. to upwards of 1 mm. In the macerated sponge, it separates from the underlying skeleton with the greatest ease, and is then seen to be not less thick, or scarcely less thick, at the position of the areolæ than elsewhere; accordingly, the original description seems again to be at variance with fact, when it speaks of "membranes which extend in the meshes of the surface-network," and mentions, further, that these membranes have "groups of small pores" situated in them and are "very thin and delicate." The skeleton of the cortex, apart from a thin external layer of microscleres (of the two non-oxeote kinds) consists of closely packed tylostyles, the most superficially situated of which are disposed vertically to the surface; within the circular meshes or areolæ, the skeleton is much less dense, and the cortex is, consequently, much softer than in the intervals between.

Spicules. – The tylostyli are straight or nearly so, gradually sharp-pointed, and of approximately uniform diameter throughout more than three-fourths of their length; are usually provided with a phyma of moderately large size, which is of very variable shape, and is frequently asymmetrical and misshapen; and measure from 330 to 450 μ in length by 12·5 μ, at most, in diameter. Styli, of similar dimensions, occur, but are comparatively rare. The microscleres are of three kinds: (i.) spirasters of variable form; frequently with a straight or nearly straight axis; with usually more or less radially disposed, not numerous, spines, the length of which is not greater than the diameter of the spicule; rarely more than 30 μ long; and in different specimens varying in maximum diameter from 5 to 7 μ, exclusive of spines. (ii.) Minutely and closely spined, generally straight, truncately-ended rods; 7 to 19 μ in length; and seldom more than 3 μ in diameter, inclusive of spines. (iii.) Sharp-pointed slender acanthoxea; with a not very pronounced, elongate, median, spiral flexure of usually less than one complete turn; with linearly and usually spirally arranged, sharp, slender spines, the length of which sometimes exceeds the diameter of the spicules; varying in length from 55 to 110 μ; and rarely more than 2·5 μ in diameter.

Loc.—Port Jackson.

Remarks.—I regard this species, provisionally, as belonging to a subgenus of *Cliona*, having as its type *Papillissa lutea* Lendf., and including *Spirastrella areolata* Dendy(14).

Very closely allied to *Cliona hixonii*—although to be regarded, I think, as a quite distinct species – is another large sponge from Port Jackson (represented in the Australian Museum by a single specimen), in which (Pl. xvi., figs.3, 4), instead of a simple areolation of the surface, there are low papillæ of very uniform size, shape, and distribution, and more widely separated from one another than the areolæ of *C. hixonii*; and in which, also, the microscleres corresponding to those termed by me spirasters in the above description, are comparatively short and stout, and provided with close-set, fairly large spines that often show a tendency to assume a whorled arrangement.

Topsent(46), in describing *Cliona celata*, has drawn attention to a number of points of resemblance between it and *C. hixonii*, and expresses the opinion that "un rapprochement entre les deux espèces est tout indiqué." The additional information which I have furnished concerning the microscleres of the latter, shows, however, that there is not such a close analogy between the spiculation of *C. celata* and that of *C. hixonii* as Topsent supposed, and particularly is it questionable whether the oxea "lisses, acérés aux deux bouts, légèrement courbés, très fins" of the former are homologous with the acanthoxea of the latter.

In their possession of a vestigial spiral flexure, and of spines linearly and in some degree spirally disposed, the acanthoxea of *C. hixonii*, as well as those of the next-described species (*C. lutea*),* exhibit characters which render it practically certain that they are derivatives of spirasters. They are, thus, quite unlike the acanthoxea of such species as *C. vastifica* Hancock, *C. stationis* Nassanow, and *C. velans* Hentschel, which are quite devoid of any sign of spirality, which are provided with numerous very minute uniformly distributed spines, and which frequently exhibit a centrotylosis; the latter spicules, indeed, are regarded by Topsent as belonging to the category of megascleres. I consider it exceedingly probable, therefore, that acanthoxea have originated in the genus *Cliona* in two independent ways; and it is possible that those of *C. vastifica*, etc., are derived from smooth oxea such as do occur in some species of *Cliona*, and which perhaps are of common origin with the tylostyli.

Papillissa lutea. (Pl. xviii., figs. 1, 2)

Though I do not doubt that the several specimens labelled *Papillissa lutea*, in Lendenfeld's handwriting, are genuine examples of the species, I am at a loss to account for the absence of any reference in his description to the fact that they are

* In *Cliona areolata* (formerly known as *Spirastrella areolata*) also, of which species I have seen a mounted section presented to the Australian Museum by Professor Dendy, the acanthoxea are undoubtedly spiraster-derivatives; and, in the case of *C. margaritifera* Dendy(15), an actual transition between acanthoxea and spirasters has been recorded.

almost completely packed throughout with the shells of operculate Cirripedes, and I cannot understand how, under the circumstance, Lendenfeld was able to speak with confidence concerning the arrangement of the canals. One can only assume that he looked upon the inclusion of the shells as fortuitous, and on that account scarcely worthy of mention, and that his opinion regarding the canal-system was arrived at by inference rather than actual investigation. The most considerable mistake, however, made by Lendenfeld in connection with this species, lies in the fact that a specimen of it has been figured by him in the Catalogue (Pl. i., fig. 1) as *Papillina panis*.

In agreement with the description of the species, the type-specimens are massive, irregular, more or less laterally expanded (*i.e.*, depressed) sponges of moderate size, are covered with papillæ (of variable size and distribution), are of a yellowish-white colour in spirits, and (in some cases) exhibit circular oscula-like openings scattered irregularly over the surface. Lendenfeld says of these openings, or "vents" as he terms them, that they are not true oscula, but "lead into a system of vestibular lacunæ which occupies the interior of the sponge": in view of the fact that, in almost all other respects, the specimens afford practically indisputable evidence of their identity with *Papillissa lutea*, I venture to say that, as regards the nature of the "vents," Lendenfeld was entirely in error. In every case, I have found that these openings are situated each immediately above the orifice of an inhabited Cirripede-shell; and it is clear that they are simply the means whereby the crustaceans maintained communication with the exterior. All indications point to the fact that, with continued growth of the sponge, these openings gradually become closed over and finally disappear from external view.* It is

* At the time of writing the above, I was inclined to attach some importance to the presence of these Cirripedes, thinking it likely that the case was one of regular symbiosis; but I have since observed sporadic occurrences of a similar association in various species. Owing to the abundance of these shells in the specimens, I have not been able to determine, with certainty, whether *C. lutea* possesses anything analogous to the trabecular skeleton of *C. hixonii* or not.

interesting to note that many of the shells, even in the upper part of the sponge, are penetrated by tubular excavations similar in nature to those produced by other species of *Cliona*.

Spicules.—The tylostyli are straight or nearly so, gradually sharp-pointed, and of nearly uniform diameter throughout three-fourths or more of their length; they are provided with a rather large phyma of variable but usually symmetrical shape, which is often surmounted by a smaller dome; and they measure from about 300 to 490 μ in length by 13 μ in maximum diameter. Occasional styli of the same dimensions are met with. The microscleres are of three kinds: (i.) spirasters, of variable form; usually with a nearly straight axis; provided with spines of medium length, rarely exceeding the diameter of the spicule, and more or less spirally disposed; rarely less than 25 or more than 45 μ in length; and measuring up to 6 μ in stoutness, exclusive of spines. (ii.) Cylindrical, slightly undulating or spiral, truncately-ended, very minutely and closely spined rods; seldom less than 10 μ or more then 30 μ in length; and rarely exceeding 3 μ in diameter, exclusive of spines. (iii.) Spined microxea; similar to those of *Cliona hixoni*; 55 to 110 μ in length.

Loc.—Port Jackson.

Remarks.—For reasons indicated in my remarks on *Cliona hixoni*, I propose that *Papillissa* be provisionally retained as a subgenus of *Cliona*.

Familia SUBERITIDÆ.

In addition to *Plectodendron elegans*, dealt with below, there is described in the Catalogue, under this family, a species, recorded from Port Jackson and the South Coast of Australia, to which Lendenfeld attached the name *Suberites domuncula* Nardo. The identity of this sponge, I have been unable to determine. A specimen labelled, in Lendenfeld's handwriting, "*Suberites domuncula*, Port Jackson," is preserved in the Australian Museum, and a fragment of a specimen, bearing the same name and locality, has been received from the British Museum; but these agree neither with the description given nor with one another,—although both, how-

ever, are examples of species of *Suberites*, and both exhibit much the same pattern of skeleton as that apparently of the species described. For one thing, their spicules are too large, —the maximum sizes of these, in the two cases, being respectively 800 by 14 μ and 1040 by 19 μ, as against 700 by 8 μ, the size stated by Lendenfeld ; and in addition to this, the spicules of the second (*i.e.*, the British Museum) specimen are *not* "constricted below the bulb," and are almost as frequently *rounded off* at the apex as they are "sharp-pointed," while those of the first-mentioned, although actually narrowed towards the base and gradually sharp-pointed at the apex, are characterised, not by a "spherical bulb," but by one, the surface of which, as a rule, is uneven and somewhat tuberculate. Lendenfeld also states, concerning the spicules, that "the bulb is situated a little below the termination ; the truncate end of the spicule appears as a slight centrally situated excrescence of the bulb" ; but in neither of the specimens do the spicules exhibit such a peculiarity, save exceptionally.

Nevertheless, in view of the frequently only rough approximation to accuracy of the measurements and descriptions of spicules given in the Catalogue, I should, perhaps, have been disposed to regard the Australian Museum specimen as a genuine example of the species, but for the fact that it also fails to comply with the description in certain additional respects. The description states that the sponge "always forms the abode of a crab" ; that the largest Australian specimens measure only 35mm. in breadth and 15mm. in height ; and that the main exhalant canals, 1mm. wide, "are not rare in the interior and pour their contents into the wide and short oscular tube." On the other hand, the specimen is merely borne loosely (in the form of a thick concave plate) upon the back of a crab ; measures 60mm. long by 45mm. broad ; and is without apparent oscula or canals visible to the naked eye. This specimen is apparently of the same species as one in the British Museum labelled "*Suberites lamella*, Port Jackson."

There is also included, among the fragments received from

the British Museum, a tiny piece labelled "*Suberitella laxa*, Port Jackson," the spicules of which correspond to the description of those of the so-called *Suberites domuncula* exactly in every way, excepting that they never attain to more than 300 μ in length. It would be interesting to know whether this sponge agrees with the description of the species in question in other respects; if it does, one would be justified, I think, in identifying the latter (as recorded from Port Jackson) with it.

PLECTODENDRON ELEGANS. (Pl. xviii., fig. 1).

In the pattern of its skeleton and the form of its spicules, *Plectodendron elegans* bears an almost exact resemblance to a species, represented in the Australian Museum by two specimens from N.W. Australia, which I unhesitatingly identify as *Caulospongia verticillata* Kent(22); as the two species are congeneric, and each is the type of its genus, *Plectodendron* is, consequently, a synonym of *Caulospongia*. Kent described also, from an unknown locality, *Caulospongia plicata;* and Bowerbank (3a) described, at a later date, as new, from Western Australia, *Chalina verticillata;*—both of which species appear to me to be identical with *Caulospongia verticillata*. In spite of these several descriptions of its type-species, the genus *Caulospongia*, for some reason, never gained recognition, and since the time of its erection (1871) has apparently received no other mention than that by Vosmaer(50), who lists it among the genera, the systematic position of which "absolut unsicher oder unbekannt ist," and that by Topsent(46), who quotes it as a synonym of *Semisuberites* Carter(4); but for this identification, there appears to be no foundation.

The main skeleton, in the several species of *Caulospongia* known to me, is a very irregular, small-meshed reticulation of spicules and spiculo-spongin fibres, some of which fibres are stout and densely multi-spicular: the pattern of the skeleton is such that, if the stouter fibres were absent, one might describe it as confusedly renieroid. In *C. elegans*, spongin is

barely more than sufficient in quantity to bind the spicules together; but in another (undescribed) species, it is developed fairly abundantly and forms a well-defined sheath to all but the slenderest fibres. The spicules are of a single kind, and of characteristic form; they are tylostyli with a much depressed phyma, which makes them appear nail-shaped. Of the dermal skeleton of *C. verticillata* I cannot speak, since both specimens at my disposal have the surface completely abraded; but in *C. elegans*, and in the undescribed species, (which comes from the south coast of Australia, and in habit somewhat resembles *C. elegans*), there is a well-defined dermal membrane containing tangential, reticulately-arranged spicules and provided also with slightly projecting spicules directed vertically. The dermal membrane of *C. elegans* is thin and translucent; that of the undescribed species is much more densely charged with spicules, and, in the dry sponge, appears as a well-marked, easily separable, whitish pellicle.

This combination of characters, to which might be added the non-massive external form of the sponge(Pl.xviii., fig.1), definitely distinguishes *Caulospongia* from any other genus of the *Suberitidæ*. Indeed, owing to the considerable degree of development of spongin, it is somewhat doubtful whether the genus really is related to the *Suberitidæ*, although in *Laxosuberites*, spongin, in small amount, is said to occur.

Lendenfeld's description of *C. elegans* is, in the main, correct, and is sufficient to enable the species to be identified: in the type-specimens, the spicules measure from (rarely) less than 140 μ to 220 μ in length, and attain 11 μ in diameter

Loc.—Port Jackson.

Familia CHONDROSIDÆ.

Chondrosia collectrix.

Introductory.—The type-specimen, allowance being made for its being only a portion of the original, is consistent in every way with the description except as regards colour, and perhaps also certain features of the canal-system—more espe-

cially those involved in the statement that "subdermal cavities are found in the shape of tangentially extended canals 0·2 mm. below the surface, which are, on an average, 0·17mm. wide, and connected with inhalant pores on the outer surface by straight or curved canals, 0·024mm. in diameter." The presence of these subdermal spaces, canals, and pores, I have been unable to demonstrate; but the sponge is so loaded with foreign matter, including abundant and often large sand-grains, that thin sections are possible only after prolonged desilicidation, and it is then very difficult to distinguish between spaces proper to the sponge and those due to particles removed. I have found another (apparent) example of the species, however, which, throughout considerable portions of the interior, is comparatively free from inclusions; and this differs from the type-specimen in other respects also. It has been described by Whitelegge(56) under the name *Reniera collectrix*, of which species it is labelled as the type; for the reasons given below, I am of opinion that it is correctly labelled so, and accordingly hold *Chondrosia collectrix* and *Reniera collectrix* to be synonymous.

Description.—The sponge is provided with a thin cortex, not easily separable nor distinctly marked off from the underlying tissue, which is of a pale greyish or dirty-white colour, and generally about 0·2 or 0·3mm. in thickness. In the type-specimen of *Reniera collectrix*, the colour of the choanosome, where not disguised by foreign inclusions, is brownish-yellow, and this is in accordance with Lendenfeld's statement regarding the internal colour of *Chondrosia collectrix;* but in the type-specimen of the latter species, the colour is greyish, and scarcely different from that of the cortex. The two specimens also differ very considerably in consistency. The former, where most free from inclusions, is dense, fleshy, firm, and fairly tough; but the latter, owing to the abundance and mainly arenaceous nature of the foreign elements, is, for the most part, hard and gritty. The "slightly conulated" appearance of portions of the surface, referred to by Lendenfeld, is

merely an unevenness due to the presence, close below the cortex, of occasional, rather large grains of sand, etc.; what other inequalities of the surface there are, appear to be the result rather of irregularity of growth than of any definite tendency or habit of growth. Oscula, or openings resembling oscula, were observed only in the complete specimen; they are situated in two small groups, and in each group are closely arranged, and of variable diameter up to 2·5mm. The canals traversing the sponge are comparatively few in proportion to its mass, and at most only about 1mm. in diameter.

(The following brief account of the minute anatomy is intended mainly only as a guide to the identification of the species. A fuller description is necessary, but is scarcely possible with the material at my disposal, the condition of preservation of which, after nearly thirty years in spirit, leaves much to be desired.).

The cortex is without fibrous tissue, and consists of a kind of chondrenchyma. The mesoglœa is very extensively developed and characterised by a peculiar vesicular structure due to numerous very distinctly outlined, apparently empty, oval cells (cystencytes), which are arranged in clusters rather than uniformly distributed, and measure 15 μ to 20 μ in diameter. There is no proper skeleton, nor anything of the nature of connective tissue fibres. The chamber-system appears to be eurypylous. The flagellated chambers vary in shape, from oval to nearly spherical; in the type-specimen, presumably owing to contraction, they are very seldom much more than 30 μ (yet may attain to 40 μ) in diameter; but in the other specimen (*Reniera collectrix*), they are usually between 35 and 40 μ in diameter, while a certain few, which are more elongated and relatively narrower than the others, measure 45 by 30 to 35 μ. Inside most (if not all) of the smaller canals, lying in contact with, or in close proximity to, their wall, there occur a variable number of irregularly rounded cells, measuring 10 to 12 μ in diameter; the nature of these is not clear, but possibly they are algæ.

Loc.—Port Jackson.

Remarks.—Whether the species belongs naturally to *Chondrosia*, is doubtful; but it conforms more closely to the definition of that genus than of any other, and there is scarcely sufficient ground to warrant the introduction of a new genus for it.

It is quite possible that the differences between the two specimens described may prove to be specific.

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EXPLANATION OF PLATES XV.-XXIV.

Plate xv.

Fig.1.—*Sollasella digitata* Lendenfeld; ($\times \frac{2}{3}$).

Fig.2.—*Sollasella digitata* Lendenfeld, from the type; ($\times \frac{2}{3}$).

Fig.3.—*Donatia fissurata* Lendenfeld; (slightly reduced).

Fig.4.—*Donatia phillipensis* Lendenfeld; surface-section showing the dermal reticulation, the primary meshes of which are subdivided (by lines of tylasters) into smaller meshes, each enclosing a pore; ($\times 18$).

Fig.5.—*Spirastrella*(?) *australis* Lendenfeld; a flabellate example; ($\times \frac{1}{2}$).

Fig.6.—*Polymastia zitteli*, from the type of *Sideroderma zittelii* Lendenfeld; (nearly nat. size). The specimen is in a fragmentary condition.

Plate xvi.

Fig.1.—*Cliona* (*Papillissa*) *hixoni*, from the type of *Raphyrus hixonii* Lendenfeld; portion of the exterior, showing the character of the surface-areolation; ($\times \frac{3}{4}$).

Fig.2.—*Cliona* (*Papillissa*) *hixoni*; showing the skeleton (after maceration by means of caustic potash) of a thick slice of a small specimen; (nat. size).

Figs. 3-4.—*Cliona* (*Papillissa*) sp., allied to *Cliona hixonii*; portions of the concave and convex surfaces respectively of a specimen having the form of a thick, curved plate, showing the character and arrangement of the surface-papillæ; ($\times \frac{3}{4}$).

Plate xvii.

Figs. 1, 2.—*Cliona* (*Papillissa*) *lutea*, from the types of *Papillissa lutea* Lendenfeld; ($\times \frac{1}{2}$).

Fig. 3.—*Spirastrella*(?) *australis* Lendenfeld; showing the skeleton (as prepared by maceration by means of caustic potash) of the specimen illustrated in Pl. xv., fig. 5; ($\times \frac{1}{2}$).

Fig. 4.—*Amorphinopsis megarrhaphea* Lendenfeld; dermal skeleton; ($\times 8$).

Fig. 5.—*Amorphinopsis megarrhaphea* Lendenfeld; pattern of the skeleton as shown in portion of a moderately thin section ($\times$ 10 approximately).

Fig. 6.—*Tedania digitata* var. *rubicunda*, from the type of *T. rubicunda* Lendenfeld; ($\times \frac{1}{2}$).

Plate xviii.

Fig. 1.—*Caulospongia elegans*, from the type of *Plectodendron elegans* Lendenfeld; ($\times \frac{2}{7}$).

Fig. 2.—*Axiamon folium*, sp. nov.; ($\times \frac{4}{9}$).

Fig. 3.—*Axiamon folium* (var.?); ($\times \frac{4}{9}$).

Fig. 4.—*Hemitedania anonyma* Carter; from a specimen of somewhat cartilaginous consistency, and with coarse-fibred skeleton; ($\times \frac{1}{2}$).

Plate xix.

Fig. 1.—*Hemitedania anonyma* Carter, from a specimen labelled as the type of *Halichondria rubra* Lendenfeld; ($\times \frac{3}{4}$).

Fig. 2.—*Hemitedania anonyma*; from a macerated, coarse-fibred specimen; ($\times \frac{1}{2}$).

Figs. 3, 4, 5.—*Hemitedania anonyma*; illustrating various forms assumed by examples of this species; ($\times \frac{1}{2}$ approximately).

Plate xx.

Fig. 1.—*Chalina finitima* Whitelegge (non Schmidt); an incomplete specimen.

Fig. 2.—*Phlæodictyon ramsayi*, from one of the co-types of *Rhizochalina ramsayi* Lendenfeld; illustrating a specimen of irregular shape provided with *many* root-like processes.

Fig. 3.—*Phlæodictyon ramsayi* var. *pyriformis* (var. nov.); portion of the upper surface showing the sieve-like area formed by the closely apposed oscula; ($\times \frac{2}{3}$)

Figs. 4-5.—*Phlæodictyon ramsayi*; tangential sections close beneath the surface, showing the pattern of the reticulation formed by fibres of the bast-layer in the wall of the fistula and in between the fistulæ respectively; ($\times$ 10).

Plate xxi.

Figs. 1, 2, 3, 4.—*Stylotella agminata* Ridley, from type-specimens of *Stylotella digitata* Lendenfeld, and of *Tedania laxa* Lendenfeld; (× ½ approximately).

Fig. 5.—*Stylotella agminata* Ridley; further illustrating the variable habit of the species.

Plate xxii.

Fig. 1.—*Axinella aurantiaca* Lendenfeld; longitudinal median section taken at the extremity of a thin branch; (× 15).

Fig. 2.—*Stylotella agminata* Ridley; longitudinal section taken at the extremity of a branch; (× 12).

Fig. 3.—*Histoderma actinioides*, sp. nov.; (× ⅔ approximately).

Fig. 4.—*Phlœodictyon ramsayi* Lendenfeld, var. *pyriformis* (var. nov.); inner surface of longitudinally bisected specimen, showing disposition of oscular canals; (× ⅔).

Fig. 6.—*Spirastrella*(?) *ramulosa* Lendenfeld; showing the skeleton which remains after maceration by means of caustic potash; (× ⅔).

Fig. 6.—*Raspailia tenella* Lendenfeld; longitudinal median section taken at the extremity of a branch; (× 12).

Fig. 7.—*Raspailia gracilis* Lendenfeld; longitudinal section of a branch; (× 9).

Plate xxiii.

Fig. 1. *Raspailia gracilis*, from the type of *Axinella hispida* var. *gracilis* Lendenfeld; (× ¾).

Figs. 2-3.—*Raspaila tenella*, from the types of *Axinella hispida* var. *tenella* Lendenfeld; (× ¾ approximately).

Fig. 4.—*Raspailia agminata*, sp. nov.; from the specimen wrongly figured in the Catalogue (Pl. ii., fig. 1) in illustration of *Halichondria rubra*, var. *digitata* Lendenfeld; (× ¾).

Fig. 5.—*Chalinodendron dendrilla* Lendenfeld; (× ⅘).

Plate xxiv.

Fig. 1.—*Mycale* (*Paresperella*) *penicillium* Lendenfeld; dermal skeleton; (× 18).

Fig. 2.—*Tedania digitata* var. *rubicunda* Lendenfeld; dermal skeleton; (× 18).

Figs. 3, 4, 5.—*Hemitedania anonyma* Carter; dermal skeleton; (× 18).

Fig. 6.—*Mycale serpens* Lendenfeld; dermal skeleton.

Figs. 7, 8.—*Axiamon folium*, sp. nov.; pattern of the skeleton as shown in moderately thin sections. Fig. 7, (× 10).

THE BONDI ANTICLINE.

By C. Hedley, F.L.S.

(Plates xxv.-xxvii.)

To ascertain the quality and position of coal-seams beneath and inland from Sydney, a series of bores were drilled to a great depth. As a result, the conformation of the remotely underlying strata is unusually well known in this neighbourhood.

Sections* composed from these borings develop a central basin rising to the coast on the one side, and to the Blue Mountains on the other. This basin is here regarded as the lap of a fold. Had the basin existed before the deposition of the strata it contains, then salt would have accumulated in an area of internal drainage below sea-level. Further, the steep slope, on the western side, of about five thousand feet in forty miles would have thrown brisk streams, and would not have supported such swamps as grew the coal. Consequently, the bowed strata were not laid down in their present attitude, but on an almost level surface. So considerable deformation of the original coal-horizon has therefore happened. Since drawing the following sketch, it occurs to me that the watershed, on which was laid down the Hawkesbury Sandstone, might have descended inland westwards, while the granite mountain-range, whose waste supplied its materials, was situated seawards and to the east. This would harmonise with deeper, coarser deposits on the east becoming finer and thinner on the west.

Compressive crustal action has already been suggested (*ante*, xxxvi., p.14) as an agent competent to effect the changes that have taken place. On this hypothesis, both the coal and the succeeding shale and sandstone were spread evenly on an almost level floor, and by subsequent earth-movements were compressed and bent, first into smaller, then into larger, folds—wavelets on a wave (text-fig. 1).

* Carne, Mem. Geol. Survey N.S.W., Geol. vi., 1908, p.160.

Various alternations of Wianamatta shale and Hawkesbury sandstone indicate the former, while the latter are represented

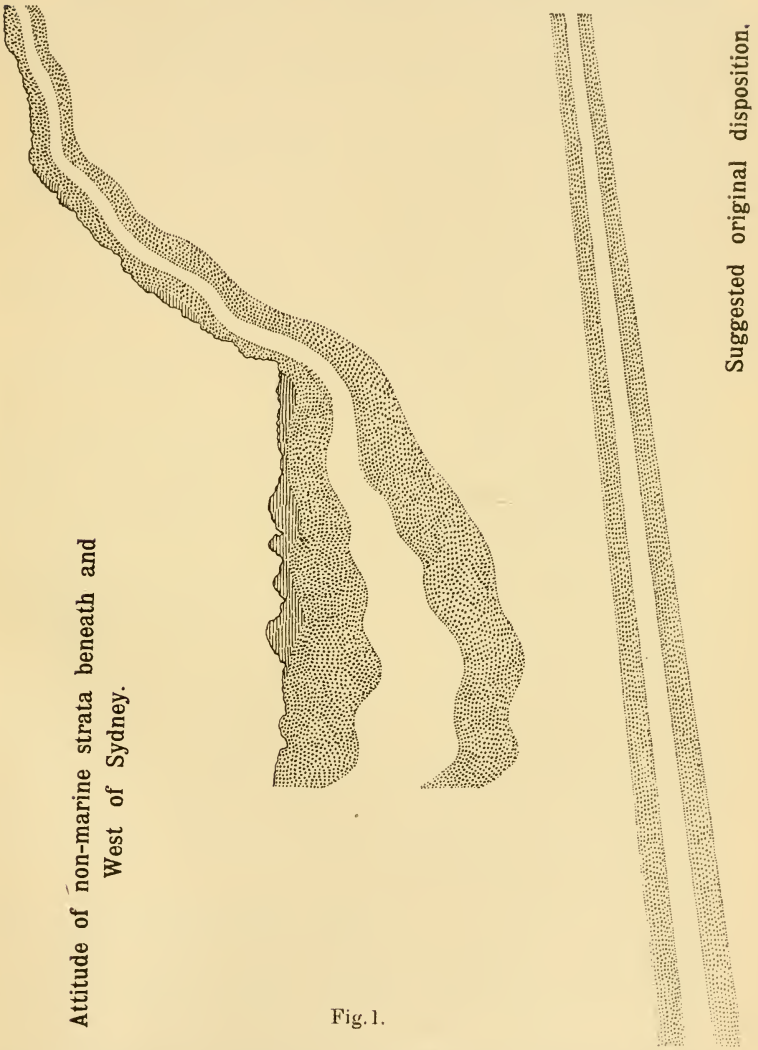

Fig. 1.

by the anticlinal ridge of the Blue Mountains and by the synclinal trough from Blacktown to Campbelltown. The strata

rising with increased rapidity near Sydney* point to the completion of the series by an anticline on the east. It is proposed to name this the Bondi Anticline. Apparently its crest lay beyond the present coast, and though now shattered and sunk, may yet be traced from its dyke-complex, and from the crushing of the rocks before it.

In its prime, the Bondi anticline probably rose to a considerable height, for denudation has pared off from its flanks the Wianamatta shale and some sandstone as well. The drowned valley of Port Jackson indicates recent subsidence; so that the anticline sank, perhaps through the withdrawal of a fluid core, perhaps through being involved in another and larger folding movement, or perhaps through faulting.

Evidence in support of this idea is offered from the radiating dykes and from the crushing of the shale.

(1) *The radial dykes.*—Around Sydney, the sandstone-rocks are fissured by a series of dykes, some of which run roughly north and south, and others cross at about right angles. Both are of later date than the crushing of the shale, as they traverse the distorted strata indifferently.

It was remarked by Mr. G. A. Waterhouse that the easterly and westerly series assumed a radial direction, and converged to a point east of Bondi.†

If the Bondi anticline swelled to bursting point and then cracked lengthwise and crosswise, these dykes would be the casts of those cracks (Plate xxv.). By their direction, the hypothetical anticline might be restored as a crescent billow convex to the present coast and rising in the centre. When pressure was relieved by the bursting of the lava into dykes, the folding movement was perhaps arrested.

(2) *The mashing of the anticline.*—In the composition of the Hawkesbury Sandstone, the Rev. J. E. Tenison-Woods distinguished a smaller stratification, whose lines are mostly inclined to the horizon, as "laminæ," and a greater division,

* David & Pittman, Journ. Roy. Soc. N. S. Wales, xxvii., 1893(1894), p. 459.
† Morrison, Rec. Geol. Survey N.S.W., vii., 1904, p. 261.

including one or more series of laminæ, as "layers." Between these layers, there is often a bed of shale. This shale may be yards in thickness, reduced to a thin sheet or spattered about in discs and pebbles.

Near Sydney, the lip of the basin bearing the brunt of the pressure, the shale is rarely undisturbed. Frequently, it rests on a floor which curves abruptly up and down, and underlies a roof which, in a short space, makes equally sudden contortions (Plate xxvi.). From its nature, the shale, deposited horizontally in calmest pools, could not have formed on such a floor or under such a roof. Into present positions the shale has slid over a strange floor, and been wedged under a misfit roof. Sometimes a shale bed thinning out is continued by a stream of biscuit-shaped flakes. These are morsels chewed in the jaws of the sandstone layers. Fish-remains are abundant in some shale-beds, and such are usually distorted by a very slow oblique pressure they have undergone. The sudden bumping of stranded icebergs could not account for the screwing these fossils have received. Besides, under floating ice the shale would disintegrate rather than bend or break. Pressure, too, is perhaps expressed by the readiness of exposed shale to crumble away, due to the breaking of its grain.

The butter would ooze out, if pressure were put upon a pile of slices of bread and butter. So where hard sandstone and soft shale were squeezed together, the shale first gave way, and thus furnishes the most obvious evidence of displacement. To some extent, the false bedding disguised dislocation, but, though less apparent, the sandstone exhibits its own signs of disturbance. Continually it falls in belly-sags, and rises in back-humps, the imprint of thrust-movements. Layers are rolled over or telescoped into each other, and in places the sandstone is curled like carpenter's shavings (Plate xxvii.).

Such phenomena are well known. Mr. C. S. Wilkinson* described disturbed beds at Fort Macquarie, Woolloomooloo, and Flagstaff Hill, where there were "angular boulders of the shale

* Wilkinson, Journ. Roy. Soc. N.S.W., xiii., 1879(1880), p.106.

of all sizes up to twenty feet in diameter, embedded in the sandstone in the most confused manner": also rounded pebbles of shale "usually oval in shape and embedded in such a manner that the longer axis of the pebble is nearly always inclined, or dips towards the South-west." In his matured opinion, these rocks were broken and pushed by the movement of ice.*

Contorted beds at Coogee were figured and described by Prof. David,† who accepted Mr. Wilkinson's explanation that the disturbance was caused by the grounding of contemporary icebergs.

Objections to this theory were raised by the Rev. J. E. Tenison-Woods,‡ who contended that the usual accompaniments of ice-action, such as transported and engraved stones, moraines, till, glacial mud, or boulder clay, are here absent. He considered that the breaking and scattering of the shale might have been accomplished by the floods of contemporary streams.

Mr. R. D. Oldham‖ was not convinced that the evidence advanced by Mr. Wilkinson proved the presence of glaciers.

Neither afloat nor aground does ice work thus. Transported rocks, so constant a feature of ice, and so easy to detect, are absent here. It is now submitted that neither ice-action nor contemporaneous denudation satisfactorily explains the crushed shales. On the contrary, it is thought that their injuries were received when they were caught in the press of the Bondi anticline, and ground between moving masses of sandstone, and that the disturbances arose from a series of thrusts and folds started in the yielding and quaking mass by the advancing anticline.

From an economic point of view, it will be of importance to consider if the coal-deposits in this area have deteriorated by crushing.

The dune-and-pond origin of the Hawkesbury Sandstone, so ably advocated by Tenison-Woods, would be favoured by the withdrawal of the ice-hypothesis.

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* Wilkinson, Mem. Dept. Mines, Pal. iii., 1890, p.28, footnote.

† David, Quart. Journ. Geol. Soc., xliii., 1887, pp.190-196.

‡ Ten.-Woods, Proc. Roy. Soc. N. S. Wales, xvi., 1882(1883), p.75.

‖ Oldham, Rec. Geol. Survey India, xix., 1886, p.43.

In conclusion, the Bondi anticline is suggested as the medium of that tremendous driving force which thrust down the basin now outlined by the Wianamatta shale, till the Prospect lava squirted through its broken floor, displaced the Hawkesbury River from Camden to Windsor, and pressed up the Blue Mountain ridge behind. The giant fold, of which it was a part, relaxed its grip and died in its youth, as the anticline cracked and burst.

EXPLANATION OF PLATES XXV.-XXVII.

Plate xxv.

Scheme of an anticline deduced to match the Blue Mountain ridge and the Parramatta trough, and to account for the disturbed shales and sandstones about Sydney. From the paths of the radial dykes it is developed as a crescent directed west and swollen medially near Bondi. Based on the Geological Sketch Map of Sydney, Dept. Mines, 1903.

Plate xxvi.

Example of a crumpled sheet of shale regarded as entangled in a slide of the sandstone-beds. Opposite Cremorne Wharf, Milson Road in the foreground. Drawn by Miss P. Clarke.

Plate xxvii.

A series of coils of sandstone which, it is presumed, were slowly rolled up and together when a superincumbent mass of rock was launched across them. From the road side, between Seaforth and the Spit, east side of Middle Harbour. Photographed by Dr. H. G. Chapman.

ORDINARY MONTHLY MEETING.

July 29th, 1914.

Mr. C. Hedley, F.L.S., Vice-President, in the Chair.

The Chairman called attention to the programme of the Meeting of the British Association for the Advancement of Science, in Sydney, August 20-26th, and particularly requested intending members to facilitate the work of the Hon. Treasurer [Dr. H. G. Chapman, Royal Society's House, 5 Elizabeth Street North] by forwarding their subscriptions without delay.

Reference was made to the decease of Mr. Richard Helms, for some time a Member of the Society, in the interval since the last Meeting. Mr. Helms had a considerable knowledge of the entomology of New Zealand, where he resided before coming to Australia. For some years, he was an officer in the Department of Agriculture of New South Wales, afterwards in West Australia, and, subsequently, again in New South Wales. As naturalist of the Elder Exploring Expedition to Central Australia, he did excellent work. Evidence of glaciation on the Kosciusko Plateau was first brought prominently into notice by him; and this was subsequently confirmed and amplified in collaboration with Prof. David, and Mr. Pittmann. Mr. Helms also prepared a very useful account of the physiography, flora, and fauna of the Plateau.

It was resolved that an expression of sympathy and good-will should be tendered to Mr. R. J. Tillyard, concerning whom a disquieting, but happily somewhat exaggerated announcement in connection with a railway accident, appeared in the morning papers.

The Donations and Exchanges received since the previous Monthly Meeting (24th June, 1914), amounting to 19 Vols.,

117 Parts or Nos., 23 Bulletins, 2 Reports, and 7 Pamphlets, received from 79 Societies, etc., and two authors, were laid upon the table.

NOTES AND EXHIBITS.

Mr. Hedley exhibited an advance copy of a monograph of Australian Rhopalocera, by Messrs. G. A. Waterhouse and G. Lyell, just published, a most important addition to entomological literature, and especially noteworthy because every known species is figured.

Mr. Fred Turner exhibited, and contributed notes on, the fol lowing grasses, now apparently acclimatised in Australia. The seeds of most of these grasses have, no doubt, been accidentally introduced with agricultural and other seeds, or in packing material. The other species are evidently escapees from cultivation, though none of them have been collected on cultivated areas. *Agrostis pulchella* Guss.,(Sicily); near Parramatta, 1905. *Agrostis stolonifera* Linn.,(Europe); Shoalhaven River, 1899. *Alopecurus agrestis* Linn.,(Europe); near Stonehenge, 1906. *Alopecurus pratensis* Linn.,(Europe); near Berry, 1901. *Avena pratensis* Linn., (Europe and Asia); near Bega, 1893. *Avena pubescens* Huds., (Europe and Asia); near Candelo, 1893. *Cynosurus cristatus* Linn.,(Europe); near Robertson, 1912. *Cynosurus echinatus* Linn.,(Europe and Orient); near Cooma, 1899. *Festuca gigantea* Vill.,(Europe, Asia, and Africa); near Uralla, 1905. *Festuca loliacea* Huds.,(Europe); Coolangatta, 1899. *Festuca pratensis* Huds.,(Europe); near Delegate, 1893. *Phleum arenarium* Linn., (Europe); Shoalhaven River, 1899. *Phleum pratense* Linn., (Europe); Tenterfield, 1905, and Moruya, 1895. *Poa distans* Linn., = *Glyceria distans* Wahlenb.,(Europe); Coolangatta, 1899. *Poa nemoralis* Linn.,(Europe and Asia); near Tenterfield, 1905. —When the plates from Bauer's "Illustrationes floræ Novæ Hollandiæ," &c., presented to the Society by Rev. J. Lamont, F.L.S., were under notice at the last Meeting, Mr. Turner remarked that he remembered having communicated, for the author, a paper entitled "Ferdinand Bauer and some of his Drawings," by the late Rev. Dr. Woolls, F.L.S., to the Horticultural Society

of New South Wales some years ago. He now supplied the information, that the paper was read at a meeting on 9th April, 1889; and was subsequently published in the "Rural Australian," 1st May, 1889, at that time the official organ of the Society.

Mr. McCulloch exhibited a copy of the first part of the "Australian Zoologist," a new publication issued by the Royal Zoological Society of New South Wales. Attention was drawn to the large-sized page and plate, which are particularly convenient for certain classes of work. He also exhibited a specimen of an interesting fish, *Jordanidia solandri* Cuv. & Val. It was originally noticed by Solander, naturalist to Cook's first voyage to Australian waters, who described it as *Scomber macrophthalmus*, a manuscript name afterwards altered to *Gempylus solandri* by Cuvier & Valenciennes. It was also named *Thyrsites micropus* by McCoy, while Waite has recently proposed the new generic and specific names *Rexea furcifera* for it. It proves to belong to the genus *Jordanidia* Snyder, however, and should, therefore, be called *J. solandri*.

Mr. Mitchell exhibited specimens of a fossil fish, found in the Newcastle Coal-Measures. It probably belongs to the *Palæoniscidæ*. This fossil is interesting, because it is the only one yet obtained from the Coal-Measures in a good state of preservation. The specimens were found in a railway cutting at the junction of the Newcastle Wallsend Coal Company's line with the Great Northern Railway. The geological horizon of the occurrence of these fossils is about 200 feet below the Borehole Coal-seam of the Newcastle Series. He also reported the occurrence of the trilobite, *Calymene nasuta*, in the Upper Silurian rocks of Bowning.

Mr. A. A. Hamilton showed a series of botanical specimens from the Botanic Gardens, Sydney, including: (1) *Lactuca virosa* Linn., (Cult.), showing complicated prolification. An umbel of abortive flowers projects from the primary capitulum, which is reduced to a foliaceous involucre. The flowers consist of an involucre supporting a series of florets, which have united, and form

an envelope occupying the greater part of the flower, partially enclosing the few remaining florets, a third primitive flower filling the vacancy on the opposite side. In some of the flowers, the involucral bracts are broadened at the expense of their length, and a number of the florets have developed an inflated corolla, together with suppression of the pappus.—(2) *Ipomœa versicolor* Meissn., (*Mina lobata* Cerv.); cultivated; showing prolification, fasciation, and torsion. The normally attenuated base of the corolla is elongated, and an abortive flower, with its apex produced into long points, proceeds from between the corolla-lobes, which are severed to thrice their usual depth. The calyx, which in the perfect flower has a short tube and lobes with a basal dilation, has separated into distinct sepals, which have elongated and lost their dilation, and, in some cases, represent the whole flower. The rhachis of the proliferous upper portion of the raceme is fasciated; flowers are observed with twisted, infertile stamens; and stem-leaves and flowers are contorted.—(3) *Phlox* (perennial; Hort. var.), showing virescence developing into frondescence. In the early stages of the trouble, the somewhat impoverished, but sexually perfect, flowers were unable to colour their petals, and, as it became more acute, the whole series of organs constituting the flower gradually lost their floral character, finally degenerating into tufts of leaves.—(4) *Conospermum* spp. The difference between *C. ericifolium* Sm., and *C. taxifolium* Sm., is, according to the Flora Austr., a foliate one, based chiefly on the length and breadth of the leaves. In the specimens exhibited, the leaves are graded, from the typical, short, and narrow form in *C. ericifolium*, to the broader and longer leaves of *C. taxifolium*; so that the two species are merged into one continuous series, in which a difficulty arises as to where the dividing line should be drawn.—(5) *Dodonæa pinnata* Sm. Description of fruit-capsules, not previously described, as far as known: four- or frequently five-angled, with a few long hairs on the top, membranous, the wings undulate-wrinkled, viscid, dotted with resinous glands. Peduncles $\frac{3}{4}$ in. long. Sepals ciliate, lanceolate, about 2 lines long.—(6) *Telopea speciosissima* R.Br., showing leaf-variation. Margins entire, serrate, or lobed; leaves from 2-9 inches

long, and from $\frac{1}{4}$-3 inches broad.--(7) *Notelæa longifolia* Vent., showing leaf-variation: ovate-lanceolate to orbicular. Some measurements: 7×3; $6 \times 1\frac{1}{3}$; $4\frac{1}{2} \times 3$: 4×1; $3 \times \frac{3}{4}$; 2×2 inches.

On behalf of Mr. C. T. Musson, Mr. Fletcher showed specimens of the coral-like surface-roots of *Macrozamia spiralis* [N.O. Cycadeæ], and transverse sections mounted in the fresh condition, showing the presence of an endophytic green alga, *Anabæna cycadearum* (*Nostocaceæ*) [*vide* Tubeuf, Diseases of Plants, p.542].

A REVISION OF THE MONAXONID SPECIES DESCRIBED AS NEW IN LENDENFELD'S "CATALOGUE OF THE SPONGES IN THE AUSTRALIAN MUSEUM." Part ii.

By E. F. Hallmann, B.Sc., Linnean Macleay Fellow of the Society in Zoology.

(Plates xv.-xxiv.)

Familia HOMORRHAPHIDÆ.

Subfamilia Renierinæ.

Reniera collectrix.

For various reasons one is obliged to conclude that this species was founded on specimens of *Chondrosia* (?) *collectrix*, the mistake in all probability having been due to the fact that the specimen examined by Lendenfeld for description happened to contain a considerable number of foreign spicules derived from a *Reniera* growing in contact with it. This, in the first place, is the conclusion to be drawn from the ostensible type-specimen, as well as from a fragment labelled *Reniera collectrix* that comes from the British Museum,—both of which are examples of the species I have named. The fragment referred to is practically free from spicules, but the complete specimen (which is encrusted in many places by other sponges, including *Reniera*) shows here and there—as already mentioned by Whitelegge(56), who himself regarded them as proper to the sponge—patches of small oxea, which occur more especially in some parts near the surface. Furthermore, this specimen, apart from the fact of its being without proper spicules, is consistent with the description of *Reniera collectrix* in every respect excepting only that its oscula are but 2·5mm. wide instead of 5mm. And a point particularly to be noted in connection with the description is the statement therein

that the consistency of the sponge is very hard; for this in itself is an indication that the species described was not a *Reniera*. Finally, some significance attaches to the fact that although the specimen in question was undoubtedly known to Lendenfeld,—as is shown by its having a label written by him attached to it—he omitted to take it into account in his description of *Chondrosia collectrix*, which he states to be an "incrusting" sponge, attaining only "a height of 20mm., and a breadth of 60mm."; and thus it seems certain that the real identity of this specimen was unsuspected. Accordingly, although it is difficult to believe that *Chondrosia* (?) *collectrix* could under any circumstances be mistaken for a species of *Reniera*, all the evidence supports the view that such a mistake was actually made.

Reniera australis. (Text-fig.2).

Introductory.—The type specimen, which is preserved in alcohol, has the form of a thick layer covering one side of a piece of blackish wood, which has imparted to the sponge a brown stain. Although at first sight not appearing so, it consists of two specimens united laterally, one of which has grown over the edge of the other in such a way as to produce an appearance of continuity. Both specimens are generically the same—*Reniera*; but one of them has a rugged and granular surface, a somewhat olive-brown colour, and spicules measuring 80 to 125 μ in length by 5 μ in maximum stoutness; while the other, which is the smaller, has a smooth surface, a yellowish to faintly reddish-brown colour, and spicules measuring 60 to (rarely) 115 μ in length by at most 4·5 μ in diameter. And there is also, apparently, a slight difference between them with regard to the mode of arrangement of the skeleton. It is not unlikely that the two are specifically distinct; and I, therefore, take the latter to be the representative of the species, since it agrees the better with

Fig.2.—*Reniera australis*. Oxea.

Lendenfeld's description. As this, the only specimen available, is small, incomplete, and much damaged, it unfortunately affords but little information regarding the external features of the species; and with respect to these, accordingly, I can only quote the original description, which was based apparently upon several specimens.

Description.—"Massive, lobose, horizontally extended, more or less incrusting sponges, with dome-shaped protuberances on the upper surface, on the summits of which the circular, 3 to 5mm. wide, oscula are situated. Surface smooth. The sponge attains a height of 30mm., a length of 150 to 200mm., and a width of 100mm. Colour in the living state rosy red, in spirit grey." The consistency is soft and fragile, and the texture slightly porous. A very thin and delicate, non-separable, dermal membrane is present, and when this is removed (by cutting a thin shaving from the surface) the structure immediately beneath is seen to be minutely and irregularly honeycomb-like.

The skeleton-reticulation (as it appears in rather thin sections) does not extend continuously, as is perhaps usually the case in *Reniera*, but is interrupted by many wider or narrower gaps in which there occur only a comparatively few scattered spicules. The pattern of the reticulation is very irregular. Main fibres, 3 to 5 spicules broad, usually not traceable for any considerable distance and not disposed in orderly parallelism with one another, run at varying distances apart in a general surfaceward direction; and between these, in addition to some inter-reticulating, 2 to 3 spicules broad, connecting fibres, is a unispicular meshwork, the meshes of which, for the most part, are formed not of spicules placed end to end, but of intercrossing spicules. A noteworthy feature of the skeleton, though one which perhaps is not uncommon in *Reniera*, is the occurrence here and there, only at irregular and very wide intervals, of broad strings of loosely associated parallel spicules, which appear to be without relation to the rest of the skeleton or to one another, and run in various directions

through the sponge; they are variable (20 to 100 μ) in width, and their spicules—as are also the scattered spicules of the skeleton—are shorter and slenderer than most of those composing the reticulation. Strings of spicules analogous to these are met with in *Tedania* and *Hemitedania*. The dermal skeleton is an irregular polygonal reticulation of pauciserial fibres, the meshes of which average about 120 μ in width.

The oxea are slightly curved, gradually sharp-pointed, and measure 60 to 115 μ in length by 4·5 μ in stoutness.

The flagellated chambers are spheroidal, and closely arranged; they measure about 40 μ in diameter. The nuclei of the choanocytes are large, averaging slightly more than 2·5 μ in diameter.

Loc.—Port Jackson.

Remarks.—Under the name *Reniera australis*, Whitelegge(**53**) has recorded several specimens from Funafuti which, in my opinion, after examination of the original preparations, belong to two different species both distinct from the sponge described above. In one of these species, the skeleton consists of a unispicular reticulation and of scattered foreign particles; while, in the other, the spicules do not form a meshwork at all, but are disposed in a quite irregular halichondroid fashion. The oxea in both species attain a length of between 130 and 140 μ.

Dragnewitsch(**16**), in a paper which I have not seen, has also recorded as *Reniera australis* Lendenfeld, a sponge from Singapore.

Reniera megarrhaphea. (Pl. xvii., figs.5, 6; and text-fig.3).

Introductory.—Whether this species is properly represented by the specimen described by Whitelegge, it is not at present possible, with complete certainty, to say. The chief reason for doubt is the fact that the specimen, which unfortunately is only a small portion of the original, fails to enable one to reconcile it with Lendenfeld's description as regards external features; it is *not* digitate or lobose, but is portion of what, to all appearance, was a massive sponge unprovided with lobes

or prominences of any kind. But in its skeletal character, it exhibits considerable agreement with the description, except in one particular. Thus, in keeping with what is therein stated, its skeleton consists of bundles of spicules arranged somewhat in the manner of a network, spongin is not discernible, the spicules of the bundles are oxea of large size, and there are present smaller spicules of a different kind. But the last-mentioned spicules are stated by Lendenfeld to be oxea, and to occur interstitially in some abundance; whereas in the specimen, as Whitelegge has already made known, they are styli, and, moreover, are comparatively scarce except in the dermal region. This discrepancy in the matter of spiculation, however, cannot be regarded as serious. For, in the first place, as the smallest of the oxea are of about the same size as the styli, one can see how, through hasty or careless observation, the mistake could easily be made of supposing that all the smaller spicules were oxea; and in the second place, as regards their abundance, it is possible that in some parts of the sponge the smaller spicules are plentiful, inasmuch as Whitelegge also has described them as numerous. Consequently, the only serious obstacle to the acceptance of the specimen, as a genuine example of *Reniera megarrhaphea*, is its apparent non-agreement therewith in respect of external features; but as this may possibly be due merely to its incompleteness, I accordingly propose that the specimen (which, for reasons stated below, I refer to the genus *Amorphinopsis*) be definitely adopted as the type.

Description.—Sponge more or less massive; its precise external form not with certainty known. Oscula scattered, variable in size (up to 2 mm. in diameter), irregular in shape, perhaps restricted in their occurrence to the more elevated parts of the surface. The surface is generally even, but may become, in places, deeply wrinkled or folded. No dermal membrane is recognisable. The arrangement of the dermal skeleton is such that the surface exhibits a minutely reticulate or a perforate pattern (Plate xvii., fig.5), the one or the other according as the

interstices, the diameter of which varies from about 150 to 400 μ, are separated by relatively narrow lines or by relatively broad. The interior of the sponge is traversed by abundant canals, of which the largest measure 4 mm. in diameter; and, in consequence of this, its structural appearance, as shown on a cut surface, somewhat resembles that of well aërated bread. The consistency is firm and moderately tough. The colour in spirit is greyish-brown within, and yellowish-grey on the surface.

Fig 3. — *Amorphinopsis megarrhaphea*. *a*, Principal spicules. *a'*, Abnormal forms (very rare) of the preceding, with accessory actines near one extremity. *b*, Dermal styli.

The main skeleton (Pl. xvii., fig. 6) is halichondroid, consisting of a dense, irregular, ill-defined meshwork of spicule-bundles; fibres, in the proper sense of the term, can scarcely be said to be present, and even the bundles as a rule are not very distinct as such. Frequently the disposition of the spicule-bundles is such as to produce a somewhat lattice-like pattern; but even so, the pattern is much confused. For the most part, the bundles are multispicular, and the meshes of the network are very much less in width than the length of the spicules. The dermal reticulation (the meshes of which, as already stated, measure in diameter from 150 to 400 μ) is formed by coarse fibres, varying from 130 to upwards of 280 μ in stoutness, composed of oxea similar to those of the main skeleton. Supported upon these fibres are closely-crowded short styli, which stand perpendicularly to the surface with their apices directed outwards. Styli similar to these also occur scattered sparsely through the interior.

Spicules.—(*a*) The oxea, which range in length, with increasing stoutness, from very rarely less than 220 to about 950 μ and attain a maximum diameter of 31 μ, are very slightly curved, fusiform spicules, tapering from the middle of their length gradually to sharp points, and peculiar in the fact that their outer or convex side is curved somewhat angulately as compared with their concave side. The last-mentioned feature is usually best marked in the stoutest spicules. As modifications of the oxea, a few styli occur, which are evidently the result of a partial atrophy as regards length, and the rounding off of the extremity, of one actine. Further, a peculiar abnormality is occasionally shown, perhaps too rare to be considered of phylogenetic significance, in which the spicule is provided near one extremity with one to several short accessory actines, so as to resemble a Tetraxonid mesoclad.

(*b*). The styli are straight or slightly curved, somewhat fusiform, and gradually sharp-pointed at the apex. They measure from 160 to 250 μ in length, and are at most 9 μ in diameter.

Loc.—Port Jackson.

Remarks.—The species is, without doubt, of the same genus as *Hymeniacidon* (?) *fœtida* Dendy(**11**), concerning whose correct generic designation, however, there is considerable difference of opinion. It has been referred by Topsent(**44**) to the genus *Amorphinopsis;* by Dendy at a later date(**15**) to *Leucophlœus;* and by Lindgren(**30**), Thiele(**42**), and again quite recently by Hentschel(**21**), to *Ciocalypta*. I cannot agree that such species, possessing a halichondroid main skeleton of oxeote spicules and a dermal skeleton of erect styli, are correctly assignable to *Ciocalypta;* nor can I see any better reason why they should be referred to *Leucophlœus*, the type-species of which, *L. massalis* Carter (**6**), besides lacking their characteristic dermal skeleton, has a main skeleton composed of styli. On the other hand, in the forms of their spicules, *Hymeniacidon* (?) *fœtida* and *Reniera megarrhaphea* agree with Carter's *Amorphinopsis excavans* very closely; though, unfortunately, we do not know whether in this, the type species of *Amorphinopsis*, the stylote spicules form a dermal skeleton. There is, however, a probability that

they do; for Lindgren (*loc. cit.*) has described as *Ciocalypta fœtida*, a sponge which, while exhibiting the characteristic skeletal features of *Hymeniacidon* (?) *fœtida*, also bears so striking a resemblance in its stelliform surface-pattern to *Amorphinopsis excavans* that he regarded it as sufficient to establish the identity of these two species. The evidence is sufficient, therefore, to render it advisable, for the present, to assign *H. fœtida* and *R. megarrhaphea* to the genus *Amorphinopsis*.

The character of the main skeleton in these two presumable species of *Amorphinopsis* suggests that the genus is related to *Halichondria* and *Topsentia*; and one cannot regard it as other than significant, therefore, that whilst oxea exhibiting the peculiarity of form of those of *R. megarrhaphea* are of very rare occurrence, closely similar spicules are found in *Topsentia colossea* Lundbeck (**31**), = *T. pachastrelloides*, *fide* Topsent (**47**). In the genus *Halichondria* also, somewhat similar spicules are possessed by *H. firma* Bowerbank (**2c**). Accordingly, I would say that these three genera, which at present are referred to three different families, ought to be included in the same family, either the *Epipolasidæ* or the *Haploscleridæ*—and perhaps preferably in the former, since it seems now generally to be conceded that *Topsentia* and (some species at least of) *Halichondria* have originated from Astromonaxonellida. If such a classification were adopted, the genera *Pyloderma* (**24**), *Eumastia*, *Trachyopsis* (**15**) and *Migas* (**37**)* might also be admitted in the *Epipolasidæ*; and it would then be advisable to divide this family into three subfamilies—Coppatiinæ, Streptasterinæ, and Halichondriinæ.

Reniera pandæa.

The specimen labelled as the type of this species—a description of which has already been furnished by Whitelegge (**56**)—agrees excellently with the original description so far as skeletal characters are concerned, but is wholly incompatible therewith in other respects; its spiculation, in consequence of which Whitelegge referred it to the genus *Rhaphisia*, is similar to

* The name *Migas* is preoccupied for a genus of spiders.

that of *Hemitedania anonyma* Carter (*vide* Appendix), and of that species I consider it to be an example. This discrepancy between the ostensible type-specimen and the description of the species renders extremely significant the fact that the skeletal characters ascribed by Lendenfeld to *Reniera pandæa* are not only quite inappropriate to the genus to which he has assigned it, but are even inconsistent with his definition of the family to which it belongs; for the *Homorrhaphidæ* are defined by him as having only oxeote or strongylote megasclera, whereas the spicules of *Reniera pandæa* are stated to be stylote.

The evidence regarding *Reniera pandæa* seems to me, therefore, to justify the conclusion that the skeletal characters attributed to it are those of a different species from that upon which the description of its external characters was based, and that the latter species, represented by the above specimen, is that to which the name *Reniera pandæa* was intended by Lendenfeld to apply; but, as to the identity of the former species, I am yet unable to express an opinion.

Under the circumstances, I consider that the name *Reniera pandæa* should be regarded as a synonym of *Hemitedania anonyma*.

Reniera lobosa.

No specimen labelled as *Reniera lobosa* occurs either in the collection of the Australian Museum or among the fragments recently received from the British Museum; and no sponge admitting of identification with the species is known to me.

Petrosia hebes. (Text-fig. 4).

Introductory.—As Whitelegge has already indicated, the specimen standing as the type is sufficiently in agreement with the description of the species to obviate any doubt as to its being a genuine example thereof, but the description omits certain important particulars concerning the spiculation. To this it may be added that the specimen is specifically identical with a fragment labelled *Petrosia hebes* from the British Museum. The information furnished by Whitelegge is very

meagre, and, moreover, is found to be not quite accurate. The species consequently needs redescription. Unfortunately, the specimen is only a very small piece of the original, and affords no information concerning the external form, or the character and arrangement of the oscula. In regard to these features, therefore, I have in the following description, in order to make it as far as possible self-complete, rewritten what is stated in the original description.

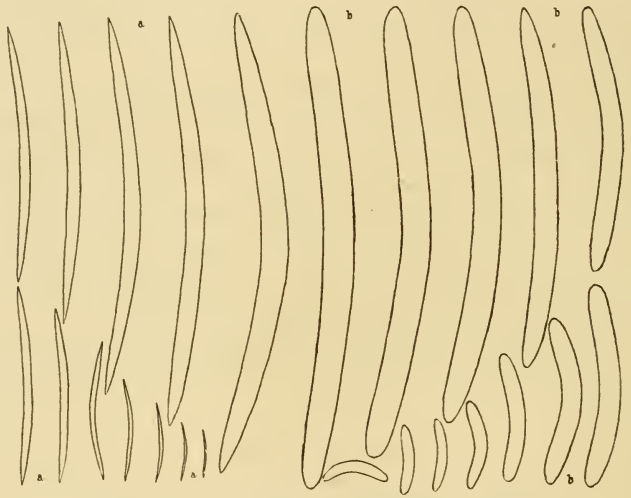

Fig. 4.—*Petrosia hebes*. *a*, Strongyla. *b*, Oxea.

Description.—"Irregular, massive sponges, horizontally extended, 80mm. broad and 30mm. high; with digitate processes on the upper surface, which attain a length of 40mm. and a thickness of 15mm.; they are irregularly curved, knotty, and often flattened. The surface is smooth. Oscula inconspicuous and scattered, circular, 1 to 3mm. in diameter."

The single piece, which is preserved in alcohol, shows a thin, delicate, non-separable dermal membrane. The consistency is firm and fairly hard, but brittle and somewhat pulverable. The texture is finely porous; the colour, light yellowish-grey.

The main skeleton is a coarse, irregular, reticulation of very stout fibres, often exceeding 300 μ in thickness, composed of densely packed strongylote and substrongylote spicules uncemented by spongin. The meshes of the reticulation, which are usually more or less rounded in outline, are of very variable width, averaging, say, 500 μ. Within the meshes are abundant scattered spicules, which sometimes form rather dense masses; these spicules for the most part are similar to those forming the fibres, but comprise also fairly numerous, slenderer, oxeote spicules of a distinct kind. At the surface, the outermost transverse fibres of the main skeleton constitute a subdermal reticulation that extends horizontally immediately beneath and in contact with the dermal membrane. The dermal membrane is provided with numerous horizontally directed oxea (similar to those scattered in the choanosome) which in general are arranged reticulately, forming meshes of about 120 μ in diameter. Where the membrane overlies the interstices of the subdermal reticulation, it is pierced by round pores, each of which singly occupies one of the meshes of the dermal reticulation.

Spicules.—(*b*). The strongyla are more or less curved, range in length from (rarely) less than 40 to about 280 μ, and attain a maximum diameter of 17 μ; the shortest have an average stoutness of about 7 μ. Generally speaking, the longer spicules are less curved than the shorter, and are less bluntly rounded off at their extremities, so that very often they might more correctly be termed sub-strongyla, or even, at times, suboxea. Also, the shorter spicules are often somewhat angulately curved. Of the longer spicules, an occasional one is asymmetrical with regard to opposite ends, approximating to the form of a bluntly pointed stylus.

(*a*). The oxea also are more or less curved, though usually in less degree than the strongyla: and their curvature likewise is often slightly angulate. The greater degree of curvature and of angularity of curvature are, however, as in the case of the strongyla, more frequently shown by the shorter than by

the longer spicules. They range in length, with increasing stoutness, from 30 to 255 μ, and attain a maximum diameter slightly exceeding 8 μ; the shortest vary in diameter from 2 to 4 μ. Intermediate forms between the oxea and strongyla, if they exist, are very rare.

Loc.—Port Jackson.

Remarks.—*Petrosia hebes* agrees in essential general features with *P. crassa* Carter, which, according to Lundbeck, is closely allied to *P. dura* Nardo, the type-species of the genus. The species is of interest, as it appears to afford indubitable proof of the very near relationship to *Petrosia* of the genus *Strongylophora* Dendy (15), which was placed by its author in the *Gelliinæ*, although regarded by him as being of somewhat doubtful systematic position. I am even inclined to think that the two genera will have to be united, though it is possible that their combined species may be found capable of separation into two genera upon a new basis of distinction. One finds that Thiele (41), prior to the establishment of Dendy's genus, has referred to the genus *Petrosia*, without comment, a species (*P. strongylata*), which possesses exactly the same peculiarities of spiculation as *Strongylophora durissima;* and these two species differ from *Petrosia hebes* apparently only in one noteworthy feature, viz., the uniformly small size of their dermal oxea.

Halichondria rubra.

As Whitelegge(54) has indicated, the specimens labelled as the types of this species and of its variety *digitata* are similar in skeletal characters to *Rhaphisia*(*Hemitedania*, g.nov) *anonyma* Carter; indeed, the only feature which at all distinguishes them is their tubular digitate habit (resembling that of *Siphonochalina*), and as other specimens occur in the collection which are intermediate between digitate and submassive in external form, this cannot be regarded as of specific value. Whitelegge makes it appear as if the specimens were quite satisfactory examples of *Halichondria rubra*, and actually

mentions that one of them "appears to be a portion of the figured type of the variety"; the fact is, however, that although the specimens show many points of agreement with Lendenfeld's description, yet as regards external features, in one respect at least, they are absolutely incompatible with that description; for Lendenfeld states that the oscula "are scattered and of varying size, 2 to 5mm. in diameter," whereas the specimens have no oscula other than the openings at the extremities of their tubular branches. It is impossible to suppose that such a mistake could arise through inaccuracy of observation, and it is equally difficult to believe that the specimens are not in some way connected with the species they purport to represent—since (i.) they accord with the description as far as skeletal features are concerned; (ii.) they occur in the collection under several independent labels all bearing the same name; and (iii.) a fragment from the British Museum labelled "*Halichondria rubra* var. *tenella*" belongs to the same species. The only explanation seems to be that Lendenfeld's descriptions of *H. rubra* and its variety were derived each from two different species—the second paragraphs of the descriptions, relating to internal features, from specimens of *Hemitedania anonyma;* and the first paragraphs, having reference to external features, from specimens of some species (or, it may be, two species) quite distinct. What the latter species may have been, I am unable to suggest, and it is scarcely of importance to know: the name *Halichondria rubra*, including the varietal name *digitata*, must be considered to belong rather to the species exemplified by the type-specimens, and hence to be a synonym of *Hemitedania anonyma*. (*Vide* Appendix).

In connection with *H. rubra* var. *digitata*, conclusive proof is forthcoming that an additional serious mistake was made. Contrary to the statement of Whitelegge quoted above, the figure given in the Catalogue (Pl.ii., fig.1) is obviously not illustrative of *Hemitedania anonyma*, and at first I therefore thought it must portray the other species implied in the

description. This, however, is not the case, for I have since found the actual specimen from which the figure was taken, and it is a comparatively quite small sponge; it is labelled in Lendenfeld's handwriting with a name ("*Renioclathria arbuscula*") which is given in the key-list as the manuscript synonym of *Clathriodendron arbuscula*, but even this information is incorrect, for it proves to be a new species of *Raspailia—R. agminata* (*vide* Appendix).

Halichondria mammillata.

In the case of this species, neither the ostensible type-specimen in the Australian Museum nor the specimen labelled as representing it in the British Museum is in the least capable of being reconciled with the description of the species; and, so far, I have met with no sponge to which the name *Halichondria mammillata* is, in my opinion, applicable. The specimens in question have already been referred to by Whitelegge, from whose remarks one would gain the impression that the former is undoubtedly a genuine example of the species and that therefore Lendenfeld's description simply is inaccurate with respect to the dimensions of the spicules. In point of fact, however, this specimen is quite as much at variance with the description in external as in internal features, being a tubular digitate sponge belonging to an (apparently undescribed) species of *Siphonochalina*. The British Museum specimen, on the other hand, has a skeleton consisting almost entirely of foreign spicule-fragments (but containing in addition proper spicules in the form of scattered slender strongyla and sigmata) and belongs to an undetermined species of *Chondropsis*. It is possible that the latter, of which I have seen only a fragment, is an example of the species described by Lendenfeld in his "Monograph of the Horny Sponges" under the name of *Sigmatella* (i.e., *Chondropsis*) *corticata* var. *mammillaris*, and accordingly that it possesses external features very similar in kind to those ascribed to *Halichondria mammillata*. If this should prove to be the case, there would be reason to suspect that the description of *Halichondria mammillata* was based

partly on one, and partly on another, of two quite distinct species. For the present, in the absence of any proof to the contrary, the species should, I think, be looked upon as a correctly described and valid one, belonging—though perhaps doubtfully—to the genus to which Lendenfeld assigned it.

HALICHONDRIA CLATHRIFORMIS. (Text-fig.5).

Introductory.—Although Whitelegge(56) seems to have definitely accepted, as the type of this species, the Australian Museum specimen labelled as such, it is nevertheless obvious from his description of it that it cannot be an example of Lendenfeld's *Halichondria clathriformis*, for in no respect does it agree with the latter as described except in its possession of oscula of moderately large size. I find it to be of the same species as the sponge (of extremely common occurrence on our beaches after storms) which Whitelegge*(54) previously described under the name *Chalina finitima* Schmidt, believing it to be identical with the *Acervochalina finitima* recorded from the east coast of Australia by Ridley(34); this, however, it certainly is not, since unlike the latter it contains multiserially arranged spicules in the secondary fibres. What the correct name is I am unable to say, though I have reason to believe that the species will prove to be one of those described by Lendenfeld under the generic name *Chalinopora*. In order to prevent confusion, I would recommend that this sponge be known, for the present, as *Chalina finitima* Whitelegge (*non* Schmidt). A figure of the specimen referred to is shown on Pl.xviii.(fig.1).

On the other hand, the British Museum specimen (labelled *Halichondria clathriformis*) referred to by Whitelegge—a small piece of which I have had the opportunity of examining

* Whitelegge's failure to perceive this identity is attributable partly to the fact that the specimen is incomplete and lacking in a shape suggestive of the species, and partly to the fact that, unlike all other specimens known to him, it is preserved in alcohol with the soft tissues intact and in this condition does not display the peculiar looseness of texture of the skeleton nor the distinctive dermal pattern which are the two most noticeable features of the sponge in the dry state of preservation.

—presents features which, if allowance be made for probable errors of omission in the original description, afford very good reason for believing it to be a genuine example of the species. For not only do its megascleres mostly conform to the descrip-

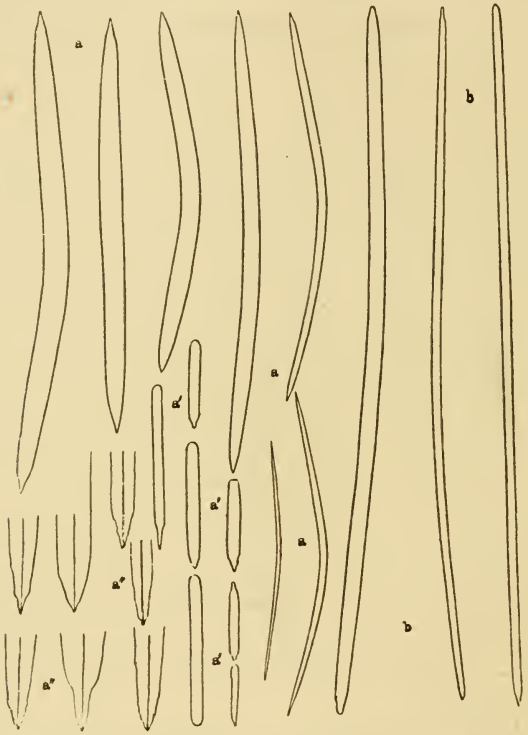

Fig. 5.— *Thrinacophora*(?) *clathriformis*. *a*, Principal oxea. *a'*, Strongylote spicules (presumably abortive forms of the preceding; exceedingly scarce). *a''*, Extremities of principal oxea. *b*, Interstitial oxea and styli.

tion, "oxystrongyla slightly curved in the middle and very slightly tapering towards the ends," but—what is especially significant—they also exhibit, at one or both extremities, "a very narrow and sharp spine." This last-mentioned pecu-

liarity, however, is not as Lendenfeld's statement with regard thereto would imply, a feature of all the spicules, nor perhaps even of a majority of them; and also at variance with the description are the facts that the megascleres (which attain to considerably greater dimensions than stated either by Lendenfeld or Whitelegge) are of two kinds, and that microscleres are present in the form of trichodragmata. Yet to these discrepancies no importance can be attached, inasmuch as the trichodragmata, owing to their minuteness of size, and the megascleres of one kind, owing to their comparative fewness and not very marked difference in form from the others, could very easily escape detection, and, in fact, were overlooked by Whitelegge; while, as regards the matter of the size of the megascleres, it has to be borne in mind that the measurements given in the Catalogue are seldom accurate. Accordingly, I have no doubt that the British Museum specimen is correctly labelled, and propose that it be taken as the type of the species—now to be known as *Thrinacophora* (?) *clathriformis*.

Description.—For an account of the external features, one must depend, for the present, upon the rather meagre information afforded by the original description, which is as follows:—"Sponge lobose, massive, attaining to a height of 250 mm., erect, attached by a small base, with very large and conspicuous oscula, 10mm. wide, which lie scattered on the summits of the lobes, and a smooth surface." It is well to be reminded of the possibility, however, that this portion of Lendenfeld's description and the remaining portion of it having reference to the internal features may have been based respectively upon two different species.

The skeleton consists, in part, (i.) of a ramifying system of multispicular plumose "funes" (compound fibres), which are distinguishable into (*a*) stouter and more compact primary ones, 0·5 mm. to perhaps 1 mm. or more in diameter and relatively few in number, constituting the chief axes of the skeleton, and (*b*) slenderer secondary ones running off from these to the surface, usually with much branching and some amount

of interconnection; and, in part, (ii.) of an irregular reticulation composed of thin pale-coloured horny fibres and of somewhat disorderly disposed spicules which for the most part are not enclosed within the horny fibres, but merely held together by them. The funes, also, are composed of reticulating horny fibres and spicules, but in them the meshes of the reticulation are much smaller and the spicules are much more uniformly oriented, the latter being in general not widely inclined from the longitudinal direction of the particular fune containing them; the funes are rendered plumose by the obliquely outward inclination of their most exteriorly situated spicules, some of which give rise to occasional short wispy strands.

In the single thick section* examined by me, these two types of skeleton-pattern—axinellid in the one case, somewhat approaching to halichondroid in the other—occur for the most part separately from each other. Thus, on the one side of a primary fune, which approximately coincides (probably merely by chance) with the mid-line of the section, the pattern is mainly of the former type; while on the opposite side of it, the pattern is mainly of the latter or more halichondroid type. The structure of the funes is such, however, that they might be interpreted simply as more condensed portions of the skeleton, in which at the same time the spicules tend towards a disposition in a common direction.

There is no dermal skeleton; and, furthermore, in a superficial layer of the sponge, varying from about 150 to 600 μ or so in width, no spicules occur except those composing the (somewhat distantly separated) extremities of the outwardly running fibres. As regards its histology, this layer (as seen in a

* In thin sections, as may easily be understood, the funes do not appear as such; and as a consequence, the arrangement of the skeleton seems to be rather confused. At first, having only examined such sections, I was disposed to regard as fairly satisfactory Lendenfeld's statement that "the skeleton consists of bundles of loosely disposed spicules, which are connected by very numerous others, scattered in such a way that the whole often appears like a dense mass of irregularly disposed spicules."

thin stained section) gradually assumes towards its exterior a structure somewhat resembling that of a stratified epithelium.

Spicules.—(*a*) The prevailing megasclere—that participating in the formation of the fibres—is a symmetrically curved, slightly fusiform, irregularly ended amphioxea, varying in length from about 240 μ (in the case of the slenderest) to slightly more than 500 μ, and in diameter from (seldom less than) 13 up to about 28 μ. The curvature when most pronounced is usually somewhat angulate. Except in the case of the slenderer (? immature) individuals, which for the most part (or perhaps exclusively) occur only between the fibres, the spicule narrows to its extremities as a rule, not by a continuous gradual tapering but by a series of more or less abrupt contractions that commence not farther than 30 μ from the extremities. The endmost contraction is frequently very pronounced, and the spicule is thereby rendered apiculate; the terminal portion of the spicule is then either sharp-pointed, resembling a mucro, or is rounded off at the point and nipple-shaped. A small proportion of the spicules are intermediate in the form of their extremities between oxea and strongyla, and rare styli also occur, the form of which clearly shows them to be the result of failure on the part of one of the actines of the oxea to attain to its normal development. In addition, there are present exceedingly scarce (apparently) abnormal, forms of cylindrical shape, either symmetrically ended (strongyla) or with one extremity abruptly narrowed, which range in length from less than 60 to (very rarely) upwards of 180 μ, and in stoutness from 8 to 14 μ; they recall the somewhat similar spicules of *Gellius rhaphidophora*, and should perhaps be reckoned as constituting a form distinct from the above spicules.

(*b*) The second form of megasclere is comparatively rare, and occurs scattered. Like the preceding, it is diactinal and very often exhibits some degree of irregularity in the formation of its extremities; but it differs in being of greater length and relatively slenderer, in having always more or less rounded extremities, and in being as a rule without curvature. The length, seldom if ever less than 500 μ, may attain to 810 μ; and the

diameter, which is usually between 3 and 11 μ, may in rare instances be as great as 18 μ.

(*c*). The trichodragmata are fairly abundant, but are not readily detected owing to their small size; they measure 12 μ long by 6 μ or less in diameter. The trichites composing them are usually arranged in a somewhat confused fashion.

Loc.—Port Jackson.

Genus Reniochalina.

No species identifiable with either of the two (*R. stalagmites* and *R. lamella*) for which this genus was established, is known to me. The two specimens purporting to be their types, a brief description of which has been given by Whitelegge (who seems to have been satisfied to regard them as the genuine types), are quite irreconcilable with Lendenfeld's account of the species, either in external features or in skeleton: as they appear to me to be specifically identical (though possibly of different varieties) and not to be assignable to any hitherto established genus I have described them (in the Appendix to this paper) under the name *Axiamon folium*.

The specimens in question, it should perhaps be mentioned, are not labelled actually as *Reniochalina stalagmites* and *Reniochalina lamella*, but as "*Chalinodendron stalagmites*" and "*Renieroplax ianthella*"—the latter names being those given in the key-list as the manuscript synonyms of the former. However, among the fragments received from the British Museum there is one labelled "*Reniochalina stalagmites*," which is identically similar to "*Chalinodendron stalagmites*," as well as two others (of different species) labelled respectively "*Reniochalina arborea*" and "*Reniochalina spiculosa*," which also are examples of the genus *Axiamon*. In the face of these facts, I can only surmise that Lendenfeld originally intended to employ the name *Reniochalina* for a genus different from that for which finally he adopted it—and for which presumably he considered it more appropriate.

The genus *Reniochalina* was defined by Lendenfeld as follows:—"Lamellar, thin, branched, more or less flower-shaped

Renierinæ, with smooth surface and fibrous skeleton; the spicules are partly embedded in spongin." From the descriptions of the two species, we learn, further, that the skeleton consists of "three systems of fibres—one longitudinal extending from the base to the margin of the lamella, the second transverse, and the third perpendicular to the plane in which the other two extend"; that these fibres, thus forming a rectangular meshwork, consist of bundles of somewhat irregular spicules; and that the spicules are pointed diactinals of moderate size accompanied or not by relatively few styli. In the typical species, *R. stalagmites*, the spicules are oxea exclusively. It would appear, therefore, that *Reniochalina* is very similar to the genus *Axinosia* established by me in the present paper for *Axinella symbiotica* Whitelegge and like species, excepting that, in the latter, the spicules are predominantly styli. Several species (as yet undescribed) differing from *Axinosia* apparently only in the fact that their spicules are exclusively or almost exclusively oxeote are known to me; and for the accommodation of such species, I think, the genus *Reniochalina* might provisionally be made to serve. I am doubtful, however, whether these species will ultimately be found separable from the genus *Reniera*, unless on the additional ground of their lamellar external form.

It will be noticed in the case of *Reniochalina lamella* that the description which Lendenfeld gives of its external characters, wherein the surface of the sponge is stated to bear conuli, is contradictory to his definition of the genus. There is reason to suspect, therefore, that the external features ascribed to this species are those of a different sponge from that upon which the description of its skeletal characters was based and to which the name *Reniochalina lamella* was intended to apply.

Familia HETERORRHAPHIDÆ.

Subfamily STYLOTELLINÆ.

Under this subfamily, erected expressly for their reception, there are described in the Catalogue four species, for which

Lendenfeld introduces the new genus *Stylotella*. The *Stylotellinæ* are defined as *Heterorrhaphidæ* without differentiated microsclera, and without a hard spicular rind; and *Stylotella* is stated to have as its distinguishing characters: (i.) a very soft texture, and (ii.) megasclera in the form of styli, scattered and in bundles. Of the four species I am able to identify, with certainty, only two, *S. digitata* and *S. polymastia*. The latter of these proves to belong to the genus *Ciocalypta* (or perhaps to *Leucophlœus*); while the former, which was the first to be described and which I propose to regard as the type-species, is found to be identical with the earlier described *Hymeniacidon agminata* Ridley(33). This species, however, as will be seen from the description given below, differs considerably from typical species of *Hymeniacidon*, and undoubtedly requires to be placed elsewhere; for its reception the genus *Stylotella* may therefore be retained, with the following definition:—"Typically non-massive Suberitidæ(?), of comparatively soft consistency, with a well-defined dermal membrane which is provided with tangentially placed spicules and is underlain by subdermal spaces, and with a main skeleton composed of longitudinal spicule-fibres (devoid of spongin) and of scattered spicules. The spicules are typically of a single kind, styli or subtylostyli; microscleres are absent."

The genus, which is of doubtful systematic position, I refer to the *Suberitidæ* chiefly on account of the character of the skeleton, and the seemingly greater difficulty of justifying its inclusion in any other family. The serious objection to this is, of course, the absence of tylostylote spicules; but as regards the other features in which it departs from typical *Suberitidæ* it may be pointed out that the possession of a dermal membrane is characteristic of *Pseudosuberites* and *Caulospongia* (=*Plectodendron*), and that most species of *Semisuberites* and *Laxosuberites* are of soft consistency.

Lendenfeld's *Stylotella aplysillioides* appears, from its description, to belong to *Hymeniacidon;* and his fourth species, *S. rigida*, I regard (provisionally) as a synonym of *S. agminata*.

Of the several species which other authors have assigned to the genus, there is only one, I think, that can be permitted to remain therein, *viz.*, *S. digitata* var. *gracilis* Hentschel (21); and as this has the styli partially differentiated into two kinds, it may be looked upon as an independent species. Hentschel's *S. flabelliformis*, described in the same paper as the preceding, appears not to be referable to any hitherto established genus, and accordingly I propose to constitute it the type of a new genus, *Stylissa*, to be placed in the *Axinellidæ*. The species which Topsent (43) has referred to *Stylotella*, under the impression that his genus *Stylinos* was identical therewith, ought perhaps to be included in *Hymeniacidon*, as Dendy has maintained. It is very doubtful, however, whether *Stylinos jullieni*, the type species of Topsent's genus, can thus be disposed of. The so-called *Stylotella irregularis* Kirkpatrick (23), appears to be related to, and is perhaps truly congeneric with, the two species described by Whitelegge (57) under the names *Phakellia multiformis* and *Axinella symbiotica;* at any rate, these three species,—and also, I should say, *Axinella arborescens* R. & D.—might very well be referred tentatively to a single genus, and I, therefore, venture to create for them the genus *Axinosia* (with *Axinella symbiotica* as the type-species) which I would define thus: *Axinellidæ*, typically of ramose or lamellar habit, with a reticulate, subrenieroid, skeleton formed by plurispicular main fibres joined at more or less regular intervals by uni- or paucispicular transverse fibres. Spongin is comparatively scantily developed. The spicules are moderately small conical styli, together with typically fewer strongyla and (or) oxea, all of approximately the same dimensions. Microscleres are absent.

STYLOTELLA DIGITATA. (Pl. xix., figs.1-5; Pl. xx., fig.2; and text-fig.6).

Introductory.—This species, now to be known as *Stylotella agminata* Ridley, is represented in the collection of the Australian Museum by sixteen specimens, all from Port Jackson;

in addition to the single type-specimen, which is labelled "*Truncatella digitata*" and conforms closely to Lendenfeld's description, these also include the specimens labelled as the types of *Stylotella rigida*, *Tedania laxa*, and *T. tenuispina*—which three species, for reasons more clearly indicated in due course, I propose to regard as synonyms of *S. agminata*. Two further examples of the species occur also among the fragments of sponges received from the British Museum, one labelled "*Truncatella micropora*" (a MS. name), the other mistakenly labelled as "*Clathriodendron irregularis*." Among these fragments there is also one labelled "*Stylotella digitata*, Port Nelson, N.Z.," but this proves to belong to quite a different species; as a consequence there is reason to doubt Lendenfeld's correctness in recording the species from any locality other than Port Jackson.

Fig.6.
Stylotella agminata. *a*, Styli (or subtylostyli). *a'*, Basal extremities of subtylostyli.

Description.—The external features of the species have already been sufficiently described by Ridley and by Lendenfeld: in regard thereto, the latter author's descriptions of *Stylotella digitata* and *Tedania laxa* are applicable, but not strictly his descriptions of *S. rigida* and *T. tenuispina*. The oscula, concerning which these several descriptions are not quite in agreement, appear always to be few in number, scattered, and small; and usually to be more or less closed over by extensions of the dermal membrane. Ridley(33) has given a figure which conveys a very good idea of the form commonly assumed by erect specimens with cylindrical branches, and to this, I now add several others—one of which (Pl.xix., fig.3) shows an erect form, with crowded compressed parts due to imperfectly differentiated branches; while another (Pl.xix., fig.4)

illustrates a more reticulately branched example of the species. The latter specimen, which consists of somewhat flattened, anastomosing branches forming a reticulate mass, approximates to Lendenfeld's description of *Tedania laxa*, though not so closely as do two other specimens which occur among the type-specimens of that species; and which, on account of their somewhat irregularly arranged skeleton, I at first thought to be specifically different from the rest. I mention this because, whereas Lendenfeld states that *Stylotella digitata* is intensely orange-coloured, and *Tedania tenuispina* bright orange-yellow in the living state, he states, of *Tedania laxa*, that "the colour of the living sponge is bright brick-red"; and it is possible, therefore, that two varieties of *S. agminata* occur, which differ in colour, and perhaps, to a slight extent also, in other respects.

The main skeleton (Pl.xx., fig.2) exhibits great variability in its precise mode of arangement, but always consists (i.) of longitudinally-running spicule-fibres, which are unconnected by cross-fibres, and from the most peripherally situated of which, short branches arise that pass outwards to the surface; and (ii.) of spicules which, though they are sometimes abundant, for the most part lie scattered singly. Diversity in the conformation of the skeleton results through variation in number of the scattered spicules, and through differences in stoutness of the main fibres, and in their distance apart. For descriptive purposes, four chief types of arrangement are distinguishable; but apparently all gradations between these occur, and different types may be found in different parts of one and the same specimen. (i.). The fibres are closely arranged, running parallel to one another at a distance apart, which may be even less than their own diameter; and scattered spicules are scarce or absent: this condition, which is uncommon, appears most usually to be met with in slender cylindrical branches. (ii.).The fibres are more widely separated, and scattered spicules occur in greater or less abundance, usually crossing one another in all directions so as to produce,

when most abundant, the appearance of an irregular reticulation extending between the fibres; in this case, as in the preceding, the fibres are usually comparatively stout, being often as much as 130μ or more in diameter. (iii.). The arrangement of the scattered spicules is as in (ii.), but the fibres are slender, 20 to 70μ in diameter, and run sinuously, with frequent interosculation. (iv.) The fibres are rather slender and somewhat distantly separated from one another, while the scattered spicules are only moderately abundant, and are sometimes, in considerable proportion, disposed more or less longitudinally.

The first-mentioned type of arrangement is shown to best advantage by the British Museum fragment above referred to, labelled *"Clathriodendron irregularis"*; the second, by certain of the type-specimens of *Tedania laxa;* the third, also by specimens of *T. laxa;* and the fourth, by the type-specimen of *Stylotella digitata.* The third type of arrangement, or something intermediate between it and the first, is the commonest and most typical.

The dermal membrane overlies wide subdermal spaces, and is supported upon the extremities of short fibres—branches from the outermost of the longitudinal fibres—which are directed towards it more or less perpendicularly. The dermal skeleton consists of horizontally disposed spicules which, in general, are either loosely scattered without order, or are arranged somewhat in an irregular paucispicular network; around the oscula, however, they become more numerous and are disposed radiately. Occasionally, fibres from the main skeleton enter and run in the dermal membrane for a short distance before terminating.

The spicules are of a single kind, subtylostyli, usually with only a very slightly developed oblongish head, which is marked off by a scarcely perceptible constriction; occasionally the head is rendered more pronounced by a subterminal annular enlargement. They are cylindrical throughout the greater part of their length, taper gradually to a sharp point, and vary from straight to curved (or sometimes flexuous); usually the

curvature is slight, and the proportion of straight to curved spicules about equal; but, at times, most of the spicules are curved, and some of them much curved. Their maximum size varies in different specimens, from 286 by 6 μ to 305 by 9 μ; while the shortest spicules in any given specimen are of between one-half and two-thirds the length of the longest.

Loc.—Port Jackson.

STYLOTELLA POLYMASTIA. (Text-fig.7).

Introductory.—The species is represented in the collection of the Australian Museum apparently only by a tiny fragment, labelled "*Truncatella polymastia,*" received from the British Museum. Judged by its spiculation, the fragment is undoubtedly a genuine example of the species, but unfortunately it is so small, that scarcely any information is obtainable from it concerning other characters. Nevertheless, it enables one to say that the species is certainly not assignable to the genus *Stylotella* as defined above, but, in all probability, belongs to *Ciocalypta*—under which genus I propose to bring it.

In connection with the figure which appears in the Catalogue (Pl.iv., fig.i.) in representation of this species, a serious error has been made. As I already have had occasion to mention, the actual specimen, from which this figure was taken, is still in existence (labelled in Lendenfeld's handwriting *Sideroderma navicelligerum* R.&D.), and belongs to a hitherto unknown species of *Histoderma*, described, in the Appendix hereto, as *H. actinioides*. One can see, on comparing the figure in question with Lendenfeld's description of *Stylotella polymastia*, that the two are not compatible, although showing in some respects an apparent agreement.

In order to make the following description of the species as complete as possible, I have repeated Lendenfeld's description of its external features; but it should be borne in mind that, possibly, this description is not applicable. In consequence of the small size of the fragment, I have not succeeded in securing sections cut in the proper direction to enable me to deter-

mine the exact arrangement of the skeleton, and my description of this is consequently to be regarded as only approximately correct.

Description.—"Massive sponges with numerous, irregular, mostly fistular processes arising from the upper surface. The sponge is attached by a broad base and attains a maximum diameter of 300mm. The oscula are situated terminally on the summits of the processes."

The main skeleton consists of dendritically branching, and occasionally interuniting, stout, plumose "funes"; and of numerous scattered spicules, the latter here and there forming dense masses connecting the "funes." The "funes" are either single fibres, or are composed each of several intimately associated fibres; these fibres consist of a spongin-axis, usually enclosing some longitudinally disposed spicules, and of numerous spicules which project from this axis at varying angles, some of them directed almost perpendicularly outwards in an echinating fashion. At the surface, the columns pass into broad, dense brushes of almost parallel spicules, the outer ends of which, apparently, give support to a dermal membrane; intermingled with the spicules of the brushes, are, sometimes, numerous irregularly disposed spicules. Whether there is a special dermal skeleton, is not quite certain; but, here and there, lying upon the outer ends of the brushes, horizontally directed spicules, forming a thin layer, were observed.

Spicules.—(*a*). The spicules which chiefly compose the fibres are straight or very slightly curved, gradually sharp-pointed, fusiform styli with a narrow handle-like basal end, of diameter sometimes less than half that of the thickest portion of the shaft, measuring from about 400 to 720 μ in length, by rarely more than 25 μ in maximum diameter. The longest spicules (those, say, of length exceeding 600 μ) are seldom, if ever, more than 20 μ in diameter; are always less distinctly narrowed at their basal end than the shorter, and relatively stouter spicules; and are connected by spicules of every intermediate grade with

(*b*). Straight or slightly curved, gradually sharp-pointed, usually slightly fusiform styli, abundant in the superficial skeleton and scattered throughout the interior. These, which range in size from less than 300 by 5 μ to upwards of 650 by 15 μ, are probably not at all separable from

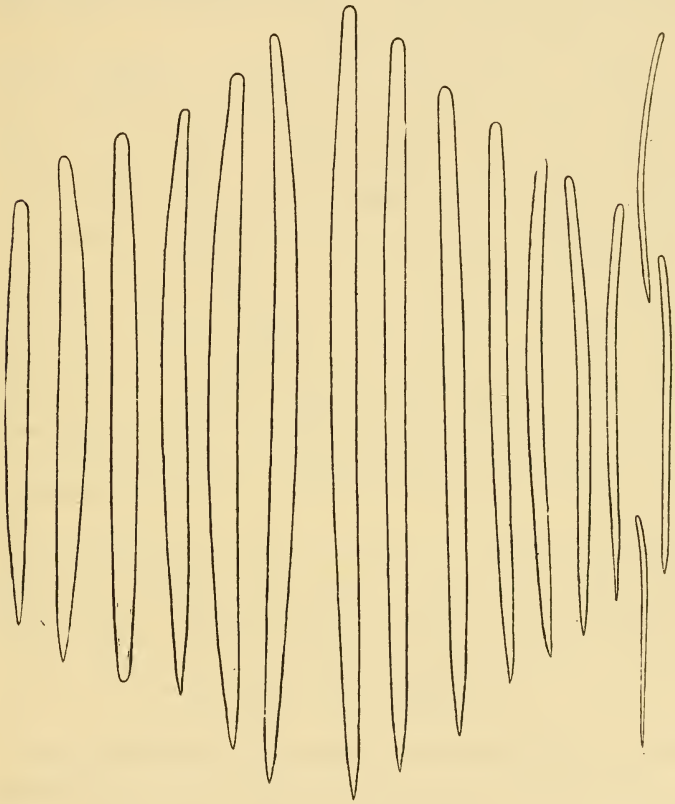

Fig. 7.—*Ciocalypta polymastia.* Styli, showing transitions from one form to another.

(*c*). More or less curved styli, comparatively few in number, apparently occurring only as scattered spicules, ranging in length from 160 to upwards of 300 μ and measuring, at most, 8 μ in diameter.

Rare oxea, of the size of the smallest styli, were observed, which possibly are of foreign origin, since no intermediates between them and the styli were observed. The larger spicules, however, are certainly never oxea, nor do they ever approach to an oxeote form; though occasionally, through rounding off at their apical end, they may pass into strongyla.

Loc.—East coast of Australia.

Remarks.—In the form of its spicules, *Ciocalypta polymastia* somewhat resembles the type-species of *Leucophlœus*—i.e., *massalis* Carter(6); and it appears to agree with the latter also in certain features of the skeleton. I am inclined to think, therefore, that the two species are congeneric. What the precise arrangement of the skeleton is, in the latter species, however, Carter's description does not make quite clear; and subsequent writers, acquainted with the species, have omitted to state explicitly. Ridley and Dendy(34a) expressed the opinion that *Leucophlœus* cannot be distinguished from *Hymeniacidon;* but, at a later date, Dendy(14) states that *Leucophlœus massalis* is identical with *Ciocalypta penicillus* (the type-species of *Ciocalypta*), and mentions that, since the resemblance between these two species was pointed out by Carter himself, he is unable to understand why the genus *Leucophlœus* should have been proposed. In view of this, I am at a loss to understand why, subsequently, Dendy(15) recognised *Leucophlœus* as a distinct genus, related to *Hymeniacidon*. If it be correct that *L. massalis* approaches rather to *Hymeniacidon* than to *Ciocalypta* in the character of its skeleton, then, beyond question, the species described above is not assignable to *Leucophlœus*, since its fibres are decidedly of the axinellid type.

Topsent(44) in a paper which I have not seen, has apparently wrongly recorded, as *Stylotella polymastia*, a sponge from Amboina; for Kirkpatrick(23), speaking with reference to *Hymeniacidon conulosum* Topsent, mentions that "the nearly related species *Stylotella polymastia* Lendenfeld, referred to by Topsent (*l.c.*, p.466), is synonymous with *Hymeniacidon fenestratum*(Ridley)."

Stylotella rigida.

The specimen labelled as the type of this species (under the MS. name "*Truncatella rigida*"), as well as a fragment labelled *Stylotella rigida* from the British Museum, are specifically the same; and, in skeletal characters, accord with Lendenfeld's description; but in one conspicuous feature attributed to *Stylotella rigida*—*viz.*, the possession of oscula 1 to 3mm. in width, and situated at the extremities of the digitate processes—they are completely lacking. As a matter of fact, they are examples of *Stylotella agminata* Ridley. One is justified in concluding, therefore, that the description of *Stylotella rigida* confounds the external features of one species with the internal features of another, the latter being that represented by the type-specimen; and as the former is unknown and indeterminable, we may, accordingly, look upon *S. rigida* as, in effect, a synonym of *S. agminata*. An independent reason for suspecting that some such mistake as this was made in connection with *S. rigida*, is afforded by its specific name, the implication of which is in direct contradiction to Lendenfeld's definition of the genus *Stylotella* as "Heterorrhaphidæ of very soft texture."

Dendy(14) has mistakenly referred to this species, under the name *Hymeniacidon rigida*, a sponge from Port Phillip. As the description given of the latter is sufficient for its identification, I propose that it be called *Hymeniacidon victoriana*.

Stylotella aplysillioides.

The specimen preserved in the Australian Museum as the supposed type of this species—for the reason that it is labelled, in Lendenfeld's handwriting, with the name ("*Truncatellina cinerea*") given in the key-list as the manuscript synonym of *Stylotella aplysillioides*—is a small, very thinly incrusting sponge, apparently belonging to the genus *Mycale*, with a thin dermal layer of foreign particles, and a main skeleton consisting (i.) of unconnected ascending fibres composed of foreign

(mostly spicule-) fragments, (ii.) of sparsely scattered subtylostyli measuring rarely as much as 130 by 3·5μ and (iii.) of a very few, scattered, slender toxa and anisochelæ, the latter measuring, at most, 17μ long. It is quite a different type of sponge, therefore, from that denoted by Lendenfeld's description, having no feature of resemblance thereto except an incrusting habit of growth, and even in this respect being not quite similar, since the layer it forms is only about 1mm. in thickness. Accordingly, in my opinion, it cannot possibly be accepted as the type-specimen.

A fragment from the British Museum, labelled *Stylotella aplysillioides*, is also totally unlike the described sponge of that name, and belongs to the genus *Dendoricella*—its spicules being skeletal oxea, dermal tylota, isochelæ arcuatæ, and two sizes of sigmata.

Hence we are left with no clue as to the identity of *Stylotella aplysillioides* except its rather brief description, which, if it can be relied upon, indicates that the correct position of the species is in the genus *Hymeniacidon*. To this genus, then, the species may, for the present, be regarded as belonging. The only other species of *Hymeniacidon* known from Port Jackson, is that recorded by Ridley(33) under the name *H. caruncula* Bowerbank; this is also a horizontally extended sponge with surface-elevations, but its spicules are stated to attain a size of 290 by 8μ, while those of *H. aplysillioides*, according to Lendenfeld, measure only 130 by 6μ.

Subfamilia Phlœodictyinæ.

Rhizochalina ramsayi. (Pl. xx., figs.2-5; Pl. xxi., fig.4; and text-fig.8).

The types consist of three half-specimens (derived by vertical bisection of the originals), and a thick, median, vertical slice of a fourth specimen. The sponge is massive, more or less globose, provided on its upper aspect with numerous thin-walled erect fistulæ, and below with few (sometimes only one) or

many, usually branched, stout, root-like processes. The fistulæ are, almost without exception, widely open at their distal end, though this appears to be due to their having had the extremity broken off. The roots are tapered, and convey the impression that they serve the function of anchoring the sponge in mud; according to the original description, they may attain to a length of 300mm. The largest specimen (Pl. xx., fig.2) is of comparatively irregular form, being elongated in one horizontal direction, and compressed at right angles thereto; it measures 230mm. in length, by 180mm. in height; and (though only a half-specimen) is provided with about a dozen roots.

The original description states that, in addition to fistulæ, there occur on the upper surface of the sponge, at its centre, two to five much wider and shorter tubes, 20mm. wide and only 25mm. high, the cavities of which are occupied by a reticular structure: unfortunately, in the type-specimens, owing no doubt to their not being symmetrical halves of the originals, none of these tubes are present. It happens, however, that the trawling steamer "Endeavour" has recently obtained, from off the coast of New South Wales several specimens of a sponge closely related to *Phlæodictyon ramsayi*—I propose to designate it a variety, *pyriformis*, of this species—which provides the clue to the nature of these tubes.

The variety is a stoutish, pear-shaped sponge without roots, which evidently, in life, was attached by its narrower end to a hard substratum. The fistulæ, which are short and stout, are usually not numerous, and may be altgether absent; as, in the only specimens so far obtained, they are all more or less damaged, it is not known whether their extremities are open or closed. A characteristic feature of the sponge is the arrangement of its oscula (Pl.xx., fig.3), which open side by side to the number of between 50 and 100, together forming a slightly depressed, oval or circular, honeycombed area occupying the centre of the upper surface. This oscular sieve differs from that of the typical form of the species, as describ-

ed by Lendenfeld, in the fact that its margin is not prolonged upward into a tube, but is level with the surrounding surface. The oscular canals are arranged in a manner conforming with the general symmetry (Pl.xx., fig.4): a few run upwards axially from the stalk, separated from one another only by thin partitions, while the remainder—which start from different points quite close beneath the surface—traverse the sponge radiately, in such manner as to come into parallelism with the axial direction before the oscula are reached. Other canals also occur, each of which is continuous with the lumen of a fistula.

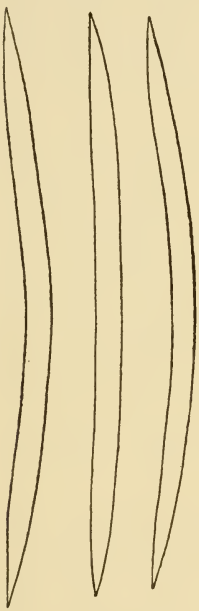

Fig.8.
Phlœodictyon ramsayi. Oxea.

As far as can be judged from the incomplete specimens of the typical form of the species, the arrangement of its canals is much the same as in the variety. (The probability is that the canals, which connect with the fistulæ, are inhalant in function).

The structure of the skeleton also is very similar in both forms, except that, in the root-like processes of the type, the main skeleton consists almost entirely of stout longitudinal fibres (50 to 200 μ in diameter) closely arranged like the strands of a rope; while, in the peduncle of the variety, the corresponding fibres are much more widely separated, and the intervening spaces are occupied by a renieroid, for the most part unispicular, reticulation, similar to that which is general throughout the body of the sponge. The fibres of the roots or peduncle, as the case may be, continue into the body of the sponge and spread dendritically through it, at a considerable average distance apart; here and there, they are connected by cross-fibres. Between the fibres, as already indicated, the skeleton consists of a renieroid reticulation. The fibres are composed of very closely packed, parallel spicules, which, apparently, are held together by a minute quantity of spongin.

The bast-layer consists of an irregular, unilamellar reticulation (Pl.xx., figs.4,5) of stout fibres immediately underlying the dermal membrane, and of numerous, inwardly directed, short, lamellar extensions of the same. The dermal skeleton proper is a single layer of horizontally disposed spicules crossing each other in all directions, and thus producing a somewhat lattice-like pattern.

The spicules are the same in all parts of the sponge—oxea, slightly and somewhat angularly curved, nearly cylindrical throughout the greater part of their length, and gradually tapering to sharp points. In the typical form of the species, their maximum size is 195 by 8μ, and their length ranges from 130 to 195 μ (but is very rarely less than 150 μ); in the variety, the spicules are a little larger, attaining to a size of 220 by 9·5 μ.

The typical form of the species comes from Port Jackson.

Rhizochalina petrosia. (Text-fig.9).

The evidence indicates, beyond reasonable doubt, that, under this name, Lendenfeld has combined portions of the descriptions of two quite different species. In the Australian Museum, labelled, in that author's handwriting, with the MS. name corresponding (according to his key-list) to *Rhizochalina petrosia*, is a small, gauzy-textured, branch-shaped sponge, apparently belonging to the genus *Ciocalypta*, the spicules of which are oxea of exactly the dimensions stated in the description, *viz.*, 700 by 15 μ; and from the British Museum comes a small fragment labelled *Rhizochalina petrosia*, which both belongs to the genus *Rhizochalina* (i.e., *Phloeodictyon*) and exhibits skeletal characters such as render the specific name *petrosia* extremely appropriate, but in which the oxea are, at most, only 165 by 8·5 μ in size. Thus the former specimen possesses the skeletal features ascribed to the species, but is entirely different to it in external form; while the British Museum specimen (the external form of which I do not know), in spite of the above-mentioned serious disagreement with the

description, affords practically indisputable reason for believ-it to exemplify the species to which the name *R. petrosia* was intended to apply. The question, as to which of these specimens is to be considered the type of the species, appears to me one that might be decided quite well by the toss of a coin ; but as the latter best accords with the name, I propose that it be taken as the type—the species thus requiring to be called *Phlœodictyon petrosia.*

An adequate description of *Ph. petrosia* cannot, at present, be given, as the small fragment at my disposal consists of scarcely more than a portion of the rind. As far as can be judged from this, however, the species is distinct from any other that has been described. The rind is usually well-developed, attaining to a thickness of nearly 2 μ ; its skeleton consists of an approximately rectangular, coarse reticulation of stout fibres, measuring up to 150 μ in diameter, composed of closely and not very regularly packed oxea uncemented by spongin. The skeleton bears a marked resemblance to that which is characteristic of many species of *Petrosia.* A dermal skeleton proper, external to the rind, appears to be absent. What little of the main skeleton is shown, consists mainly of scattered spicules exhibiting a tendency towards an arrangement in an irregular subrenieroid manner; but there also occur, at intervals, very stout fibres, similar to those of the rind, which apparently belong to inwardly-directed extensions of the latter, such as have been noticed in *Ph. ramsayi.* The spicules, which are the same in the rind as in the main skeleton, are somewhat angulately curved and abruptly sharp-pointed oxea, ranging in length from 130 to 165 μ, and measuring seldom less than 6 and not more than 8·5 μ in stoutness.

Fig. 9.
Phlœodictyon petrosia.
Oxea.

Loc.—Port Jackson.

Subfamilia Gellinæ.

Gellius panis.

The species is without a type-specimen, and, so far, I have met with no sponge identifiable with it. There appears to be no reason to doubt that the species belongs to the genus to which Lendenfeld has referred it.

Loc.—Port Jackson.

Gellius raphidiophora. (Text-fig.10).

Introductory.—The type-specimen conforms recognisably to the description, but the latter is at fault regarding the size of the sigmata and the maximum stoutness (which is 9·5, not 6 μ) attained by the oxea, and also omits to mention that the oxea are of three kinds, two of which—hence rather to be termed raphides—occur in dragmata: that raphides, however, were present in the original specimen, is both indicated by the description and implied by the specific name.

I have lately collected three specimens (from the underside of rocks exposed at low tide, near Port Jackson), which apparently in no way differ from the type of the species, excepting that their spicules are much slenderer, the stoutest oxea having (as it happens) only about the same diameter as that stated by Lendenfeld. As these specimens differ also among themselves (to the extent of 1·5 μ) in the diameter of their stoutest spicules, it is practically certain that they are not varietally distinct from the typical form, and, therefore, I have taken them into account in drawing up the following description.

Description.—Sponge massive, depressed, basally encrusting. Surface even or slightly undulated, smooth, very minutely reticulate (owing to the dermal skeleton). Oscula few, scattered, marginally flush with the general surface, measuring up to 3 mm. in diameter. Colour in life, bright yellow; in alcohol, light yellowish-grey. Consistency fairly soft and friable. The interior is traversed in various directions by many canals measuring up to 2 or 3 mm. wide; otherwise the structure is fairly compact.

Of the four specimens at hand, the largest measures 100 mm. long, by 70 mm. broad, and from 2 to 15 mm. in thickness; according to the original description, the sponge may grow to a thickness of 50 mm.

The main skeleton is an irregularly renieroid, paucispicular reticulation, the pattern of which usually appears much confused owing to the great number of scattered bundles of raphides; spongin is present in minute quantity, though apparently only at the angles of the meshes. In the most superficial region, loose polyspicular strands of spicules occur, which run perpendicularly to the surface and terminate in slightly projecting tufts coinciding in position with the nodes of the dermal reticulation. The dermal reticulation, for the most part, is triangular in pattern, and has the sides of its meshes formed of from two to five roughly parallel spicules.

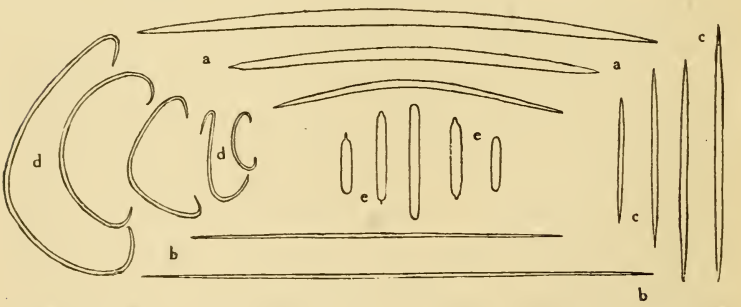

Fig. 10.—*Gellius raphidiophora*. *a*, Oxea. *b*, Sigmata. *c*, Longer raphides. *d*, Shorter raphides. *e*, Microstrongyles.

Spicules.—(*a*) Slightly curved oxea, very nearly cylindrical throughout the greater part of their length, and tapering gradually to sharp points. Size*: (*i*) 150 to 215 by 9·5 μ; (*ii*) 120 to 195 by 5 μ.

* The two sets of measurements—which refer to the range in length of the spicules, and to their maximum stoutness—are taken from the specimens whose spicules are the most different in point of size; the former measurements are those of the type-specimen.

(*b*) Longer raphides, occurring only in dragmata, straight, cylindrical, gradually sharp-pointed, and slightly dilated at intervals. Size: (*i*) 130 to 255 by 2·5 μ; (*ii*) 120 to 245 by 1·5 μ.

(*c*) Shorter raphides, occurring only in dragmata; straight, fusiform. Size: (*i*) 45 to 120 by 4·5 μ; (*ii*) 40 to 95 by 2·5 μ.

(*d*) Sigmata, very variable in size, but apparently not separable into two groups; the larger, as well as many of the smaller, are intermediate in shape between ordinary and flagellate sigmata. Length: (*i*) 15 to 76 μ; (*ii*) 15 to 70 μ. Stoutness: (*i*) 3·7 μ; (*ii*) 1·5 μ.

(*e*) Microstongyles, often somewhat pointed at one or both extremities; rare, but occurring in all specimens. Size: 16 to 50 by (*i*) 3 to (*ii*) 4 μ.

Loc.—Port Jackson.

Remarks.—On the evidence of a single specimen from Port Phillip, which I identify as *Gellius phillipensis* Dendy(12), this latter species is not more than a variety of *G. raphidiophora,* from which it differs chiefly in the fact that its longer raphides are immeasurably fine. In the specimen referred to, microstrongyles also occur, but are exceedingly rare, only a single example having been found in two slide-preparations.

G. raphidiophora is distinguished from all other species of the genus, not only in having two sorts of raphides, but also in the possession of microstrongyles; its sigmata, too, are of unusual form, and recall those of certain species of *Biemna*—e.g., *B. chilensis* Thiele(42), and *B. hamifera* Lundbeck(31). This fact concerning the sigmata seems not unworthy of notice, since also in *Biemna* the microscleres may include raphides and—if not microstrongyles exactly—siliceous globules. Actual microstrongyles, in association with raphides and sigmata, are elsewhere known to occur only in the somewhat aberrant *Tylodesma microstrongyla* Hentschel(21), and *Allantophora plicata* Whitelegge(57), two species which, I think, are allied to one another, though scarcely to be regarded as congeneric; but whether these microstrongyles (showing as they do some trace of centrotylosis) are homologous with those of *G. raphidiophora,* it is at present impossible to say.

TEDANIA RUBICUNDA. (Pl. xvii., fig. 4; and text-fig. 11).

Introductory.—The type-specimen—labelled "*Pellina rubicunda*"—although somewhat at variance with the description as regards spiculation, is so closely in agreement therewith, in most other respects, that any doubt as to its genuineness is quite precluded. The spicules are not, as Lendenfeld has stated, mainly *tylota,* but mainly styli—the former being abundant only in the dermal layer; furthermore, oxea are entirely absent, the tylota have conspicuously spined extremities, and the trichites are minutely spinulous. Thus, the spiculation—and, I might add, the general arrangement of the skeleton also—conform to those of *T. digitata,* of which species, therefore, *T. rubicunda* may, for the present, be considered a variety.

Description.—The single specimen (Pl. xvii., fig. 4) is a sessile, massive sponge, with a somewhat cylindriform, stoutish body, about 80 mm. in diameter and 100 mm. in height; which divides above into two larger, and is provided also, towards its upper aspect, with several smaller, digitiform, tapering lobes or processes. There is a well-defined dermal membrane, and the surface generally, except where bruised and damaged, is smooth and glabrous; the processes, however, show a few, usually quite shallow, longitudinal furrows or wrinkles. According to the original description, the processes are traversed by a central oscular tube, and have, at their summit, a number of small oscula. The first part, at least, of this statement is not strictly correct; except in their lower portion, the processes are traversed by distantly separated canals, and these are of small size, usually less than 1 mm. in diameter. These canals run longitudinally, gradually converging as the process becomes narrower, and (perhaps not in all cases) finally unite, at a variable distance from the extremity of the process, to form a single fairly wide canal. This terminal canal, no doubt, communicates with the exterior at the apex of the process, though the manner of accomplishment of this is not apparent in the present specimen; if it is by means of oscula, as is probably the case, these must be very small. The chief excurrent canals, both in the processes and in the body of the sponge, are surrounded

by a relatively very broad layer or wall of collenchymatous tissue, which, to the naked eye, has a somewhat gelatinous and translucent appearance as compared with the surrounding denser tissue. The specimen, which is preserved in alcohol, is of a dull yellowish-white colour; it is of rather soft consistency, and is very easily torn asunder. In the living state, according to the original description, the colour is a bright orange-red, which is more pronounced and intense on the surface than in the interior.

In the body of the sponge, the main skeleton consists of a rather dense and confused, somewhat renieroid, reticulation of single spicules and of spicule-bundles (or short, paucispicular fibres), traversed at close intervals by well-defined, multispicular fibres (usually less than 50μ in stoutness) running, for the most part, in a surfaceward direction; scattered through the reticulation are raphides, which occur both singly and in bundles. In the processes, however, in correspondence with an increase in development of the multispicular fibres, the reticular component of the skeleton is more or less reduced, and, in their more central region, may occasionally disappear altogether; in the latter case, the skeleton consists almost exclusively of closely approximated, longitudinally-running fibres, the diameter of the stoutest of which may exceed 200μ. The fibres are everywhere composed of loosely aggregated, parallel styli, together with a small proportion of tylota. Spongin is entirely absent. In the extensively developed collenchyma surrounding the canals, the only skeletal elements are singly scattered raphides and tylota, the former abundant, the latter usually scarce. The ectosomal skeleton consists of closely approximated, slightly divergent, vertical tufts of tylota, with numerous raphides scattered between; the tufts often, though not usually, are prolonged inwards into loose straggling strands (of tylota) connecting with the multispicular fibres of the main skeleton; but in many places, especially where the dermal layer is immediately underlain by collenchyma, a discontinuity exists between the dermal and main skeletons, which is very marked.

Spicules.—(*a*) The styli are (as a rule, slightly) curved, or rarely straight spicules, of nearly uniform diameter throughout their

entire length except for a distance of about 5 μ (or less) through which they taper to a sharp point; proceeding towards the basal end, however, they usually undergo a slight contraction, and then usually expand again, though only very slightly, at their extremity. Their length, which very rarely falls below 160 μ, may attain to 215 μ, and, on the average, is nearer to the latter figure than to the former; the diameter of the stoutest is 6 μ.

Fig. 11.
T. digitata var. *rubicunda*. *a*, Styli. *b*, Tylota. (Onychetæ not figured; similar in spinulation to those of *T. digitata* var. *rubra*).

(*b*) The tylota are straight or nearly so, with cylindrical or slightly fusiform shaft, and with elongate narrow heads, the extremities of which are truncate, and provided with about a dozen spines, averaging, say, 2 μ long; they range between 190 and 240 μ, and are seldom less than 210 μ in length, while their diameter is rarely, if ever, more than 3·5 μ.

(*c*) The raphides (onychetæ) are straight, asymmetrically fusiform, stylote, tapering gradually to a fine point at one end and to a truncated extremity at the other; their region of maximum stoutness lies nearer to the latter or basal end. Their base is frequently rendered apiculate by a minute spine situated at its edge, *i.e.*, outside the line of continuation of the axis of the spicule; sometimes there appear to be two such spines. The basal moiety (only) of the spicule is covered with minute spinules, which decrease in size towards the middle of the spicule and, gradually becoming indistinct, finally give place to a scarcely more than perceptible roughness of the surface. The raphides are, at most, 1·8 μ in diameter, and vary in length from 35 to 130 μ; individuals of length between 60 and 90 μ, however, are rare, thus indicating a partial differentiation of the spicules into two groups. The smaller raphides are

scarce, except in the dermal skeleton, where their number equals, if it does not exceed, that of the longer ones.

Loc.—Port Jackson.

Remarks.—In the aggregate of its characters, *T. digitata* var. *rubicunda* appears to be well distinguished from any hitherto described variety of the species, and, in many respects, diverges so widely from the typical form as almost to justify its recognition as an independent species; possibly, however, it may prove to be identical with the insufficiently described *T. digitata* var. *fibrosa*, R. and D., which is recorded from the same locality (Port Jackson). Its chief diagnostic features are the digitate, massive, external form; the well-defined asponginous fibres; the considerable range in length, and partial separation into two groups of the raphides; and the character of the extremities of the tylota.

Hentschel(20), misled by Lendenfeld's description of *Tedania rubicunda*, has briefly described, under that name, a sponge, from the west coast of Australia, in which the dermal spicules are amphistrongyla (apparently with non-spinose extremities), and which, in other respects also, differs markedly from the sponge here redescribed.

Tedania laxa.

Labelled in Lendenfeld's handwriting "Truncatella laxa"—the MS. synonym of *Tedania laxa*—there are, in all, twelve specimens, eleven occurring together in one jar, and one separately. They vary very considerably in their exact external form, though all are much alike in colour, consistency, and surface-appearance; and all agree in being composed of clustered, usually more or less interunited, moderately slender branches. Some, for example, have the branches very intimately intergrown and partially fused with one another, in such a way as to give rise to a rather compact reticulate mass, and are thus, as regards external form, apparently in close agreement with the description of the species; whereas others are more erect and arborescent, and include among them several that

exhibit a conspicuous resemblance to the type-specimen of *Stylotella digitata* (= *S. agminata*). While external examination of the specimens afforded no reason to doubt that at least the more massive-looking would be found in complete conformity with the description of *T. laxa*, microscopical examination yielded, in every case, the same result, and showed them to be no more than a series of forms of *Stylotella agminata*. Yet, at the same time, there was presented the very striking coincidence that, in the arrangement of their skeleton and approximate size of their spicules, the specimens actually do agree with the description of *T. laxa*, almost perfectly. In the face of such evidence, a contention that the specimens are other than examples of this species cannot well be sustained; and one has to conclude that *Tedania laxa* is no more than a synonym of *Stylotella agminata*. The probability of the correctness of this conclusion is supported by other considerations, as follows:— According to its description, *T. laxa* differs from *S. agminata* only in the following particulars: the sponge grows to a comparatively large size (nearly twice that of the largest specimen of *S. agminata* in the collection); oscula are not apparent; the colour of the living sponge is bright brick-red; and the spicules, in addition to styli, include tylota, oxea, and rare trichites. But the difference in mere size of the sponges is of very doubtful importance, as also is their difference in colour; the oscula of *S. agminata* are often very difficult to make out (owing apparently to their becoming closed over, as a result of contraction, by the dermal membrane); and there is present, in this species, a small proportion of slender megascleres which, without critical inspection, could very easily be mistaken for trichites. Also, allowance must be made for the fact that, in regard to matters of spiculation, the Catalogue is often seriously at fault; and of especial significance in this connection is the erroneous spiculation ascribed to *Tedania rubicunda* and *T. rubra*. And, finally, it is to be noted that the pattern of the skeleton of *S. agminata* bears no inconsiderable resemblance to that (in certain parts) of *T. rubicunda*, and, indeed, might be described in precisely the same terms as Lendenfeld, in his description of the latter species, employs.

Tedania rubra. (Text-fig. 12).

Introductory.—Although the specimen which I describe hereunder, is far from satisfactorily agreeing with the original description, yet, as it is labelled in Lendenfeld's handwriting with the name ("Truncatella renieroides"), given in the key-list as the MS. equivalent of *T. rubra,* and as it actually is a *Tedania,* the balance of evidence undoubtedly points to its being a genuine example of the species, and justifies the conclusion that the original description is inaccurate. The latter states, among other things, that oscula are present, which measure 2 to 3 mm. in width; that the fibres consist (only) of spicules; and that the spicules are styli measuring on the average $200 \times 6\mu$, tylota, oxea, and irregularly curved, hair-like spicules. In the specimen, on the other hand, there are no evident oscula (though scattered over the exterior, there is a number of small oscula-like openings, due to the presence of operculate cirripedes close beneath the surface); the fibres are composed of spicules cemented and usually also ensheathed by spongin; oxea are entirely absent; the styli measure at most $205 \times 6\mu$; the "tylota" have spined, and scarcely at all expanded, extremities; and the hair-like spicules (spinulous raphides) are almost invariably straight. As an indication of the limited importance attachable to these discrepancies, it may be remarked, firstly, that those in connection with the spiculation are almost exactly the same as have been found to occur in the case of *Tedania rubicunda,* and, secondly, that the actual mistake of describing, as oscula, holes caused by symbiotic cirripedes, was made by Lendenfeld in the case of *Cliona lutea* and of *Spirastrella ramulosa.*

The megascleres (and, at first sight, also the raphides) of *T. rubra* resemble so very closely those of *T. digitata* var. *rubicunda,* that had I examined no more than preparations of their spicules, I should certainly have pronounced the two sponges to be specifically identical; in view of its well-developed spongin-fibre, however, the like of which apparently has not been met with in any other of the numerous known forms of *T. digitata,* it seems necessary that *T. rubra* should be ranked as an independent variety.

Description.—The single specimen is a solid massive sponge, of somewhat brick-shaped form (but with rounded angles and partly uneven surface), measuring 55 mm. in height, and 45 mm. by 30 mm. in cross-section; the inequalities of the surface are mostly restricted to the upper aspect of the sponge, and take the form of conical, dome-shaped, or papilliform elevations of small size, the largest (which is of exceptional size) measuring 6 mm. in height, and 5 mm. across at its base. There is a well-developed, non-separable, dermal membrane, with smooth, almost glabrous, surface. Oscula of minute size, certainly less than 0·5 mm. in width, are probably present, and, judging by the direction of the main excurrent canals, occur on the upper surface, generally (though apparently not exclusively) at the summits of the elevations; as, however, the canals are of very small size (being rarely as much as 1 mm. in diameter), and are not traceable, owing to their partial collapse, all the way to the surface, the existence of undoubted oscula could not be demonstrated.

The colour in alcohol is yellowish within, and dull white on the surface. In consistency, the sponge is moderately firm, yet compressible, and, by reason of its fibrous skeleton, is resilient and fairly tough.

The main skeleton is a reticulation of spiculo-spongin fibres between which there lie scattered, without recognisable order and in varying abundance, usually not numerous megascleres and raphides, the latter occurring both singly and in bundles; entering into its composition also, but not contributing to form the reticulation, are occasional (yet constantly occurring) continuous strands of loosely associated, parallel spicules uncemented by spongin. The spicules of the sponginous fibres are styli and tylota, the latter relatively very scarce except in the ectosomal region; in the asponginous fibres, on the other hand, the tylota may predominate over the styli, and also a few raphides make their appearance. The scattered megascleres are chiefly tylota. The skeleton-reticulation consists chiefly of multispicular main fibres (with compact spicule-core, on the average less than ten spicules broad) running irregularly, usually not much more than a spicule's length apart, and

with occasional branching and anastomosis, in a general surfaceward-direction; the connecting fibres, which vary from unispicular to rarely multispicular, occur at rather variable intervals, and, where the main fibres are more widely separated, from between them an irregular inter-reticulation. As the surface is nearly approached, the connecting fibres disappear, and the outwardly-running fibres become split up into numerous closely-arranged and parallel strands of loosely-associated tylota, ending at the surface, each in a slightly penicillate tuft: in the dermal skeleton thus constituted, there occur in addition to the vertically arranged spicule-strands only a very few scattered raphides. In places—though this seems to be exceptional—the dermal skeleton, while otherwise unchanged in character, appears not to be in continuity with the main skeleton. The extent to which spongin is developed in connection with the fibres, varies considerably in different parts; frequently it forms a quite conspicuous sheath which, in thickness, may exceed the diameter of the spicule-core, the fibre as a consequence attaining sometimes to a stoutness of 40μ or more; usually, however, it is barely more than sufficient to hold the spicules together; while towards the surface, it further diminishes in quantity and finally disappears. The main excurrent canals are surrounded by a narrow layer of collenchymatous tissue in which the only skeletal elements are scattered tylota and raphides.

Spicules.—The megascleres, as already stated, are hardly distinguishable from those of *T. digitata* var. *rubicunda*—even in size being not materially different. The styli (when full-grown) vary in length from 155 to 200μ, and are at most 6μ in diameter; the tylota are never less than 175μ in length, and attain a maximum size of 230 × 4 μ. The very slenderest immature tylota, it was noticed, have the axial canal open at one end, and, at that end, their spines are less advanced in development than at the other.

Raphides (onychetæ) occur of all lengths between 20 and 155μ, but those exceeding 135 μ are scarce; there is also a rarity of individuals of certain intermediate sizes, with the consequence that, roughly, three groups are recognisable, having the following approximate ranges of length: (i.) 20-40 μ; (ii.) 55-70 μ; (iii.)

90-155μ. Those of the third group are the most abundant, while those of medium size, which are the least frequent, are comparatively very scarce. Besides differing in size, the raphides of the three groups exhibit, as a general rule, certain appreciable differences in other respects also, though all agree in being very gradually sharp-pointed at one extremity, and abruptly truncated at the other, in being more or less spinulous, and in having the spinules pointing in the direction of, and progressively increasing in size towards, the truncated or basal end of the spicule. (i.) The smallest raphides are conical in shape, tapering gradually from base to apex; are spinulous over their entire extent; and are usually much less than 1 μ in diameter. (ii.) The rather rare raphides of intermediate size are fusiform, with the region of greatest stoutness nearer to the basal end than to the middle of their length; are provided over their whole length with spinules which attain to a larger size than those of either (i.) or (iii.); and are always relatively stout in proportion to their length, their diameter being seldom much less than 2 μ. (iii.) The longest raphides are slightly fusiform, with the region of greatest stoutness situated nearer to the middle of their length than to the basal end; have a merely roughened surface, or (as a rule, only in the case of the stoutest) are perceptibly spinulous over their basal moiety only; are commonly terminated at their truncated end by a slender spine; and vary in stoutness from less than 1 μ to slightly more than 2 μ.

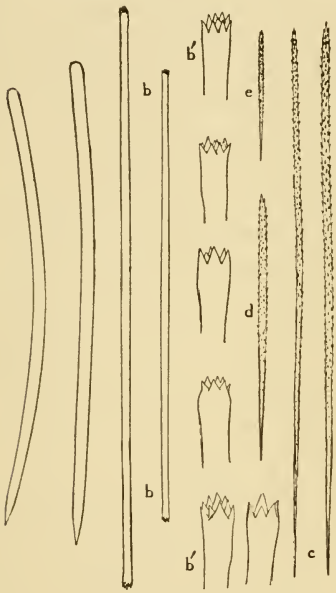

Fig. 12.
T. digitata var. *rubra*. *a*, Styli. *b*, Tylota. *c*, Onychetæ.

Loc.—Port Jackson.

Tedania tenuispina.

The specimen purporting to be the type of this species—and, moreover, the only specimen, either in the collection of the Australian Museum or among the fragments received from the British Museum, which is labelled as representing the species—is considerably at variance with the description of *Tedania tenuispina* in regard to its outward form, and departs therefrom also in some other respects,—being, in fact, an example of *Stylotella agminata*. Nevertheless, in skeletal characters it exhibits, on the whole, a very considerable degree of correspondence with that description; and were the specimen but possessed of the external habit ascribed to *T. tenuispina*, one would not hesitate at all to accept it as an example thereof. Accordingly, the question presents itself as to whether the alleged type-specimen should be rejected as wrongly labelled, and as having no relation whatsoever to the species under consideration; or whether the description should be regarded as an erroneous one, combining an account of the external features of one species with that of the internal features of another, the latter species being that which is exemplified by the type-specimen. The evidence is insufficient to enable one to decide positively; but, for the following reasons, I am disposed to give preference to the view that the description confuses two species, one of which is *Stylotella agminata*. In the first place, the external form ascribed to *T. tenuispina* is opposed to the likelihood of its belonging to *Tedania*, inasmuch as the species of that genus appear always to be more or less massive in habit; and it is an admissible assumption, therefore, that the species has been either generically misnamed or else misdescribed in respect of its external characters. Secondly, the description is open to suspicion owing to an apparent incongruity; for, in the paragraph relating to the outward characters of the sponge, it is stated that the surface is "roughened by projecting spicules"—which would seem unlikely except in the case of a sponge having spicules of fair length, say, 0·5 mm. or more; whereas, according to the latter part of the description, the spicules have a length of only 220 μ. Thirdly, no reliance can be

placed upon the statement that, in addition to styli, "a few tylota and oxea are also found"; for Lendenfeld has erroneously also attributed all these three kinds of megascleres to each of the other three species assigned by him to *Tedania*. Fourthly, the description is not in accordance with Lendenfeld's definition of *Tedania*, inasmuch as it contains no mention of the occurrence of raphides in the species. And, lastly, owing to the doubt which thus attaches to the account given of the spiculation of *Tedania tenuispina*, it is impossible to assert that the ostensible type-specimen is *not* an example of the species upon which the description of the skeletal characters of *Tedania tenuispina* was based, for in other respects, it agrees with that description sufficiently well.

I propose, therefore, to regard *Tedania tenuispina* as practically synonymous with *Stylotella agminata*.

For Reference List of Literature, see *antea*, pp.310-313.

For Explanation of Plates xv.-xxiv., see *antea*, pp.313-315

A REVISION OF THE MONAXONID SPECIES DESCRIBED AS NEW IN LENDENFELD'S "CATALOGUE OF THE SPONGES IN THE AUSTRALIAN MUSEUM." Part ii.

By E. F. Hallmann, B.Sc., Linnean Macleay Fellow of the Society in Zoology.

(Plates xv.-xxiv.)

Familia HOMORRHAPHIDÆ.

Subfamilia Renierinæ.

Reniera collectrix.

For various reasons one is obliged to conclude that this species was founded on specimens of *Chondrosia* (?) *collectrix*, the mistake in all probability having been due to the fact that the specimen examined by Lendenfeld for description happened to contain a considerable number of foreign spicules derived from a *Reniera* growing in contact with it. This, in the first place, is the conclusion to be drawn from the ostensible type-specimen, as well as from a fragment labelled *Reniera collectrix* that comes from the British Museum,—both of which are examples of the species I have named. The fragment referred to is practically free from spicules, but the complete specimen (which is encrusted in many places by other sponges, including *Reniera*) shows here and there—as already mentioned by Whitelegge(56), who himself regarded them as proper to the sponge—patches of small oxea, which occur more especially in some parts near the surface. Furthermore, this specimen, apart from the fact of its being without proper spicules, is consistent with the description of *Reniera collectrix* in every respect excepting only that its oscula are but 2·5mm. wide instead of 5mm. And a point particularly to be noted in connection with the description is the statement therein

that the consistency of the sponge is very hard; for this in itself is an indication that the species described was not a *Reniera*. Finally, some significance attaches to the fact that although the specimen in question was undoubtedly known to Lendenfeld,—as is shown by its having a label written by him attached to it—he omitted to take it into account in his description of *Chondrosia collectrix*, which he states to be an "incrusting" sponge, attaining only "a height of 20mm., and a breadth of 60mm."; and thus it seems certain that the real identity of this specimen was unsuspected. Accordingly, although it is difficult to believe that *Chondrosia* (?) *collectrix* could under any circumstances be mistaken for a species of *Reniera*, all the evidence supports the view that such a mistake was actually made.

Reniera australis. (Text-fig.2).

Introductory.—The type specimen, which is preserved in alcohol, has the form of a thick layer covering one side of a piece of blackish wood, which has imparted to the sponge a brown stain. Although at first sight not appearing so, it consists of two specimens united laterally, one of which has grown over the edge of the other in such a way as to produce an appearance of continuity. Both specimens are generically the same—*Reniera*; but one of them has a rugged and granular surface, a somewhat olive-brown colour, and spicules measuring 80 to 125 μ in length by 5 μ in maximum stoutness; while the other, which is the smaller, has a smooth surface, a yellowish to faintly reddish-brown colour, and spicules measuring 60 to (rarely) 115 μ in length by at most 4·5 μ in diameter. And there is also, apparently, a slight difference between them with regard to the mode of arrangement of the skeleton. It is not unlikely that the two are specifically distinct; and I, therefore, take the latter to be the representative of the species, since it agrees the better with

Fig.2.—*Reniera australis*. Oxea.

Lendenfeld's description. As this, the only specimen available, is small, incomplete, and much damaged, it unfortunately affords but little information regarding the external features of the species; and with respect to these, accordingly, I can only quote the original description, which was based apparently upon several specimens.

Description.—"Massive, lobose, horizontally extended, more or less incrusting sponges, with dome-shaped protuberances on the upper surface, on the summits of which the circular, 3 to 5mm. wide, oscula are situated. Surface smooth. The sponge attains a height of 30mm., a length of 150 to 200mm., and a width of 100mm. Colour in the living state rosy red, in spirit grey." The consistency is soft and fragile, and the texture slightly porous. A very thin and delicate, non-separable, dermal membrane is present, and when this is removed (by cutting a thin shaving from the surface) the structure immediately beneath is seen to be minutely and irregularly honeycomb-like.

The skeleton-reticulation (as it appears in rather thin sections) does not extend continuously, as is perhaps usually the case in *Reniera*, but is interrupted by many wider or narrower gaps in which there occur only a comparatively few scattered spicules. The pattern of the reticulation is very irregular. Main fibres, 3 to 5 spicules broad, usually not traceable for any considerable distance and not disposed in orderly parallelism with one another, run at varying distances apart in a general surfaceward direction; and between these, in addition to some inter-reticulating, 2 to 3 spicules broad, connecting fibres, is a unispicular meshwork, the meshes of which, for the most part, are formed not of spicules placed end to end, but of intercrossing spicules. A noteworthy feature of the skeleton, though one which perhaps is not uncommon in *Reniera*, is the occurrence here and there, only at irregular and very wide intervals, of broad strings of loosely associated parallel spicules, which appear to be without relation to the rest of the skeleton or to one another, and run in various directions

through the sponge; they are variable (20 to 100 μ) in width, and their spicules—as are also the scattered spicules of the skeleton—are shorter and slenderer than most of those composing the reticulation. Strings of spicules analogous to these are met with in *Tedania* and *Hemitedania*. The dermal skeleton is an irregular polygonal reticulation of pauciserial fibres, the meshes of which average about 120 μ in width.

The oxea are slightly curved, gradually sharp-pointed, and measure 60 to 115 μ in length by 4·5 μ in stoutness.

The flagellated chambers are spheroidal, and closely arranged; they measure about 40 μ in diameter. The nuclei of the choanocytes are large, averaging slightly more than 2·5 μ in diameter.

Loc.—Port Jackson.

Remarks.—Under the name *Reniera australis*, Whitelegge(**53**) has recorded several specimens from Funafuti which, in my opinion, after examination of the original preparations, belong to two different species both distinct from the sponge described above. In one of these species, the skeleton consists of a unispicular reticulation and of scattered foreign particles; while, in the other, the spicules do not form a meshwork at all, but are disposed in a quite irregular halichondroid fashion. The oxea in both species attain a length of between 130 and 140 μ.

Dragnewitsch(**16**), in a paper which I have not seen, has also recorded as *Reniera australis* Lendenfeld, a sponge from Singapore.

Reniera megarrhaphea. (Pl. xvii., figs.5, 6; and text-fig.3).

Introductory.—Whether this species is properly represented by the specimen described by Whitelegge, it is not at present possible, with complete certainty, to say. The chief reason for doubt is the fact that the specimen, which unfortunately is only a small portion of the original, fails to enable one to reconcile it with Lendenfeld's description as regards external features; it is *not* digitate or lobose, but is portion of what, to all appearance, was a massive sponge unprovided with lobes

or prominences of any kind. But in its skeletal character, it exhibits considerable agreement with the description, except in one particular. Thus, in keeping with what is therein stated, its skeleton consists of bundles of spicules arranged somewhat in the manner of a network, spongin is not discernible, the spicules of the bundles are oxea of large size, and there are present smaller spicules of a different kind. But the last-mentioned spicules are stated by Lendenfeld to be oxea, and to occur interstitially in some abundance; whereas in the specimen, as Whitelegge has already made known, they are styli, and, moreover, are comparatively scarce except in the dermal region. This discrepancy in the matter of spiculation, however, cannot be regarded as serious. For, in the first place, as the smallest of the oxea are of about the same size as the styli, one can see how, through hasty or careless observation, the mistake could easily be made of supposing that all the smaller spicules were oxea; and in the second place, as regards their abundance, it is possible that in some parts of the sponge the smaller spicules are plentiful, inasmuch as Whitelegge also has described them as numerous. Consequently, the only serious obstacle to the acceptance of the specimen, as a genuine example of *Reniera megarrhaphea*, is its apparent non-agreement therewith in respect of external features; but as this may possibly be due merely to its incompleteness, I accordingly propose that the specimen (which, for reasons stated below, I refer to the genus *Amorphinopsis*) be definitely adopted as the type.

Description.—Sponge more or less massive; its precise external form not with certainty known. Oscula scattered, variable in size (up to 2 mm. in diameter), irregular in shape, perhaps restricted in their occurrence to the more elevated parts of the surface. The surface is generally even, but may become, in places, deeply wrinkled or folded. No dermal membrane is recognisable. The arrangement of the dermal skeleton is such that the surface exhibits a minutely reticulate or a perforate pattern (Plate xvii., fig.5), the one or the other according as the

interstices, the diameter of which varies from about 150 to 400 μ, are separated by relatively narrow lines or by relatively broad. The interior of the sponge is traversed by abundant canals, of which the largest measure 4 mm. in diameter; and, in consequence of this, its structural appearance, as shown on a cut surface, somewhat resembles that of well aërated bread. The consistency is firm and moderately tough. The colour in spirit is greyish-brown within, and yellowish-grey on the surface.

Fig 3. — *Amorphinopsis megarrhaphea*. *a*, Principal spicules. *a'*, Abnormal forms (very rare) of the preceding, with accessory actines near one extremity. *b*, Dermal styli.

The main skeleton (Pl. xvii., fig. 6) is halichondroid, consisting of a dense, irregular, ill-defined meshwork of spicule-bundles; fibres, in the proper sense of the term, can scarcely be said to be present, and even the bundles as a rule are not very distinct as such. Frequently the disposition of the spicule-bundles is such as to produce a somewhat lattice-like pattern; but even so, the pattern is much confused. For the most part, the bundles are multispicular, and the meshes of the network are very much less in width than the length of the spicules. The dermal reticulation (the meshes of which, as already stated, measure in diameter from 150 to 400 μ) is formed by coarse fibres, varying from 130 to upwards of 280 μ in stoutness, composed of oxea similar to those of the main skeleton. Supported upon these fibres are closely-crowded short styli, which stand perpendicularly to the surface with their apices directed outwards. Styli similar to these also occur scattered sparsely through the interior.

Spicules.—(*a*) The oxea, which range in length, with increasing stoutness, from very rarely less than 220 to about 950 μ and attain a maximum diameter of 31 μ, are very slightly curved, fusiform spicules, tapering from the middle of their length gradually to sharp points, and peculiar in the fact that their outer or convex side is curved somewhat angulately as compared with their concave side. The last-mentioned feature is usually best marked in the stoutest spicules. As modifications of the oxea, a few styli occur, which are evidently the result of a partial atrophy as regards length, and the rounding off of the extremity, of one actine. Further, a peculiar abnormality is occasionally shown, perhaps too rare to be considered of phylogenetic significance, in which the spicule is provided near one extremity with one to several short accessory actines, so as to resemble a Tetraxonid mesoclad.

(*b*). The styli are straight or slightly curved, somewhat fusiform, and gradually sharp-pointed at the apex. They measure from 160 to 250 μ in length, and are at most 9 μ in diameter.

Loc.—Port Jackson.

Remarks.—The species is, without doubt, of the same genus as *Hymeniacidon* (?) *fœtida* Dendy(**11**), concerning whose correct generic designation, however, there is considerable difference of opinion. It has been referred by Topsent(**44**) to the genus *Amorphinopsis;* by Dendy at a later date(**15**) to *Leucophlœus;* and by Lindgren(**30**), Thiele(**42**), and again quite recently by Hentschel(**21**), to *Ciocalypta*. I cannot agree that such species, possessing a halichondroid main skeleton of oxeote spicules and a dermal skeleton of erect styli, are correctly assignable to *Ciocalypta;* nor can I see any better reason why they should be referred to *Leucophlœus*, the type-species of which, *L. massalis* Carter (**6**), besides lacking their characteristic dermal skeleton, has a main skeleton composed of styli. On the other hand, in the forms of their spicules, *Hymeniacidon* (?) *fœtida* and *Reniera megarrhaphea* agree with Carter's *Amorphinopsis excavans* very closely; though, unfortunately, we do not know whether in this, the type species of *Amorphinopsis*, the stylote spicules form a dermal skeleton. There is, however, a probability that

they do; for Lindgren (*loc. cit.*) has described as *Ciocalypta fœtida*, a sponge which, while exhibiting the characteristic skeletal features of *Hymeniacidon* (?) *fœtida*, also bears so striking a resemblance in its stelliform surface-pattern to *Amorphinopsis excavans* that he regarded it as sufficient to establish the identity of these two species. The evidence is sufficient, therefore, to render it advisable, for the present, to assign *H. fœtida* and *R. megarrhaphea* to the genus *Amorphinopsis*.

The character of the main skeleton in these two presumable species of *Amorphinopsis* suggests that the genus is related to *Halichondria* and *Topsentia*; and one cannot regard it as other than significant, therefore, that whilst oxea exhibiting the peculiarity of form of those of *R. megarrhaphea* are of very rare occurrence, closely similar spicules are found in *Topsentia colossea* Lundbeck (**31**), = *T. pachastrelloides*, *fide* Topsent (**47**). In the genus *Halichondria* also, somewhat similar spicules are possessed by *H. firma* Bowerbank (**2c**). Accordingly, I would say that these three genera, which at present are referred to three different families, ought to be included in the same family, either the *Epipolasidæ* or the *Haploscleridæ*—and perhaps preferably in the former, since it seems now generally to be conceded that *Topsentia* and (some species at least of) *Halichondria* have originated from Astromonaxonellida. If such a classification were adopted, the genera *Pyloderma* (**24**), *Eumastia*, *Trachyopsis* (**15**) and *Migas* (**37**)* might also be admitted in the *Epipolasidæ*; and it would then be advisable to divide this family into three subfamilies—Coppatiinæ, Streptasterinæ, and Halichondriinæ.

Reniera pandæa.

The specimen labelled as the type of this species—a description of which has already been furnished by Whitelegge (**56**)—agrees excellently with the original description so far as skeletal characters are concerned, but is wholly incompatible therewith in other respects; its spiculation, in consequence of which Whitelegge referred it to the genus *Rhaphisia*, is similar to

* The name *Migas* is preoccupied for a genus of spiders.

that of *Hemitedania anonyma* Carter (*vide* Appendix), and of that species I consider it to be an example. This discrepancy between the ostensible type-specimen and the description of the species renders extremely significant the fact that the skeletal characters ascribed by Lendenfeld to *Reniera pandæa* are not only quite inappropriate to the genus to which he has assigned it, but are even inconsistent with his definition of the family to which it belongs; for the *Homorrhaphidæ* are defined by him as having only oxeote or strongylote megasclera, whereas the spicules of *Reniera pandæa* are stated to be stylote.

The evidence regarding *Reniera pandæa* seems to me, therefore, to justify the conclusion that the skeletal characters attributed to it are those of a different species from that upon which the description of its external characters was based, and that the latter species, represented by the above specimen, is that to which the name *Reniera pandæa* was intended by Lendenfeld to apply; but, as to the identity of the former species, I am yet unable to express an opinion.

Under the circumstances, I consider that the name *Reniera pandæa* should be regarded as a synonym of *Hemitedania anonyma*.

Reniera lobosa.

No specimen labelled as *Reniera lobosa* occurs either in the collection of the Australian Museum or among the fragments recently received from the British Museum; and no sponge admitting of identification with the species is known to me.

Petrosia hebes. (Text-fig. 4).

Introductory.—As Whitelegge has already indicated, the specimen standing as the type is sufficiently in agreement with the description of the species to obviate any doubt as to its being a genuine example thereof, but the description omits certain important particulars concerning the spiculation. To this it may be added that the specimen is specifically identical with a fragment labelled *Petrosia hebes* from the British Museum. The information furnished by Whitelegge is very

meagre, and, moreover, is found to be not quite accurate. The species consequently needs redescription. Unfortunately, the specimen is only a very small piece of the original, and affords no information concerning the external form, or the character and arrangement of the oscula. In regard to these features, therefore, I have in the following description, in order to make it as far as possible self-complete, rewritten what is stated in the original description.

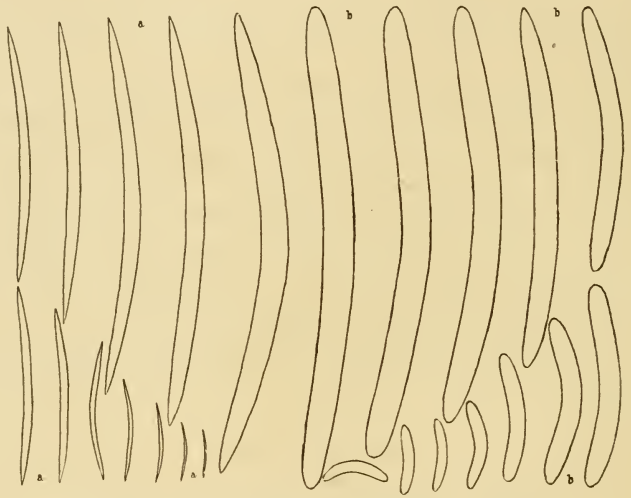

Fig. 4.—*Petrosia hebes*. *a*, Strongyla. *b*, Oxea.

Description.—"Irregular, massive sponges, horizontally extended, 80mm. broad and 30mm. high; with digitate processes on the upper surface, which attain a length of 40mm. and a thickness of 15mm.; they are irregularly curved, knotty, and often flattened. The surface is smooth. Oscula inconspicuous and scattered, circular, 1 to 3mm. in diameter."

The single piece, which is preserved in alcohol, shows a thin, delicate, non-separable dermal membrane. The consistency is firm and fairly hard, but brittle and somewhat pulverable. The texture is finely porous; the colour, light yellowish-grey.

The main skeleton is a coarse, irregular, reticulation of very stout fibres, often exceeding 300 μ in thickness, composed of densely packed strongylote and substrongylote spicules uncemented by spongin. The meshes of the reticulation, which are usually more or less rounded in outline, are of very variable width, averaging, say, 500 μ. Within the meshes are abundant scattered spicules, which sometimes form rather dense masses; these spicules for the most part are similar to those forming the fibres, but comprise also fairly numerous, slenderer, oxeote spicules of a distinct kind. At the surface, the outermost transverse fibres of the main skeleton constitute a subdermal reticulation that extends horizontally immediately beneath and in contact with the dermal membrane. The dermal membrane is provided with numerous horizontally directed oxea (similar to those scattered in the choanosome) which in general are arranged reticulately, forming meshes of about 120 μ in diameter. Where the membrane overlies the interstices of the subdermal reticulation, it is pierced by round pores, each of which singly occupies one of the meshes of the dermal reticulation.

Spicules.—(*b*). The strongyla are more or less curved, range in length from (rarely) less than 40 to about 280 μ, and attain a maximum diameter of 17 μ; the shortest have an average stoutness of about 7 μ. Generally speaking, the longer spicules are less curved than the shorter, and are less bluntly rounded off at their extremities, so that very often they might more correctly be termed sub-strongyla, or even, at times, suboxea. Also, the shorter spicules are often somewhat angulately curved. Of the longer spicules, an occasional one is asymmetrical with regard to opposite ends, approximating to the form of a bluntly pointed stylus.

(*a*). The oxea also are more or less curved, though usually in less degree than the strongyla: and their curvature likewise is often slightly angulate. The greater degree of curvature and of angularity of curvature are, however, as in the case of the strongyla, more frequently shown by the shorter than by

the longer spicules. They range in length, with increasing stoutness, from 30 to 255 μ, and attain a maximum diameter slightly exceeding 8 μ; the shortest vary in diameter from 2 to 4 μ. Intermediate forms between the oxea and strongyla, if they exist, are very rare.

Loc.—Port Jackson.

Remarks.—*Petrosia hebes* agrees in essential general features with *P. crassa* Carter, which, according to Lundbeck, is closely allied to *P. dura* Nardo, the type-species of the genus. The species is of interest, as it appears to afford indubitable proof of the very near relationship to *Petrosia* of the genus *Strongylophora* Dendy (15), which was placed by its author in the *Gelliinæ*, although regarded by him as being of somewhat doubtful systematic position. I am even inclined to think that the two genera will have to be united, though it is possible that their combined species may be found capable of separation into two genera upon a new basis of distinction. One finds that Thiele (41), prior to the establishment of Dendy's genus, has referred to the genus *Petrosia*, without comment, a species (*P. strongylata*), which possesses exactly the same peculiarities of spiculation as *Strongylophora durissima;* and these two species differ from *Petrosia hebes* apparently only in one noteworthy feature, viz., the uniformly small size of their dermal oxea.

Halichondria rubra.

As Whitelegge(54) has indicated, the specimens labelled as the types of this species and of its variety *digitata* are similar in skeletal characters to *Rhaphisia*(*Hemitedania*, g.nov) *anonyma* Carter; indeed, the only feature which at all distinguishes them is their tubular digitate habit (resembling that of *Siphonochalina*), and as other specimens occur in the collection which are intermediate between digitate and submassive in external form, this cannot be regarded as of specific value. Whitelegge makes it appear as if the specimens were quite satisfactory examples of *Halichondria rubra*, and actually

mentions that one of them "appears to be a portion of the figured type of the variety"; the fact is, however, that although the specimens show many points of agreement with Lendenfeld's description, yet as regards external features, in one respect at least, they are absolutely incompatible with that description; for Lendenfeld states that the oscula "are scattered and of varying size, 2 to 5mm. in diameter," whereas the specimens have no oscula other than the openings at the extremities of their tubular branches. It is impossible to suppose that such a mistake could arise through inaccuracy of observation, and it is equally difficult to believe that the specimens are not in some way connected with the species they purport to represent—since (i.) they accord with the description as far as skeletal features are concerned; (ii.) they occur in the collection under several independent labels all bearing the same name; and (iii.) a fragment from the British Museum labelled "*Halichondria rubra* var. *tenella*" belongs to the same species. The only explanation seems to be that Lendenfeld's descriptions of *H. rubra* and its variety were derived each from two different species—the second paragraphs of the descriptions, relating to internal features, from specimens of *Hemitedania anonyma;* and the first paragraphs, having reference to external features, from specimens of some species (or, it may be, two species) quite distinct. What the latter species may have been, I am unable to suggest, and it is scarcely of importance to know: the name *Halichondria rubra*, including the varietal name *digitata*, must be considered to belong rather to the species exemplified by the type-specimens, and hence to be a synonym of *Hemitedania anonyma*. (*Vide* Appendix).

In connection with *H. rubra* var. *digitata*, conclusive proof is forthcoming that an additional serious mistake was made. Contrary to the statement of Whitelegge quoted above, the figure given in the Catalogue (Pl.ii., fig.1) is obviously not illustrative of *Hemitedania anonyma*, and at first I therefore thought it must portray the other species implied in the

description. This, however, is not the case, for I have since found the actual specimen from which the figure was taken, and it is a comparatively quite small sponge; it is labelled in Lendenfeld's handwriting with a name ("*Renioclathria arbuscula*") which is given in the key-list as the manuscript synonym of *Clathriodendron arbuscula*, but even this information is incorrect, for it proves to be a new species of *Raspailia—R. agminata* (*vide* Appendix).

Halichondria mammillata.

In the case of this species, neither the ostensible type-specimen in the Australian Museum nor the specimen labelled as representing it in the British Museum is in the least capable of being reconciled with the description of the species; and, so far, I have met with no sponge to which the name *Halichondria mammillata* is, in my opinion, applicable. The specimens in question have already been referred to by Whitelegge, from whose remarks one would gain the impression that the former is undoubtedly a genuine example of the species and that therefore Lendenfeld's description simply is inaccurate with respect to the dimensions of the spicules. In point of fact, however, this specimen is quite as much at variance with the description in external as in internal features, being a tubular digitate sponge belonging to an (apparently undescribed) species of *Siphonochalina*. The British Museum specimen, on the other hand, has a skeleton consisting almost entirely of foreign spicule-fragments (but containing in addition proper spicules in the form of scattered slender strongyla and sigmata) and belongs to an undetermined species of *Chondropsis*. It is possible that the latter, of which I have seen only a fragment, is an example of the species described by Lendenfeld in his "Monograph of the Horny Sponges" under the name of *Sigmatella* (i.e., *Chondropsis*) *corticata* var. *mammillaris*, and accordingly that it possesses external features very similar in kind to those ascribed to *Halichondria mammillata*. If this should prove to be the case, there would be reason to suspect that the description of *Halichondria mammillata* was based

partly on one, and partly on another, of two quite distinct species. For the present, in the absence of any proof to the contrary, the species should, I think, be looked upon as a correctly described and valid one, belonging—though perhaps doubtfully—to the genus to which Lendenfeld assigned it.

HALICHONDRIA CLATHRIFORMIS. (Text-fig.5).

Introductory.—Although Whitelegge(56) seems to have definitely accepted, as the type of this species, the Australian Museum specimen labelled as such, it is nevertheless obvious from his description of it that it cannot be an example of Lendenfeld's *Halichondria clathriformis*, for in no respect does it agree with the latter as described except in its possession of oscula of moderately large size. I find it to be of the same species as the sponge (of extremely common occurrence on our beaches after storms) which Whitelegge*(54) previously described under the name *Chalina finitima* Schmidt, believing it to be identical with the *Acervochalina finitima* recorded from the east coast of Australia by Ridley(34); this, however, it certainly is not, since unlike the latter it contains multiserially arranged spicules in the secondary fibres. What the correct name is I am unable to say, though I have reason to believe that the species will prove to be one of those described by Lendenfeld under the generic name *Chalinopora*. In order to prevent confusion, I would recommend that this sponge be known, for the present, as *Chalina finitima* Whitelegge (*non* Schmidt). A figure of the specimen referred to is shown on Pl.xviii.(fig.1).

On the other hand, the British Museum specimen (labelled *Halichondria clathriformis*) referred to by Whitelegge—a small piece of which I have had the opportunity of examining

* Whitelegge's failure to perceive this identity is attributable partly to the fact that the specimen is incomplete and lacking in a shape suggestive of the species, and partly to the fact that, unlike all other specimens known to him, it is preserved in alcohol with the soft tissues intact and in this condition does not display the peculiar looseness of texture of the skeleton nor the distinctive dermal pattern which are the two most noticeable features of the sponge in the dry state of preservation.

—presents features which, if allowance be made for probable errors of omission in the original description, afford very good reason for believing it to be a genuine example of the species. For not only do its megascleres mostly conform to the descrip-

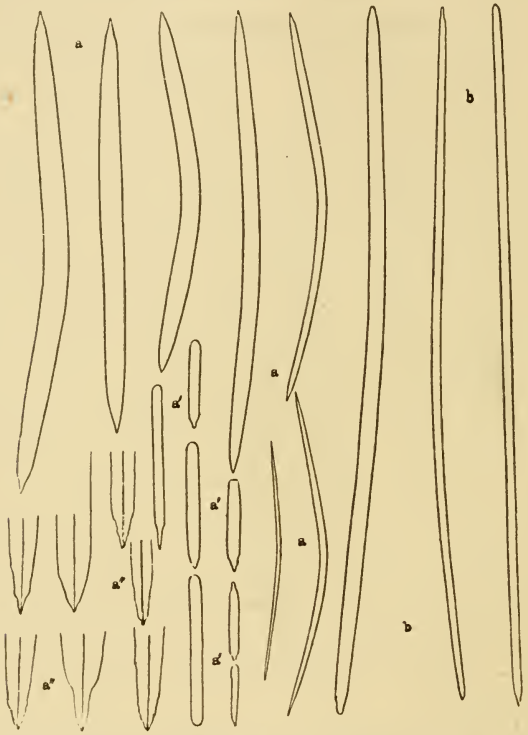

Fig. 5.— *Thrinacophora*(?) *clathriformis*. *a*, Principal oxea. *a'*, Strongylote spicules (presumably abortive forms of the preceding; exceedingly scarce). *a''*, Extremities of principal oxea. *b*, Interstitial oxea and styli.

tion, "oxystrongyla slightly curved in the middle and very slightly tapering towards the ends," but—what is especially significant—they also exhibit, at one or both extremities, "a very narrow and sharp spine." This last-mentioned pecu-

liarity, however, is not as Lendenfeld's statement with regard thereto would imply, a feature of all the spicules, nor perhaps even of a majority of them; and also at variance with the description are the facts that the megascleres (which attain to considerably greater dimensions than stated either by Lendenfeld or Whitelegge) are of two kinds, and that microscleres are present in the form of trichodragmata. Yet to these discrepancies no importance can be attached, inasmuch as the trichodragmata, owing to their minuteness of size, and the megascleres of one kind, owing to their comparative fewness and not very marked difference in form from the others, could very easily escape detection, and, in fact, were overlooked by Whitelegge; while, as regards the matter of the size of the megascleres, it has to be borne in mind that the measurements given in the Catalogue are seldom accurate. Accordingly, I have no doubt that the British Museum specimen is correctly labelled, and propose that it be taken as the type of the species—now to be known as *Thrinacophora* (?) *clathriformis*.

Description.—For an account of the external features, one must depend, for the present, upon the rather meagre information afforded by the original description, which is as follows:—"Sponge lobose, massive, attaining to a height of 250 mm., erect, attached by a small base, with very large and conspicuous oscula, 10mm. wide, which lie scattered on the summits of the lobes, and a smooth surface." It is well to be reminded of the possibility, however, that this portion of Lendenfeld's description and the remaining portion of it having reference to the internal features may have been based respectively upon two different species.

The skeleton consists, in part, (i.) of a ramifying system of multispicular plumose "funes" (compound fibres), which are distinguishable into (*a*) stouter and more compact primary ones, 0·5 mm. to perhaps 1 mm. or more in diameter and relatively few in number, constituting the chief axes of the skeleton, and (*b*) slenderer secondary ones running off from these to the surface, usually with much branching and some amount

of interconnection; and, in part, (ii.) of an irregular reticulation composed of thin pale-coloured horny fibres and of somewhat disorderly disposed spicules which for the most part are not enclosed within the horny fibres, but merely held together by them. The funes, also, are composed of reticulating horny fibres and spicules, but in them the meshes of the reticulation are much smaller and the spicules are much more uniformly oriented, the latter being in general not widely inclined from the longitudinal direction of the particular fune containing them; the funes are rendered plumose by the obliquely outward inclination of their most exteriorly situated spicules, some of which give rise to occasional short wispy strands.

In the single thick section* examined by me, these two types of skeleton-pattern—axinellid in the one case, somewhat approaching to halichondroid in the other—occur for the most part separately from each other. Thus, on the one side of a primary fune, which approximately coincides (probably merely by chance) with the mid-line of the section, the pattern is mainly of the former type; while on the opposite side of it, the pattern is mainly of the latter or more halichondroid type. The structure of the funes is such, however, that they might be interpreted simply as more condensed portions of the skeleton, in which at the same time the spicules tend towards a disposition in a common direction.

There is no dermal skeleton; and, furthermore, in a superficial layer of the sponge, varying from about 150 to 600 μ or so in width, no spicules occur except those composing the (somewhat distantly separated) extremities of the outwardly running fibres. As regards its histology, this layer (as seen in a

* In thin sections, as may easily be understood, the funes do not appear as such; and as a consequence, the arrangement of the skeleton seems to be rather confused. At first, having only examined such sections, I was disposed to regard as fairly satisfactory Lendenfeld's statement that "the skeleton consists of bundles of loosely disposed spicules, which are connected by very numerous others, scattered in such a way that the whole often appears like a dense mass of irregularly disposed spicules."

thin stained section) gradually assumes towards its exterior a structure somewhat resembling that of a stratified epithelium.

Spicules.—(*a*) The prevailing megasclere—that participating in the formation of the fibres—is a symmetrically curved, slightly fusiform, irregularly ended amphioxea, varying in length from about 240 μ (in the case of the slenderest) to slightly more than 500 μ, and in diameter from (seldom less than) 13 up to about 28 μ. The curvature when most pronounced is usually somewhat angulate. Except in the case of the slenderer (? immature) individuals, which for the most part (or perhaps exclusively) occur only between the fibres, the spicule narrows to its extremities as a rule, not by a continuous gradual tapering but by a series of more or less abrupt contractions that commence not farther than 30 μ from the extremities. The endmost contraction is frequently very pronounced, and the spicule is thereby rendered apiculate; the terminal portion of the spicule is then either sharp-pointed, resembling a mucro, or is rounded off at the point and nipple-shaped. A small proportion of the spicules are intermediate in the form of their extremities between oxea and strongyla, and rare styli also occur, the form of which clearly shows them to be the result of failure on the part of one of the actines of the oxea to attain to its normal development. In addition, there are present exceedingly scarce (apparently) abnormal, forms of cylindrical shape, either symmetrically ended (strongyla) or with one extremity abruptly narrowed, which range in length from less than 60 to (very rarely) upwards of 180 μ, and in stoutness from 8 to 14 μ; they recall the somewhat similar spicules of *Gellius rhaphidophora*, and should perhaps be reckoned as constituting a form distinct from the above spicules.

(*b*) The second form of megasclere is comparatively rare, and occurs scattered. Like the preceding, it is diactinal and very often exhibits some degree of irregularity in the formation of its extremities; but it differs in being of greater length and relatively slenderer, in having always more or less rounded extremities, and in being as a rule without curvature. The length, seldom if ever less than 500 μ, may attain to 810 μ; and the

diameter, which is usually between 3 and 11 μ, may in rare instances be as great as 18 μ.

(*c*). The trichodragmata are fairly abundant, but are not readily detected owing to their small size; they measure 12 μ long by 6 μ or less in diameter. The trichites composing them are usually arranged in a somewhat confused fashion.

Loc.—Port Jackson.

Genus Reniochalina.

No species identifiable with either of the two (*R. stalagmites* and *R. lamella*) for which this genus was established, is known to me. The two specimens purporting to be their types, a brief description of which has been given by Whitelegge (who seems to have been satisfied to regard them as the genuine types), are quite irreconcilable with Lendenfeld's account of the species, either in external features or in skeleton: as they appear to me to be specifically identical (though possibly of different varieties) and not to be assignable to any hitherto established genus I have described them (in the Appendix to this paper) under the name *Axiamon folium*.

The specimens in question, it should perhaps be mentioned, are not labelled actually as *Reniochalina stalagmites* and *Reniochalina lamella*, but as "*Chalinodendron stalagmites*" and "*Renieroplax ianthella*"—the latter names being those given in the key-list as the manuscript synonyms of the former. However, among the fragments received from the British Museum there is one labelled "*Reniochalina stalagmites*," which is identically similar to "*Chalinodendron stalagmites*," as well as two others (of different species) labelled respectively "*Reniochalina arborea*" and "*Reniochalina spiculosa*," which also are examples of the genus *Axiamon*. In the face of these facts, I can only surmise that Lendenfeld originally intended to employ the name *Reniochalina* for a genus different from that for which finally he adopted it—and for which presumably he considered it more appropriate.

The genus *Reniochalina* was defined by Lendenfeld as follows:—"Lamellar, thin, branched, more or less flower-shaped

Renierinæ, with smooth surface and fibrous skeleton; the spicules are partly embedded in spongin." From the descriptions of the two species, we learn, further, that the skeleton consists of "three systems of fibres—one longitudinal extending from the base to the margin of the lamella, the second transverse, and the third perpendicular to the plane in which the other two extend"; that these fibres, thus forming a rectangular meshwork, consist of bundles of somewhat irregular spicules; and that the spicules are pointed diactinals of moderate size accompanied or not by relatively few styli. In the typical species, *R. stalagmites*, the spicules are oxea exclusively. It would appear, therefore, that *Reniochalina* is very similar to the genus *Axinosia* established by me in the present paper for *Axinella symbiotica* Whitelegge and like species, excepting that, in the latter, the spicules are predominantly styli. Several species (as yet undescribed) differing from *Axinosia* apparently only in the fact that their spicules are exclusively or almost exclusively oxeote are known to me; and for the accommodation of such species, I think, the genus *Reniochalina* might provisionally be made to serve. I am doubtful, however, whether these species will ultimately be found separable from the genus *Reniera*, unless on the additional ground of their lamellar external form.

It will be noticed in the case of *Reniochalina lamella* that the description which Lendenfeld gives of its external characters, wherein the surface of the sponge is stated to bear conuli, is contradictory to his definition of the genus. There is reason to suspect, therefore, that the external features ascribed to this species are those of a different sponge from that upon which the description of its skeletal characters was based and to which the name *Reniochalina lamella* was intended to apply.

Familia HETERORRHAPHIDÆ.

Subfamily STYLOTELLINÆ.

Under this subfamily, erected expressly for their reception, there are described in the Catalogue four species, for which

Lendenfeld introduces the new genus *Stylotella*. The *Stylotellinæ* are defined as *Heterorrhaphidæ* without differentiated microsclera, and without a hard spicular rind; and *Stylotella* is stated to have as its distinguishing characters: (i.) a very soft texture, and (ii.) megasclera in the form of styli, scattered and in bundles. Of the four species I am able to identify, with certainty, only two, *S. digitata* and *S. polymastia*. The latter of these proves to belong to the genus *Ciocalypta* (or perhaps to *Leucophlœus*); while the former, which was the first to be described and which I propose to regard as the type-species, is found to be identical with the earlier described *Hymeniacidon agminata* Ridley(33). This species, however, as will be seen from the description given below, differs considerably from typical species of *Hymeniacidon*, and undoubtedly requires to be placed elsewhere; for its reception the genus *Stylotella* may therefore be retained, with the following definition:—"Typically non-massive Suberitidæ(?), of comparatively soft consistency, with a well-defined dermal membrane which is provided with tangentially placed spicules and is underlain by subdermal spaces, and with a main skeleton composed of longitudinal spicule-fibres (devoid of spongin) and of scattered spicules. The spicules are typically of a single kind, styli or subtylostyli; microscleres are absent."

The genus, which is of doubtful systematic position, I refer to the *Suberitidæ* chiefly on account of the character of the skeleton, and the seemingly greater difficulty of justifying its inclusion in any other family. The serious objection to this is, of course, the absence of tylostylote spicules; but as regards the other features in which it departs from typical *Suberitidæ* it may be pointed out that the possession of a dermal membrane is characteristic of *Pseudosuberites* and *Caulospongia* (=*Plectodendron*), and that most species of *Semisuberites* and *Laxosuberites* are of soft consistency.

Lendenfeld's *Stylotella aplysillioides* appears, from its description, to belong to *Hymeniacidon;* and his fourth species, *S. rigida*, I regard (provisionally) as a synonym of *S. agminata*.

Of the several species which other authors have assigned to the genus, there is only one, I think, that can be permitted to remain therein, *viz.*, *S. digitata* var. *gracilis* Hentschel (21); and as this has the styli partially differentiated into two kinds, it may be looked upon as an independent species. Hentschel's *S. flabelliformis*, described in the same paper as the preceding, appears not to be referable to any hitherto established genus, and accordingly I propose to constitute it the type of a new genus, *Stylissa*, to be placed in the *Axinellidæ*. The species which Topsent (43) has referred to *Stylotella*, under the impression that his genus *Stylinos* was identical therewith, ought perhaps to be included in *Hymeniacidon*, as Dendy has maintained. It is very doubtful, however, whether *Stylinos jullieni*, the type species of Topsent's genus, can thus be disposed of. The so-called *Stylotella irregularis* Kirkpatrick (23), appears to be related to, and is perhaps truly congeneric with, the two species described by Whitelegge (57) under the names *Phakellia multiformis* and *Axinella symbiotica;* at any rate, these three species,—and also, I should say, *Axinella arborescens* R. & D.—might very well be referred tentatively to a single genus, and I, therefore, venture to create for them the genus *Axinosia* (with *Axinella symbiotica* as the type-species) which I would define thus: *Axinellidæ*, typically of ramose or lamellar habit, with a reticulate, subrenieroid, skeleton formed by plurispicular main fibres joined at more or less regular intervals by uni- or paucispicular transverse fibres. Spongin is comparatively scantily developed. The spicules are moderately small conical styli, together with typically fewer strongyla and (or) oxea, all of approximately the same dimensions. Microscleres are absent.

STYLOTELLA DIGITATA. (Pl. xix., figs.1-5; Pl. xx., fig.2; and text-fig.6).

Introductory.—This species, now to be known as *Stylotella agminata* Ridley, is represented in the collection of the Australian Museum by sixteen specimens, all from Port Jackson;

in addition to the single type-specimen, which is labelled "*Truncatella digitata*" and conforms closely to Lendenfeld's description, these also include the specimens labelled as the types of *Stylotella rigida*, *Tedania laxa*, and *T. tenuispina*—which three species, for reasons more clearly indicated in due course, I propose to regard as synonyms of *S. agminata*. Two further examples of the species occur also among the fragments of sponges received from the British Museum, one labelled "*Truncatella micropora*" (a MS. name), the other mistakenly labelled as "*Clathriodendron irregularis*." Among these fragments there is also one labelled "*Stylotella digitata*, Port Nelson, N.Z.," but this proves to belong to quite a different species; as a consequence there is reason to doubt Lendenfeld's correctness in recording the species from any locality other than Port Jackson.

Fig.6.
Stylotella agminata. *a*, Styli (or subtylostyli). *a'*, Basal extremities of subtylostyli.

Description.—The external features of the species have already been sufficiently described by Ridley and by Lendenfeld: in regard thereto, the latter author's descriptions of *Stylotella digitata* and *Tedania laxa* are applicable, but not strictly his descriptions of *S. rigida* and *T. tenuispina*. The oscula, concerning which these several descriptions are not quite in agreement, appear always to be few in number, scattered, and small; and usually to be more or less closed over by extensions of the dermal membrane. Ridley(33) has given a figure which conveys a very good idea of the form commonly assumed by erect specimens with cylindrical branches, and to this, I now add several others—one of which (Pl.xix., fig.3) shows an erect form, with crowded compressed parts due to imperfectly differentiated branches; while another (Pl.xix., fig.4)

illustrates a more reticulately branched example of the species. The latter specimen, which consists of somewhat flattened, anastomosing branches forming a reticulate mass, approximates to Lendenfeld's description of *Tedania laxa*, though not so closely as do two other specimens which occur among the type-specimens of that species; and which, on account of their somewhat irregularly arranged skeleton, I at first thought to be specifically different from the rest. I mention this because, whereas Lendenfeld states that *Stylotella digitata* is intensely orange-coloured, and *Tedania tenuispina* bright orange-yellow in the living state, he states, of *Tedania laxa*, that "the colour of the living sponge is bright brick-red"; and it is possible, therefore, that two varieties of *S. agminata* occur, which differ in colour, and perhaps, to a slight extent also, in other respects.

The main skeleton (Pl.xx., fig.2) exhibits great variability in its precise mode of arangement, but always consists (i.) of longitudinally-running spicule-fibres, which are unconnected by cross-fibres, and from the most peripherally situated of which, short branches arise that pass outwards to the surface; and (ii.) of spicules which, though they are sometimes abundant, for the most part lie scattered singly. Diversity in the conformation of the skeleton results through variation in number of the scattered spicules, and through differences in stoutness of the main fibres, and in their distance apart. For descriptive purposes, four chief types of arrangement are distinguishable; but apparently all gradations between these occur, and different types may be found in different parts of one and the same specimen. (i.). The fibres are closely arranged, running parallel to one another at a distance apart, which may be even less than their own diameter; and scattered spicules are scarce or absent: this condition, which is uncommon, appears most usually to be met with in slender cylindrical branches. (ii.).The fibres are more widely separated, and scattered spicules occur in greater or less abundance, usually crossing one another in all directions so as to produce,

when most abundant, the appearance of an irregular reticulation extending between the fibres; in this case, as in the preceding, the fibres are usually comparatively stout, being often as much as 130μ or more in diameter. (iii.). The arrangement of the scattered spicules is as in (ii.), but the fibres are slender, 20 to 70μ in diameter, and run sinuously, with frequent interosculation. (iv.) The fibres are rather slender and somewhat distantly separated from one another, while the scattered spicules are only moderately abundant, and are sometimes, in considerable proportion, disposed more or less longitudinally.

The first-mentioned type of arrangement is shown to best advantage by the British Museum fragment above referred to, labelled *"Clathriodendron irregularis"*; the second, by certain of the type-specimens of *Tedania laxa;* the third, also by specimens of *T. laxa;* and the fourth, by the type-specimen of *Stylotella digitata.* The third type of arrangement, or something intermediate between it and the first, is the commonest and most typical.

The dermal membrane overlies wide subdermal spaces, and is supported upon the extremities of short fibres—branches from the outermost of the longitudinal fibres—which are directed towards it more or less perpendicularly. The dermal skeleton consists of horizontally disposed spicules which, in general, are either loosely scattered without order, or are arranged somewhat in an irregular paucispicular network; around the oscula, however, they become more numerous and are disposed radiately. Occasionally, fibres from the main skeleton enter and run in the dermal membrane for a short distance before terminating.

The spicules are of a single kind, subtylostyli, usually with only a very slightly developed oblongish head, which is marked off by a scarcely perceptible constriction; occasionally the head is rendered more pronounced by a subterminal annular enlargement. They are cylindrical throughout the greater part of their length, taper gradually to a sharp point, and vary from straight to curved (or sometimes flexuous); usually the

curvature is slight, and the proportion of straight to curved spicules about equal; but, at times, most of the spicules are curved, and some of them much curved. Their maximum size varies in different specimens, from 286 by 6 μ to 305 by 9 μ; while the shortest spicules in any given specimen are of between one-half and two-thirds the length of the longest.

Loc.—Port Jackson.

STYLOTELLA POLYMASTIA. (Text-fig.7).

Introductory.—The species is represented in the collection of the Australian Museum apparently only by a tiny fragment, labelled "*Truncatella polymastia,*" received from the British Museum. Judged by its spiculation, the fragment is undoubtedly a genuine example of the species, but unfortunately it is so small, that scarcely any information is obtainable from it concerning other characters. Nevertheless, it enables one to say that the species is certainly not assignable to the genus *Stylotella* as defined above, but, in all probability, belongs to *Ciocalypta*—under which genus I propose to bring it.

In connection with the figure which appears in the Catalogue (Pl.iv., fig.i.) in representation of this species, a serious error has been made. As I already have had occasion to mention, the actual specimen, from which this figure was taken, is still in existence (labelled in Lendenfeld's handwriting *Sideroderma navicelligerum* R.&D.), and belongs to a hitherto unknown species of *Histoderma*, described, in the Appendix hereto, as *H. actinioides*. One can see, on comparing the figure in question with Lendenfeld's description of *Stylotella polymastia*, that the two are not compatible, although showing in some respects an apparent agreement.

In order to make the following description of the species as complete as possible, I have repeated Lendenfeld's description of its external features; but it should be borne in mind that, possibly, this description is not applicable. In consequence of the small size of the fragment, I have not succeeded in securing sections cut in the proper direction to enable me to deter-

mine the exact arrangement of the skeleton, and my description of this is consequently to be regarded as only approximately correct.

Description.—"Massive sponges with numerous, irregular, mostly fistular processes arising from the upper surface. The sponge is attached by a broad base and attains a maximum diameter of 300mm. The oscula are situated terminally on the summits of the processes."

The main skeleton consists of dendritically branching, and occasionally interuniting, stout, plumose "funes"; and of numerous scattered spicules, the latter here and there forming dense masses connecting the "funes." The "funes" are either single fibres, or are composed each of several intimately associated fibres; these fibres consist of a spongin-axis, usually enclosing some longitudinally disposed spicules, and of numerous spicules which project from this axis at varying angles, some of them directed almost perpendicularly outwards in an echinating fashion. At the surface, the columns pass into broad, dense brushes of almost parallel spicules, the outer ends of which, apparently, give support to a dermal membrane; intermingled with the spicules of the brushes, are, sometimes, numerous irregularly disposed spicules. Whether there is a special dermal skeleton, is not quite certain; but, here and there, lying upon the outer ends of the brushes, horizontally directed spicules, forming a thin layer, were observed.

Spicules.—(*a*). The spicules which chiefly compose the fibres are straight or very slightly curved, gradually sharp-pointed, fusiform styli with a narrow handle-like basal end, of diameter sometimes less than half that of the thickest portion of the shaft, measuring from about 400 to 720 μ in length, by rarely more than 25 μ in maximum diameter. The longest spicules (those, say, of length exceeding 600 μ) are seldom, if ever, more than 20 μ in diameter; are always less distinctly narrowed at their basal end than the shorter, and relatively stouter spicules; and are connected by spicules of every intermediate grade with

(*b*). Straight or slightly curved, gradually sharp-pointed, usually slightly fusiform styli, abundant in the superficial skeleton and scattered throughout the interior. These, which range in size from less than 300 by 5 μ to upwards of 650 by 15 μ, are probably not at all separable from

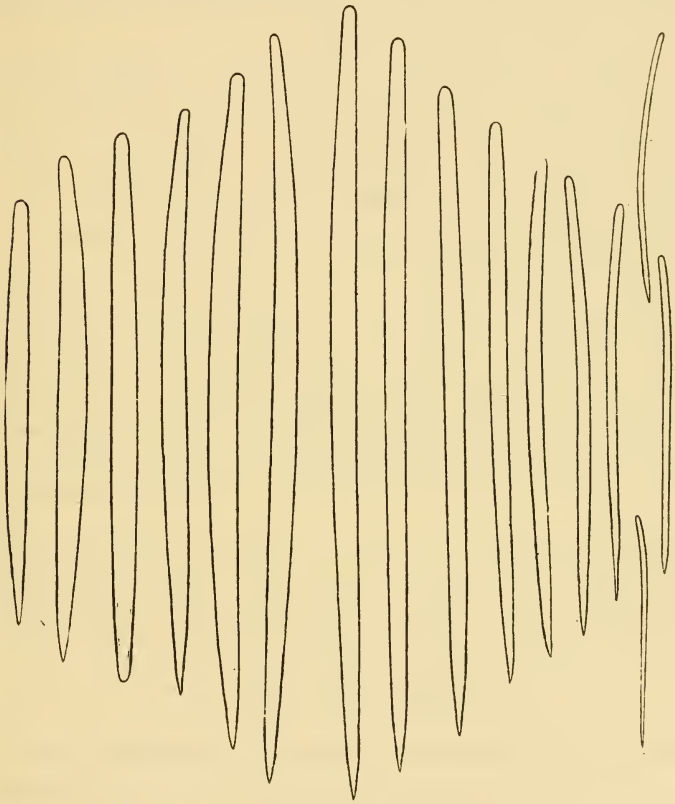

Fig. 7.—*Ciocalypta polymastia.* Styli, showing transitions from one form to another.

(*c*). More or less curved styli, comparatively few in number, apparently occurring only as scattered spicules, ranging in length from 160 to upwards of 300 μ and measuring, at most, 8 μ in diameter.

Rare oxea, of the size of the smallest styli, were observed, which possibly are of foreign origin, since no intermediates between them and the styli were observed. The larger spicules, however, are certainly never oxea, nor do they ever approach to an oxeote form; though occasionally, through rounding off at their apical end, they may pass into strongyla.

Loc.—East coast of Australia.

Remarks.—In the form of its spicules, *Ciocalypta polymastia* somewhat resembles the type-species of *Leucophlœus*—i.e., *massalis* Carter(6); and it appears to agree with the latter also in certain features of the skeleton. I am inclined to think, therefore, that the two species are congeneric. What the precise arrangement of the skeleton is, in the latter species, however, Carter's description does not make quite clear; and subsequent writers, acquainted with the species, have omitted to state explicitly. Ridley and Dendy(34a) expressed the opinion that *Leucophlœus* cannot be distinguished from *Hymeniacidon;* but, at a later date, Dendy(14) states that *Leucophlœus massalis* is identical with *Ciocalypta penicillus* (the type-species of *Ciocalypta*), and mentions that, since the resemblance between these two species was pointed out by Carter himself, he is unable to understand why the genus *Leucophlœus* should have been proposed. In view of this, I am at a loss to understand why, subsequently, Dendy(15) recognised *Leucophlœus* as a distinct genus, related to *Hymeniacidon*. If it be correct that *L. massalis* approaches rather to *Hymeniacidon* than to *Ciocalypta* in the character of its skeleton, then, beyond question, the species described above is not assignable to *Leucophlœus*, since its fibres are decidedly of the axinellid type.

Topsent(44) in a paper which I have not seen, has apparently wrongly recorded, as *Stylotella polymastia*, a sponge from Amboina; for Kirkpatrick(23), speaking with reference to *Hymeniacidon conulosum* Topsent, mentions that "the nearly related species *Stylotella polymastia* Lendenfeld, referred to by Topsent (*l.c.*, p.466), is synonymous with *Hymeniacidon fenestratum*(Ridley)."

Stylotella rigida.

The specimen labelled as the type of this species (under the MS. name "*Truncatella rigida*"), as well as a fragment labelled *Stylotella rigida* from the British Museum, are specifically the same; and, in skeletal characters, accord with Lendenfeld's description; but in one conspicuous feature attributed to *Stylotella rigida*—*viz.*, the possession of oscula 1 to 3mm. in width, and situated at the extremities of the digitate processes—they are completely lacking. As a matter of fact, they are examples of *Stylotella agminata* Ridley. One is justified in concluding, therefore, that the description of *Stylotella rigida* confounds the external features of one species with the internal features of another, the latter being that represented by the type-specimen; and as the former is unknown and indeterminable, we may, accordingly, look upon *S. rigida* as, in effect, a synonym of *S. agminata*. An independent reason for suspecting that some such mistake as this was made in connection with *S. rigida*, is afforded by its specific name, the implication of which is in direct contradiction to Lendenfeld's definition of the genus *Stylotella* as "Heterorrhaphidæ of very soft texture."

Dendy(14) has mistakenly referred to this species, under the name *Hymeniacidon rigida*, a sponge from Port Phillip. As the description given of the latter is sufficient for its identification, I propose that it be called *Hymeniacidon victoriana*.

Stylotella aplysillioides.

The specimen preserved in the Australian Museum as the supposed type of this species—for the reason that it is labelled, in Lendenfeld's handwriting, with the name ("*Truncatellina cinerea*") given in the key-list as the manuscript synonym of *Stylotella aplysillioides*—is a small, very thinly incrusting sponge, apparently belonging to the genus *Mycale*, with a thin dermal layer of foreign particles, and a main skeleton consisting (i.) of unconnected ascending fibres composed of foreign

(mostly spicule-) fragments, (ii.) of sparsely scattered subtylostyli measuring rarely as much as 130 by 3·5μ and (iii.) of a very few, scattered, slender toxa and anisochelæ, the latter measuring, at most, 17μ long. It is quite a different type of sponge, therefore, from that denoted by Lendenfeld's description, having no feature of resemblance thereto except an incrusting habit of growth, and even in this respect being not quite similar, since the layer it forms is only about 1mm. in thickness. Accordingly, in my opinion, it cannot possibly be accepted as the type-specimen.

A fragment from the British Museum, labelled *Stylotella aplysillioides*, is also totally unlike the described sponge of that name, and belongs to the genus *Dendoricella*—its spicules being skeletal oxea, dermal tylota, isochelæ arcuatæ, and two sizes of sigmata.

Hence we are left with no clue as to the identity of *Stylotella aplysillioides* except its rather brief description, which, if it can be relied upon, indicates that the correct position of the species is in the genus *Hymeniacidon*. To this genus, then, the species may, for the present, be regarded as belonging. The only other species of *Hymeniacidon* known from Port Jackson, is that recorded by Ridley(33) under the name *H. caruncula* Bowerbank; this is also a horizontally extended sponge with surface-elevations, but its spicules are stated to attain a size of 290 by 8μ, while those of *H. aplysillioides*, according to Lendenfeld, measure only 130 by 6μ.

Subfamilia Phlœodictyinæ.

Rhizochalina ramsayi. (Pl. xx., figs.2-5; Pl. xxi., fig.4; and text-fig.8).

The types consist of three half-specimens (derived by vertical bisection of the originals), and a thick, median, vertical slice of a fourth specimen. The sponge is massive, more or less globose, provided on its upper aspect with numerous thin-walled erect fistulæ, and below with few (sometimes only one) or

many, usually branched, stout, root-like processes. The fistulæ are, almost without exception, widely open at their distal end, though this appears to be due to their having had the extremity broken off. The roots are tapered, and convey the impression that they serve the function of anchoring the sponge in mud; according to the original description, they may attain to a length of 300mm. The largest specimen (Pl. xx., fig.2) is of comparatively irregular form, being elongated in one horizontal direction, and compressed at right angles thereto; it measures 230mm. in length, by 180mm. in height; and (though only a half-specimen) is provided with about a dozen roots.

The original description states that, in addition to fistulæ, there occur on the upper surface of the sponge, at its centre, two to five much wider and shorter tubes, 20mm. wide and only 25mm. high, the cavities of which are occupied by a reticular structure: unfortunately, in the type-specimens, owing no doubt to their not being symmetrical halves of the originals, none of these tubes are present. It happens, however, that the trawling steamer "Endeavour" has recently obtained, from off the coast of New South Wales several specimens of a sponge closely related to *Phlæodictyon ramsayi*—I propose to designate it a variety, *pyriformis*, of this species—which provides the clue to the nature of these tubes.

The variety is a stoutish, pear-shaped sponge without roots, which evidently, in life, was attached by its narrower end to a hard substratum. The fistulæ, which are short and stout, are usually not numerous, and may be altgether absent; as, in the only specimens so far obtained, they are all more or less damaged, it is not known whether their extremities are open or closed. A characteristic feature of the sponge is the arrangement of its oscula (Pl.xx., fig.3), which open side by side to the number of between 50 and 100, together forming a slightly depressed, oval or circular, honeycombed area occupying the centre of the upper surface. This oscular sieve differs from that of the typical form of the species, as describ-

ed by Lendenfeld, in the fact that its margin is not prolonged upward into a tube, but is level with the surrounding surface. The oscular canals are arranged in a manner conforming with the general symmetry (Pl.xx., fig.4): a few run upwards axially from the stalk, separated from one another only by thin partitions, while the remainder—which start from different points quite close beneath the surface—traverse the sponge radiately, in such manner as to come into parallelism with the axial direction before the oscula are reached. Other canals also occur, each of which is continuous with the lumen of a fistula.

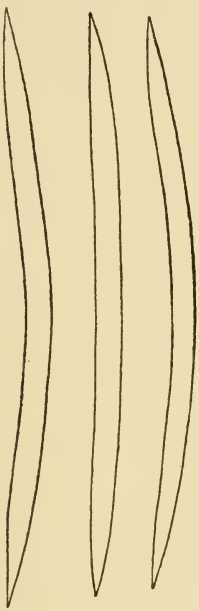

Fig.8.
Phlœodictyon ramsayi. Oxea.

As far as can be judged from the incomplete specimens of the typical form of the species, the arrangement of its canals is much the same as in the variety. (The probability is that the canals, which connect with the fistulæ, are inhalant in function).

The structure of the skeleton also is very similar in both forms, except that, in the root-like processes of the type, the main skeleton consists almost entirely of stout longitudinal fibres (50 to 200 μ in diameter) closely arranged like the strands of a rope; while, in the peduncle of the variety, the corresponding fibres are much more widely separated, and the intervening spaces are occupied by a renieroid, for the most part unispicular, reticulation, similar to that which is general throughout the body of the sponge. The fibres of the roots or peduncle, as the case may be, continue into the body of the sponge and spread dendritically through it, at a considerable average distance apart; here and there, they are connected by cross-fibres. Between the fibres, as already indicated, the skeleton consists of a renieroid reticulation. The fibres are composed of very closely packed, parallel spicules, which, apparently, are held together by a minute quantity of spongin.

The bast-layer consists of an irregular, unilamellar reticulation (Pl.xx., figs.4,5) of stout fibres immediately underlying the dermal membrane, and of numerous, inwardly directed, short, lamellar extensions of the same. The dermal skeleton proper is a single layer of horizontally disposed spicules crossing each other in all directions, and thus producing a somewhat lattice-like pattern.

The spicules are the same in all parts of the sponge—oxea, slightly and somewhat angularly curved, nearly cylindrical throughout the greater part of their length, and gradually tapering to sharp points. In the typical form of the species, their maximum size is 195 by 8μ, and their length ranges from 130 to 195 μ (but is very rarely less than 150 μ); in the variety, the spicules are a little larger, attaining to a size of 220 by 9·5 μ.

The typical form of the species comes from Port Jackson.

Rhizochalina petrosia. (Text-fig.9).

The evidence indicates, beyond reasonable doubt, that, under this name, Lendenfeld has combined portions of the descriptions of two quite different species. In the Australian Museum, labelled, in that author's handwriting, with the MS. name corresponding (according to his key-list) to *Rhizochalina petrosia*, is a small, gauzy-textured, branch-shaped sponge, apparently belonging to the genus *Ciocalypta*, the spicules of which are oxea of exactly the dimensions stated in the description, *viz.*, 700 by 15 μ; and from the British Museum comes a small fragment labelled *Rhizochalina petrosia*, which both belongs to the genus *Rhizochalina* (i.e., *Phloeodictyon*) and exhibits skeletal characters such as render the specific name *petrosia* extremely appropriate, but in which the oxea are, at most, only 165 by 8·5 μ in size. Thus the former specimen possesses the skeletal features ascribed to the species, but is entirely different to it in external form; while the British Museum specimen (the external form of which I do not know), in spite of the above-mentioned serious disagreement with the

description, affords practically indisputable reason for believ-it to exemplify the species to which the name *R. petrosia* was intended to apply. The question, as to which of these specimens is to be considered the type of the species, appears to me one that might be decided quite well by the toss of a coin ; but as the latter best accords with the name, I propose that it be taken as the type—the species thus requiring to be called *Phlœodictyon petrosia.*

An adequate description of *Ph. petrosia* cannot, at present, be given, as the small fragment at my disposal consists of scarcely more than a portion of the rind. As far as can be judged from this, however, the species is distinct from any other that has been described. The rind is usually well-developed, attaining to a thickness of nearly 2 μ ; its skeleton consists of an approximately rectangular, coarse reticulation of stout fibres, measuring up to 150 μ in diameter, composed of closely and not very regularly packed oxea uncemented by spongin. The skeleton bears a marked resemblance to that which is characteristic of many species of *Petrosia.* A dermal skeleton proper, external to the rind, appears to be absent. What little of the main skeleton is shown, consists mainly of scattered spicules exhibiting a tendency towards an arrangement in an irregular subrenieroid manner; but there also occur, at intervals, very stout fibres, similar to those of the rind, which apparently belong to inwardly-directed extensions of the latter, such as have been noticed in *Ph. ramsayi.* The spicules, which are the same in the rind as in the main skeleton, are somewhat angulately curved and abruptly sharp-pointed oxea, ranging in length from 130 to 165 μ, and measuring seldom less than 6 and not more than 8·5 μ in stoutness.

Fig. 9.
Phlœodictyon petrosia.
Oxea.

Loc.—Port Jackson.

Subfamilia Gellinæ.

Gellius panis.

The species is without a type-specimen, and, so far, I have met with no sponge identifiable with it. There appears to be no reason to doubt that the species belongs to the genus to which Lendenfeld has referred it.

Loc.—Port Jackson.

Gellius raphidiophora. (Text-fig.10).

Introductory.—The type-specimen conforms recognisably to the description, but the latter is at fault regarding the size of the sigmata and the maximum stoutness (which is 9·5, not 6 μ) attained by the oxea, and also omits to mention that the oxea are of three kinds, two of which—hence rather to be termed raphides—occur in dragmata: that raphides, however, were present in the original specimen, is both indicated by the description and implied by the specific name.

I have lately collected three specimens (from the underside of rocks exposed at low tide, near Port Jackson), which apparently in no way differ from the type of the species, excepting that their spicules are much slenderer, the stoutest oxea having (as it happens) only about the same diameter as that stated by Lendenfeld. As these specimens differ also among themselves (to the extent of 1·5 μ) in the diameter of their stoutest spicules, it is practically certain that they are not varietally distinct from the typical form, and, therefore, I have taken them into account in drawing up the following description.

Description.—Sponge massive, depressed, basally encrusting. Surface even or slightly undulated, smooth, very minutely reticulate (owing to the dermal skeleton). Oscula few, scattered, marginally flush with the general surface, measuring up to 3 mm. in diameter. Colour in life, bright yellow; in alcohol, light yellowish-grey. Consistency fairly soft and friable. The interior is traversed in various directions by many canals measuring up to 2 or 3 mm. wide; otherwise the structure is fairly compact.

Of the four specimens at hand, the largest measures 100 mm. long, by 70 mm. broad, and from 2 to 15 mm. in thickness; according to the original description, the sponge may grow to a thickness of 50 mm.

The main skeleton is an irregularly renieroid, paucispicular reticulation, the pattern of which usually appears much confused owing to the great number of scattered bundles of raphides; spongin is present in minute quantity, though apparently only at the angles of the meshes. In the most superficial region, loose polyspicular strands of spicules occur, which run perpendicularly to the surface and terminate in slightly projecting tufts coinciding in position with the nodes of the dermal reticulation. The dermal reticulation, for the most part, is triangular in pattern, and has the sides of its meshes formed of from two to five roughly parallel spicules.

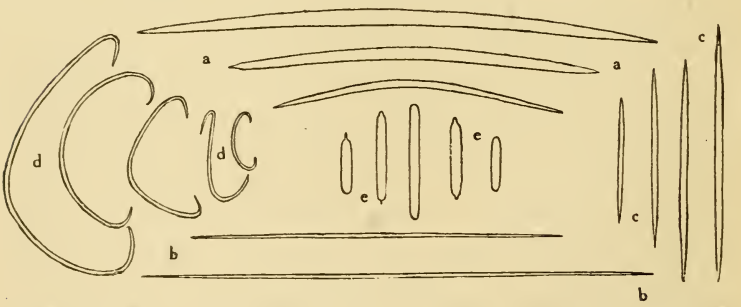

Fig. 10.—*Gellius raphidiophora*. *a*, Oxea. *b*, Sigmata. *c*, Longer raphides. *d*, Shorter raphides. *e*, Microstrongyles.

Spicules.—(*a*) Slightly curved oxea, very nearly cylindrical throughout the greater part of their length, and tapering gradually to sharp points. Size*: (*i*) 150 to 215 by 9·5 μ; (*ii*) 120 to 195 by 5 μ.

* The two sets of measurements—which refer to the range in length of the spicules, and to their maximum stoutness—are taken from the specimens whose spicules are the most different in point of size; the former measurements are those of the type-specimen.

(*b*) Longer raphides, occurring only in dragmata, straight, cylindrical, gradually sharp-pointed, and slightly dilated at intervals. Size: (*i*) 130 to 255 by 2·5 μ; (*ii*) 120 to 245 by 1·5 μ.

(*c*) Shorter raphides, occurring only in dragmata; straight, fusiform. Size: (*i*) 45 to 120 by 4·5 μ; (*ii*) 40 to 95 by 2·5 μ.

(*d*) Sigmata, very variable in size, but apparently not separable into two groups; the larger, as well as many of the smaller, are intermediate in shape between ordinary and flagellate sigmata. Length: (*i*) 15 to 76 μ; (*ii*) 15 to 70 μ. Stoutness: (*i*) 3·7 μ; (*ii*) 1·5 μ.

(*e*) Microstongyles, often somewhat pointed at one or both extremities; rare, but occurring in all specimens. Size: 16 to 50 by (*i*) 3 to (*ii*) 4 μ.

Loc.—Port Jackson.

Remarks.—On the evidence of a single specimen from Port Phillip, which I identify as *Gellius phillipensis* Dendy(12), this latter species is not more than a variety of *G. raphidiophora,* from which it differs chiefly in the fact that its longer raphides are immeasurably fine. In the specimen referred to, microstrongyles also occur, but are exceedingly rare, only a single example having been found in two slide-preparations.

G. raphidiophora is distinguished from all other species of the genus, not only in having two sorts of raphides, but also in the possession of microstrongyles; its sigmata, too, are of unusual form, and recall those of certain species of *Biemna*—e.g., *B. chilensis* Thiele(42), and *B. hamifera* Lundbeck(31). This fact concerning the sigmata seems not unworthy of notice, since also in *Biemna* the microscleres may include raphides and—if not microstrongyles exactly—siliceous globules. Actual microstrongyles, in association with raphides and sigmata, are elsewhere known to occur only in the somewhat aberrant *Tylodesma microstrongyla* Hentschel(21), and *Allantophora plicata* Whitelegge(57), two species which, I think, are allied to one another, though scarcely to be regarded as congeneric; but whether these microstrongyles (showing as they do some trace of centrotylosis) are homologous with those of *G. raphidiophora,* it is at present impossible to say.

TEDANIA RUBICUNDA. (Pl. xvii., fig. 4; and text-fig. 11).

Introductory.—The type-specimen—labelled "*Pellina rubicunda*"—although somewhat at variance with the description as regards spiculation, is so closely in agreement therewith, in most other respects, that any doubt as to its genuineness is quite precluded. The spicules are not, as Lendenfeld has stated, mainly *tylota,* but mainly styli—the former being abundant only in the dermal layer; furthermore, oxea are entirely absent, the tylota have conspicuously spined extremities, and the trichites are minutely spinulous. Thus, the spiculation—and, I might add, the general arrangement of the skeleton also—conform to those of *T. digitata,* of which species, therefore, *T. rubicunda* may, for the present, be considered a variety.

Description.—The single specimen (Pl. xvii., fig. 4) is a sessile, massive sponge, with a somewhat cylindriform, stoutish body, about 80 mm. in diameter and 100 mm. in height; which divides above into two larger, and is provided also, towards its upper aspect, with several smaller, digitiform, tapering lobes or processes. There is a well-defined dermal membrane, and the surface generally, except where bruised and damaged, is smooth and glabrous; the processes, however, show a few, usually quite shallow, longitudinal furrows or wrinkles. According to the original description, the processes are traversed by a central oscular tube, and have, at their summit, a number of small oscula. The first part, at least, of this statement is not strictly correct; except in their lower portion, the processes are traversed by distantly separated canals, and these are of small size, usually less than 1 mm. in diameter. These canals run longitudinally, gradually converging as the process becomes narrower, and (perhaps not in all cases) finally unite, at a variable distance from the extremity of the process, to form a single fairly wide canal. This terminal canal, no doubt, communicates with the exterior at the apex of the process, though the manner of accomplishment of this is not apparent in the present specimen; if it is by means of oscula, as is probably the case, these must be very small. The chief excurrent canals, both in the processes and in the body of the sponge, are surrounded

by a relatively very broad layer or wall of collenchymatous tissue, which, to the naked eye, has a somewhat gelatinous and translucent appearance as compared with the surrounding denser tissue. The specimen, which is preserved in alcohol, is of a dull yellowish-white colour; it is of rather soft consistency, and is very easily torn asunder. In the living state, according to the original description, the colour is a bright orange-red, which is more pronounced and intense on the surface than in the interior.

In the body of the sponge, the main skeleton consists of a rather dense and confused, somewhat renieroid, reticulation of single spicules and of spicule-bundles (or short, paucispicular fibres), traversed at close intervals by well-defined, multispicular fibres (usually less than 50μ in stoutness) running, for the most part, in a surfaceward direction; scattered through the reticulation are raphides, which occur both singly and in bundles. In the processes, however, in correspondence with an increase in development of the multispicular fibres, the reticular component of the skeleton is more or less reduced, and, in their more central region, may occasionally disappear altogether; in the latter case, the skeleton consists almost exclusively of closely approximated, longitudinally-running fibres, the diameter of the stoutest of which may exceed 200μ. The fibres are everywhere composed of loosely aggregated, parallel styli, together with a small proportion of tylota. Spongin is entirely absent. In the extensively developed collenchyma surrounding the canals, the only skeletal elements are singly scattered raphides and tylota, the former abundant, the latter usually scarce. The ectosomal skeleton consists of closely approximated, slightly divergent, vertical tufts of tylota, with numerous raphides scattered between; the tufts often, though not usually, are prolonged inwards into loose straggling strands (of tylota) connecting with the multispicular fibres of the main skeleton; but in many places, especially where the dermal layer is immediately underlain by collenchyma, a discontinuity exists between the dermal and main skeletons, which is very marked.

Spicules.—(*a*) The styli are (as a rule, slightly) curved, or rarely straight spicules, of nearly uniform diameter throughout their

entire length except for a distance of about 5 μ (or less) through which they taper to a sharp point; proceeding towards the basal end, however, they usually undergo a slight contraction, and then usually expand again, though only very slightly, at their extremity. Their length, which very rarely falls below 160 μ, may attain to 215 μ, and, on the average, is nearer to the latter figure than to the former; the diameter of the stoutest is 6 μ.

Fig. 11.
T. digitata var. *rubicunda*. *a*, Styli. *b*, Tylota. (Onychetæ not figured; similar in spinulation to those of *T. digitata* var. *rubra*).

(*b*) The tylota are straight or nearly so, with cylindrical or slightly fusiform shaft, and with elongate narrow heads, the extremities of which are truncate, and provided with about a dozen spines, averaging, say, 2 μ long; they range between 190 and 240 μ, and are seldom less than 210 μ in length, while their diameter is rarely, if ever, more than 3·5 μ.

(*c*) The raphides (onychetæ) are straight, asymmetrically fusiform, stylote, tapering gradually to a fine point at one end and to a truncated extremity at the other; their region of maximum stoutness lies nearer to the latter or basal end. Their base is frequently rendered apiculate by a minute spine situated at its edge, *i.e.*, outside the line of continuation of the axis of the spicule; sometimes there appear to be two such spines. The basal moiety (only) of the spicule is covered with minute spinules, which decrease in size towards the middle of the spicule and, gradually becoming indistinct, finally give place to a scarcely more than perceptible roughness of the surface. The raphides are, at most, 1·8 μ in diameter, and vary in length from 35 to 130 μ; individuals of length between 60 and 90 μ, however, are rare, thus indicating a partial differentiation of the spicules into two groups. The smaller raphides are

scarce, except in the dermal skeleton, where their number equals, if it does not exceed, that of the longer ones.

Loc.—Port Jackson.

Remarks.—In the aggregate of its characters, *T. digitata* var. *rubicunda* appears to be well distinguished from any hitherto described variety of the species, and, in many respects, diverges so widely from the typical form as almost to justify its recognition as an independent species; possibly, however, it may prove to be identical with the insufficiently described *T. digitata* var. *fibrosa*, R. and D., which is recorded from the same locality (Port Jackson). Its chief diagnostic features are the digitate, massive, external form; the well-defined asponginous fibres; the considerable range in length, and partial separation into two groups of the raphides; and the character of the extremities of the tylota.

Hentschel(20), misled by Lendenfeld's description of *Tedania rubicunda*, has briefly described, under that name, a sponge, from the west coast of Australia, in which the dermal spicules are amphistrongyla (apparently with non-spinose extremities), and which, in other respects also, differs markedly from the sponge here redescribed.

Tedania laxa.

Labelled in Lendenfeld's handwriting "Truncatella laxa"—the MS. synonym of *Tedania laxa*—there are, in all, twelve specimens, eleven occurring together in one jar, and one separately. They vary very considerably in their exact external form, though all are much alike in colour, consistency, and surface-appearance; and all agree in being composed of clustered, usually more or less interunited, moderately slender branches. Some, for example, have the branches very intimately intergrown and partially fused with one another, in such a way as to give rise to a rather compact reticulate mass, and are thus, as regards external form, apparently in close agreement with the description of the species; whereas others are more erect and arborescent, and include among them several that

exhibit a conspicuous resemblance to the type-specimen of *Stylotella digitata* (= *S. agminata*). While external examination of the specimens afforded no reason to doubt that at least the more massive-looking would be found in complete conformity with the description of *T. laxa*, microscopical examination yielded, in every case, the same result, and showed them to be no more than a series of forms of *Stylotella agminata*. Yet, at the same time, there was presented the very striking coincidence that, in the arrangement of their skeleton and approximate size of their spicules, the specimens actually do agree with the description of *T. laxa*, almost perfectly. In the face of such evidence, a contention that the specimens are other than examples of this species cannot well be sustained; and one has to conclude that *Tedania laxa* is no more than a synonym of *Stylotella agminata*. The probability of the correctness of this conclusion is supported by other considerations, as follows:— According to its description, *T. laxa* differs from *S. agminata* only in the following particulars: the sponge grows to a comparatively large size (nearly twice that of the largest specimen of *S. agminata* in the collection); oscula are not apparent; the colour of the living sponge is bright brick-red; and the spicules, in addition to styli, include tylota, oxea, and rare trichites. But the difference in mere size of the sponges is of very doubtful importance, as also is their difference in colour; the oscula of *S. agminata* are often very difficult to make out (owing apparently to their becoming closed over, as a result of contraction, by the dermal membrane); and there is present, in this species, a small proportion of slender megascleres which, without critical inspection, could very easily be mistaken for trichites. Also, allowance must be made for the fact that, in regard to matters of spiculation, the Catalogue is often seriously at fault; and of especial significance in this connection is the erroneous spiculation ascribed to *Tedania rubicunda* and *T. rubra*. And, finally, it is to be noted that the pattern of the skeleton of *S. agminata* bears no inconsiderable resemblance to that (in certain parts) of *T. rubicunda*, and, indeed, might be described in precisely the same terms as Lendenfeld, in his description of the latter species, employs.

Tedania rubra. (Text-fig. 12).

Introductory.—Although the specimen which I describe hereunder, is far from satisfactorily agreeing with the original description, yet, as it is labelled in Lendenfeld's handwriting with the name ("Truncatella renieroides"), given in the key-list as the MS. equivalent of *T. rubra,* and as it actually is a *Tedania,* the balance of evidence undoubtedly points to its being a genuine example of the species, and justifies the conclusion that the original description is inaccurate. The latter states, among other things, that oscula are present, which measure 2 to 3 mm. in width; that the fibres consist (only) of spicules; and that the spicules are styli measuring on the average $200 \times 6\mu$, tylota, oxea, and irregularly curved, hair-like spicules. In the specimen, on the other hand, there are no evident oscula (though scattered over the exterior, there is a number of small oscula-like openings, due to the presence of operculate cirripedes close beneath the surface); the fibres are composed of spicules cemented and usually also ensheathed by spongin; oxea are entirely absent; the styli measure at most $205 \times 6\mu$; the "tylota" have spined, and scarcely at all expanded, extremities; and the hair-like spicules (spinulous raphides) are almost invariably straight. As an indication of the limited importance attachable to these discrepancies, it may be remarked, firstly, that those in connection with the spiculation are almost exactly the same as have been found to occur in the case of *Tedania rubicunda,* and, secondly, that the actual mistake of describing, as oscula, holes caused by symbiotic cirripedes, was made by Lendenfeld in the case of *Cliona lutea* and of *Spirastrella ramulosa.*

The megascleres (and, at first sight, also the raphides) of *T. rubra* resemble so very closely those of *T. digitata* var. *rubicunda,* that had I examined no more than preparations of their spicules, I should certainly have pronounced the two sponges to be specifically identical; in view of its well-developed spongin-fibre, however, the like of which apparently has not been met with in any other of the numerous known forms of *T. digitata,* it seems necessary that *T. rubra* should be ranked as an independent variety.

Description.—The single specimen is a solid massive sponge, of somewhat brick-shaped form (but with rounded angles and partly uneven surface), measuring 55 mm. in height, and 45 mm. by 30 mm. in cross-section; the inequalities of the surface are mostly restricted to the upper aspect of the sponge, and take the form of conical, dome-shaped, or papilliform elevations of small size, the largest (which is of exceptional size) measuring 6 mm. in height, and 5 mm. across at its base. There is a well-developed, non-separable, dermal membrane, with smooth, almost glabrous, surface. Oscula of minute size, certainly less than 0·5 mm. in width, are probably present, and, judging by the direction of the main excurrent canals, occur on the upper surface, generally (though apparently not exclusively) at the summits of the elevations; as, however, the canals are of very small size (being rarely as much as 1 mm. in diameter), and are not traceable, owing to their partial collapse, all the way to the surface, the existence of undoubted oscula could not be demonstrated.

The colour in alcohol is yellowish within, and dull white on the surface. In consistency, the sponge is moderately firm, yet compressible, and, by reason of its fibrous skeleton, is resilient and fairly tough.

The main skeleton is a reticulation of spiculo-spongin fibres between which there lie scattered, without recognisable order and in varying abundance, usually not numerous megascleres and raphides, the latter occurring both singly and in bundles; entering into its composition also, but not contributing to form the reticulation, are occasional (yet constantly occurring) continuous strands of loosely associated, parallel spicules uncemented by spongin. The spicules of the sponginous fibres are styli and tylota, the latter relatively very scarce except in the ectosomal region; in the asponginous fibres, on the other hand, the tylota may predominate over the styli, and also a few raphides make their appearance. The scattered megascleres are chiefly tylota. The skeleton-reticulation consists chiefly of multispicular main fibres (with compact spicule-core, on the average less than ten spicules broad) running irregularly, usually not much more than a spicule's length apart, and

with occasional branching and anastomosis, in a general surfaceward-direction; the connecting fibres, which vary from unispicular to rarely multispicular, occur at rather variable intervals, and, where the main fibres are more widely separated, from between them an irregular inter-reticulation. As the surface is nearly approached, the connecting fibres disappear, and the outwardly-running fibres become split up into numerous closely-arranged and parallel strands of loosely-associated tylota, ending at the surface, each in a slightly penicillate tuft: in the dermal skeleton thus constituted, there occur in addition to the vertically arranged spicule-strands only a very few scattered raphides. In places—though this seems to be exceptional—the dermal skeleton, while otherwise unchanged in character, appears not to be in continuity with the main skeleton. The extent to which spongin is developed in connection with the fibres, varies considerably in different parts; frequently it forms a quite conspicuous sheath which, in thickness, may exceed the diameter of the spicule-core, the fibre as a consequence attaining sometimes to a stoutness of 40μ or more; usually, however, it is barely more than sufficient to hold the spicules together; while towards the surface, it further diminishes in quantity and finally disappears. The main excurrent canals are surrounded by a narrow layer of collenchymatous tissue in which the only skeletal elements are scattered tylota and raphides.

Spicules.—The megascleres, as already stated, are hardly distinguishable from those of *T. digitata* var. *rubicunda*—even in size being not materially different. The styli (when full-grown) vary in length from 155 to 200μ, and are at most 6μ in diameter; the tylota are never less than 175μ in length, and attain a maximum size of 230 × 4 μ. The very slenderest immature tylota, it was noticed, have the axial canal open at one end, and, at that end, their spines are less advanced in development than at the other.

Raphides (onychetæ) occur of all lengths between 20 and 155μ, but those exceeding 135 μ are scarce; there is also a rarity of individuals of certain intermediate sizes, with the consequence that, roughly, three groups are recognisable, having the following approximate ranges of length: (i.) 20-40 μ; (ii.) 55-70 μ; (iii.)

90-155μ. Those of the third group are the most abundant, while those of medium size, which are the least frequent, are comparatively very scarce. Besides differing in size, the raphides of the three groups exhibit, as a general rule, certain appreciable differences in other respects also, though all agree in being very gradually sharp-pointed at one extremity, and abruptly truncated at the other, in being more or less spinulous, and in having the spinules pointing in the direction of, and progressively increasing in size towards, the truncated or basal end of the spicule. (i.) The smallest raphides are conical in shape, tapering gradually from base to apex; are spinulous over their entire extent; and are usually much less than 1 μ in diameter. (ii.) The rather rare raphides of intermediate size are fusiform, with the region of greatest stoutness nearer to the basal end than to the middle of their length; are provided over their whole length with spinules which attain to a larger size than those of either (i.) or (iii.); and are always relatively stout in proportion to their length, their diameter being seldom much less than 2 μ. (iii.) The longest raphides are slightly fusiform, with the region of greatest stoutness situated nearer to the middle of their length than to the basal end; have a merely roughened surface, or (as a rule, only in the case of the stoutest) are perceptibly spinulous over their basal moiety only; are commonly terminated at their truncated end by a slender spine; and vary in stoutness from less than 1 μ to slightly more than 2 μ.

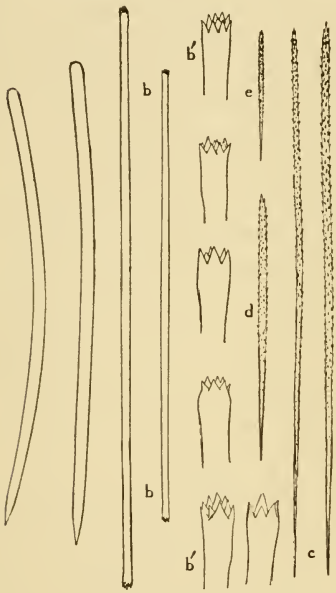

Fig. 12.
T. digitata var. *rubra*. *a*, Styli. *b*, Tylota. *c*, Onychetæ.

Loc.—Port Jackson.

Tedania tenuispina.

The specimen purporting to be the type of this species—and, moreover, the only specimen, either in the collection of the Australian Museum or among the fragments received from the British Museum, which is labelled as representing the species—is considerably at variance with the description of *Tedania tenuispina* in regard to its outward form, and departs therefrom also in some other respects,—being, in fact, an example of *Stylotella agminata*. Nevertheless, in skeletal characters it exhibits, on the whole, a very considerable degree of correspondence with that description; and were the specimen but possessed of the external habit ascribed to *T. tenuispina*, one would not hesitate at all to accept it as an example thereof. Accordingly, the question presents itself as to whether the alleged type-specimen should be rejected as wrongly labelled, and as having no relation whatsoever to the species under consideration; or whether the description should be regarded as an erroneous one, combining an account of the external features of one species with that of the internal features of another, the latter species being that which is exemplified by the type-specimen. The evidence is insufficient to enable one to decide positively; but, for the following reasons, I am disposed to give preference to the view that the description confuses two species, one of which is *Stylotella agminata*. In the first place, the external form ascribed to *T. tenuispina* is opposed to the likelihood of its belonging to *Tedania*, inasmuch as the species of that genus appear always to be more or less massive in habit; and it is an admissible assumption, therefore, that the species has been either generically misnamed or else misdescribed in respect of its external characters. Secondly, the description is open to suspicion owing to an apparent incongruity; for, in the paragraph relating to the outward characters of the sponge, it is stated that the surface is "roughened by projecting spicules"—which would seem unlikely except in the case of a sponge having spicules of fair length, say, 0·5 mm. or more; whereas, according to the latter part of the description, the spicules have a length of only 220 μ. Thirdly, no reliance can be

placed upon the statement that, in addition to styli, "a few tylota and oxea are also found"; for Lendenfeld has erroneously also attributed all these three kinds of megascleres to each of the other three species assigned by him to *Tedania*. Fourthly, the description is not in accordance with Lendenfeld's definition of *Tedania*, inasmuch as it contains no mention of the occurrence of raphides in the species. And, lastly, owing to the doubt which thus attaches to the account given of the spiculation of *Tedania tenuispina*, it is impossible to assert that the ostensible type-specimen is *not* an example of the species upon which the description of the skeletal characters of *Tedania tenuispina* was based, for in other respects, it agrees with that description sufficiently well.

I propose, therefore, to regard *Tedania tenuispina* as practically synonymous with *Stylotella agminata*.

For Reference List of Literature, see *antea*, pp.310-313.

For Explanation of Plates xv.-xxiv., see *antea*, pp.313-315

A REVISION OF THE MONAXONID SPECIES DESCRIBED AS NEW IN LENDENFELD'S "CATALOGUE OF THE SPONGES IN THE AUSTRALIAN MUSEUM." Part iii.

By E. F. Hallmann, B.Sc., Linnean Macleay Fellow of the Society in Zoology.

(Plates xv.-xxiv.)

Familia DESMACIDONIDÆ.

Subfamilia Esperellinæ.

Under this subfamily, Lendenfeld describes four new species, one of which—wrongly named *Sideroderma zittelii*—is found to belong elsewhere; the other three, he correctly assigned to the genus *Esperella*. In addition, he records *Sideroderma navicelligerum* R. & D., from Port Jackson; but, for reasons stated in connection with my remarks on *Sideroderma zittelii*, I consider this record too doubtful for acceptance. One of these species of *Esperella* (or *Mycale*, as it is now called), namely *E. penicillium*, belongs to the small group of related species for which Dendy(15) has proposed the genus *Paresperella*. Concerning the necessity for this genus, there is room for difference of opinion; and Hentschel(20), the only author who has since had occasion to deal with a *Paresperella*-species, does not recognise nor even mention it. I propose to take a middle course, and to regard *Paresperella* as a subgenus of *Mycale*. As the species of *Mycale* number considerably over one hundred, and comprise a wide diversity of forms, it is much to be hoped that a subdivision of the genus, into a number of subgenera, will be found possible. One other group, at least, which seems deserving of subgeneric rank is that comprising the species characterised by the possession of pore-grooves, viz., *M. lingua* Bow., *M.*

*artica** Frstdt., *M. placoides* Cart., *M. murrayi* R. & D., and *M. dendyi* Row; and for this group, of which *M. lingua* would be considered the type, the name *Raphiodesma* Bow.(1) stands available. Also it is probable, in virtue of the peculiarities of their chelæ, that *M. parasitica* Cart., and the closely related *M. ancorina* Whtlg.(57), – for the former of which Carter(8) introduced the genus *Pseudoesperia*—are entitled to subgeneric distinction. A figure of a chela, that undoubtedly came from a *Pseudoesperia*-species, is given in Bowerbank's Monograph(Vol. i., fig.135) with the information, "from a circular group on the interstitial membranes of an undescribed species of *Hymeniacidon,* from Fremantle, Australia." For this undescribed sponge, although known to him only from a single spicule, Gray(17) proposed the generic name *Grapelia;* and this, being of older date than *Pseudoesperia,* would perhaps require to be employed if the subgenus were adopted. Another possibly admissible subgenus of *Mycale* is *Protoesperia,* proposed by Czerniavsky (10) for certain species from the Black Sea; and, as I have lately made known (18), it was for a species of *Mycale,* of somewhat divergent type, that Lendenfeld introduced the genus *Arenochalina.*

In the event of its being considered advisable to establish other subgenera, the possible validity of certain names proposed by Gray (e.g., *Corybas* for *M. lobata, Aegagropila* for *M. aegagropila,* and *Carmia* for *M. macilenta*) should receive consideration.

I might here record the fact that *Cladorhiza waitei* Whtlg.(57) belongs to the genus *Mycale.*

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* *M. lingua* Bow., var. *artica* Fristedt, which, as it differs from *M. lingua* in the dimensions of its spicules, must be an independent species according to Lundbeck(31a).

† I am acquainted with a species from Port Phillip (provided, like *M. ancorina*, with anisochele-rosettes of *two* kinds) which I formerly believed to be *M. parasitica*, having assumed that the non-mention of the occurrence of rosettes of a second kind in Carter's and in Dendy's account of that species was due to an omission. But recently Hentschel(20) has described, from Western Australia, *Mycale parasitica* var. *arenosa*, in which, also, rosettes of one kind only are said to be present. It is possible, therefore, that *M. parasitica* has been correctly described in regard to its spiculation, and that the species above referred to is a new one.

SIDERODERMA ZITTELII. (Pl.xv., fig.6).

The description of this sponge, which atttributes to it a unique combination of the spicular characters, proves to be erroneous in two vital particulars; the trichites, mentioned therein as forming the cortical skeleton, are, in reality, small tylostyli, and chelæ are absent; also, there are no oxea present, though some of the principal megascleres are so narrowed at the base as closely to resemble oxea. The general characters of the species are, in fact, distinctly those of the genus *Polymastia;* and this, it would appear, was subsequently discovered by Lendenfeld himself, for, among the fragments received from the British Museum, there are two of this species, one labelled actually *Polymastia zittelii,* the other bearing the MS. name *"Polymastia australis."* There is only one specimen (Pl. xv., fig. 6) of the species in the Australian Museum, the claim of which to be considered the type-specimen rests on the fact that it is labelled, in Lendenfeld's handwriting, with the manuscript name *"Zittelia digitata,"* the published equivalent of which is given in the key-list as *Sideroderma zittelii;* and on the fact that, except in the mentioned particulars and in some minor points in relation to the dimensions of the spicules, it corresponds in every way exactly with the description. One can only suppose that the chelæ, mentioned by Lendenfeld as occurring in the outer layer of the cortex, were foreign; and the other errors are explicable on the supposition that the spicules were examined and measured only *in situ.*

The species is nearly related to *P. insidis* Thiele(42), and perhaps also to *P. affinis* Thiele(42), both of which it resembles in this respect, namely, that the largest or fibre-forming spicules frequently exhibit bulbous dilatations of their shaft. The following brief account of the spiculation, taken along with Lendenfeld's description of the external features and (*vide infra*) his figure of the sponge (27, Pl. ii., fig. 2), will be sufficient to enable one to identify the species.

Spicules.—These are: (1) Elongated, fusiform styli; forming the fibres and also scattered between; frequently polytylote; sharp-pointed at the apex; narrowing much (sometimes almost pointed), at the base; with a maximum diameter of 22 μ, and a

length which, usually exceeding 900μ, ranges from (rarely less than) 500μ up to 1200μ (ii) Small tylostyli; composing the cortical skeleton and scattered in the choanosome; as a rule, slightly curved; 85 to 135μ long, and seldom as much as 4·5μ in diameter. (iii) Larger tylostyli; occurring only in the choanosome; closely resembling the preceding in shape, and possibly connected with them by intermediate forms; 145 to 210μ in length, and up to 7μ in diameter.

It remains to be mentioned, that the type-specimen of *Polymastia zittelii* bears a likeness so extremely close to the figure given in the Catalogue (Pl. ii., fig. 2), with the title *Sideroderma navicelligerum* R. & D., as to enable one to say, with the utmost positiveness, that the original of the figure actually was a specimen of *P. zittelii*. Moreover, I am inclined to doubt, on the evidence available, whether Lendenfeld really had a specimen of *Sideroderma navicelligerum* at his disposal. The only specimen in the Australian Museum bearing Lendenfeld's label certifying it to be one identified by him as such, namely, a specimen labelled *"Desmacidon polymastia"* (which name is given in the key-list as the MS. synonym of *S. navicelligerum*), is found to be an example of a new species of *Histoderma—H. actinioides* (*vide* Appendix). This exhibits so many analogies with *S. navicelligerum* as to render quite possible its having been mistaken for that species, at any rate by so careless an observer as Lendenfeld was at the time of writing the Catalogue; and, moreover, there is reason to believe that Lendenfeld did not examine his *"Sideroderma navicelligerum"* very critically, since his description of it, practically word for word, even to the minutest details regarding the spicule-measurements, is copied from Ridley and Dendy's preliminary account of *S. navicelligerum*(34). But most remarkable to relate, in connection with this specimen, labelled *"Desmacidon polymastia,"* is the fact that it is figured in the Catalogue (Pl. iv., fig. 1) as an example of *Stylotella polymastia!*

Taking everything into consideration, I think we are justified in regarding Lendenfeld's *Sideroderma navicelligerum* as a synonym of *Histoderma actinioides.*

Ridley and Dendy (**34a**), in their remarks on *Sideroderma,* refer to the fact of their having been enabled "through the kindness of Dr. R. v. Lendenfeld, to examine a second species (of the genus) which occurs in his large collection of Australian sponges." Probably this species has generally been thought to be *Sideroderma zitelii,* but one must now conclude that it has never been described.

Esperella ridleyi. (Text-fig.13.)

Introductory.—The species is represented in the collection by two specimens, one of which is that figured in the Catalogue in illustration of the variety *robusta,* while the other is labelled as the type of the variety *intermedia.* As the two are exactly alike in all but details of shape, it would seem as if the latter were incorrectly labelled—for, according to description, the variety *intermedia* should be distinguished by a much softer and more elastic consistency, due to its fewer spicules and finer fibres; however, a British Museum specimen, labelled as belonging to this same variety, is (at any rate in its spiculation) likewise precisely similar to the variety *robusta.* Under the circumstances, and in view of the fact also that the only stated differences between them are insufficient as a basis for distinction, we may reasonably and safely assume that the two so-called varieties are identical.

A British Museum specimen labelled with the MS. name *"Esperella ridleyi* var. *mollis"* (and, indeed, bearing a certain degree of outward resemblance to the present species, due to its trabecular structure) proves to belong to a species of *Echinochalina,* with spiculation similar to that of *Echinochalina intermedia* Whitelegge (*vide* **18**).

Of the several errors needing correction in the original description, there is one that calls for special mention. This is the statement that, among the microscleres, diancistra occur, which are rare and confined to the surface. The occurrence of diancistra along with anisochelæ—of which we have no instance except in the very doubtful case of Schmidt's *Vomerula tibicen*—would be of great interest as affording conclusive evidence of a relationship

between the genera *Mycale* and *Hamacantha*. After the most thorough search, however, I have failed to find any such spicules, and am confident, therefore, in the assertion that those observed by Lendenfeld must have been of foreign origin. In support of this also is the fact of the very close correspondence in spiculation between *M. ridleyi* and certain other species of *Mycale*, which we well know to be without diancistra.

Both specimens are dry, and bear every appearance of having undergone complete maceration; here and there only, they show the faintest traces of what was probably a continuous and well-defined dermal membrane. The specimens were in this same condition, no doubt, when Lendenfeld described them—as may be judged from the figure he has given of the type-specimen. Accordingly, in relying upon that figure and the following description of external features of the species as aids to its identification, one must allow for the possibility that the therein indicated trabecular structure of the sponge may be wholly internal, and, in the undamaged specimen, concealed from view by the dermal membrane.

Description.—The sponge, which is probably semi-encrusting or submassive at the outset of its growth, grows up into one or several, usually branching, stout stems, which may attain a height of 500 mm. These stems (and their branches) are made up of anastomosing trabeculæ. The latter are roughly circular in cross-section, and measure from 3 mm. to (rarely) 7 mm. in diameter; their surface (in the absence of dermal membrane) is highly rugose. In the more central portion of the stems, especially in the older parts of the sponge, the trabeculæ become more or less fused together, thus to a great extent losing their individual outline, and tending in some measure to give rise to a solid axis; the (simple or branched) superficial trabeculæ, for the most part, project separately outwards, in an obliquely upward direction. The characteristic appearance of the sponge is well portrayed in the figure which Lendenfeld has given of the type-specimen. This, which is much less stoutly proportioned than the second specimen, measures 380 mm. in height, and has attached to it, near the top, three large bivalve shells, over the surface of which it has formed a thin crust.

The main skeleton is a very irregular, small-meshed reticulation of stout, spicular fibre, of diameter often exceeding 100 mm. The spicules of the fibres are closely packed together side by side, while the spongin-cement, which unites them, is inconspicuous on account of its pale colour, and, only in connection with the slenderer connecting fibres, forms a visible sheath. Owing to the washed-out condition of the specimens, scarcely any interfibral substance

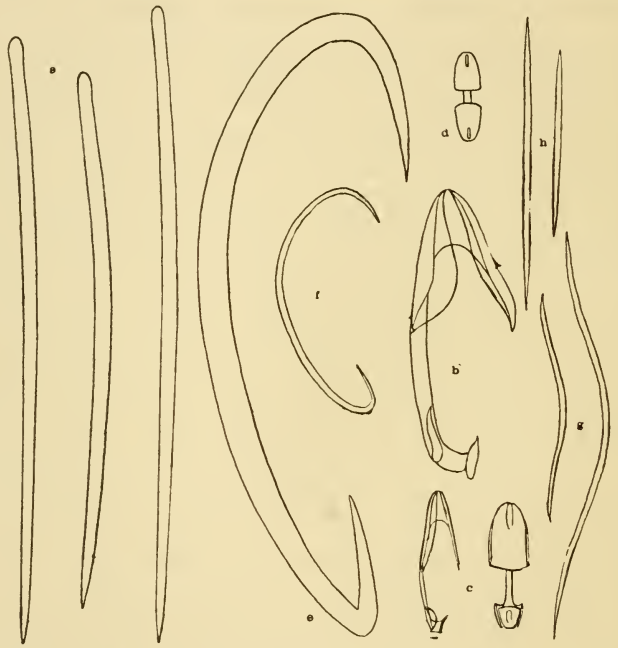


Fig. 13.—*Mycale ridleyi*. *a*, Styli. *b*, Larger anisochelæ. *c*, Smaller anisochelæ. *d*, Isochelæ. *e*, Larger sigma. *f*, Smaller sigma. *g*, Toxa. *h*, Microxea (trichites).

remains; but what little there is, serves to show that, in all probability, microscleres were abundantly scattered everywhere through the tissues. The dermal skeleton is a more or less confused, somewhat lattice-like, reticulation, formed by the branching and anastomosing of strands of loosely associated subtylostyli similar

to those of the main skeleton; also, there occur, in the dermal membrane, microscleres in great abundance, and the most numerous of these are the smaller anisochelæ, the isochelæ, and the smaller sigmata, while the larger sigmata are the rarest.

Spicules.—(*a*) Subtylostyli; with elongated oval heads, narrower than the middle of the shaft; typically straight, though often, in slight degree, variously curved; gradually sharp-pointed; slightly fusiform, with the apical half of their shaft of greater average stoutness than the basal. Length, 250 μ to 305 μ; maximum stoutness, 9 or 10 μ.

(*b*). Larger anisochelæ; 40-45 μ long, 13-17 μ wide;* 15-18·5 μ broad; occurring singly and in rosettes. The upper alæ and palm are of equal length, approximately one-half that of the spicule; the upper tuberculum is 7·5-11 μ long, and about one-fourth of this in breadth; the distance between the free ends of the two palms is about 15 μ. Rosettes appear to be rare and always composed of comparatively very few chelæ; they were found only in the dermal membrane, and the greatest observed number of spicules composing any one of them was eight.

(*c*). Smaller anisochelæ; 18-22·5 μ long, 6-7·5 μ wide, 4·5-8 μ broad; occurring singly. The upper alæ and palm are about equal in length, which is approximately three-fifths that of the spicule; the distance between the free ends of the palms is about 3·5 μ.

(*d*). Isochelæ palmatæ; 7·5-12 μ long, at most 3 μ wide, and 3-3·5 μ broad. These are the most abundant of the microscleres, at any rate in the dermal membrane.

(*e*). Larger sigmata; 72 μ to (rarely) 20 μ in length from bend to bend; and, at most, slightly over 6 μ in stoutness.

(*f*). Smaller sigmata; very slender; varying in length from 15 μ to 35 μ.

* In using, for convenience' sake, the ordinarily synonymous terms *wide* and *broad* in order to express the two principal transverse dimensions of a chela, I imply by the former the maximum cross-measurement of the spicule as seen in profile, or, more precisely, the distance from the free or distal end of the (in case of anisochelæ, major) palm to the posterior edge of the shaft; and by the latter, the maximum cross-measurement of the spicule as seen from the front.

(*g*). Slender toxa, 30-63 μ long; occurring singly and in dragmata.

(*h*). Slender microxea, 20-35μ long; occurring in dragmata, and also singly.

Loc.— Western Australia.

Remarks.—*M. ridleyi* is the fifth species of the genus known to possess isochelæ, the other four being *M. plumosa* Carter, *M. parishi* Bowk., *M. isochela* Hentschel(**20**), and *M. pectinicola* Hentschel(**20**); an undescribed sixth is represented in the British Museum by a specimen labelled (by Lendenfeld) with the MS. name "*Esperella australis.*" On the assumption that the toxa observed by Ridley(**33**) in Bowerbank's preparations of *M. pectinicola* were proper, all these species likewise agree in the possession of toxa, besides showing a very close correspondence (with each other) in the remaining features of their spiculation.

ESPERELLA SERPENS. (Pl.xxiv., fig.6; and text-fig.14).

Description.—The single type-specimen (as also a fragment labelled *Esperella serpens* from the British Museum) corresponds satisfactorily to Lendenfeld's description of the species. It is a cake-shaped sessile sponge, measuring 80 mm. in length, 50 mm. in breadth, and about 25 mm. in height, the visible external portion of which is formed by confusedly anastomosing irregular lax processes, usually more or less round in cross-section and averaging 2 or 3 mm. in diameter. On cutting through the specimen, the more compact—and, at first sight, seemingly solid—interior is found to have a structure affording reason for believing it to have resulted through the very complete and intimate fusion of what originally were similar processes. In alcohol (perhaps largely owing to imperfect preservation) the consistency is soft, almost pulpy; and the whole sponge is exceedingly fragile. The colour is a dull faintly yellowish pale grey. The dermal membrane is thin and delicate. Oscula were not observed.

The main skeleton is exceedingly reduced, being composed almost entirely of sparsely and quite irregularly scattered slender tylostyli. The dermal skeleton, although much better developed, is also comparatively scanty; it consists of ramifying spicular

fibres, seldom more than 20 μ broad, which here and there are partially connected by loose spicule-bundles. The dermal megascleres are similar to those of the interior. Scattered microscleres—anisochelæ, sigmata, and trichodragmata—are comparatively scarce; the chelæ do not form rosettes. In the dermal membrane, chelæ and sigmata are more frequent than in the choanosome, and trichodragmata apparently do not occur.

Scattered through the sponge are small patches of foreign material, comprising sand-grains, spicule-fragments, foraminifera, etc.; and immediately surrounding each of these patches there occur a few fibres and spicule-bundles such as elsewhere are seldom met with except in the superficial (*i.e.*, the dermal) skeleton. These patches presumably occupy spaces (*lacunæ relictæ*) originally due to, and now almost obliterated by, the fusion of once separate processes of the sponge, as suggested above—or, in other words, are, strictly speaking, external to the sponge—and, on this view, the spicule-bundles and fibres referred to, that occur seemingly within the sponge, are really portions of the dermal skeleton. To a misconception arising from the presence of such fibres and bundles in the preparations examined by him, was probably due Lendenfeld's incorrect description of the main skeleton as consisting of "longitudinal spicule-bundles,* which are on an average . . . . 0·15 mm. apart," etc.

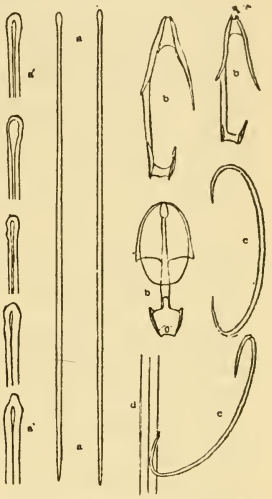


Fig. 14.—*Mycale serpens*. *a*, Tylostyli. *a'*, Basal ends of tylostyli. *b*, Anisochelæ. *c*, Sigmata. *d*, Trichites.

Spicules.—(*a*) The tylostyli are straight or (less frequently) variously curved, gradually sharp-pointed, slender spicules with a well-developed elongated phyma; the shaft is slightly narrower

* By "spicule-bundles," Lendenfeld always (in the "Catalogue") means "fibres composed solely of spicules"; this is most clearly shown in his description of *Sideroderma zittelii*.

towards the base than at the middle. They measure from 220 μ to 295 μ in length and are seldom as much as 5 μ in diameter.

(*b*) The anisochelæ are of the ordinary form; they are variable in stoutness and range in length from 18 to 27 μ.

(*c*) The sigmata are very slender, seldom much more than 1 μ in diameter; they are simple and contort, and vary from 18·5 to 29 μ in length, measured from bend to bend.

(*d*) The trichodragmata are 12 to 25 μ long, and usually less than 5 μ in stoutness. The trichites composing them are sometimes partially fused, so that the dragma remains intact even after boiling in nitric acid, and are sometimes differentiated into separate microxea. Microxea also occur scattered singly, but as such are extremely rare.

Embryos.—The examined portion of the sponge teems with aspiculous embryos of approximately spherical form, the largest of which measured 150 μ in diameter.

Loc.—Port Jackson.

Remarks.—The species that seems most closely related to *M. serpens* is *M. fistulifera* Row(**35**). In the latter, trichodragmata have not been observed and the processes bear each an osculum at the summit. If similarly located oscula occur in *M. serpens*, they must be extremely small; but I am unable to say positively they are absent, owing to the poor preservation and pulpy condition of the specimen.

ESPERELLA PENICILLIUM. (Pl.xxiv., fig.1; and text-fig.15).

Introductory.—As the specimen which I take to be the type of this species is not entirely in agreement with the description of the species, I might mention that its claim to be so considered is proven, both by the fact that it is labelled in Lendenfeld's handwriting with a manuscript name—"*Esperia incrustans*"—which according to the key-list stands for *Esperella penicillium*—and by the fact, also, that it agrees in all essential respects with a British Museum specimen labelled *Esperella penicillium*. The species belongs to the subgenus *Paresperella* and is related to *P. moluccensis* Thiele(**41**), *P. bidentata* Dendy(**15**), *P. repens* Whitelegge(**57**), and *P. dichela* Hentschel(**20**)—apparently more closely

to the two last mentioned, because like them and unlike the others (as described), it possesses smaller, scattered anisochelæ in addition to those which form rosettes.

The type-specimen consists of only a few ill-preserved scraps attached to pieces of shell and other débris. This condition of the specimen would lead one to suppose that the species is of encrusting habit, and the manuscript specific name "*incrustans*" implies the same. According to Lendenfeld's description, however, the sponge is "composed of anastomosing branches on an average 7 mm. thick." One might conclude, therefore, that the sponge is variable in habit; but, for the present, I think it would be as well to disregard altogether what has been stated concerning the outward features of the species, and, for its identification, to rely solely upon skeletal characters.

Unfortunately, owing to the fragmentary condition of the specimen, several points in connection with the skeleton, of possible diagnostic value, have not admitted of elucidation; among other things, it could not be determined whether, as Lendenfeld's description implies, the reticulate character of the skeleton results simply through the interosculation of dendritically branching longitudinal fibres, or whether it is due to the union of longitudinal by means of transverse fibres.

Description.—The main skeleton is a loose reticulation of spicule-fibres devoid of spongin, the stoutest of which exceed 150 μ in diameter. Close beneath the surface, the outwardly-running fibres subdivide each into a number of divergent strands, whose penicillately outspread extremities support the dermal membrane. The dermal skeleton is a wide-meshed, somewhat lattice-like reticulation, the meshes of which, formed by interconnecting, branched, paucispicular fibres, are, as a rule, sparingly subdivided by independent short spicule-strands, and single spicules. There are also present in the dermal membrane a few scattered microscleres of the same three kinds as occur interiorly.

Spicules.—(*a*). The megascleres in general agree exactly in form with those of *P. bidentata*(15); in rare cases, however, the small apical tines are wanting, and the spicule is then a subtylostrongyle. These tines are usually two in number, occasionally

three : when one only is developed, it is situated not centrally, *i.e.*, not in continuity with the axis of the spicule, but laterally. The spicules are from 325 to 410 μ long by 8 μ at most in diameter.

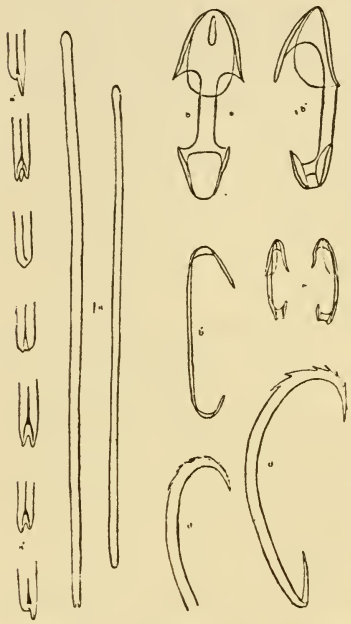


Fig. 15.

Mycale (*Paresperella*) *penicillium*. *a*, Subtylostyli. *a'*, Apical ends of subtylostyli. *b*, Larger anisochelæ. *b'*, Developmental form of preceding. *c*, Smaller anisochelæ. *d*, Sigmata.

(*b*) Larger anisochelæ, occurring fairly abundantly in rosettes, and in lesser number scattered singly; they closely resemble in form those of *P. bidentata*, but are larger, measuring from 34 to 39μ in length.

(*c*). Smaller, scattered anisochelæ, in form much like the preceding, measuring from 18 to 22·5 μ in length; they are about as numerous as the scattered larger chelæ.

(*d*). Sigmata, similar to those of *P. bidentata*; fairly abundant; measuring 44 to 48 μ long from bend to bend, by at most 3 μ thick in the middle.

Loc.—Port Jackson.

Remarks. — From the same locality as *P. penicillium*, comes *P. repens* Whitelegge. The latter, judging from its description—for I have been unable to find any specimen or mounted slide of it - differs from *P. penicillium* in quite a number of points, but the differences are of degree rather than of kind, and may be due to nothing more than individual variation. Whether this is so, it is not yet possible to decide, since both species are known only from single specimens.

The several species, *P. penicillium*, *P. moluccensis*, *P. bidentata*, *P. repens*, and *P. dichela*—enumerating them in the order in

which they were described—are obviously so closely related that they might be ranked as varieties of a single species. The second and third mentioned, however, according to their descriptions, are lacking in the smaller chelæ found in the others; if this be so, one might regard these two as varieties of one species, *P. moluccensis*, and the remaining three as varieties of a second species, *P. penicillium*.

Subfamilia Ectyoninæ.

With the exception of *Lissodendoryx jacksoniana*, described below, all the species which I have so far succeeded in identifying of the Ectyoninæ described in the Catalogue have already been dealt with, at least sufficiently to render possible their identification, in my former paper. The fuller treatment of such of them as require further description, I propose to defer until a suitable opportunity offers itself of my undertaking a general revision of the Australian *Desmacidonidæ*.

It is necessary here to refer, however, to certain alterations which a knowledge of additional facts has led me to consider advisable in the conclusions I expressed regarding the four species, *Echinonema levis, E. rubra, Clathria macropora,* and *C. australis*. As already stated, the specimens labelled as the types* of the first-mentioned three (as also the specimens representing them in the British Museum) are examples of a single variety of *Crella incrustans,* while those of the fourth species belong to another variety of the same—the variety *arenacea* Carter; and thus, although corresponding exactly—except (in one important particular) those of *Clathria macropora*—with the descriptions of the species they respectively purport to represent as regards external features, they are all rather considerably at variance therewith in the matter of spiculation. Nevertheless, except in the case of *Clathria australis* (which is described as possessing only *scarce* acanthostyles) the latter discrepancies are such as might conceivably be

* They are labelled as the types by Mr. Whitelegge. Their original labels in Lendenfeld's handwriting bear only the MS. names "*Clathria levis*," "*Clathria rubra*," "*Clathria macropora*," and "*Clathria flabellum*" respectively.

due to carelessness of observation; and hence I decided to accept as correctly labelled the ostensible specimens of *Echinonema levis* and *E. rubra,* and to reject as bogus those of *Clathria macropora* and *C. australis.* It is now my opinion that the descriptions of *E. levis, E. rubra,* and perhaps also *Clathria australis* combine each a description of the outward characters of one species with one of the inward characters of another—the former of which species is alone represented by the specimens; and that the chief ground of my rejection of the specimens labelled '*Clathria macropora*—namely, the unlikeliness of Lendenfeld's having mistaken for oscula, holes produced by crustaceans—is untenable, inasmuch as such mistakes actually have since been found to have been made by him in connection with *Cliona hixoni, C. lutea,* and apparently also *Tedania rubra.* Consequently, as synonyms of the sponge which I described in my previous paper as *Crella incrustans* var. *levis,* I would now write *Clathria macropora, Echinonema levis* (? pars), and *Echinonema rubra* (? pars); and should a Port Jackson species possessing the skeletal characters ascribed by Lendenfeld to *Echinonema levis* prove to be existent, I think it would be preferable to give to the former sponge the name *Crella incrustans* var. *macropora,* and to employ the specific name *levis* for the latter.

Those of the remaining species not yet identified are: *Clathrissa elegans, Clathriodendron irregularis, Plectispa macropora* (the type of *Plectispa*), *P. elegans, Thalassodendron typica* (the type of *Thalassodendron*), *T. digitata,* and, lastly, the three which through some misconception Lendenfeld described as varieties of *Echinonema anchoratum* Carter. The last mentioned are nominally represented in the Australian Museum by specimens which, while labelled with the names that the key-list indicates to be the MS. synonyms of their published names, accord neither in external nor internal features with their descriptions;—the variety *ramosa* being represented by an imperfect example (labelled "*Ceraospina arbuscula*") of *Clathriodendron arbuscula,* and the two varieties *dura* and *lamellosa* by specimens (labelled "*Antherospongia dura*" and "*Ceraospina flabellum*") of the species which(18) I have named re-

spectively *Clathria indurata* and *C. spicata*. Also, *Plectispa elegans* is falsely represented by a specimen of *Echinoclathria arborea*.* But with these exceptions no example labelled with the name of any of the species enumerated above is to be found either in the Australian Museum or among the fragments from the British Museum. Occurring among the latter, however, there is an unattached label inscribed with the name *Clathriodendron irregularis*, so that this species is in all probability represented by an example in the British Museum.

Myxilla jacksoniana. (Text-fig. 16).

Introductory.—As the type of this species I take the sponge representing it in the British Museum, which agrees fairly closely with the original description; the ostensible type-specimen in the Australian Museum is mislabelled, being in reality an example of a species of *Gellius*, closely related to *G. raphidiophora*. Having only a small fragment at my disposal I am unable to say anything concerning the outward characters of the species. The original description states in reference thereto merely that the sponge is massive, lobose, and provided with conspicuous oscula; but it may be that this statement is incorrect, since it is one that would apply very well to the false type-specimen.

Description.—The skeleton is a renieroid reticulation with for the most part quadrangular and triangular meshes, the sides of which are formed each of one to three (or rarely more) spicules; the spicules have a not very orderly arrangement, and in many places, as a consequence, the reticular pattern is ill-defined. Definite fibres are apparently not developed, and spongin is indiscernible. The spicules of the mesh-work are styli, together with a very appreciable proportion of shorter and stouter stronglya which undoubtedly are derivatives of the styli. Occurring scattered

* That my identification of this species with Lendenfeld's *Plectispa arborea* is correct, is supported by the fact that the MS. synonym of *Plectispa arborea* is, according to the key-list, "*Plectochalina halme*"—a name which would be more appropriate in its application to *Echinoclathria arborea* (owing to the species' resemblance in reticulate structure to *Halme nidus-vesparum*) than to any other species described in the Catalogue.

are very few tylota and moderately abundant chelæ and sigmata, the last-mentioned predominating. The microscleres are most numerous surrounding the canals. The dermal skeleton appears to be developed interruptedly, but this may be in consequence of the

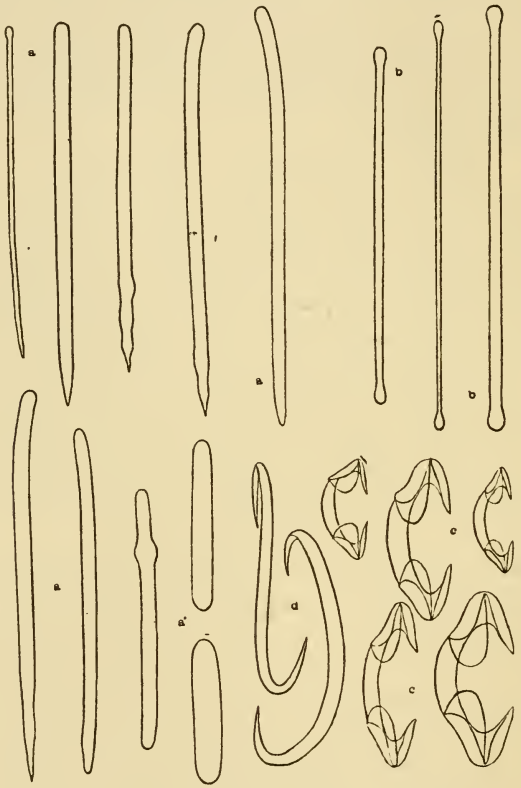


Fig. 16.—*Lissodendoryx jacksoniana*. *a*, Principal styli. *a'*, Strongyliform modifications of principal spicules. *b*, Auxiliary tylota. *c*, Isochelæ arcuatæ. *d*, Sigmata.

abrasion of portions of the original surface; here and there, in patches, closely-arranged short strands of tylota occur, disposed vertically to the surface; while in the relatively broad intervals between these groups of strands the main skeleton extends almost

or quite to the surface, and in the outermost layer a few scattered tylota only, mostly more or less vertically directed, are to be seen.

Spicules.—(*a*) The principal megascleres are smooth styli and strongyla, the former being about ten times as numerous as the latter. The styli, which vary from (rarely less than) 140 to about 185 μ in length, and very seldom exceed 7 μ in diameter, are straight or slightly curved (more especially near the basal end), often very faintly dilated at the base, nearly cylindrical throughout the greater part of their length, and, as a rule, gradually sharp-pointed; the pointed end almost invariably exhibits irregularities such as are commonly shown by spicules of the Axinellidæ, and in extremely rare cases is provided with a few minute spines, less rarely an odd spine is to be observed on other portions of the shaft. The slenderest forms are tylostyli, which are equal in length to the fully-grown spicules. The strongyla range in length from about 50 to upwards of 160 μ, and their maximum stoutness, which is attained only by the shorter spicules, is 9·5 μ; they not infrequently show a deformity in the shape of a bulbous swelling. Spicules of intermediate form between the longest strongyla and the styli occur, but are rather rare.

(*b*) Straight tylota, with nearly cylindrical shaft (often slightly narrower at one end), and well-developed oval heads; measuring from 155 to 195 μ long and at most 5·5 μ in stoutness.

(*c*) Isochelæ arcuatæ of ordinary shape; with well curved shaft, slightly antero-posteriorly compressed; varying in length from 12 to 23 μ. Individuals of medium length are rare in proportion to those of greater and of lesser length.

(*d*) Sigmata; simple and contort; measuring between 19 and 36 μ in length from bend to bend, and up to 3 μ in stoutness.

Embryos.—Deeply brownish-tinted embryos of oval shape, the largest measuring 320 by 270 μ, were present, and most of them contained spicules. The spicules were always of three kinds, viz., straight or (very often) flexuous slender tylota, exceedingly slender sigmata, and developmental chelæ. Usually the tylota, like the microscleres, were scattered; but in a few instances they were

arranged in a radiating bundle placed towards one end of the embryo.

Remarks.—Lundbeck has noted the embryonic spiculation in quite a number of Myxillinæ, but in every case observed by him, contrary to what happens in the present species, the basical megascleres make their appearance in advance of the auxiliary. In reference to *Grayella pyrula* and *Grayella gelida*, Lundbeck(**31b**, p. 33), says: "It is worthy of notice that the first occurring spicules here are the spined dermal spicules, while elsewhere in the Myxilleæ it is the skeletal spicules which occur first." These exceptions, however, are only apparent, since, as I have previously pointed out(**18**), the dermal spicules of *Grayella* undoubtedly correspond morphologically to the skeletal spicules of normal Myxillinæ, and *vice versâ*.

L. jacksoniana is probably most nearly related to the species recorded from Port Phillip by Carter(**7**) as *Halichondria isodictyalis* and by Dendy(**13**) as *Myxilla isodictyalis*; but it is hardly likely that the two are identical, since in the case of the latter no mention has been made of the occurrence of strongylote modifications of the skeletal spicules. The original *Lissodendoryx isodictyalis* Carter(**5**), comes from Puerto Cabello, Venezuela, and probably is not identical with the Port Phillip sponge.

Familia AXINELLIDÆ.

Under this, the final family dealt with in the Catalogue, Lendenfeld describes six species, five of which are referred to the genus *Axinella*, and one to a new genus *Spirophorella*. Each of these, with the exception of the last-mentioned, is (nominally) represented in the Australian Museum by a specimen duly labelled in Lendenfeld's handwriting, but only in the case of one, *Axinella aurantiaca*, is it possible to reconcile the specimen with the description. It seems quite beyond doubt, however, that the descriptions of two of the species—namely, those designated varieties of *A. hispida* Montagu—are erroneous, the probability being that each is made up of portions of the descriptions of two entirely different species. For in the diagnosis introductory to these descriptions, we are told

that the spiculation is composed of "large and long styli and spined oxea," together with "microsclera" in the form of "styli and oxea, long and very slender, in bundles (trichites)"; whereas in the descriptions themselves, in contradiction to this, we find it stated, in the case of one variety, merely that "the spicules of the supporting skeleton are 0·14 mm. long and 0·005 mm. thick," and in the case of the other, that "the spicules of the supporting skeleton are chiefly styli, 0·2 mm. long and 0·005 mm. thick. Nor are these contradictory statements the only indication of error; the diagnosis referred to is clearly only an intended copy, with a few alterations in terms, of the description of *Dictyocylindrus hispidus* given by Bowerbank(2), yet, in Bowerbank's description, no mention is made of "spined oxea," but only of spined styli, and no warrant is to be found for the statement that the "styli and oxea, long and very slender" occur in bundles It is unaccountable also why Lendenfeld calls the last-mentioned spicules microsclera, especially since he states, in his definition of *Axinella,* that the genus is without microsclera. Because of these anomalies, and as the specimens left by Lendenfeld to represent his varieties of *Axinella hispida* agree in some measure with the descriptions so far as external features are concerned, and actually are examples of species of *Raspailia,* I have thought it proper to regard them as the types. I consider the specimens to be representative of two distinct species to be designated *Raspailia gracilis* and *R. tenella* respectively.

AXINELLA HISPIDA, var. GRACILIS. (Pl. xxiii., fig.1; Pl. xxii., fig.7; and text-fig.17).

Description.—Sponge erect, arborescent; with dichotomous and polytomous branches, seldom uniting by anastomosis. The branches are short, stiff, cylindrical, or slightly tapered, and sometimes sharply pointed at their end. Surface hispid with spicules, which project 1 mm. or so beyond it. Oscula apparently absent. Colour in spirit pale grey, for the most part with a faint tinge of purple. Consistency fairly tough, compressible, and resilient.

The single specimen (Pl. xxiii., fig. 1), 80 mm. in height, is attached to a stone by an expanded disc-like base, from which two

short stalks, each about 5 mm. in diameter, and each with its own "head" of branches, arise independently. The stoutest branches are 4 to 5 mm. in diameter; the slenderest, about 2 mm.

The skeleton, as seen in section, presents quite different aspects according as the mounting medium is balsam or glycerin. In the latter medium, the spicules being thereby rendered almost indiscernible, it appears as if mainly consisting of a small meshed irregular reticulation of colourless, or (in older parts of the sponge) faintly yellowish-tinted, spongin fibres, of diameter seldom exceeding 50 or 60μ; the reticulation, which is not more condensed in the axial than in the peripheral region of the branches, and in pattern bears a certain slight resemblance to that of the skeleton of *Euspongia*, is formed by longitudinal main fibres pauciserially cored by principal spicules and by a network of connecting fibres which are without contained spicules.

On the other hand, in sections mounted in balsam, the spongin fibres are difficult to perceive, and may even be quite invisible; and the skeleton then shows itself as a lattice-like interlacement of longitudinally-running (or, if near to the surface, slightly outwardly-trending), mostly paucispicular, loose strands of principal spicules, interspersed between which, in comparatively small number, are single spicules likewise with a generally longitudinal orientation. In addition, isolated single spicules constantly occur, which are disposed transversely to the prevailing direction, and are consequently very noticeable even although comparatively few. The interlacing spicule-strands are constituted partly by the spicules which core the main spongin-fibres and partly by spicules which lie extra-fibrally; some of the latter are directed with their apex pointing to the contrary direction, *i.e.*, towards the base of the sponge Echinating acanthostyli occur only sparsely and irregularly upon the fibres of the interior; and since (in balsam) the fibres themselves are not readily perceived, these acanthostyli appear at first sight as if scattered. On the other hand, in connection with the superficial fibres (comprising not only those situated most externally, *i.e.*, in immediate juxtaposition to the dermal layer, but usually also most of the longitudinal fibres running near

to the surface) acanthostyles are abundantly developed; these superficial acanthostyles are located entirely upon the external aspect of the fibres supporting them, and are thus directed perpendicularly to the surface with their apices outwards.

In the outermost region of the main skeleton, a considerable proportion of the short spongin-fibres, whose disposition is more or less at right angles to the surface, ensheathe each the basal portion of one or several of the outwardly-projecting long tylostyli to which is due the already-mentioned hispidity of the surface. The dermal skeleton proper consists of scattered clusters and bundles of styli and oxea (auxiliary spicules), which are mostly directed more or less parallel to the surface, and, contrary to what usually is the case in *Raspailia*, are never disposed in outwardly-directed divergent tufts situated around the points of exit of the long projecting spicules.

Spicules.—(a) The principal megascleres are styli and tylostyli and intermediate forms, together with relatively very few oxea. The styli and tylostyli (the latter of which are the more numerous) are sharp-pointed and more or less curved spicules, typically with the curvature most pronounced in, and often restricted to, their basal moiety; the very slenderest are not infrequently flexuously curved (flagelliform). They range from about 420 to 1580 μ in length, and attain a maximum diameter of 15 μ. The two forms, styli and tylostyli, show some degree of differentiation from each other, but not sufficient to admit of their separation into two groups. The styli are, in general, the shorter and relatively stouter spicules (being rarely less than 11 μ in diameter), and, unlike the tylostyli, are usually a trifle stouter towards the middle of their length than at the base. The tylostyli, which usually have only a slightly developed phyma, are very variable in stoutness (the slenderest of them being less than 3 μ in diameter), and are seldom below 800 μ, and rarely, if ever, below 500 μ in length. The slenderest spicules are usually not expanded at the extreme base, but at some short distance above it, and then not as a rule bulbously, but elongately and somewhat irregularly; and a consider-

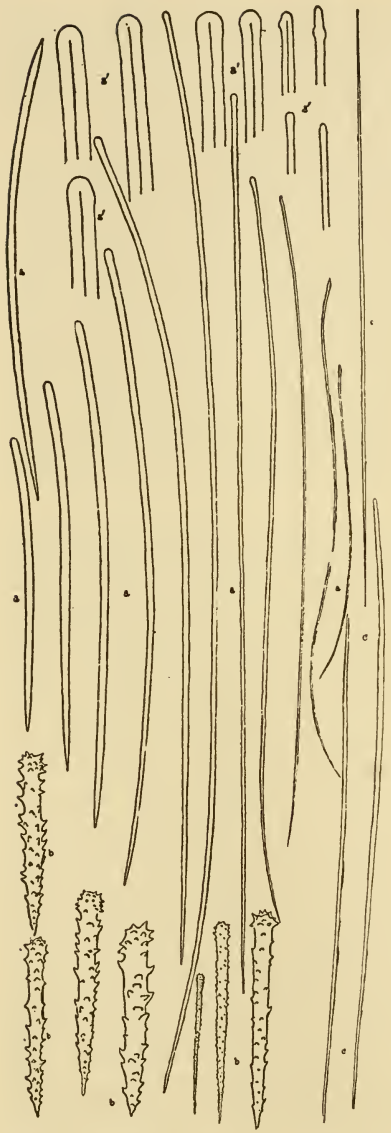


Fig. 17.—*Raspailia gracilis.* *a*, Principal spicules; styli, subtylostyli, and scarce oxea. *a'*, Basal ends of principal spicules. *b*, Acanthostyli. *c*, Auxiliary styli and oxea.

able proportion of them exhibit no basal enlargement at all. It is to be noted that styli are unrepresented among the spicules which project from the surface, while they comprise almost all of those spicules abovementioned which are disposed transversely to the longitudinal direction.

The oxea are curved fusiform spicules varying in length from 430 to 1040 μ, and in diameter from (seldom less than) 7 up to 12 μ. At a rough estimate, they number somewhere between one and five per cent. of the principal megascleres.

(*b*) The acanthostyles, when fully developed, are conical spicules with recurved spines (about 3 μ high), measuring from 65 μ to 102 μ in length, and at their base 10 μ in diameter exclusive of spines; the spines are scattered uniformly and pretty closely over the whole surface. A considerable number of immature acanthostyles also occur—of only slightly lesser length than the fully developed—which are usually provided with a slight basal knob and are more and more minutely spined in proportion as they are slender.

(*c*) The auxiliary spicules are straight or slightly curved oxea and styli (together with intermediate forms), which are approximately equal in size and number,—the styli being, if anything, somewhat the stouter and more numerous. They measure from 260 to about 410μ in length, and, at most, 3·5μ in diameter. The longest of the styli are scarcely, if at all, distinguishable from certain of the shortest and slenderest of the principal spicules. The auxiliary spicules are chiefly confined to the dermal layer, where, as previously stated, they are disposed in bundles; in the interior they lie scattered, either singly or (more usually) in pairs.

Loc.—Port Jackson.

Axinella hispida, var. tenella. (Pl. xxiii., figs. 2, 3; Pl. xxii., fig. 6; and text-fig. 18).

Description.—Sponge erect, ramose, stipitate; of small size; with the branches disposed in one plane or in overlapping planes. Branches compressed in the plane of branching, and usually increasing in breadth upwards; stalk relatively very slender, and cylindrical or only slightly compressed. Surface hispid with spicules, which often project more than 1 mm. beyond it. Oscula apparently absent. Colour in spirit pale grey. Consistency firm, tough and elastic.

Of the two type-specimens, the larger and more robust (Pl. xxiii., fig. 2) measures 60 mm. in height and 1·5 mm. in diameter of stalk, and for the most part has only slightly compressed branches, which spread in the one plane. The slightly smaller, and more profusely-branched specimen (Pl. xxiii., fig. 3) has the branches very much flattened, and in consequence of the bifurcation of the stalk, is biflabellate; as, also, the branches are somewhat curled, it assumes a slightly aborescent form. Both specimens are (in alcohol) of a light yellowish-grey colour.

The main skeleton is composed in exactly the same way as in *R. gracilis*, but the longitudinally-directed extra-fibral spicules are more numerous in the present species, and they thus (unless the sections examined be fairly thin) tend to obscure the lattice-like pattern due to the interlacement of the spicule-strands. The spongin-fibres are colourless and (in balsam) quite invisible.

Fig. 18.—*Raspailia tenella*. *a*, Principal spicules; styli and subtylostyli. *a'*, Basal ends of principal spicules. *b*, Acanthostyli. *c*, Auxiliary oxea and styli; *c'*, the same, drawn to a larger scale.

The dermal skeleton, on the other hand, is quite different from that of *R. gracilis* and very closely resembles that of *R. viminalis* as depicted by Pick (**32**, Pl. iii., fig. 1). Externally to the fibres and the spicules of the main skeleton is a soft-tissued dermal layer, usually not less than 300 μ in thickness, and almost entirely free from scattered spicules; and this layer, which is crossed by the deeply-embedded long tylostyli which project beyond the surface, gives support superficially to elegantly radiate projecting tufts of auxiliary spicules. These tufts occur not only at the points of emergence of the tylostyli, but also between them.

Spicules.—(*a*) The principal megascleres are exclusively styli and tylostyli, which are similar in form and about equal in stoutness to the corresponding spicules of *R. gracilis,* and, like them (though to a less appreciable extent), exhibit some degree of differentiation into two groups; they range in length from about 380 to 1970 μ and obtain a diameter of 18 μ.

(*b*) The acanthostyles, when full-grown, are conically or slightly basally-knobbed spicules, with recurved spines (about 3 μ high), measuring 63 to 85 μ in length, and at their base 8 μ at most in diameter; the spines are scattered uniformly and pretty closely over the entire surface. The slender immature spicules range in length from less than 30μ to upwards of 60μ; the slenderest have almost invisibly minute spines, and are provided with a well-developed basal knob.

(*c*) The auxiliary spicules are styli and oxea; intermediate forms between these are rare or absent. The styli, which are by far the more abundant, are straight or (more usually) slightly curved, and taper towards the base; they vary between 280 and 410μ in length, and attain to 4·5μ in diameter. The oxea are shorter and slender, being very rarely more than 340μ in length, or more than 3μ in diameter. Apparently the latter occur only as single and paired scattered spicules in the interior; while the styli are found both in the interior (nearly always in pairs) and in the dermal tufts.

Loc.—Port Jackson.

Axinella aurantiaca. (Pl. xxii., fig.1; and text-fig.19).

Introductory.—Fortunately Lendenfeld has furnished us with a figure of this species, and the actual specimen from which the figure was taken is extant. Otherwise, owing to a mistake in the original description,—wherein the spicules are stated to be styli, instead of oxea (with only occasional styli) and flexuous strongyla —the species in all probability could never have been identified. But, with this exception, the description is fairly appropriate; and the omission from it of any mention of strongyla is attributable to the fact that these spicules are sometimes sufficiently scarce to be easily overlooked. The inaccuracies in this case, therefore, are to be explained as due to careless observation, and not to the commingling of the descriptions of two different species.

Description.—Sponge arborescent, erect, stipitate; with cylindrical pointed branches, which multiply by frequent dichotomy and occasionally anastomose at points of contact. The branches increase in stoutness towards the base, and may there attain a diameter of 12 mm. The surface is minutely granular, owing to the impingement upon it at very close intervals of outwardly running skeletal fibres. There is present a very thin, but well-defined dermal membrane, which remains intact when the sponge is carefully macerated with caustic potash solution. Small oscula, about 1 mm. in diameter, occur scattered at rather distant intervals. The canals leading into the oscula,—not only the main canals which open into the oscula, but also their chief tributaries—run for some distance immediately beneath the dermal membrane, and are faintly discernible through it. The specimen of Lendenfeld's figure measures 120 mm. in height, and is in an unusual degree profusely branched; large specimens may attain a height of 200 mm. The colour in life, according to the original description, is bright orange; spirit specimens are yellowish-grey, and those preserved in the dry state whitish. Except for a soft superficial layer about 1·5 mm. in thickness, the consistency is in alcohol very firm and tough, particularly in the older portions of the sponge. Dry specimens vary in consistency and texture, and present a very different

appearance, according to the extent to which the fleshy substance has been removed. Those dried without previous maceration are slightly shrunken, have a rough, granular, usually uncracked surface, and are hard and brittle; on the other hand, well macerated and washed-out specimens, which are moderately flexible, show in each of the branches a dense core, and from this numerous short fibres stand out like bristles, producing an appearance not unlike that of a worn-down bottle-brush. The skeleton consists (i.) axially, of a stout, densely spicular, core occupying the whole interior of the branches to within about 1·5 mm. of the surface; and (ii.) extra-axially, of non-plumose, sometimes slightly wispy multispicular fibres, which, issuing in an obliquely upward direction from the core, run outwards at fairly regular distances apart, gradually curving on the way, to meet the surface almost at right angles. These fibres, which are composed of oxea held together by a barely discernible amount of spongin, usually remain unbranched, and are not connected by transverse fibres. Scattered spicules occurring between the fibres are extremely rare in the more superficial, canal-traversed, region of the sponge, but become more numerous in proximity to the core, and are there sometimes rather abundant. It is apparently owing to the gradual addition to the core, as growth proceeds, of the innermost of these spicules, (oxea) lying circum-

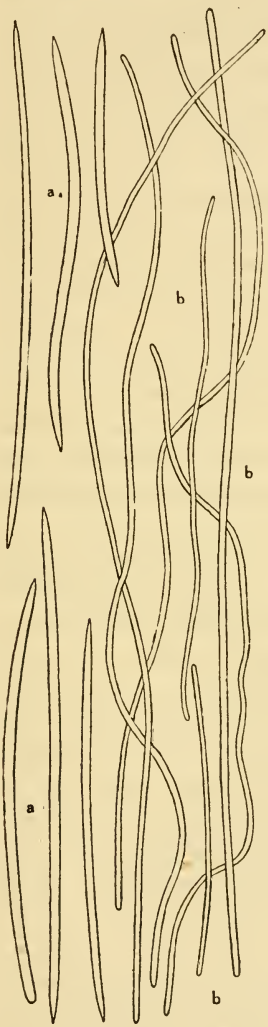


Fig. 19—*Axinella aurantiaca*. *a*. Oxea and occasional styli. *b*, Strongyla.

jacent to it, that the core becomes stouter with age; for one finds, in the older portions of the sponge, that the core consists of an outer (secondarily formed) layer composed of fairly closely packed oxea, and of an axial region which is differently constituted. In spite of the increase in size of the core, no appreciable reduction occurs in the width of the layer extending between it and the surface, nor does there seem to be any marked diminution in the number of the scattered spicules. The axial or first-formed region of the core, as seen in sections of an appropriate thickness, exhibits a structure very similar to that figured by Vosmaer(52) in illustration of the skeleton of the type-species of *Axinella*. It consists of: (i.)numerous longitudinally-running, and interlacing, multispicular fibres ("funicles"), which are similar in character to the already mentioned fibres that run out to the surface, and form a kind of reticulation with narrow elongated meshes; (ii.) intermingled with these, numerous slenderer diffuse strands, likewise composed of oxea, and usually more or less oblique to the axial direction; and(iii.)singly-occurring elongated flexuous strongyles,* which are interwoven with the fibres.

Spicules.—In different specimens, one finds differences in the sizes of the spicules, more particularly of the oxea, the differences being chiefly in stoutness and in average length. The maximum length, both of the oxea and the strongyla, appears to be fairly constant; but the relative number of spicules which attain to this varies considerably, and may sometimes be extremely small. The spicules which, throughout the description, have been referred to simply as oxea, include also a number of styli; these styli are usually rare, but, in one of several slides prepared from different parts of the type-specimen, they were met with rather frequently. Variability is shown also in the relative abundance of the

* Whitelegge(54) says regarding the arrangement of the strongyles that they are "usually disposed at right angles to the columns of oxeote spicules in the main fibres." On the contrary, it seems to be the rule that, like almost all the other spicules composing the core, they have a more or less longitudinal disposition.

strongyles, which, always far fewer than the oxea, are sometimes very scarce. The characters of the spicules are as follows:—

(*a*) The oxea (and occasional styli) are in general slightly curved; are cylindrical to within a short distance (at most 40 μ) of their extremities; and taper, either evenly or somewhat irregularly, to usually sharp points. They range in length from about 220 to 500μ, occasionally to as much as 600μ; in some specimens, relatively very few exceed 400μ. The stoutest are sometimes not more than 12μ in diameter, and even so may be comparatively scarce; but, in other cases, spicules exceeding 12μ in stoutness are quite plentiful, and a diameter of as much as 17 μ may be attained. Spicules of all degrees of stoutness down to 2μ, and even less, are present.

(*b*) The strongyla are cylindrical and, in general, variously and irregularly flexuous. They vary in length, independently of diameter, from about 300 to upwards of 900μ; the longest observed in any specimen measured 1120 μ. The maximum stoutness is usually between 6 and 8 μ, but in occasional specimens may reach 11 μ. According to Whitelegge's measurements, the strongyla may attain a length of 1500 μ, but apparently this is an overstatement.

Loc.—Port Jackson and neighbourhood.

Axinella inflata.

I have failed to find, either in the collection of the Australian Museum or among the fragments received from the British Museum, any species which—in skeletal characters, at any rate—conforms to the description of *Axinella inflata* even in a remote way. An ostensible type-specimen (labelled "Dictyocylindrus inflata") does, indeed occur, and, in certain outward features, it exhibits points of agreement with the description; thus it is of "ramifying" habit, attains approximately to "a height of 100 mm.," and is also of "soft and resilient consistency"; but these resemblances are clearly only accidental, inasmuch as the branches are not "cylindrical," but more or less compressed, and are not terminally inflated, but, on the contrary, are much flattened at

the extremities. The specimen (Pl. xxiii., fig. 5), which possesses a sparse reticulate skeleton of slender horny fibres cored with small strongyla, is identically similar to a fragment from the British Museum labelled *Chalinodendron dendrilla,*—and to that species it undoubtedly belongs.

For the identification of *Axinella inflata,* accordingly, one will have to depend solely on the scanty description of the species. If this description is correct, the species does not belong to *Axinella* in the strict sense, but to a new genus apparently possessing affinity with *Axinosia* (vide p.349). Until it is rediscovered, however, and its precise nature known, and while the genus *Axinella* still remains "a receptacle for all Axinellidæ which do not belong to more clearly defined genera," the species perhaps had better remain known, for the present, by its original name.

Axinella obtusa.

The same remarks apply to this species as have been made above in the first sentence and concluding paragraph of my remarks in reference to *Axinella inflata,* to which species *A. obtusa* appears, from its description, to be very closely related. A specimen labelled in Lendenfeld's handwriting, *"Dictyocylindrus obtusa,"* the MS. name corresponding to *A. obtusa,* according to the key-list—occurs in the Australian Museum, but neither in external nor internal features does it comply with the description of the species; it belongs to an undescribed species of *Raspailia,* similar to *R. tenella,* in the size and form of its spicules, and also in the possession of radiate tufts of dermal spicules, but approaching rather to *R. gracilis* in the precise pattern of its skeleton. In its external shape, however, irrespective of its relatively small size and slender proportions, the specimen exhibits a very considerable degree of correspondence with the description; and it is just possible, therefore, that the outward description of *A. obtusa* was based upon a much larger and more stoutly proportioned specimen of the same Raspailia species. Consequently, if, as seems not unlikely, this species should be found to grow to the size to which *A. obtusa* is

stated to attain, there would be justification for regarding the latter species as synonymous partly with the former (which would then have to be called *Raspailia obtusa*) and partly with *Axinella inflata.*

Spirophorella digitata.

In the absence of a type-specimen, it is impossible to speak with certainty regarding this species; but there are peculiar circumstances surrounding it, which justify the suspicion that some serious mistake in connection therewith has been made. In the first place, one is at a loss to understand why a new genus was introduced for its reception, for, apart from the fact that Carter had some years previously proposed the genus *Trachycladus* for a species with essentially similar spiculation, Lendenfeld, in his paper on the Australian Chalininæ—published just immediately in advance of the Catalogue—had himself already proposed a genus *Spirophora,* whose definition and that of *Spirophorella* are virtually identical. Besides this, the identity of *Spirophora* with *Trachycladus* had been pointed out by Dendy, in his criticism of the paper above referred to, prior to the publication of the Catalogue. If it be suggested, in explanation, that Lendenfeld must have considered the slight differences to be of generic value which he ascribed to the species respectively assigned by him to *Spirophora* and to *Spirophorella,* the further question needs to be answered as to why he referred the two genera to different families, and having done so, why he has omitted, in his remarks on the latter, to make any reference whatsoever to the former, while yet deeming it of sufficient importance to observe that *Spirophorella* "appears very similar to *Spiretta,*"—a Tetractinellid genus having no other special point of agreement with the genus in question than the possession of spiral microscleres. One cannot suppose that the idea of a relationship between his species of *Spirophora* and *Spirophorella* did not occur to Lendenfeld, since evidently the one generic name is coined from the other; and, furthermore, it would seem as if he shortly afterwards decided to regard the two genera

as identical, for in his paper(28) published but a year later than the Catalogue, in which a complete classification of the sponges is proposed, only one of these genera, viz., *Spirophorella*, receives mention. Hence one would have thought that, as a precaution, in view of the possibility of its becoming necessary later to unite the genera, the author would have avoided using similar specific names in the two cases; yet we find that the first-described of the two species of *Spirophora* and the single species of *Spirophorella* are both designated *digitata,* a name which moreover, is altogether inappropriate as applied to the latter, since the species is, according to description, "irregular, massive." The explanation of these anomalies, I think, must in some way be connected with the fact that the manuscripts of the Catalogue and of the paper on the Chalininæ were in course of preparation at one and the same time. It is possible that Lendenfeld, having at first intended to refer the the genus *Spirophora* to the Gelliinæ, and having described two species of it for inclusion in his paper on the Chalininæ, afterwards decided to refer the genus to the *Axinellidæ*, and to introduce it in the Catalogue, but through an oversight omitted to delete the paragraphs relating thereto from the manuscript of the former paper; hence, that *Spirophorella* is merely another spelling for *Spirophora*—preferred perhaps on account of the similarity between the names *Spirophora* and *Spiriphora;* and that *Spirophorella digitata* is nothing more than *Spirophora digitata* wrongly described in respect of its external characters. Support to this suggested explanation is provided by the fact that, in the key-list of Lendenfeld's manuscript names, *Spirophora digitata* is written as the MS. synonym of *Spirophorella digitata.*

Several specimens labelled *Spirophora digitata,* in Lendenfeld's handwriting, occur in the Australian Museum, and these I regard as correctly representing that species, which must now be called *Trachycladus digitatus.* Contrary to Lendenfeld's description, however, the megascleres are not styli, but almost exclusively oxea, and the microscleres are of two kinds, spirulæ and microstrongyles. A description of this, and of some other species of *Trachycladus,* will be given in my next paper.

APPENDIX.

Hemitedania, gen.nov.

Tedaniinæ in which the skeleton is a reticulation of spiculospongin fibre, and the only megascleres are smooth oxea or tornota. The raphides are spinulous, and are typically provided, near one extremity, with a bulbous dilatation.

The raphides of *Amorphina anonyma*, I find, exhibit characters which render it certain that the species is closely allied to *Tedania*, and particularly to such species as *T. pectinicola* and *T. fuegiensis* Thiele(42); and as its possession of well-defined sponginous fibres is additional reason against the inclusion of this species in the genus *Rhaphisia*, to which Dendy referred it (and which, by the way, Lundbeck(31) with some justification regards as a synonym of *Gellius*), I accordingly propose for its reception a new genus, *Hemitedania*.

Spinulous raphides—or onychetæ, as Topsent(48) has termed them—peculiar in having a subterminal bulb, occur also in two undescribed species (represented by specimens in the Australian Museum) in which the megascleres are styli and strongyla, and which, in skeletal structure, differ markedly both from typical species of *Tedania* and from each other. One of these species, for which a new genus will certainly be required, is remarkable in possessing peculiar acanthostyle-like spicules, which undoubtedly are derivatives of onychetæ, but attain a size of 115 by 6 μ; they have a slightly roughened surface, a subfusiform shape, and an abruptly truncated base provided with a central mucro and a circumferential whorl of minute spines. Another species, which I consider to be related to *Tedania*, and for which a new genus is probably necessary, is that described by Kirkpatrick(24) under the name *Oceanapia tantula*.

Concerning the systematic position of *Tedania* and its allies, there is not yet agreement of opinion, though generally they are placed along with the genera formerly included in the subfamily Dendoricinæ; Dendy, however, has always favoured the recognition of a subfamily Tedaniinæ which he would include in the *Haplosclerida*. In view of the difficulty in classification occasioned by the genus *Hemitedania*, it seems to me advisable, if

not necessary, to retain the family Tedaniinæ, though, at present, I am unable to form an opinion as to whether it should be placed under the *Haploscleridæ* or the *Desmacidonidæ*. A very considerable resemblance certainly exists between *Trachytedania* and certain Myxilline genera like *Lissodendoryx*, but inasmuch as no form of spicule, affording evidence of an homology with the onycheta, is known in any of these genera, there is no sufficient warrant for regarding the resemblance as other than the result of convergent evolution.

HEMITEDANIA ANONYMA Carter. (Pl. xviii., fig.4; Pl. xix., figs.1-5; Pl. xxiv., figs.3-5; and text-fig.20).

1886. *Amorphina anonyma*; Carter(**7**), p.49.
1895. *Rhaphisia anonyma*; Dendy(**12**), p.256.
1888. *Reniera pandæa*(partim); Lendenfeld(**27**), p.79.
——. *Halichondria rubra*(partim); Lendenfeld(**27**), p.81.
——. *Halichondria rubra* var. *digitata*(partim); Lendenfeld(**27**), p.81; not Pl. ii., fig.1(= *Raspailia agminata*, sp.n.).
1901. *Rhaphisia rubra*; Whitelegge(**54**), p 77.
1902. *Rhaphisia pandæa*; Whitelegge(**56**), p.281.

The material at my disposal comprises some twenty specimens from Port Jackson and neighbouring localities; a specimen from Port Phillip; and a slide-preparation of *Rhaphisia anonyma*, presented to the Australian Museum by Prof. Dendy.

Description.—In the simplest form, the sponge is an irregularly digitate cluster of stout branch-like parts (Pl. xix., figs.1-4), which are united below, forming a sessile base; the branches are tubular, with a single osculum at the summit, are cylindrical and slightly tapered, may attain to a length of 200 mm. or more, and, while ordinarily not much less than 20 mm. in diameter, vary in stoutness in different specimens from 10 to 30 mm. More usually, however, a formation into separate tubes is only partially effected, and the sponge accordingly consists, in part, of more or less flabellate portions with marginal oscula (Pl. xix., fig.5). Finally, the branching habit is often almost entirely suppressed, and the sponge is then lobose, semi-massive, as a rule more or less compressed, with the oscula situated on the uppermost and

prominent parts. The surface is free from characteristic inequalities, and, in general, is smooth and even; a dermal membrane is present, and, though thin, is usually well-defined. The oscular tubes, whose diameter varies from 3 to (rarely) 10 mm., are lined by a stouter and tougher membrane, which also forms numerous diaphragm-like dissepiments stretching across their lumen. Concerning the life-colour, which is known with certainty only in the case of Port Phillip specimens, Dendy states that "orange is the prevailing tint and there are no very great deviations from this"; the colour in spirit ranges from dull yellowish-white to a pale brown. Well preserved specimens are of firm, sometimes slightly cartilaginous, moderately tough consistency, and are brittle rather than flexible; but apparently the sponge readily undergoes some amount of maceration, with the result that, as a rule, spirit-specimens are comparatively soft, compressible, and resilient. The consistency depends to some extent upon the degree of coarseness of the fibres, which is variable. Specimens dried in the ordinary way (without previous removal of the sarcode) are light, open, and somewhat bread-like in texture, and, considering their horny fibrous skeleton, are somewhat brittle. The fibrous reticulate skeleton, obtained by treatment with caustic potash, presents certain constant features, but, in different specimens, varies greatly in the closeness of its texture and in elasticity, and to some extent also in colour and pattern. A dense irregular network of stouter (primary) fibres bounds each of the oscular tubes, and from this—taking the (simple) case of a separate branch—dendritically branching, secondary fibres run out (in a slightly upward direction) to the surface; these secondary fibres, which to within a short distance of their outer extremities are connected together by (usually plexus-forming) cross-fibres, are disposed in such a way that the skeleton, viewed from the exterior, presents a very imperfectly honeycomb-like structure. The colour of the skeleton varies from yellowish-white to golden-yellow, according to the degree of development of spongin.

As seen in section under the microscope, the skeleton-reticulation is of a very irregular pattern, and the fibres are of very

varying stoutness; the latter are composed of roughly parallel spicules cemented by spongin, which usually forms a distinct sheath, but sometimes is barely more than sufficient in quantity to hold the spicules together. The primary fibres attain a diameter ranging in different specimens from about 80 to 130 μ, while the slenderest of the connecting fibres are but two or three spicules broad; single connecting spicules also occur. In the meshes of the reticulation, megascleres are scattered in some abundance, together with a few raphides; in the canal-traversed soft tissues occupying the wider interstices of the skeleton, on

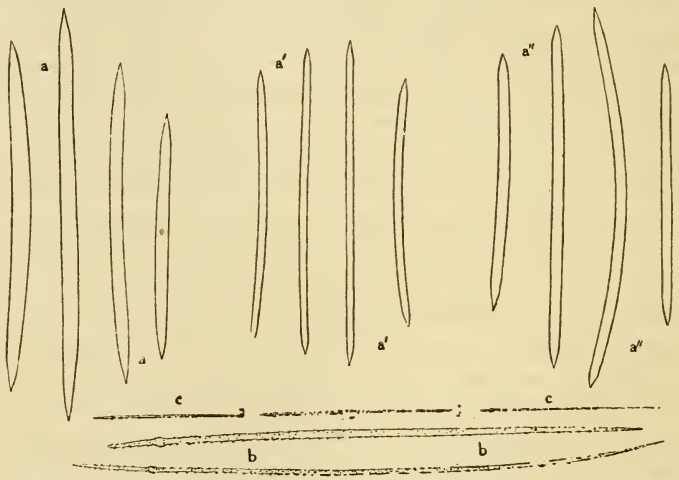


Fig. 20.—*Hemitedania anonyma*. *a*, Oxea, from each of three different specimens. *b*, Onychetæ.

the other hand, it is the raphides which are the more numerous. In addition to the fibres which compose the reticulation, separate strands of loosely associated parallel spicules, free from spongin, occur, sometimes consisting of oxea alone, more frequently of oxea and raphides in variable proportion, and apparently sometimes of raphides alone. The raphides also occur in dragmata, but these are sometimes extremely scarce. The dermal skeleton consists of vertical tufts of megascleres projecting slightly beyond the surface, and usually so disposed in linear series as to produce

a more or less distinctly reticulate pattern; these tufts, for the most part, are the outer ends of radiating spicule-strands into which the outwardly running (secondary) fibres of the main skeleton break up on nearing the surface.

Spicules. – (*a.*) The oxea are mostly straight or nearly so, and abruptly sharp-pointed (tornotiform); among them, rare individuals occur, which are more or less rounded off at one extremity (stylote). Their maximum size in different specimens is fairly constant as regards length, but variable as regards stoutness: in Dendy's slide of *Rhaphisia anonyma*, they measure from 155 to 265 μ in length by at most 6 μ in diameter; in the type-specimen of *Reniera pandœa*, 165 to 245 by 8 μ; in the type-specimen of "*Halichondria rubra*," 160 to 230 by about 7 μ; and in another specimen, of unusually cartilaginous consistency, 150 to 275 by 12 μ.

(*b.*) The raphides are straight, slightly fusiform, asymmetrical with regard to opposite extremities; they taper gradually to a very fine point at one extremity, are abruptly truncated and produced into a minute extra-axial mucro at the other, and, at a distance of between one-sixth and one-tenth their length from the latter end, exhibit a small bulbous dilation. The spinules are very minute, are most pronounced at the basal end of the spicule, and, gradually diminishing in size, finally become indiscernible somewhere about the middle of the spicule. The spicules are of two sizes, the larger being the more numerous. The smaller occur plentifully in Dendy's slide of *R. anonyma*, but, in all the other specimens examined, including the one from Port Phillip, they are rather rare and in some cases apparently absent. In the two Port Phillip examples, the longer raphides measure from 135 to 175 μ, while in the Port Jackson examples, with one exception (viz., the specimen with oxea 12 μ in diameter), they are shorter, having a maximum length varying between 138 and 150 μ; their maximum stoutness varies in different specimens, proportionately with that of the megascleres, from less than 1 μ to about 2 μ. The smaller raphides are extremely slender, and seldom more than 40 or 50 μ long.

Locs.—Port Jackson and neighbourhood; Port Phillip.

HISTODERMA ACTINIOIDES sp.nov. (Pl. xxii., fig.3; and text-fig.21).

1888. *Stylotella polymastia* (err.), Lendenfeld(**27**), Pl. iv., fig.1.

——. *Sideroderma navicelligerum* R. et D. (err), Lendenfeld(**27**), p.210.

The sponge is of massive rounded form, and apparently grows attached by a narrow base. From the surface, over its entire extent, arise numerous longer or shorter digitiform, tapering, lax tubular processes (with thin membranous wall), which somewhat resemble the tentacles of a sea-anemone. Between the processes, the surface is smooth, and either even or much wrinkled. Oscula appear to be absent. The colour in alcohol is pale yellowish-grey within, and more whitish on the surface. The consistency is firm, compact, moderately tough and compressible, yet brittle rather than elastic. The dermal layer does not form a noticeable rind, but is thin and closely adherent to the underlying tissue.

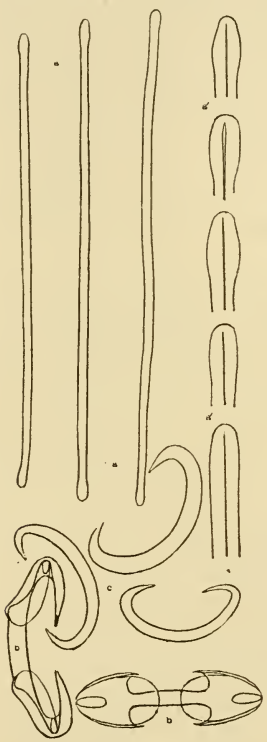


Fig.21.

Histoderma actinioides. *a*, Tylota. *a'*, Extremities of tylota. *b*, Isochelæ arcuatæ. *c*, Sigmata.

The single example*(Catalogue, Pl. iv., fig.1), which is a half-specimen, would, when complete, measure about 100 by 80 by 55 mm., in its three principal diameters. The tubular processes vary in length up to about 20 mm., and are 2 to 4 mm. wide at the base.

The main skeleton consists of non-reticulating fibres running in various directions without regular course, and, scattered between these, of plentiful single spicules, and spicules aggregated in bundles and strands. The fibres

* Another specimen of the species has since been found among a collection of sponges belonging to the Department of Biology, Sydney University, and is figured in the present paper.

are of very variable stoutness, occasionally attain to 100 μ in diameter, and are composed of roughly parallel spicules usually not very compactly arranged. Spongin appears to be entirely absent. The microscleres are scattered chelæ and sigmata, the former rare except in the outermost layer of the dermis, the latter fairly abundant and occurring only in the choanosome. The dermal layer, which is never much more than 100 μ in thickness, is provided with moderately abundant single spicules disposed horizontally in several layers and crossing one another in various directions. In the fistulæ, however, the dermal skeleton (which is there the only skeleton) undergoes a gradual alteration in its arrangement, and towards their extremities becomes a reticulation of stout fibres. The meshes of this reticulation are tympanised by a thin membrane, which is perforated with numerous rounded pores varying from 15 to upwards of 80 μ in diameter.

Spicules. – (*a.*) The megascleres, which vary in form from tylota to strongyla, the tylota being the more numerous, are nearly or quite straight and scarcely, if at all, stouter at the middle than towards the ends. The end-swellings of the tylota are elongate and oblongish in shape, and, as a rule, are more pronounced in the stouter spicules than in the slenderer. The very slenderest (developmental) spicules are invariably strongyla, and usually taper slightly from one end to the other. The maximum size of the megascleres is 430 by 10 μ, and their length seldom falls below 320 μ.

(*b.*) Isochelæ arcuatæ, 12·5 to 18 μ long, with the distal end of the alæ pointed and abruptly incurved, and apparently with a tooth-like prolongation of the tubercula.

(*c.*) Simple and contort sigmata, 33 to 42 μ long from bend to bend, and at most 3·5 μ stout.

Embryos.—A few embryos of oval shape, the largest measuring 900 by 600 μ, were observed, most of which were provided with spicules in the form of equal-ended tylota of size rarely exceeding 190 by 2 μ. The spicules were usually scattered throughout the entire body of the embryo, but, in a few cases, were chiefly collected in a loose bundle situated near one end. The largest embryo without spicules measured 700 by 500 μ, but others, of

smaller size than this, were present, which contained quite abundant spicules.

Loc.—Port Jackson.

RASPAILIA AGMINATA, sp.n (Pl. xxiii., fig.4; and text-fig.22).

1888. *Halichondria rubra* var. *digitata* (err.) Lendenfeld(27), Pl. ii., fig.1.

Description.—Sponge a compact tussock-like sessile cluster of erect tapered branches, which combine below into gradually fewer and stouter stems ultimately proceeding from a narrow area of attachment. An adequate idea of the outward form is conveyed by the figure of the single specimen (Pl. xxiii., fig.4), which measures 95 mm. in height. The surface is smooth, or in places minutely pustulate; and is sparingly hispid with spicules which project about 1 mm. beyond it. The colour in spirits is greyish-white, and the consistency fairly tough, compressible, and resilient.

The main skeleton, which is not condensed in the axial region, consists: (i.) of an irregular wide-meshed reticulation of pale slender spongin-fibres echinated, as a rule unilaterally, by moderately closely-spaced acanthostyles, the principal fibres of which are cored by pauciserial tylostyli, while the (usually plexus-forming) connecting fibres are with rare exceptions aspiculous; and (ii.) of, for the most part, longitudinally-directed styli and tylostyli lying between the fibres. In sections mounted in balsam, the spongin is scarcely or not at all discernible, and the by no means dense skeleton appears as if composed solely of spicules. An outermost layer of the sponge, which is sometimes as much as 0·5 mm. in width, though usually much narrower, is comparatively or quite free from spicules, excepting that it is crossed by the long styli, which hispidate the surface and give support superficially to tufts of small (auxiliary) spicules surrounding the points of exit of these styli. Auxiliary spicules also occur, in very small number, and usually not singly, but in pairs, scattered through the interior.

Spicules.—(*a.*) The principal megascleres are partially differentiated into groups, styli and tylostyli, the latter of which are almost invariably sharp-pointed, while the former are often more

or less rounded off at the apex and occasionally pass into more or less abbreviated strongyla; both kinds are (usually not much) curved, especially in their basal moiety. The tylostyli, which are seldom, if ever, less than 950 μ long, are of very varying stoutness, and have the bulb less pronounced in proportion as they are stouter; between tylostyli and styli of the same length, there are all intermediate gradations. The styli are always proportionately stouter than the tylostyli and range in length from about 450 to 2800 μ; their maximum diameter is 28 μ.

(*b.*) The acanthostyles are straight, conical spicules, measuring at most 12·5 μ in stoutness, and varying from 80 to upwards of 190 μ, though rarely exceeding 150 μ in length. The spines are recurved, generally between 2 and 4 μ in height, and nearly always are more or less reduced in number over portion of the basal half of the spicule.

(*c.*) The auxiliary spicules are styli and asymmetrically-ended oxea, straight or slightly curved, the latter comparatively few in number and, on the average, shorter and slenderer than the styli. They measure from 245 to about 400 μ in length, and seldom as much as 6 μ in stoutness.

Loc.— Port Jackson.

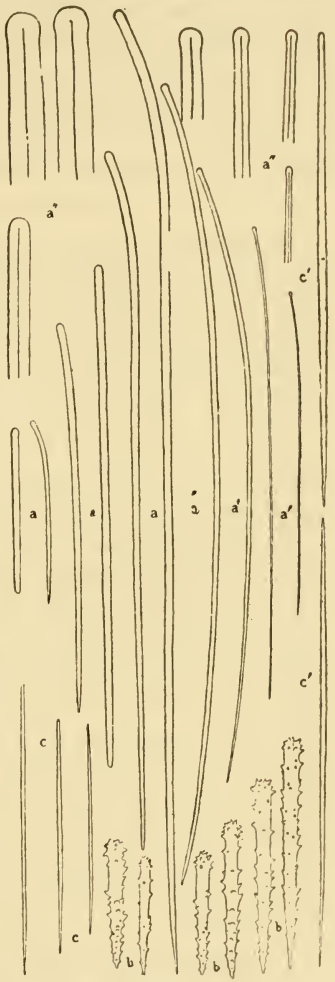


Fig. 22.

Raspailia agminata. *a*, *a'*, Principal spicules, styli and tylostyli with occasional substrongyla. *a''*, Basal ends of principal spicules. *b*, Acanthostyli. *c*, Auxiliary oxea and styli. *c'*, The same drawn to a larger scale.

Remarks.—The occurrence, as in this species, of auxiliary spicules in pairs – in incipient dragmata, as it were—is perhaps not uncommon in the genus *Raspailia*; although, as far as I am aware, no mention of it has hitherto been made. I have observed it not only in the three species of this genus described in the present paper, but also in *R. atropurpurea* (Carter) Whitelegge(54), and in the allied genus *Clathriodendron*(18).

Axiamon, gen.nov.

Axinellidæ(?), typically of ramose or flabellate habit, and with conulose or lamelliferous surface, in which the characteristic megasclere is an oxea with spinose extremities, and the skeleton is a lattice-like reticulation of fibres formed of these spicules (and admissibly also of derivatives of them) cemented and ensheathed by spongin. Microscleres are absent.

The nearest approach I know of to the type of skeleton-reticulation typical of this genus, I have observed in an undescribed sponge from New Zealand; but, in the latter—which thus belongs to an unnamed genus—the fibres are cored by smooth styli, and echinated by rare distally spined rhabdostyli. I have also observed a somewhat similar type of skeleton in an undescribed species of *Trikentrion* from North-west Australia. As it seems highly probable that the New Zealand sponge is generically related to *Trikentrion* (but distinguished in having *stylote* instead of oxeote megascleres and cladose acanthostyli with only *one basal actine* instead of several), I am inclined to think that *Axiamon* also is related to *Trikentrion*, and thus of "Ectyonine" origin. Since, however, the genus is lacking in any character that would warrant its inclusion in the *Desmacidonidæ* as at present defined, the only course open seems to be to place it in the *Axinellidæ*.

In the form of its spicules, the type-species, *A. folium*, sp.nov., shows analogies, probably indicative of relationship, with *Axechina raspailioides* Hentschel(21); and it also presents points of agreement with *Thrinacophora funiformis* Ridley & Dendy.

A species, which, I believe, will be found to belong to *Axiamon*, has been described by Carter(6), from Australia(?), under the name

Ptilocaulis rigidus. But there is perhaps equal justification for the view expressed by Thiele(39), that this species should be included in the genus *Phycopsis;* and it is quite likely that *Phycopsis* and *Axiamon* are closely allied.

AXIAMON FOLIUM, sp.nov. (Pl. xviii., figs.2, 3; Pl. xxiv., figs 7, 8; and text-fig.23).

1902. *Reniochalina stalagmites*(err.) + *Reniochalina lamella*(err.), Whitelegge(56), p.283.

Two specimens only are at hand – those which Whitelegge very briefly and not quite accurately described as the types respectively of *Reniochalina stalagmites* and *Reniochalina lamella*; and as these differ to some extent in certain external features, and may thus be varietally distinct, it is advisable to mention that I choose, as the typical specimen, that which Whitelegge took to be *R. stalagmites*.

Description.—Sponge flabellate, stipitate; the lamina entire, or palmato-digitate, or deeply dissected into branch-like parts. Surface ornamented with longitudinal close-set septiform ridges, usually either deeply notched at short intervals or segmented into separate languettes; between the ridges, the lamina is exceedingly thin except in the region of the stalk. Consistency in the dry state, dense, hard, tough, flexible within limits; colour greyish-brown.

The digitate typical specimen (Pl. xviii., fig.2), which is incomplete below, measures 250 mm. in height, and is provided with highly segmented ridges averaging 3 mm. in height, and set at a distance apart of from 2 to 3 mm. The second specimen (Pl. xviii., fig.3), 145 mm. in height, has continuous though deeply crenate ridges, averaging 1·5 mm. in height and 1 to 2 mm. in distance apart.

The main skeleton is a compact lattice-like reticulation with, for the most part, rhomboidal meshes, composed of spongin-ensheathed spicules arranged (somewhat confusedly) in pauci-serial fibres; the sides of the meshes are of about a spicule's length. Better defined primary fibres are sometimes observable running longitudinally and gradually trending outwards; but, as

a rule, no distinction between main and connecting fibres can be drawn. Spongin is developed only in relatively slight amount in the younger parts of the sponge, but later comes to form well-defined fibres (up to 60 μ in diameter) enclosing the spicules and rounding off the angles of the meshes. Many spicules, however, remain uncovered by spongin; and, on the other hand, a small

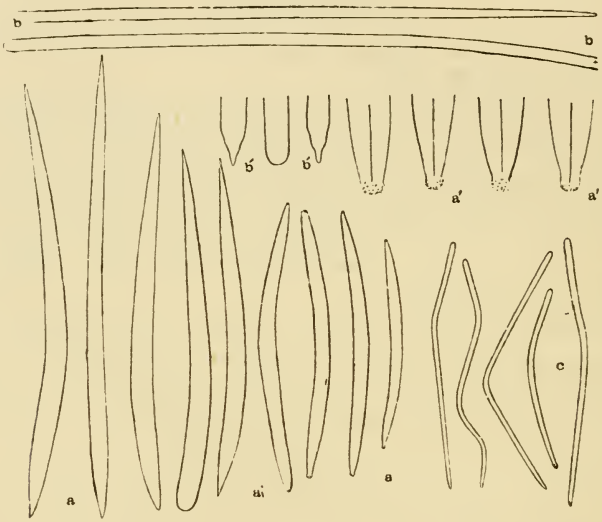


Fig. 23.—*Axiamon folium*. *a*, Principal oxea, anisoxea, and styli. *a'*, Extremities of principal spicules. *b*, Interstitial stylus. *b'*, Basal extremities of interstitial styli. *c*, Dermal styli.

proportion of short fibres are to be found composed entirely of spongin. The spiculation consists almost entirely of the characteristic oxea and of unequal-ended derivatives of these (anisoxea); but here and there, in some parts of the sponge at least, a long slender stylus may be met with; and, in the most superficial layer of the sponge, a very few small dermal spicules occur, lying scattered. The surface is rendered hispid by anisoxea projecting singly or in twos or threes, for three-fourths or more of their length, usually in an obliquely upward direction.

Spicules.—(*a.*) The oxea and anisoxea, which range from 180 to 420 μ in length, and up to 21 μ in stoutness, are moderately

(and, as a rule, slightly angulately) curved, the oxea symmetrically so, the anisoxea only in their basal moiety. The shortest and slenderest spicules are invariably oxea, the longest and stoutest, anisoxea; those of intermediate dimensions include both oxea and anisoxea, and all possible gradations between them. Many of the slenderest oxea are (gradually) sharp-pointed at both ends, and most of the anisoxea are (somewhat abruptly) either sharp-pointed or more or less bluntly rounded off at the basal end; but, with these exceptions, the extremities of the spicules are almost invariably surmounted by a cap of minute spinules. Occasional spicules are stylote.

(*b.*) Exceedingly rare, long, slender styli, tapering very gradually to a fine point at the apex, sometimes abruptly somewhat pointed at the base, and measuring from about 550 to 1200 μ in length by 7 to 12 μ in stoutness.

(*c.*) Small dermal styli, straight or variously bent or flexuous, either gradually or more or less abruptly sharp-pointed, and, in the latter case, usually provided near the apex with a few minute spines; measuring 190 to 280 μ in length by 3 to 5 μ in stoutness.

Loc.—Western Australia.

Remarks.—In the British Museum, in addition to a specimen of this species (labelled "*Reniochalina stalagmites*"), there occur two further examples of the genus *Axiamon*, labelled respectively "*Reniochalina spiculosa* Port Jackson," and "*Reniochalina arborea*, New Zealand." These have oxeote and anisoxeote megascleres of almost or quite identically the same size and form as those of the type-species, but they appear to be entirely lacking in the other kinds of spicules. The former, of which I have seen only a small fragment, is apparently not widely different in surface-features from the typical specimen of *A. folium*; but the latter – which is represented also in the Australian Museum, by an almost complete specimen – has a peculiar densely conulose surface, and is obviously a quite distinct species.

For Reference List of Literature, see *antea*, pp.310-313.

EXPLANATION OF PLATES XV.-XXIV.

Plate xv.

Fig. 1.—*Sollasella digitata* Lendenfeld; (× $\frac{2}{3}$).

Fig. 2.—*Sollasella digitata* Lendenfeld, from the type; (× $\frac{2}{3}$).

Fig. 3.—*Donatia fissurata* Lendenfeld; (slightly reduced).

Fig. 4.—*Donatia phillipensis* Lendenfeld; surface-section showing the dermal reticulation, the primary meshes of which are subdivided (by lines of tylasters) into smaller meshes, each enclosing a pore; (× 18).

Fig. 5.—*Spirastrella*(?) *australis* Lendenfeld; a flabellate example; (× $\frac{1}{2}$).

Fig. 6.—*Polymastia zitteli*, from the type of *Sideroderma zittelii* Lendenfeld; (nearly nat. size). The specimen is in a fragmentary condition.

Plate xvi.

Fig. 1.—*Cliona* (*Papillissa*) *hixoni*, from the type of *Raphyrus hixonii* Lendenfeld; portion of the exterior, showing the character of the surface-areolation; (× $\frac{3}{4}$).

Fig. 2.—*Cliona* (*Papillissa*) *hixoni*; showing the skeleton (after maceration by means of caustic potash) of a thick slice of a small specimen; (nat. size).

Figs. 3-4.—*Cliona* (*Papillissa*) sp., allied to *Cliona hixonii*; portions of the concave and convex surfaces respectively of a specimen having the form of a thick, curved plate, showing the character and arrangement of the surface-papillæ; (× $\frac{3}{4}$).

Plate xvii.

Figs. 1, 2.—*Cliona* (*Papillissa*) *lutea*, from the types of *Papillissa lutea* Lendenfeld; (× $\frac{1}{2}$).

Fig. 3.—*Spirastrella*(?) *australis* Lendenfeld; showing the skeleton (as prepared by maceration by means of caustic potash) of the specimen illustrated in Pl. xv., fig. 5; (× $\frac{1}{2}$).

Fig. 4.—*Amorphinopsis megarrhaphea* Lendenfeld; dermal skeleton; (× 8).

Fig. 5.—*Amorphinopsis megarrhaphea* Lendenfeld; pattern of the skeleton as shown in portion of a moderately thin section (× 10 approximately).

Fig. 6.—*Tedania digitata* var. *rubicunda*, from the type of *T. rubicunda* Lendenfeld; (× $\frac{1}{2}$).

Plate xviii.

Fig. 1.—*Caulospongia elegans*, from the type of *Plectodendron elegans* Lendenfeld; (× $\frac{2}{7}$).

Fig. 2.—*Axiamon folium*, sp. nov.; (× $\frac{4}{5}$).

Fig. 3.—*Axiamon folium* (var.?); (× $\frac{4}{5}$).

Fig. 4.—*Hemitedania anonyma* Carter; from a specimen of somewhat cartilaginous consistency, and with coarse-fibred skeleton; (× $\frac{1}{2}$).

Plate xix.

Fig. 1.—*Hemitedania anonyma* Carter, from a specimen labelled as the type of *Halichondria rubra* Lendenfeld; (× ¾).

Fig. 2.—*Hemitedania anonyma*; from a macerated, coarse-fibred specimen; (× ½).

Figs. 3, 4, 5.—*Hemitedania anonyma*; illustrating various forms assumed by examples of this species; (× ½ approximately).

Plate xx.

Fig. 1.—*Chalina finitima* Whitelegge (non Schmidt); an incomplete specimen.

Fig. 2.—*Phlœodictyon ramsayi*, from one of the co-types of *Rhizochalina ramsayi* Lendenfeld; illustrating a specimen of irregular shape provided with *many* root-like processes.

Fig. 3.—*Phlœodictyon ramsayi* var. *pyriformis* (var.nov.); portion of the upper surface showing the sieve-like area formed by the closely apposed oscula; (× ⅔)

Figs. 4-5.—*Phlœodictyon ramsayi*; tangential sections close beneath the surface, showing the pattern of the reticulation formed by fibres of the bast-layer in the wall of the fistula and in between the fistulæ respectively; (× 10).

Plate xxi.

Figs. 1, 2, 3, 4.—*Stylotella agminata* Ridley, from type-specimens of *Stylotella digitata* Lendenfeld, and of *Tedania laxa* Lendenfeld; (× ½ approximately).

Fig. 5.—*Stylotella agminata* Ridley; further illustrating the variable habit of the species.

Plate xxii.

Fig. 1.—*Axinella aurantiaca* Lendenfeld; longitudinal median section taken at the extremity of a thin branch; (× 15).

Fig. 2.—*Stylotella agminata* Ridley; longitudinal section taken at the extremity of a branch; (× 12).

Fig. 3.—*Histoderma actinioides*, sp.nov.; (× ⅔ approximately).

Fig. 4.—*Phlœodictyon ramsayi* Lendenfeld, var. *pyriformis* (var.nov.); inner surface of longitudinally bisected specimen, showing disposition of osculer canals; (× ⅔).

Fig. 6.—*Spirastrella*(?) *ramulosa* Lendenfeld; showing the skeleton which remains after maceration by means of caustic potash; (× ⅔).

Fig. 6.—*Raspailia tenella* Lendenfeld; longitudinal median section taken at the extremity of a branch; (× 12).

Fig. 7.—*Raspailia gracilis* Lendenfeld; longitudinal section of a branch; (× 9).

Plate xxiii.

Fig. 1. *Raspailia gracilis*, from the type of *Axinella hispida* var. *gracilis* Lendenfeld; ($\times \frac{3}{4}$).

Figs. 2-3. —*Raspaila tenella*, from the types of *Axinella hispida* var. *tenella* Lendenfeld; ($\times \frac{3}{4}$ approximately).

Fig. 4. —*Raspailia agminata*, sp.nov.; from the specimen wrongly figured in the Catalogue (Pl. ii., fig. 1) in illustration of *Halichondria rubra*, var. *digitata* Lendenfeld; ($\times \frac{3}{4}$).

Fig. 5. —*Chalinodendron dendrilla* Lendenfeld; ($\times \frac{4}{5}$).

Plate xxiv.

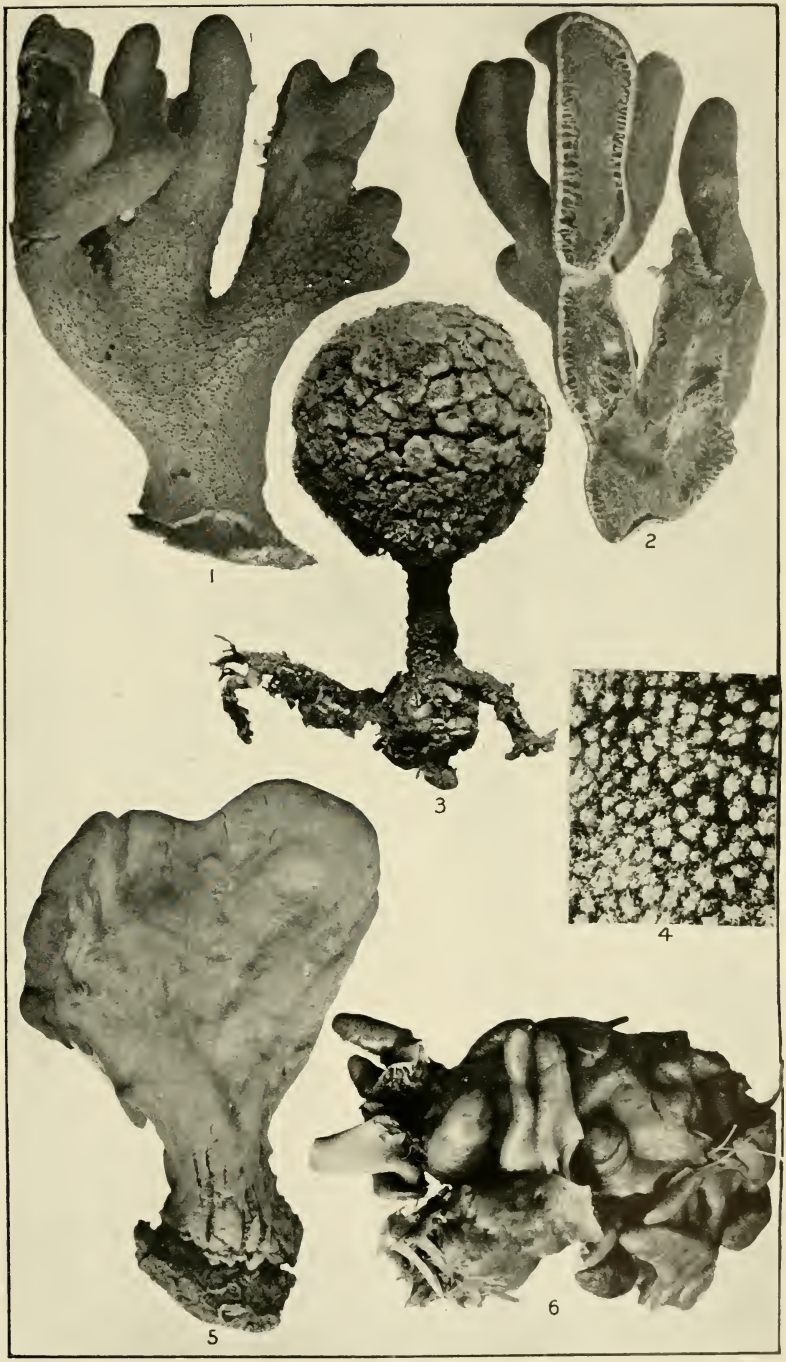
Fig. 1. —*Mycale* (*Paresperella*) *penicillium* Lendenfeld ; dermal skeleton ; ($\times$ 18).

Fig. 2. —*Tedania digitata* var. *rubicunda* Lendenfeld ; dermal skeleton ; ($\times$ 18).

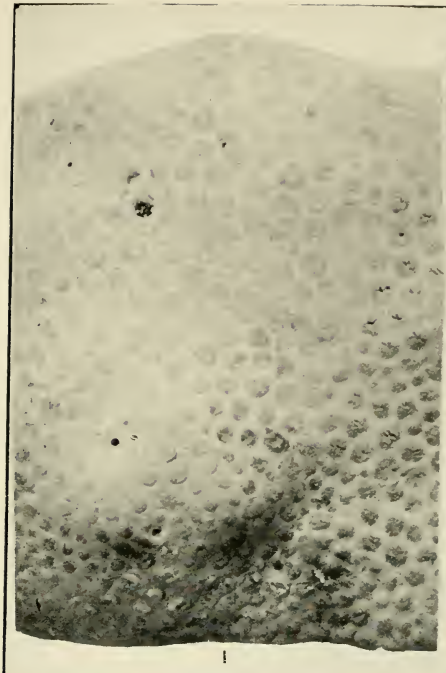
Figs. 3, 4, 5. —*Hemitedania anonyma* Carter; dermal skeleton; ($\times$ 18).

Fig. 6. —*Mycale serpens* Lendenfeld; dermal skeleton.

Figs. 7, 8. —*Axiamon folium*, sp.nov.; pattern of the skeleton as shown in moderately thin sections. Fig. 7, ($\times$ 10).



Sollasella, Donatia, Spirastrella, Polymastia.



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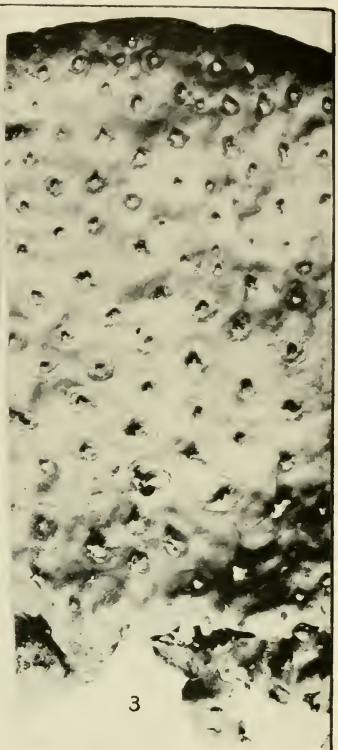

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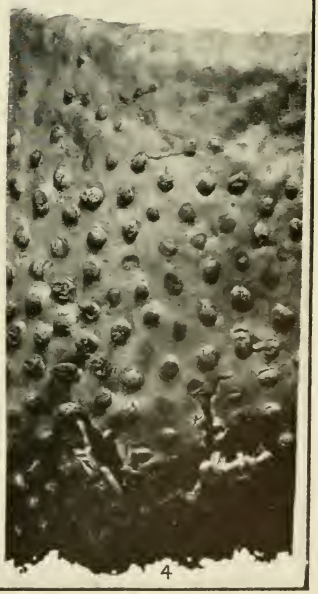

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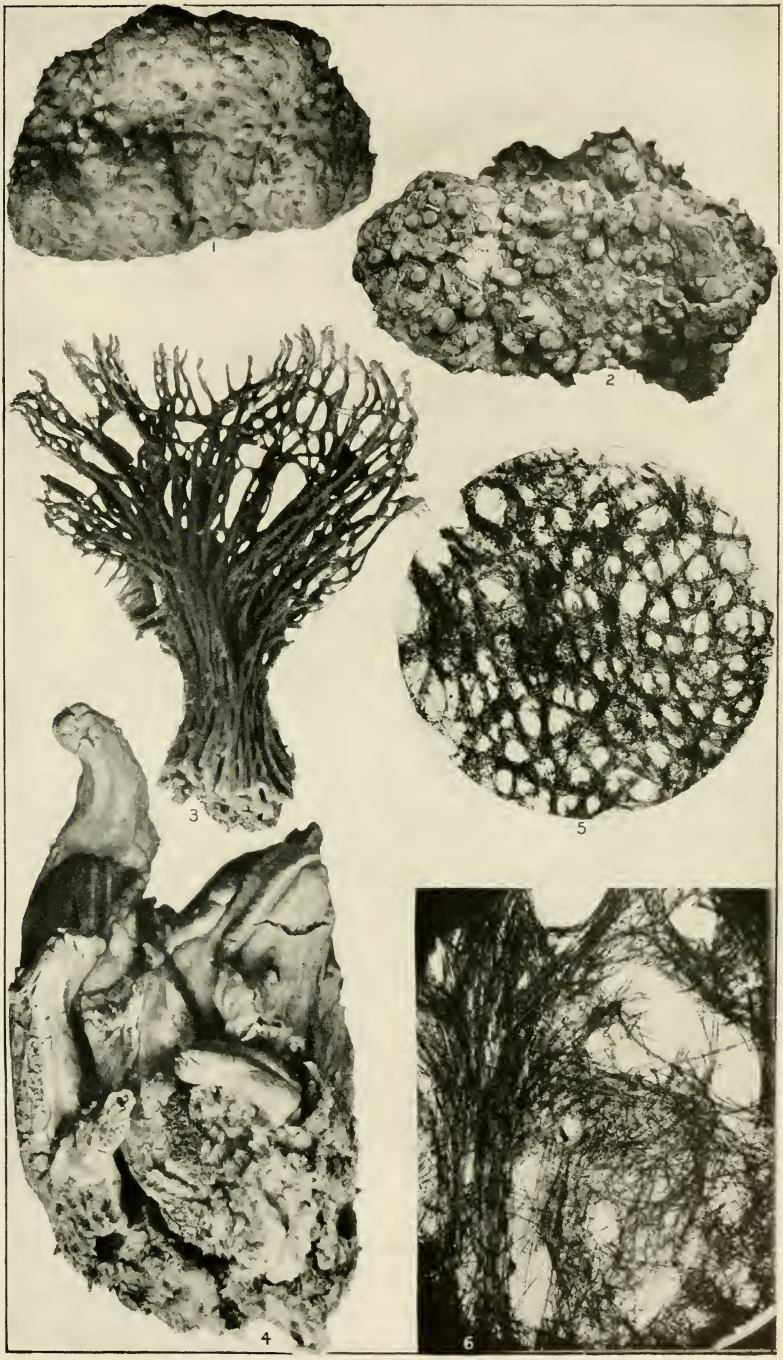
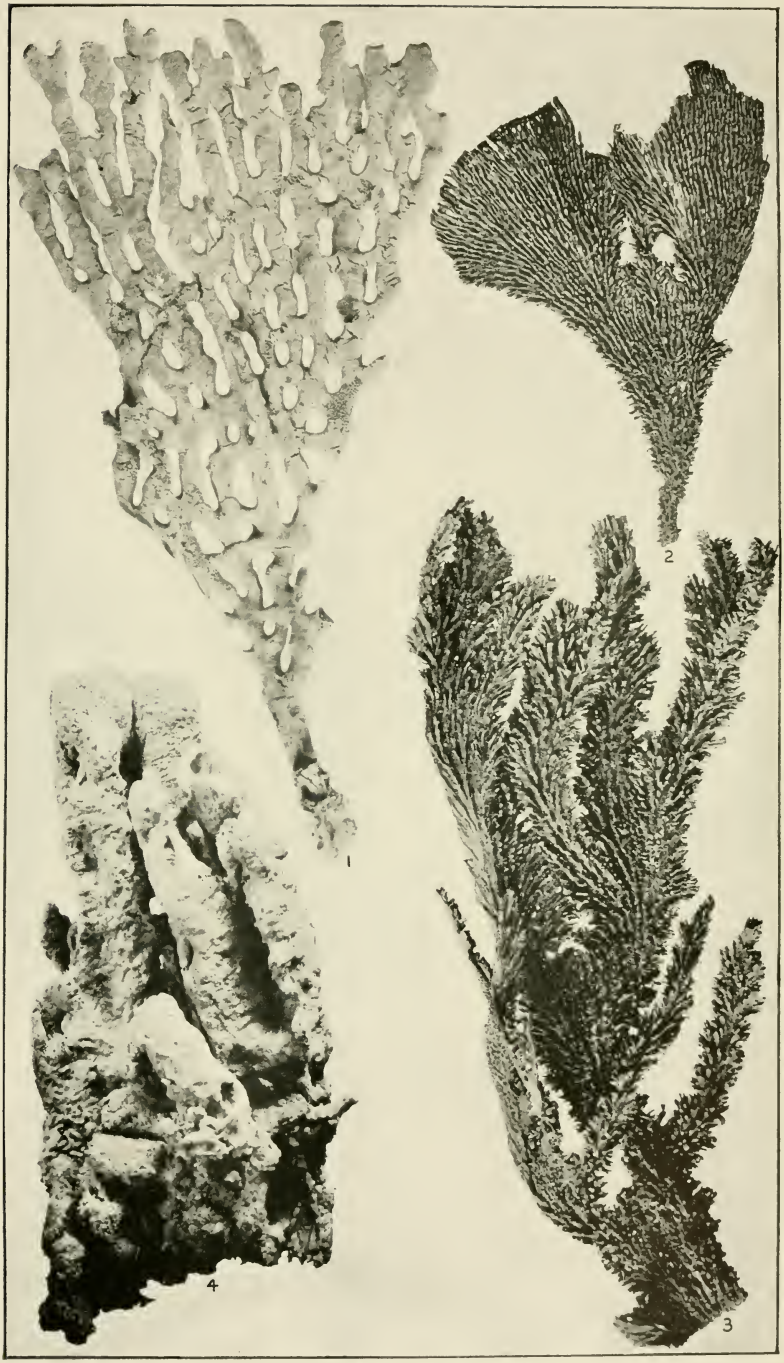
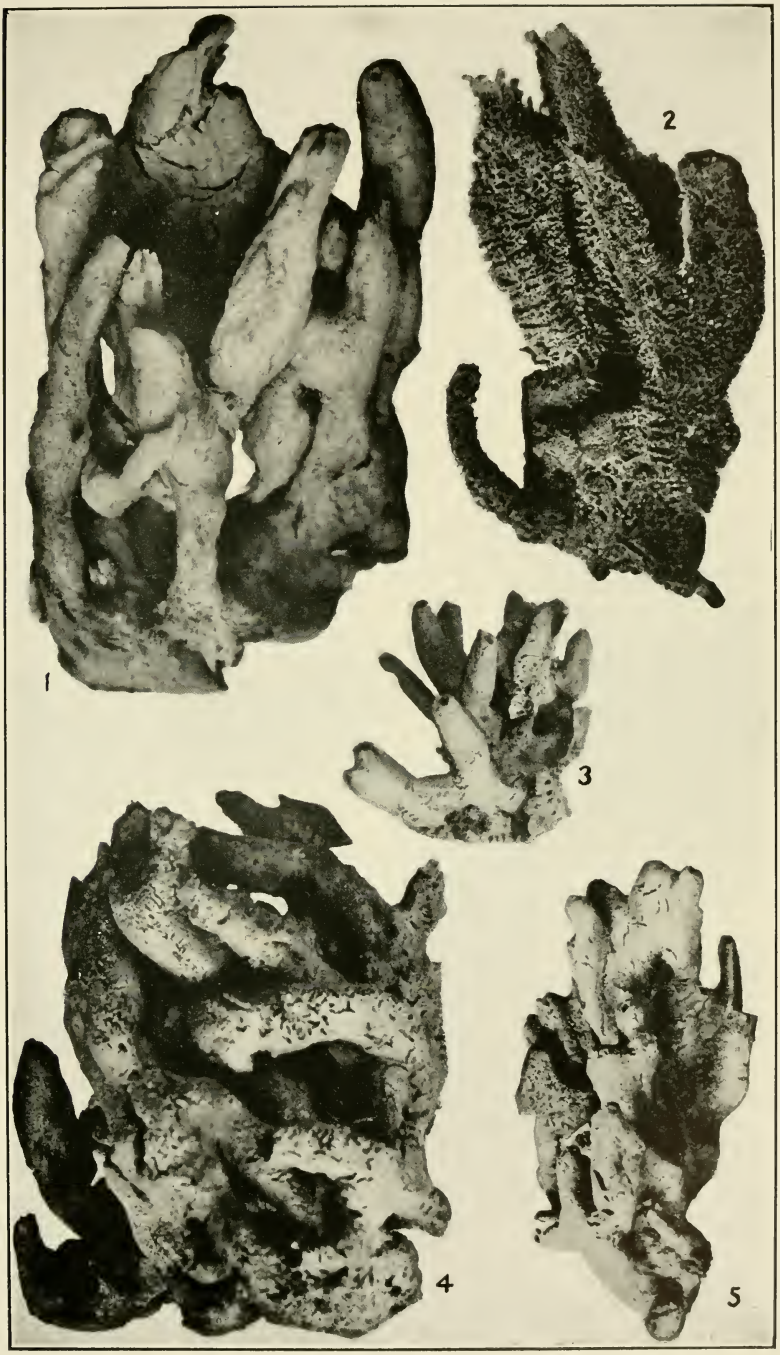
Cliona (Papillissa).



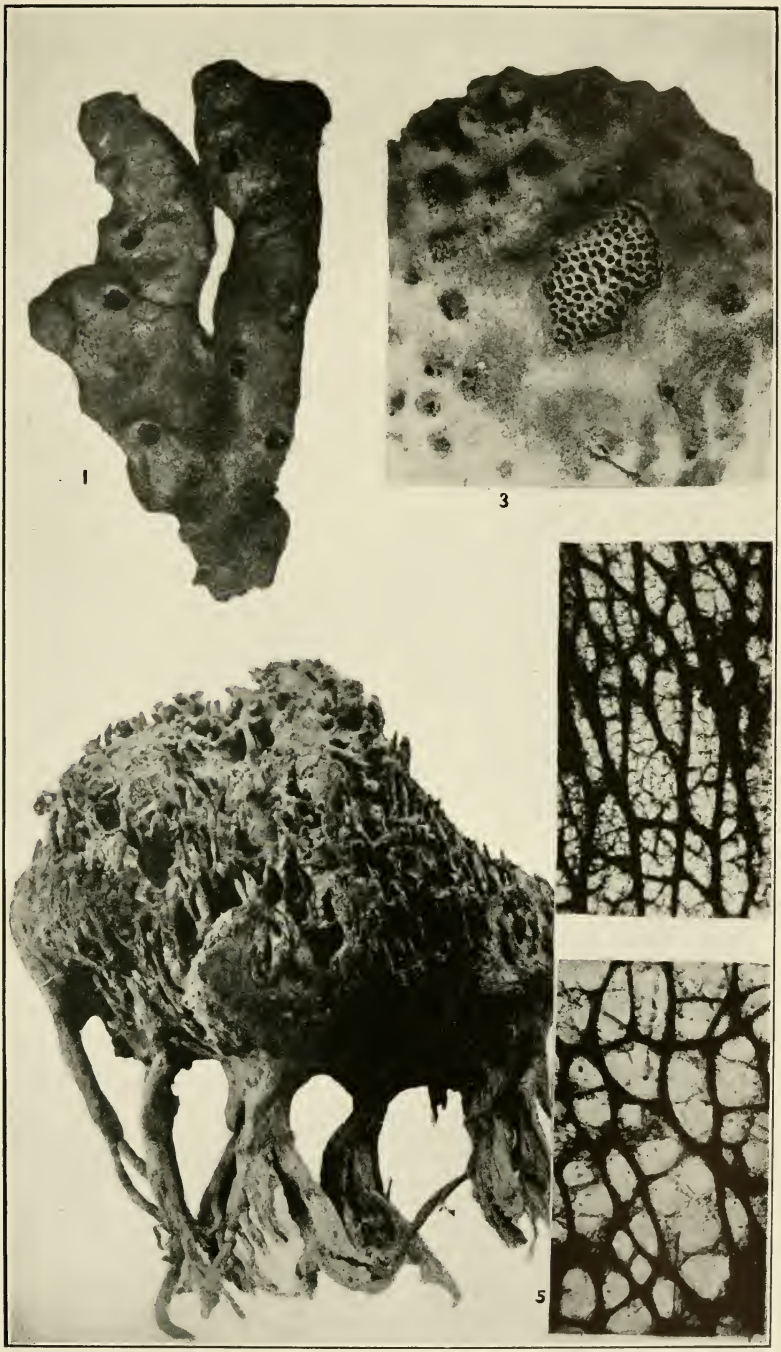
Cliona (Papillissa), Spirastrella, Amorphinopsis, Tedania.



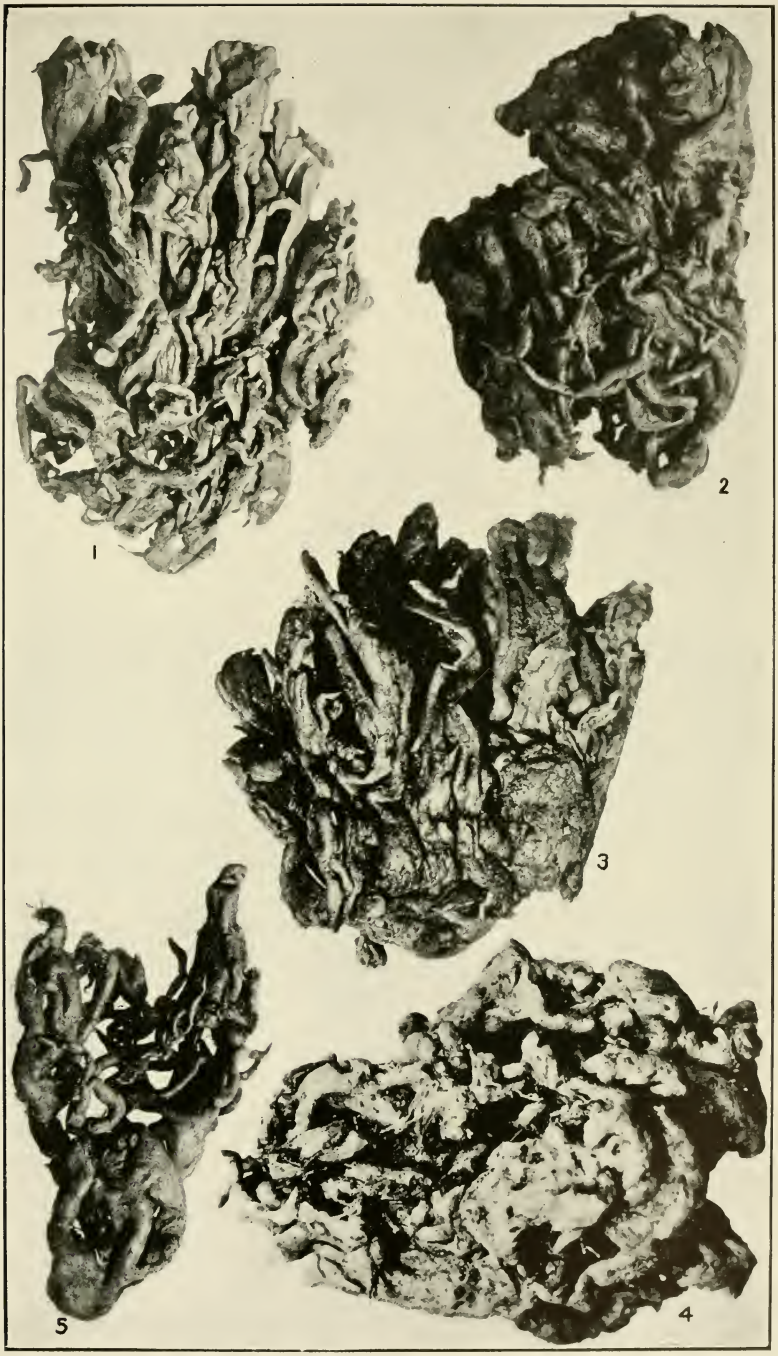
Caulospongia, Axiamon, Hemitedania.



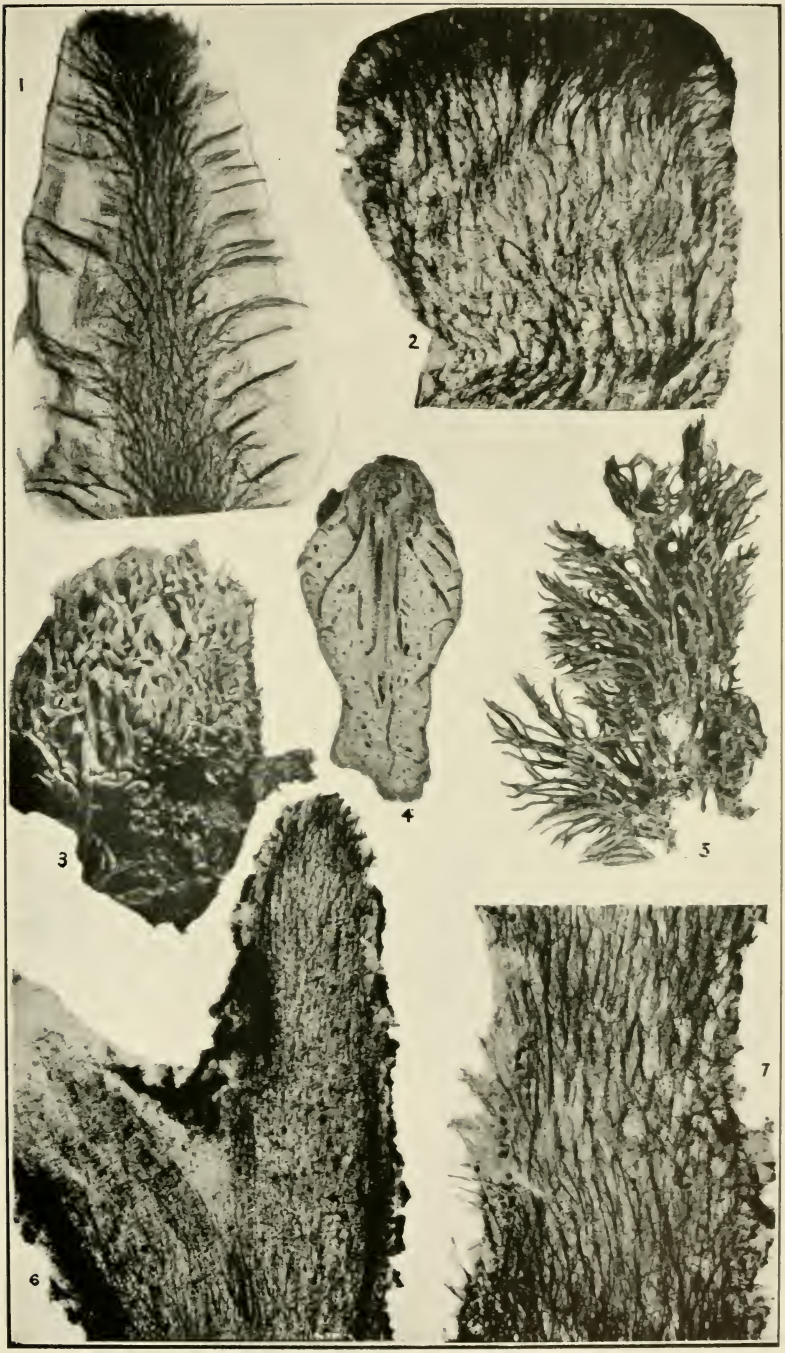
Hemitedania anonyma Carter.



Chalina, Phlœodictyon.

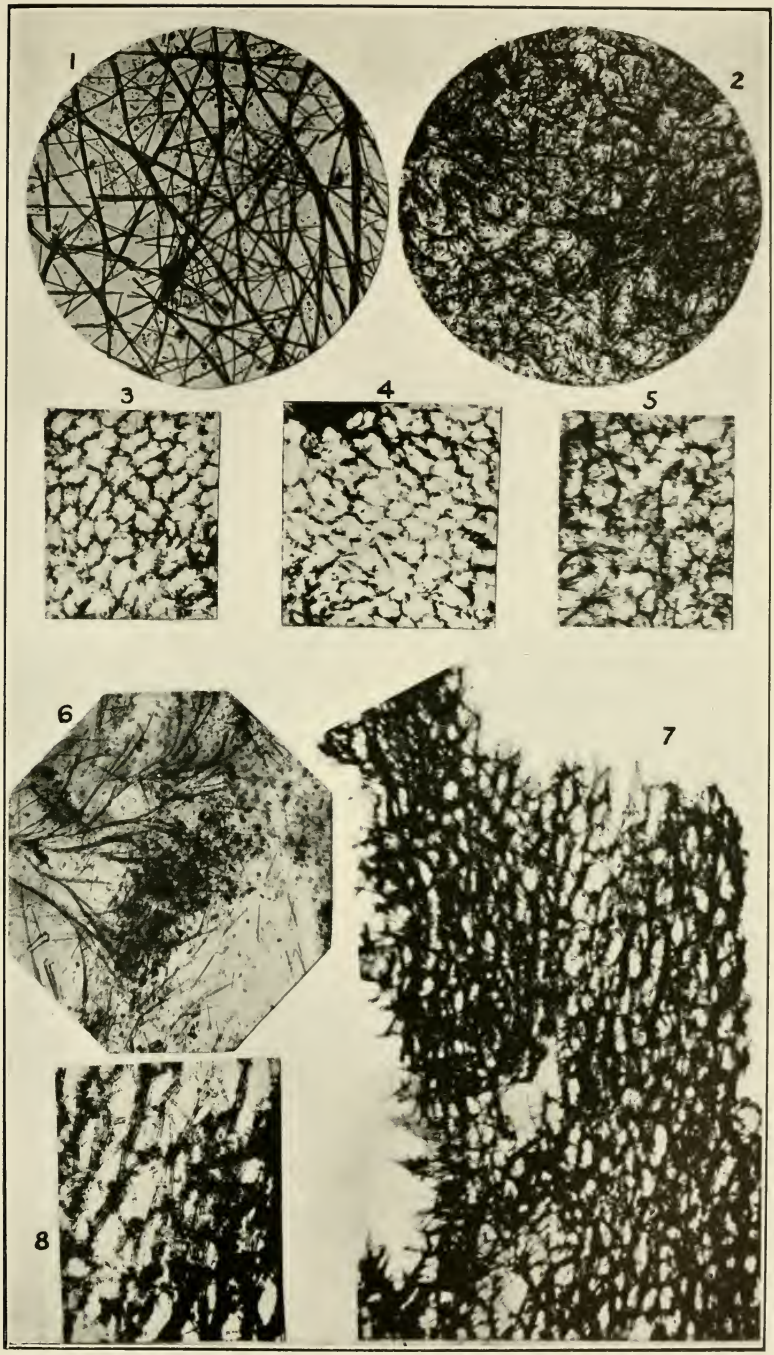


Stylotella agminata.



Axinella, Stylotella, Histoderma, Phlœodictyon, Spirastrella, Raspailia.

Raspailia, Chalinodendron.



Mycale, Tedania, Hemitedania, Axiamon.