1912.

Commonwealth of Australia.

Department of Trade and Customs.

FISHERIES.

Zoological Results of the Fishing Experiments carried out by the F.I.S. "Endeavour," 1909-10 (H. C. Dannevig, Commonwealth Director of Fisheries).

PART II.

PUBLISHED BY DIRECTION OF THE
HONORABLE FRANK GWYNNE TUDOR,
MINISTER FOR TRADE AND CUSTOMS.

Sydney, July 9th, 1912.

EDWARD LEE & CO., 14 CARRINGTON STREET, SYDNEY.

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PART I.

BY

E. F. HALLMANN, B.Sc., Zoologist

Australian Museum,
Sydney.

Plates XXI.-XXXVI.; Text figs. 21-69.

III.—REPORT ON THE SPONGES.

Part I.

I.—Introduction.

The Sponges which have so far been obtained by the "Endeavour" consist almost exclusively of Monaxonellida and Keratosa in approximately equal numbers. In this Report I propose to deal only with the former of these; the latter will scarcely prove suitable for purposes of investigation unless taken in conjunction with additional material, since in the main they are preserved in a dry condition, and there are among them altogether too few specimens of any one species. Inasmuch as an extensive collection of well-preserved Keratose sponges, particularly from the Australian area, would unquestionably be of extreme scientific value, it is greatly to be hoped that the fullest advantage will be taken of the unique opportunities provided by the trawling operations of the "Endeavour" to bring together as large a number as possible of these forms.

In order to deal effectively with the material placed at my disposal, it was found necessary, as a preliminary task, to undertake the re-investigation of certain previously described species, including more particularly a number of those which were first described by Dr. R. von Lendenfeld in his "Descriptive Catalogue of Sponges in the Australian Museum,"[1] and afterwards by Mr. T. Whitelegge in his "Report on Sponges from the Coastal Beaches of New South Wales."[2] As a result I find that, whereas the latter author is correct in pronouncing the original descriptions of these species to be in many instances inaccurate, yet he himself has committed a number of serious errors, owing to a too hasty conclusion that the specimens investigated were the actual types. This explains the anomalous circumstance that the descriptions which the two authors have given of certain species are devoid of agreement in any essential particular. Unfortunately, however, not all the discrepancies can be thus explained, and considerable caution will be necessary in deciding particular cases. Mr. Whitelegge evidently proceeded on the assumption that the specimen carrying the author's label must be accepted unquestioningly, in preference to the description, as the ultimate criterion of the species; but, although such a

1 8vo, Sydney, 1888.

2 Whitelegge—Rec. Austr. Mus., iv., 2, 1901, p. 55, pls. x.-xv

course may be perfectly reasonable and right so long as the authenticity of the specimen remains undoubted, it surely can no longer be pursued when sufficient evidence exists to prove the contrary.

It was not my intention, at the outset, to include in this Report any details of the results of this subsidiary investigation (except in so far as they bore directly upon the species of the "Endeavour" collection), but to reserve them as the subject of an independent paper. Owing, however, to the very unsatisfactory state of the descriptions of many of the species examined, and in view of the possibility that a considerable time may elapse before a complete account of them can be furnished, I came to the conclusion that it would be wrong to allow this opportunity to pass without at any rate making such corrections as might render possible their identification. Accordingly I have added to the Report, often in the form merely of foot-notes, a series of observations which practically amount to a brief revision of the Ectyoninæ originally described in various publications of the Australian Museum. As the work of preparation was conducted in the Australian Museum itself, I have had the advantage of having before me in most cases the actual specimens, and in many cases the actual slides upon which the original descriptions were based. In addition, very material assistance was afforded me in the identification of species by a valuable series of mounted sections of Port Phillip sponges and a large number of fragments of Australian sponges preserved in the British Museum, which Prof. A. Dendy some years ago generously placed at the disposal of this Museum.

In regard to certain Ectyonine species I have expressed the opinion that new genera should be established for them, but I have purposely refrained from introducing such new genera because I recognise that, in order to do this in a thoroughly satisfactory manner, it would be necessary to undertake a much wider comparative study of the species of this group than—owing to lack of literature, if for no other reason—I have found to be possible.

After the manuscript of the Report had been completed and at too late a date to admit of any alterations in the text, I received a copy of the second part of Dr. Hentschel's paper on the sponges of South-west Australia; consequently any deductions which it has enabled me to make are necessarily relegated to the footnotes, or to concluding paragraphs.

II.—DESCRIPTION OF THE GENERA AND SPECIES.

Family SPIRASTRELLIDÆ.

Genus Spirastrella, *Schmidt.*

Spirastrella montiformis, *sp. nov.*

(Plate xxi., fig. 3, and fig. 21.)

Sponge mound-shaped, rising to a central peak, on the summit of which one or several oscula are situated; upper aspect of sponge with short digitiform or ridge-like processes on which apical oscula are rarely to be found. No rind. Spicules not aggregated into definite fibres. Megascleres:—Tylostyli (sometimes reduced to styli), of varying length and stoutness, reaching a maximum size of 710 x 12 μ. Microscleres:—Spirasters of two kinds, viz., shorter tuberculated forms principally confined to the superficial layer, 25 μ long; and slender zigzag sharp-spined forms chiefly to be found in the canal walls of the interior and reaching to 80 μ or more in length.

This species is represented in the collection by eight specimens, all of which are preserved in the dry state. Although showing a moderate amount of variability in external form, they may be satisfactorily described in general terms as massive, sessile, somewhat mound-shaped sponges, roughly circular in horizontal section, and usually prolonged upwards into a more or less well-defined pinnacle. They are attached by a broad base of only slightly lesser extent than the maximum transversal of the sponge, which is attained some short distance above it. The fact that the maximum girth does not coincide with the actual base, renders the term "mound-shaped" not perfectly applicable, and admits of a distinction into an extensive upper surface, and a restricted lower one. From the former there arise few or many elevations in the form either of short digitiform processes, or of compressed ridges. The interior of the sponge, to within a few millimetres of the surface, is traversed by numerous rather wide canals, some of which attain a diameter of 10 mm.; they are lined by a distinct aspiculous membrane, which also forms dissepiments across their lumina. The central peak is penetrated to its apex by one or several of these canals, which terminate in a corresponding number of oscula. Occasionally a few of the secondary elevations are similarly provided, but usually they contain only minor branches of the canal system.

In the present condition of the sponges, the oscula are closed, and not readily perceived; but their presence is, in every case, indicated by longitudinal furrows and puckers of the extremity of the processes bearing them, and is, of course, readily demonstrated by sectioning. Of the specimens of the present series, the largest and the smallest are those which depart most from the mean form. The former is sub-elliptical in horizontal outline, and in 120 mm. in height; the principal diameters of its base are 140 mm. and 90 mm. respectively, whilst the corresponding measurements of its greatest transverse section are 200 mm. and 120 mm. It is furnished with more than 100 processes, the greater number of which are ridge-shaped. The smallest specimen is subfusiform in shape, and is provided with only four digitiform processes. The consistency in the dry state is, one might say, intermediate between that of cork and pith; the superficial layer is slightly harder and more friable, but there is no indication of a rind. The colour is pale grey within, and yellowish-grey on the surface. The skeleton is diffuse, without any indication of definite fibres, and consists of a fairly dense and irregular aggregation of straight spicules showing all gradations between styli and tylostyli. Even in proximity to the surface there is no well-defined arrangement of the megascleres, although a considerable proportion of them stand more or less perpendicularly, with their points (or not infrequently, in the case of the larger spicules, with their basal extremities) impinging on, or barely projecting beyond, the surface. The spirasters are comparatively few in number and are confined almost exclusively to the external surface and to the walls of the canals immediately beneath their lining membrane.

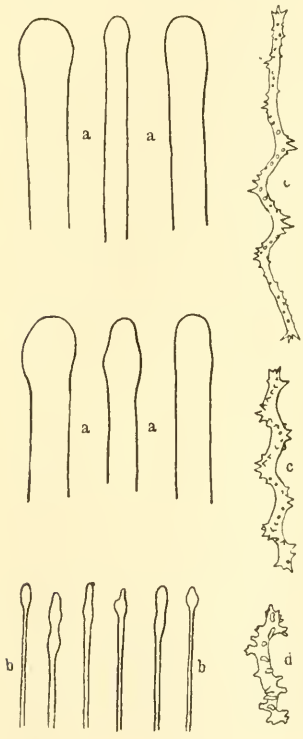

Fig. 21—*S. montiformis*. a Larger tylostyli (basal extremity). b Slender tylostyli (ditto). c Spined spirasters. d Tuberculated spiraster.

Megascleres.—It is difficult to say whether these belong to one, two, or three categories. At first sight it might appear that two kinds are to be distinguished, viz., (i.) stouter tylostyli, with a tylosis of only moderate size, which is perhaps most frequently subterminal in position and more or less reduced (or sometimes absent) and which has a quite smooth surface and not very variable contour; and (ii.) very slender tylostyli (of scarcely lesser length), in which the frequently relatively large tylosis is extremely variable in shape and size, often exhibits tubercular irregularities of the surface, and is occasionally several times repeated. The former spicules vary in length from less than 200 μ to slightly more than 700 μ, and in diameter up to 12 μ; it is seldom, however, that their length exceeds 650 μ or their diameter 10 μ; usually they taper to a quite sharp point, but more or less strongylote terminations occur. The latter or slender tylostyli appear to be rarely more than 3 μ in diameter and may attain a length of at least 640 μ. A more thorough scrutiny of the spicules shows, however, that forms intermediate between these kinds occur, though they are comparatively few in number; and, taking all the facts into consideration, it is not possible to decide with certainty whether the two degrees of stoutness are merely the expression of different developmental stages, or whether they have a more important significance and indicate either that the spicules have undergone a partial differentiation into two groups or actually represent two distinct orders. Again, it is to be observed that the stouter spicules vary considerably in length; and on analysis it appears not improbable that in another respect also a certain amount of differentiation into two groups has been affected since a relatively large proportion of the spicules below a length of 300 μ or thereabouts (the diameter of which is 6 to 8 μ) are simply stylote, and are subfusiform in shape. But these peculiarities are not confined to the shorter spicules, and are not, indeed, strikingly characteristic of them. These shorter spicules appear to greatly predominate amongst those which stand perpendicularly at the surface of the sponge.

Microscleres.—Spirasters of two kinds occur:

(i.) Small tuberculated forms, extremely variable in shape, often with the tubercules chiefly confined to one side, 12 to 32 μ in length, and up to 4 μ in breadth exclusive of the tubercules. These, together with an inconsiderable admixture of those of the second kind, form an exceedingly thin but apparently not continuous superficial layer, and also occur in limited numbers in the canal walls.

(ii.) Elongated spined forms, occurring for the most part only in the immediate circumference of the canals, in the walls of which they lie tangentially, loosely scattered in a single layer. It frequently happens that several together are apposed so closely, and in such a way, that they cannot by any means be distinguished from a single large branched spicule. Speaking generally, they are characterised by their slender zigzag form, and the very evident spiral arrangement of their spines. Their length, which is rather variable, sometimes reaches above 80 μ; their diameter rarely exceeds 3 μ.

Loc.—East coast of Queensland, seven miles east of Double Island Point, 33 fms. ("Endeavour").

S. montiformis is probably most nearly related to *S. vagabunda*, Ridley, and *S. tentorioides*, Dendy. The striking resemblance which its elongated zigzag spirasters bear to those of *Clionopsis platei*, Thiele, and to certain species of *Cliona*, not only supports the opinion that *Spirastrella*, *Cliona* and *Clionopsis* are allied genera, but seems also to show that such spirasters are of primitive form.

Spirastrella poculoides, *sp. nov.*

(Plate xxi., fig. 1, and fig. 22.)

Sponge sessile, massively cup-shaped. Surface smooth; even, or provided with a few low dome-shaped elevations. The oscula (?) are microscopic circular openings on an average ·25 mm. apart. Skeleton semi-diffuse, non-fibrous; spirasters scattered in moderate abundance throughout all parts and forming a cortical layer. Megascleres:—Tylostyli of a single kind measuring 560 x 13 μ. Microscleres:—Spirasters of a single kind, 50 x 10 μ.

The following description is based on a single specimen.

The sponge is a stout-walled and exceeding thick-bottomed, compressed, sessile cup. Its shape may be conceived as having been attained by the upgrowth of a broad pillar, in which growth has proceeded most rapidly at the periphery. The surface is very smooth, and generally even; the only inequalities are in the form of a few broad, rounded protuberances. The interior of the sponge is free from noticeable cavities, and of very uniform structure throughout. The texture of its internal substance, when dry, is such as might result from the close compression of some finely divided fibrous material; there is no appearance macroscopically of extended fibres. Owing to the firmness and density of the superficial layer and the

compactness of the skeleton generally, the sponge is (in the dry state) fairly hard and incompressible. The dimensions of the specimen are as follows:—Height, 100 mm.; depth of cup, 40 mm.; average thickness of cup-wall, 15 mm.; principal internal diameters of cup, 120 mm. and 30 mm. No oscula are visible to the naked eye. The surface, however, is pierced by minute circular openings 40 to 50 μ in diameter and, on an average, about 250 μ apart. In a thick vertical section, cut transversely through the cup-wall, two regions are roughly distinguishable:

(i.) A superficial layer varying from 1 mm. to 4 mm. wide, in which the spicules are not at all collected into strands, but are closely crowded without recognisable order except in some parts of its outer limits, where the majority of the spicules may stand more or less perpendicularly to the surface. The spirasters, which are plentifully scattered throughout the whole sponge, become more and more closely aggregated as the surface is approached, and ultimately produce, by their close crowding, a dense and compact thin external crust.

(ii.) An extensive central region traversed by irregularly sinuous, ascending "fibres" or "columns" composed of loosely associated spicules. In the section the "columns" appear to be discontinuous, owing probably to their passing out of the plane of section. They sometimes broaden out into diffuse bands, sometimes contract into more compact strands. The

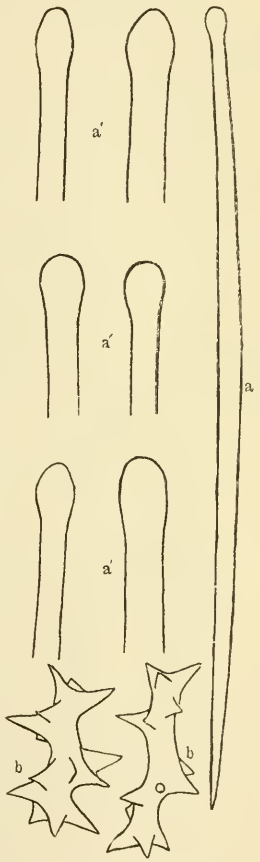

Fig. 22—*S. poculoides* a Tylostyle. á Ditto basalextremity). b Spirasters.

spaces between the "columns" are occupied by a profusion of single spicules, spicule bundles, short spicule strands and sheet-like patches, as well as by scattered spirasters: all of which together constitute no inconsiderable proportion of the entire skeleton, and in macroscopic examination mask from view the more definitely fibrous aggregations of the spicules.

Spicules.

(i.) The megascleres are tylostyli which, as a rule, are straight; they are of uniform diameter throughout the greater part of their length and gradually taper thence to a sharp point; greatest size 560 x 13 μ.

(ii.) The spirasters are of a single kind and reach a length of 50 μ (though usually much shorter) and a diameter, exclusive of spines, of 5 to 10 μ. The spines are large, approximating in length to the diameter of the spicule-shaft, and in the case of the larger spicules are about twenty in number.

Loc.—North coast of New South Wales, eight miles east of Sandon Bluffs, 35-40 fms. ("Endeavour").

Spirastrella alcyonioides, *sp. nov.*

(Plate xxi., fig. 2, and fig. 23.)

Sponge an erect, compact, sessile cluster of frondiform or of angular or only slightly compressed digitiform upgrowths, of which some proceed from the very base of the sponge, whilst some arise as outgrowths or lobes from others. Oscula situated apically on the digitiform terminals. Surface smooth, with slight longitudinal inequalities and a few small ascendant papilliform projections. Sponge in the dry state very hard. Skeleton semi-diffuse; without fibres, but with occasional very broad columns of parallely-arranged spicules. The substance of the sponge is abundantly traversed by brownish spongin-like streaks which, however, show no particular relation to the spicule arrangement. Spirasters of a single kind are plentifully scattered through all parts and form a compact superficial layer. Spicules:—Tylostyli of one kind, with blunt rounded distal extremity, measuring 440 x 8 μ; and large-spined stout spirasters, 40 x 7 μ.

Two specimens of this species were obtained, both of which are preserved in a dry state. The characteristic form of the sponge appears to result from the upgrowth, in the first place, of a few processes from a basal disk of limited extent, which processes, as they grow, either remain simply digitiform,

or become broadened and flattened (frondiform) and more or less subdivided. In any case the uppermost part of the sponge consists chiefly, of separated digitiform terminals, which are usually tapered and somewhat pointed, and are provided apically each with one or a few oscula. The larger specimen (Plate xxi., fig. 3), which measures 130 mm. in height, consists almost entirely of frondiform components; the smaller, if digitiform. In its dried condition, the sponge is particularly dense, hard and tough; although the amount of shrinkage has seemingly been but slight. The surface is smooth, but slightly uneven owing to the presence of discontinuous undulations and obscure ridges, which, however, may be due to contraction. In addition, the sponge is provided with small scattered verruciform upwardly directed elevations; these are sometimes fairly numerous on the upper margins of the more flattened upgrowths, but, generally speaking, their occurrence is irregular and it is not certain that they are a constant feature. The colour of the sponge is yellowish-grey.

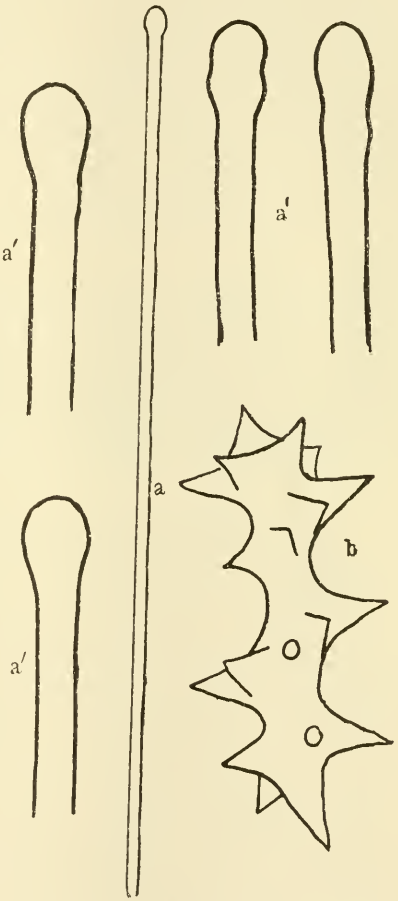

Fig. 23—*Spirastrella alcyonioides.* a Tylostyle. á Ditto. (basal extremity). b Spiraster.

The precise arrangement of the skeleton is not apparent in the present condition of the specimens owing to the distortion which it has undergone, consequent upon drying. It is only possible to refer in general terms to its main features (*e.g.*, as exhibited in longitudinal section of a

digitiform terminal). Such a section, in general, shows one or two main or oscular canals cut longitudinally, and a spicular skeleton which is, for the most part, of a diffuse type, without any definite aggregation of spicules into fibres. It is traversed, however, by a few broad "columns" of rather closely packed parallel spicules, somewhat resembling the "axial condensations" of certain Axinellids. Some of these run longitudinally, whilst others are cut transversely. Another feature, perhaps deserving of note, is the occurrence of numerous longitudinal pale brownish-coloured streaks, the appearance of which is somewhat suggestive of spongin. These streaks are absent from the columnar spicule-tracts.

Megascleres.—The megascleres are straight cylindrical tylostyli of a single kind, with strongylote distal extremity; size, 400-440 x 4-8 μ.

Microscleres.—The spirasters are fairly straight spicules, provided with twenty to thirty large spines, which are about 7 μ in length. They are plentifully scattered through the tissues, and form a dense superficial layer 100 to 200 μ in thickness; the size of the largest is about 40 x 7 μ.

Loc.—East coast of Queensland, twenty-five miles south-east of Double Island Point, 33 fms. ("Endeavour.")

Spirastrella papillosa, *Ridley and Dendy.*

1887. *Spirastrella papillosa*, Ridley and Dendy, "Challenger" Monaxonida, 1887, p. 232, pl. xli., fig. 5, pl. xlv., figs. 11, 11a.

The Museum collection contains six speciments of this species. They vary considerably in shape, but are always provided with several large apically situated oscula, and in other respects agree exactly with the description of the type, except that they do not show any sign of "deep longitudinal wrinkles" near the apex. The warty appearance of the surface appears to be a constant character.

Locs.—Shoalhaven Bight, New South Wales, 15-45 fms. ("Endeavour"); Port Jackson, New South Wales, 30-35 fms. ("Challenger"); Port Jackson, New South Wales, and Port Phillip, Victoria (Austr. Mus. Coll.).

Genus Latrunculia, *Bocage.*

Latrunculia conulosa, *sp. nov.*

(Plate xxii., fig. 1, and fig. 24.)

Sponge submassive, sessile, with aculeated surface. Consistency and texture dense, somewhat rubber-like. No oscula. Surface glabrous, dotted with minute pore-groups. Main skeleton a reticulation of strongly-

developed, stout fibres composed of styli. Surface conuli, each forming the centre of a radiate system of slender fibres. There is a dermal layer of discasters of the larger kind. Megascles:—Blunt-pointed styli 365 x 11 μ, together with a few (probably immature) sharp-pointed, slenderer spicules which attain an equal length. Microscleres:—Discasters of two kinds, of which the larger form a superficial layer and a packing round the main fibres, and are also scattered through the ground substance along with the smaller. The larger are provided with simple spines, the smaller often with compound spines, the spines in both cases being arranged in four whorls, two at either end.

The single specimen consists of a sessile, submassive, erect, cylindrical main portion, together with a similar but smaller upgrowth which arises partly from the substratum in continuity with the base of the former and partly from its side. The main trunk is 70 mm. in height, and 30 mm. in diameter. The surface, which is smooth and glabrous, is provided with numerous spine-like conuli, 1 to 3 mm. in height. There are no oscula. The surface is closely dotted with minute pore areas, about .2 mm. in diameter, and each with two to four pores. The texture is dense and compact, the consistency firm and fairly tough; in both respects the sponge is somewhat suggestive of india-rubber, although, of course, not so dense, homogeneous or elastic. The colour (in spirits) is pale brownish-grey.

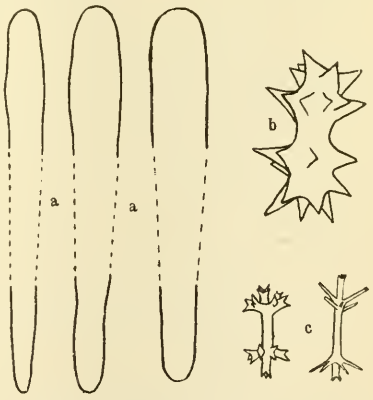

Fig. 24—*Latrunculia conulosa.* a Styli. b Larger discaster. c Smaller discasters.

The main skeleton consists of a very loose reticulation of stout fibres (up to 400 mm. or more in thickness) which are composed solely of densely packed parallel styli. Each surface-conulus forms the apex of a convergent pencil of fibres, of which the axial or principal fibre only is derived from the main skeletal reticulation, whilst the remainder—which are very much slenderer fibres—both begin and terminate at the surface. Probably it would be more correct to say

of the latter, that they proceed *from* the apex of the conulus, and after running inwards, with gradually increasing divergence, for a short distance towards the sponge-interior, gradually curve round and return again to meet the surface at varying distances from their starting point—the more centrally situated fibres of the pencil proceeding to a further distance than the more peripheral. Styli similar to those composing the fibres are sparingly scattered through the tissues together with discasters of two kinds, a larger and a smaller. The former are closely aggregated in the immediate surrounding of all the main fibres encircling them as a kind of loose sheath. The cortical skeleton is a layer of closely packed discasters almost exclusively of the larger kind; it is about 300 to 400 μ in thickness.

Megascleres.—These are styli, probably of a single kind—the stouter with a more or less blunt or rounded distal extremity, and occasionally becoming almost perfectly strongylote; the slenderest usually sharply pointed. They are sometimes elongately subtylote at the basal end, and have a maximum size of 365 x 11 μ.

Microscleres.—(i.) The larger discasters are stout spicules, having a short central region devoid of spines, and on either side of this two more or less distinct whorls of large spines: those of the terminal whorl projecting obliquely forwards; those of the sub-terminal, standing more or less perpendicularly to the spicule-axis. They are about 40 μ in length (exclusive of spines), and have a diameter in their spineless central region of about 12 μ. The spines are 10 to 12 μ long.

(ii.) The smaller discasters are very variable in form, no two apparently being quite alike. They are much slenderer spicules than the preceding, with an elongated spineless central region, and at either end, two more or less distinct whorls of simple or (more usually) compound spines, the latter of which are columnar in form, with a few terminal spinules. The terminal whorl of spines is often reduced and then appears as a prolongation of the axis of the spicule. These spicules are at most 38 μ in length (inclusive of spines), and have a diameter centrally of 1 to 4 μ (rarely more than 2.5 μ). The stouter individuals may represent a third kind of discaster intermediate between the other two.

Loc.—North coast of Tasmania, off Devonport. ("Endeavour.")

Family POLYMASTIIDÆ.

Genus Polymastia, *Bowerbank.*

Polymastia craticia, *sp. nov.*

(Plate xxii., fig. 3, and fig. 25.)

Sponge depressed dome-shaped, sessile, with thick-walled digitiform tubular processes some of which are provided with a single apical osculum. Main skeleton consisting of a fairly dense matrix of scattered spicules and spicule bundles traversed vertically by fairly stout distant fibres. The fibres lying immediately beneath the cortex of the processes comprise an outer series of wavy fibres running circumferentially and forming an elegant wickerwork, and of an underlying series of equidistant longitudinal fibres. The cortex consists of styli arranged in a dense palisade. Spicules:—These are of three kinds, viz., fusiform styli of two orders of size which (particularly the larger) are scarcely distinguishable from oxea, the larger occurring in the main skeleton, the smaller in the cortex; and fusiform tylostyli which occur along with the larger styli scattered through the ground tissues. The first attain a size of 1200 x 22 μ; the second, 350 x 9 μ; and the last, 200 x 5 μ.

The sponge is sub-circular in horizontal outline, broadest at the base, with a convex upper surface from which numerous longer or shorter stout digitiform processes arise. Of four specimens, the two which differ most in their proportions are respectively 55 x 80 x 50 mm., and 40 x 90 x 75 mm. in height, length and breadth. These two also differ most in the lengths of their processes, which in the former are never more than 10 mm. long, in the latter usually between 15 and 30 mm. The processes are usually tapered to a point and vary from 60 to 80 in number. When, as sometimes is the case, they are cylindrical and distally rounded, the osculum, if it occurs, is situated on the summit of a small terminal papilla.

The specimens are preserved in a dry state, and the following remarks therefore apply to the sponge in that condition. The surface is quite smooth to the touch but has a minutely velvety appearance due to the slightly projecting points of the densely crowded cortical spicules. Internally the sponge consists of a dense, but rather soft and friable matrix traversed vertically by fibres about 250 μ in stoutness. The fibres are composed solely of closely packed spicules of the largest kind, which are fusiform styli closely resembling oxea; the matrix consists of a disorderly profusion of spicule-bundles and single

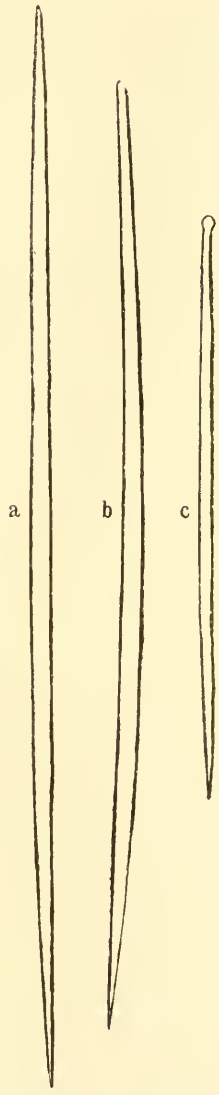

Fig. 25– *P. craticia*.
a Stylus (of the fibres).
b Stylus (of the cortex, drawn to a larger scale than the preceding).
c Tylostylus (of the cortex).

spicules of the same kind together with smaller tylostyli. The cortical skeleton proper consists of crowded fusiform substyli arranged perpendicularly to the surface, but immediately beneath and closely associated with it is a thin matted layer of mostly horizontally disposed styli of the larger kind. Fibres from the inner skeleton penetrate into the cortex, spreading out slightly at their extremities in a penicillate fashion; the terminal spicules of these fibres usually project slightly at the surface. The arrangement of the fibres immediately underlying the cortex is one of marked regularity. In the body of the sponge, a series of equidistant parallel fibres running upwards from the base is most conspicuous, but in the processes, a series of circumferentially directed fibres external to these also comes into prominence. The latter run undulatingly and intercross so as to form a wickerwork-like structure of very elegant pattern. The specific name has been bestowed in reference to this feature.

Spicules.—

(i.) The larger oxea-like styli are straight, and measure 660-1200 x 12-22 μ.

(ii.) The smaller are usually slightly curved and more distinctly stylote; they range in size from 220 x 6 to 350 x 9 μ.

(iii.) The tylostyli (or subtylostyli) are fusiform and usually slightly curved. They occur singly and in small bundles in the ground substance. Size: 120 x 3 to 200 x 5 μ.

Loc.—North coast of New South Wales, eight miles east of Sandon Bluffs, 35-40 fms. ("Endeavour.")

Family ASTRAXINELLIDÆ, *Dendy*.

Dendy[1] has suggested the advisability of instituting a new family—Astraxinellidæ—for the reception of certain Axinellidæ which are distinguished by the possession of astrose microscleres. The Astraxinellidæ he would place in the division Astromonaxonellida, whilst the Axinellidæ in the restricted sense would remain in the Sigmatomonaxonellida. If we could learn all the facts concerning the phylogeny of the Axinellidæ it would no doubt be found that, whereas some have been evolved from Desmacidonid and Haplosclerid ancestors and some (*? e.g.*, *Trachycladus*[2]) directly from more primitive sigmatophorous forms, yet a considerable number have developed along lines of descent which diverge from the Astrotetraxonid stem. In a natural system of classification the last-mentioned would be excluded from the Sigmatomonaxellida, and they would probably require several families for their reception. Unfortunately, it is impossible in the present state of our knowledge to determine, in the majority of cases, to which of the two primary Tetraxonid subdivisions a given Axinellid genus belongs, and consequently no altogether satisfactory bipartition of the family is to be expected without much further enquiry. Nevertheless, there is much to be said in favor of a removal forthwith from the Axinellidæ of such genera as afford sufficient evidence of their Astrotetraxonid affinities; and these might very well be placed provisionally in a single family, irrespective of any question as to whether their relationships are close or distant. On this understanding I feel but slight hesitation in placing under the family Astraxinellidæ the new genus *Paracordyla*, which possesses an Axinellid type of skeletal structure and yet has microscleres in the form of amphiasters.

1 Dendy—Rept. Pearl Oyster Fisheries, Gulf of Manaar, with Rept. Mar. Biol. Ceylon, Part 3, 1905, p. 107.

2 In this connection, I would suggest that a new family—Spirasigmidæ—be established to include *Trachya globosa*. Carter (Ann. Mag. Nat. Hist., 5, xvii., 1886, p. 121), and its variety, *rugosa* (*Op. cit.*, xviii. 1886, p. 457), *Gellius aculeatus*. Whitelegge (Sponges of Funafuti, Austr. Mus. Mem., iii., 5, 1897, p. 326), and perhaps also the genus *Trachycladus*. For the first-mentioned of these species Topsent (Mém. Soc. Zool. France, vii., 1894, p. 8), has already proposed the genus *Trachygellius*; for the second I now propose a new genus *Spirasigma*. In both of these genera the microscleres resemble the sigmaspires of *Trachycladus* more closely than they resemble ordinary sigmata, and the conformation of the skeleton is strongly suggestive of their derivation from the Tetillidæ. Of these species I have examined (only) sections which were prepared by Mr. Whitelegge—those of *T. globosa* and its variety having been cut from pieces of British Museum specimens, and that of the latter from its type-specimen. If the former sections are correctly labelled—and I scarcely doubt that they are—*T. globosa* and *T. globosa*, var. *rugosa* are specifically distinct. Both in *Trachygellius* and *Spirasigma* the skeleton has a radial arrangement recalling that of the Donatiidæ. In the former the large diactinal spicules (oxea in the two known species) are accompanied by sigmata only; in the latter (in which, in the single species, the large

Genus Paracordyla, *gen. nov.*

The inner skeleton is a dense columnar aggregation of large oxea which, in linear outgrowths of the sponge-body (if these be present), takes the form of a very compact axial core. Spongin appears to be wholly absent. The ectosomal skeleton is a dense palisade of vertical microxea supplemented by "dermal brushes" of styli or oxea. Between the ectosomal layer and the inner skeleton-mass is a narrow zone penetrated by canals and crossed by strands of the large oxea. In addition to microxea, microscleres in the form of small amphiasters are present.

The spiculation of this genus is remarkably similar to that of *Scolopes moseleyi*, Sollas;[1] but since Sollas speaks of fibres in connection with his species, and remarks that the general character of its skeleton reminds one forcibly of that in Carter's genus *Trachya*, there is evidently a distinct generic difference between *Paracordyla* and *Scolopes*. Amongst the Axinellidæ, the genus which makes the nearest approach to *Paracordyla*, appears to be *Ceratopsis*, Thiele.[2]

Paracordyla lignea, *sp. nov.*

(Plate xxii., fig. 2, and figs. 26, 27.)

Sponge sessile, with a massive body from which branch-like elongations may arise. Consistency, owing to the enormous development of the spicules, very dense and solid. Surface even, pilose. Oscula wanting. The skeleton of the whole of the inner mass of the sponge to within a few millimetres of the surface is formed of closely aggregated large oxea, with a general parallel arrangement, which, in the branch-like parts, form an almost solid core. Between the core and the superficial layer (cortex) is a narrow zone, 2 to 3 mm. wide, crossed by strands of similar oxea, the outer spicules of which project well beyond the surface. The surface is also protected by brushes of shorter spicules varying in form from styli to oxea. The canals of the subcortical zone are surrounded by radially disposed microxea, and similar spicules, together with minute amphiasters, are scattered through the ground substance. Megascleres:—(i.) Oxea of the main skeleton reaching a size of 3200 x 50 μ; (ii.) styli and asymmetrical oxea of the dermal brushes varying in length from less than 200 to about 700 μ, with

spicules of the fibres are substrongyla) there are in addition scattered small oxea. If in *Spirasigma aculeata* the fibre-forming strongyla disappeared, the species would, without doubt, owing to the mode of distribution of its smaller oxea, be classed as a *Gellius*.

1 Sollas—"Challenger" Tetraxonida, 1885, p. 432, pl. xliii., figs. 1-9.

2 Thiele—Studien uber pazifische spongien, Zoologica, Heft 24, 1898, p. 56.

maximum diameter of 18 μ. Microscleres:—(*i.*) *Microxea, 100 to 140 μ in length by about 4 μ in diameter;* (*ii.*) *amphiasters, 4 to 5 μ long.*

The single specimen is a moderately large, massive, sessile sponge, of great density and solidity, with a rounded cuboidal or sub-globose body which measures about 120 mm. in each of its three principal directions. From the marginal region of the somewhat flattened upper surface of the main body there are given off, at sub-equal distances, three stout branch-like processes, 100 to 150 mm. in length. One of these is cylindrical, the others are club-shaped and are polytomously divided at their extremities into incipient branches. The specimen, which has been longitudinally bisected, is, with the exception of one of its processes, preserved in a dry state. The contraction resulting from drying has caused the surface to split in places, giving rise to a number of shallow gaping fissures, such as are occasioned under similar circumstances in many Axinellids. The surface of the dried portion somewhat resembles short-piled velvet, both in appearance and to the touch; that of the spirit piece has a harsher feeling. The colour of the former is yellowish-white, both externally and internally; the latter is similarly tinted, except superficially, where to a depth of about one-third of a millimetre, it exhibits an intense purple colouration which, however, is almost certainly a stain derived from crinoids originally preserved in the same liquid. The texture, as revealed by the cut surface resulting from the bisection of the specimen, bears a close resemblance to that of some coarse and exceedingly short-grained hardwood. The densely packed spicules are visible to the naked eye, and throughout the entire central mass of the sponge have

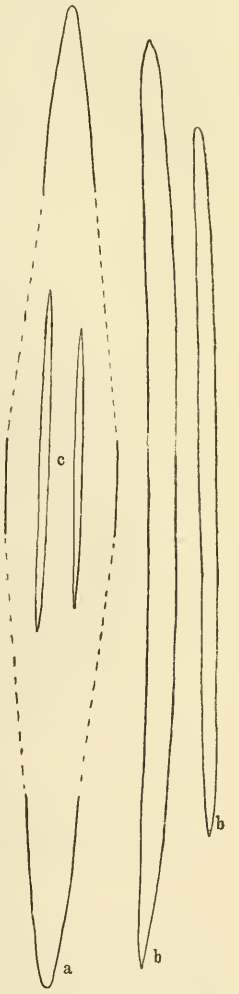

Fig. 26.—*P. lignea.* a Oxea (showing the spicule's extremities and its diameter relatively to that of the other spicules). b Styli (of the dermal brushes). c Microxea.

an approximately parallel arrangement. (The general structure and arrangement of the skeleton were examined microscopically only in the branch-like processes; the following description is drawn from a rather thick median longitudinal section of one of such preserved in alcohol. Owing to the great development of spicules and their disposition, the preparation of a transverse section would be wholly impossible without desilicification. The structure of the main body of the sponge is apparently not essentially different from that described for the processes).

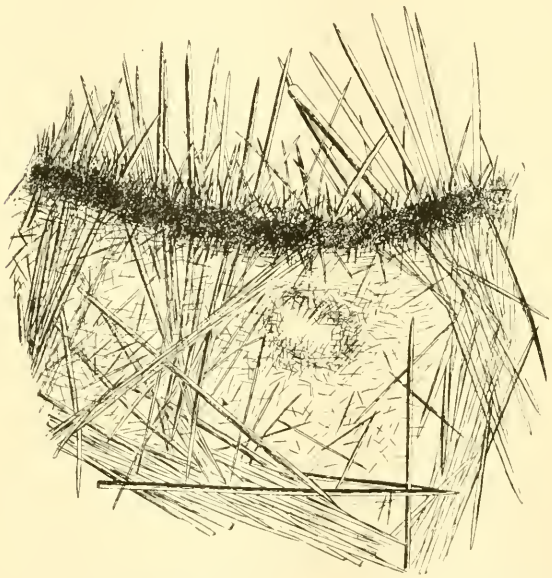

Fig. 27—*Paracordyla lignea*. Vertical section, showing the arrangement of the skeleton in the cortical and subcortical region.

Superficially, there is a fairly well-defined layer, about 150 μ in thickness, densely packed with perpendicular microxea which appear to project about half their length beyond the surface. In addition, the surface is provided with brushes of fusiform styli and oxea, of much shorter length than the spicules composing the main skeleton. The components of a single bundle diverge from a point close beneath the cortex. With the exception of a sub-cortical zone about two or three millimetres wide the whole of the interior of the branch-like process is occupied by an almost solid core of longitudinally-

disposed large oxea. The sub-cortical zone is crossed at close intervals by slightly penicillate fascicles of similar spicules, which give support to the cortical layer. The innermost spicules of these bundles emerge from between the spicules of the core; the outermost project for a considerable distance beyond the surface. There are thus three orders of projecting spicules at the surface. The inter-fascicular spaces of the subcortical zone are filled-in with soft tissues containing scattered spicules and traversed by canals which in cross-section show a circular outline and a surrounding whorl of radially-disposed microxea. The largest canals occur in the deeper parts of the zone, and may attain a diameter of .6 mm. In the immediate neighbourhood of the cortex, the canals are of capillary dimensions, and the microxea—which presumably surround them—are so closely and confusedly intermingled, that the precise inner limit of the cortex is very often difficult of determination.

Megascleres.—

(i.) The oxea of the inner skeleton are straight or only slightly curved symmetrical fusiform spicules attaining a size of 3200 x 50 μ. They are usually much more than 1000 μ long, but spicules of all lengths between these larger oxea and the dermal oxea occur, and (since the asymmetry of the latter is sometimes inappreciable) consequently no actual lower limit can be assigned to their size. Abnormalities of these spicules in the shape of styli of only about one-half their length are of extremely rare occurrence.

(ii.) The fusiform styli and (usually asymmetrical) oxea, which form the dermal brushes and are also to be found in small number scattered in the subcortical zone, range in length from somewhat less than 200 to slightly more than 700 μ; the largest may attain a diameter of 18 μ. All intermediate grades of form between styli and oxea occur.

Microscleres.—

(i.) The microxea are similar in form to the largest oxea, but are about twice as stout in proportion to their length. They are rarely less than 100 μ, or more than 140 μ long, and attain a diameter of slightly more than 4 μ. Occasionally spicules intermediate in size between these and the shortest dermal oxea are met with, but appear to belong rather to the latter category.

(ii.) The amphiasters[1] bear at either end a terminal whorl of about six to eight rays which stand almost perpendicularly to the shaft or are directed forwards at a small angle (up to 30°, say). The width of the spicule, between the tips of the rays, measures from about three-fourths of, to slightly less than the length of the spicule, which is rarely as much as 5 μ.

Loc.—Coast of New South Wales, eight miles east of Sandon Bluffs, 35-40 fms. ("Endeavour.")

Family DESMACIDONIDÆ.

Whether the Desmacidonidæ be divided into two sub-families, Mycalinæ and Ectyoninæ, in the usual way; or whether, in accordance with Topsent's proposal, the Mycalinæ be sub-divided so as to yield an additional sub-family, the Dendoricinæ—the result, if a natural grouping of the genera be our aim, is not altogether satisfactory. Of the two, Topsent's classification is the better since, with very few exceptions as their microscleres show, the genera which remain in the Mycalinæ after the removal of the Dendoricinæ stand well apart from the rest of the family. The main fault lies in the artificiality of the distinction upon which the separation of the Ectyoninæ and Dendoricinæ is based. Species are placed in one or the other of these sub-families according as spicules of one particular kind—the accessory spicules—are present or absent, whilst no value at all is placed upon the presence or absence of the equally important "skeletal" and "dermal" spicules, nor any notice taken of the plain indications afforded by the microscleres. As a consequence, we have closely allied if not almost identical genera like *Ectyodoryx* and *Lissodendoryx*, *Ectyomyxilla* and *Myxilla*, *Pocillon* and *Iophon*, *Hymetrochota* and *Iotrochota* placed, the one in the Ectyoninæ, the other in the Dendoricinæ, whilst on the other hand wholly unrelated species like those of *Wilsonella* and *Clathria* are put in a single genus without question or comment. Under these circumstances there is no advantage in maintaining these subdivisions, and I propose therefore to merge the Dendoricinæ and Ectyoninæ in a single sub-family, to be called the Myxillinæ. It is probable that the Myxillinæ are capable of subdivision into two fairly natural groups in the way suggested below, but on this question I prefer to reserve judgment. I would, however, venture the opinion that the Myxillinæ are derived from a single stem distinct from that from which the great majority of the Mycalinæ have sprung, and from this point of view will enter upon a brief discussion of the subfamily.

1 Not having succeeded in making out the details of the structure of this spicule, I have not attempted to figure it. The rays appear to be often bifurcate and to have at times a slightly tuberculated surface.

Sub-family MYXILLINÆ.

The preponderance of evidence is in favour of the supposition that the most primitive Myxillinæ possessed a type of organisation closely resembling that which obtains in certain existing genera such as *Leptosia*, *Hymenancora*, *Hymetrochota* and *Hymeraphia*; and it is possible, in accordance therewith, to imagine a common ancestral form, or hypothetical "Promyxilline," characterised by the following features:—The sponge grew in the form of a thin encrustment, and produced in contact with the substratum a basal layer of spongin echinated by erect acanthostylote spicules which acted as pillars for the support of the soft structures. These spicules (which for convenience will be termed the *basical* megascleres) exhibited a tendency to differentiate into two kinds, a less spiny larger, and a more spiny smaller kind, and this was probably associated with an accompanying tendency towards an arrangement of the spicules in clusters, in each of which larger individuals were surrounded by smaller. Megascleres of a second kind, smooth and probably monactinal, were also present, these (which may be distinguished as *auxiliary*[1] megascleres) occurred, without definite arrangement, more particularly in the superficial layers of the sponge, and also formed descending strands stretching towards the sponge-base. Sponginous fibres were not produced, but the primordia of such, in the form of low dome-shaped elevations of the basal spongin lamina, coinciding in position with the areas occupied by the spicule-clusters, had probably made their appearance. It is difficult to say what the microscleres were, but since cheloids, sigmata, toxa and rhaphides (often in dragmata) are found in the group, it is necessary to assume that these, or at least the forms from which they have been derived, were present.

From such a hypothetical form all the different types of Myxillinæ are capable of being derived.

The evidence afforded by the microscleres, considered in conjunction with other facts, indicates either that a considerable amount of evolution in various directions had been accomplished, and that the prototypes of quite a number of different groups of co-related genera had already come into existence prior to the origin of sponginous fibres and to the

1 These spicules are commonly known as "dermal" or "ectosomal" megascleres; but the part which they play in the conformation of the skeleton varies to such an extent in different genera that it is advisable in a comparative treatment to designate them by a term unsuggestive of position or function. The term "auxiliary" is not altogether an appropriate one, but it will suit the present purpose; the spicules to which it applies correspond for the most part, in the Myxillinæ, to the megascleres which Bowerbank included under the same name. I shall apply the epithet "dermal" only to those spicules, of whatever category, which are specially concerned in the formation of a dermal skeleton.

assumption of an erect habit of growth, or that a return to a primitive condition on the part of more or less highly evolved species has occurred again and again within the group; otherwise it is impossible to account for the existence of groups of genera—*e.g. Hymeraphia*, *Microciona*, *Clathria* and *Ophlitaspongia*; *Leptosia*, *Stylostichon*, *Ectyodoryx and Lissodendoryx*; *Hymenancora*, *Plumohalichondria*, *Ectyomyxilla* and *Myxilla*; *Dragmatyle*, *Tedania* and *Acheliderma*; and others—each of which comprises a natural series connecting "promyxilline" with Ectyonine and Dendoricine forms. Whilst it is probable that each of the two possible explanations contains some portion of the truth, it would seem that the former is more satisfactorily in accord with the bulk of the evidence, although it involves the assumption that, amongst the Myxillinæ, sponginous fibres have originated independently many times over. If, however, as is scarcely to be doubted, such fibres have arisen as linear upgrowths of the basal spongin-lamina, there is no great improbability in such an assumption provided that there already existed in the common ancestor an incipient tendency, such as has been postulated, towards fibre-formation.

Taking into account only those features which belong to the skeleton, but neglecting, for the time being, any considerations in reference to the microscleres, it may be said that nearly all of the diversities of spiculation and structure which occur in the Myxillinæ are ascribable to (*a*) modifications in the form of the megascleres and the division of either or both of the original groups of megascleres into two or more kinds; (*b*) differences in the arrangement and constitution of the fibres, and in connection therewith different combinations of the megascleres in respect to their particular location in the skeleton; or (*c*) the loss by atrophy of one or more groups of megascleres formerly present.

Of very common occurrence has been the differentiation of the basical megascleres into two kinds, a larger, in the case of which the primitive spination has usually undergone partial reduction or become entirely lost, and a smaller, in which it has almost invariably been retained; these may be distinguished as *principal* and *accessory* basical megascleres respectively, or simply as "principals" and "accessories." The resultant trimegascleric condition is that which is characteristic of normal "Ectyoninæ." In many Myxillinæ, however, the "basicals" are only incompletely differentiated and in such cases, unless (as in *Crella*) there be a determinable difference of function between the spicules which lie at one end of the series and those which lie at the other, it is difficult to decide whether they should be regarded as belonging to one or to two groups (*e.g.* species of *Stylostichon*, *Clathrissa*, etc.). The maximum

degree of differentiation between principal and accessory spicules appears to have been attained in genera like *Raspailia* and *Echinodictyum* and in those in which the microscleres are isochelæ palmatæ and toxa, though amongst the last-mentioned there are species (*vide Clathria caelata, sp. n.*) in which an unbroken transition of spicule forms occurs between the small echinating spined "accessories" and the large (often quite smooth) principal styli of the fibre-core. Finally, in a third group of genera, comprising the "Dendoricinæ" and certain "Ectyoninæ" (*e.g.*, *Ophlitaspongia*, *Echinoclathria*, *Wilsonella*, *Agelas*, etc.) the basical spicules are unequivocally of but a single kind. The logical conclusion with regard to these is that either a differentiation of their basical spicules has never occurred or that one or the other of the resultants of such a differentiation has subsequently disappeared in the course of evolution; in most cases, the probability is that the absence of a second kind is due to loss, inasmuch as the (basical) spicules actually present, usually exhibit, in the matter of form and function, features which are more characteristic either of principal megascleres or of accessory. The further consideration of the spicules renders it necessary to take into account other features of the skeleton, and particularly the fibres.

In the Myxillinæ skeletal fibres have originated in apparently two quite independent ways, viz., by the upgrowth of processes from the basal lamina, and by the "ingrowth" of strands of auxiliary spicules from the superficial layer. In many cases, however, the fibres are the product of both modes of formation. Fibres which are wholly or partly of basal origin are, with possible exceptions, more or less sponginous and traverse the whole extent of the sponge; those of purely superficial origin are, at the most, scantily provided with spongin and proceed from the surface (usually?) only for a short distance (as, for example in "*Echinodictyum*" *arenosum*, "*Plumohalichondria*" *gravida* and *Fusifer fistulatus*).[1] The former might be distinguished as *basifugal*, the latter as *basipetal* fibres.

The mode of origination of basifugal fibres in the Myxillinæ is capable of being explained as follows:—The spongoblasts (and probably also the "basical" scleroblasts) which primitively—it may be presumed—were uniformly distributed over the surface of the basal lamina, became at particular points on it more closely aggregated. The consequent more rapid deposition of spongin at these points produced at each of them a thickening of the lamina which gradually assumed the form, say, of a papilla. Scattered over the surface of this papilla, just as over other portions of the surface of the lamina, though perhaps more closely, were scleroblasts

1 Dendy—Proc. Roy. Soc. Victoria, ix. (n.s.), 1897.

producing echinatingly-disposed basical megascleres. As a final step the cells, which, by their proliferation, maintain the supply of spongoblasts and scleroblasts, became localised at the extremity of the papilla, the further growth of which was thereby limited to increase in length. The manner of growth of the fibre might accordingly be likened to that of a Phanerogam stem—the spongoblast- and scleroblast-producing cells of the former corresponding to the apical meristematic cells of the latter, and the spicules, like the leaves, developing in acropetal succession. Thus at every stage of growth the fibre would be surmounted at its extremity by a "tuft" of newly-formed basical spicules, and it would depend almost solely upon the initial orientation of these spicules with regard to the direction of growth of the fibre, and their precise location (whether at the extreme tip of the fibre or subterminally) whether they subsequently became wholly enveloped by the onwardly developing spongin as *coring* spicules or whether, being more or less perpendicularly disposed, they were left with only their bases imbedded in spongin, as *echinating* spicules. When the fibre-forming spicules are of a single kind the attempt to draw a distinction between *coring* and *echinating* spicules is, to a great extent, artificial, and usually breaks down in practice; as a matter of fact the spicules at the time of their formation at the growing-point of the fibre are, in a sense, all of them *echinating*. Accordingly *Ophlitaspongia* and *Echinoclathria* which, by common agreement, were placed in the "Ectyoninæ," should logically have been included in the "Dendoricinæ."

The foregoing remarks concerning the mode of origin and formation of basifugal fibres apply more particularly to those of which the constituent spicules are basical megascleres only. Although fibres of this kind are the rule, there are a number of genera in which auxiliary spicules also participate in their formation and some again in which these are the only fibre-forming spicules. In these exceptional cases we may consider either that the ascending sponginous fibres have come into association with, and have enveloped in their progress the "descending" (basipetal) strands of auxiliary spicules;[1] or that in connection with the formation of the fibres, "auxiliary" scleroblasts have come to take a regular place amongst the cells of the fibre-growing point. From the point of view of spicular constitution merely, the skeletal fibres of the Myxillinæ are referable to three main types, according as basical megascleres only, basical and auxiliary both, or auxiliary megascleres only, take part in their formation.

1 In *Aulospongus tubulatus*, Bowbk. (Proc. Zool. Soc., 1873, p. 29; Dendy, Ann. Mag. Nat. Hist. (6), iii., 1889, p. 29), the fibres appear to grow up in an analagous way around the tubes of commensal worms.

This introduces an interesting point in connection with the megascleres, viz., their versatility in respect to the different parts they play in different genera in the conformation of the skeleton; and it also raises the question as to the nature of the criteria at our disposal for determining, in a given species, to which category—principal, accessory or auxiliary—the megascleres of each kind belong. According to my interpretation, if we take into account only the *situation* of the megascleres, the following types of skeleton are, amongst others, distinguishable:—

I.—The spicules of the fibres are "basicals" of one or two kinds; the "auxiliaries," if (as is almost invariably the case) present, occur interstitially and dermally.

(*a*) The "basicals" are of two kinds, both of which occur in connection with the fibres.

(i.) The fibres are cored by "principals" and echinated by "accessories." Normal "Ectyoninæ."

(ii.) Both kinds of "basicals" are longitudinally disposed in the fibres. "*Clathria*" *chartacea* (*vide* remarks on *Clathria*); *Heteroclathria*.

(*b*) The "basicals" are scarcely or not at all differentiated into two groups, and echinating spicules, if present, are not distinguishable in form from the directive spicules; or either the one kind or the other of the "principal" and "accessory" groups has been lost by atrophy.

(iii.) The "basicals" are imperfectly differentiated. *Stylostichon*.

(iv.) "Accessories" are absent. Normal "Dendoricinæ," *Ophlitaspongia*, *Echinoclathria*.

(v). "Principals" are absent. "*Clathria*" *mollis*,[1] *Paramyxilla infrequens*.[2]

II.—The spicules composing the fibres comprise both "basicals" and "auxiliaries;" the latter, which are situated axially in the fibres also occur interstitially or dermally.

(vi.) Principal and accessory spicules are well distinguished, and both kinds are associated with the fibres. "*Echinodictyum*" *ridleyi* (p. 151).

1 Kirkpatrick—Marine Investigations in South Africa, ii., 1904, p. 249.

2 Carter—Ann. Mag. Nat. Hist. (5), vii., 1881, p. 369; Dendy—Report Pearl Oyster Fisheries, Gulf of Manaar, iii., 1905, p. 233.

(vii.) Principal and accessory spicules are more or less well distinguished; the former echinate the fibres, the latter are interstitial and dermal. *Crella*.

(viii.) The "basicals" are scarcely or not at all differentiated into two kinds or are represented only by accessory spicules. *Clathrissa*, *Plumohalichondria*, *Stylotellopsis*, *Wilsonella*, *Fusifer*, "*Echinodictyum*" *spongiosum*,[1] "*E.*" *arenosum*,[1] "*Microciona*" *scabida* (p. 150).

(ix.) The "basicals" are represented only by principal spicules. *Echinochalina*.

III.—The fibre-forming spicules are "auxiliaries" only; basical spicules, if present, are (so far as known) of a single kind, and, on account of their spination, appear to belong rather to the category of accessory than of principal megascleres.

(x.) Basical megascleres are present. *Pseudoclathria Grayella*, *Histodermella*, *Microtylotella*.

(xi.) Auxiliary megascleres only are present. Species of *Iotrochota* and *Melonanchora*, and certain species included in the Mycalinæ.

In the case of those Myxillinæ in which the megascleres are of three kinds, the homologies of the spicules are, as a rule, obvious; and almost invariably it is found that the directive or axial spicules of the fibres belong to the *principal*, the echinating spicules to the *accessory*, and the interstitial or dermal to the *auxiliary* category of megascleres. When this mode of arrangement of the spicules obtains, or when it is departed from only through the loss of accessory spicules, the skeleton might be described as being of the *normal* type, since it is that in particular which is characteristic of most Myxillinæ. Amongst "trimegascleric" genera, *Crella* is exceptional in the fact that in it the fibres are cored by auxiliary and echinated by principal megascleres whilst the accessory occur extra-fibrally. From a study of the different forms assumed by the spicules (both megascleres and microscleres) amongst the *normal* Myxillinæ, we obtain much information which is of service in enabling us to form a conclusion concerning the identity of the megascleres in cases where the skeleton is of an anomalous or aberrant type. Thus there can be absolutely no doubt that the "skeletal" spicules of *Melonanchora emphysema*, *Forcepia*

1 Dendy—Proc. Roy. Soc. Viet., viii., 1896, p. 50.

colonensis,[1] *Iotrochota coccinea*[2] and of other species which might be mentioned, are auxiliary megascleres, and that they therefore differ from normal species of their respective genera in the absence of principal megascleres; and since we are enabled to detect the relationships of these species only by reason of the marked peculiarities of their microscleres, it is extremely probable that a number of the species included in certain Mycaline genera (*e.g.*, *Desmacidon*, *Amphilectus*, *Esperiopsis* and *Batzella*) are similarly derived from various Myxillinæ which are lacking in striking microscleric characters. Further, one feels scarcely any hesitation in asserting that the dermal spicules of *Pseudoclathria*, *Crella* and *Grayella*, and the scattered spined diactinal spicules of *Histodermella*, are *accessory* or, at any rate, undifferentiated *basical* megascleres; whilst the peculiar forms assumed by the accessory spicules in certain species of *Acarnus*, *e.g.*, by the "cladotylostyles" of *A. tortilis*[3] and the cladotylota of *A. tenuis*[4] lead one to suspect that the microtylota of *Microtylotella güntheri* belong to the same category, and that this genus ought therefore to be given a place in the vicinity of *Acarnus*. Also, it is not altogether improbable that the spined forcipes of *Leptobasis* and *Forcepia* are derivatives of accessory megascleres; the larger forcipes of *L. arcuata*[5] are especially suggestive of such a derivation, and it is worthy of notice also that in the genera *Crella*, *Grayella* and *Histodermella*, which, like *Forcepia* and *Leptobasis*, possess chelæ arcuatæ, the scattered accessory spicules are frequently curved and diactinal. If the megascleres other than the accessory are of a single kind only, it is not always possible to decide with certainty whether they are principal or auxiliary spicules; as a rule, however, reasons can be found, depending upon their form, in support of their identification with one, rather than with the other, of these categories. Principal megascleres, in nearly all cases in which their identity is certain, are sub-conical or more or less fusiform, somewhat curved styli, which are either quite smooth or are provided with spines over a greater or less portion of their length extending from the basal extremity upwards. The auxiliary megascleres, on the other hand, are typically straight and of fairly uniform diameter, and are rarely spined except at their extremities; in comparison with the principal spicules they are of relatively slender proportions, and in most genera are typically diactinal in the fully developed state, with usually tornote,

1 Carter—Ann. Mag. Nat. Hist. (5), xv., 1885, p. 110. For this species Hentschel (1911) has recently proposed a new name, *F. Michaelseni*.

2 Carter—Ann. Mag. Nat. Hist. (5), xviii., 1886, p. 378; Dendy—Proc. Roy. Soc. Vict., viii (n.s.), 1896, p. 23.

3 Topsent—Résultats Camp. Scient. Pr. de Monaco, Fasc. xxv., 1904, p. 171, pl. xiv., fig. 8.

4 Dendy—Proc. Roy. Soc. Vict., viii., (n.s.), 1896, p. 50.

5 Topsent—*Op. cit.*, p. 183, pl. xv., fig. 18b.

strongylote or tylote extremities. One is inclined to think, therefore—in regard to those genera included in the Mycalinæ which afford reason for believing that they are degraded Myxillinæ—that the megascleres of typical species of *Desmacidon* and *Homœodictya* are homologous with *principal* spicules whilst in some species at least which have been assigned to the same genera and to *Amphilectus* and *Batzella* they are homologous with *auxiliary* megascleres.[1] The presence or absence of spination on the principal spicules has been found lacking in generic value, and everything points to the fact that the spined condition is the more primitive; it is perhaps not a rare occurrence in species in which they are smooth when fully mature, that they are spined in their early developmental stages (as, for example, in *Myxilla diversiancorata*[2]), or during the larval period of life of the sponge (as in *Myxilla pedunculata*[3]). It is a peculiar circumstance that the principal megascleres are almost invariably curved; exceptions to the rule are provided by *Raspailia* and its allies, but it is significant that these are also aberrant in other respects. In *Echinodictyum* and *Trikentrion* amongst the "Ectyoninæ," and in *Dendoricella* and some species of other genera (*e.g.*, *Iotrochota*) amongst the "Dendoricinæ," they are diactinal (as in *Desmacidon* and *Homœodictya*), and take the form of oxea or strongyla; yet they still exhibit the curvature and fusiformity which, in general, are characteristic of principal megascleres.

Certain Myxillinæ are possessed of more than three kinds of megascleres owing to the division of one or more of the primary groups into two kinds; and this division usually appears to be correlated with, and to have been the outcome of a performance by the spicules concerned of two different functions. Instances of such, in which the principal megascleres have undergone division, are provided by *Echinodictyum clathratum*[4] and species of *Raspailia* (*e.g.*, R. *ramosa*, Mont., and *R. tenuis*, R. and D.); and in which the "accessories" have undergone division by the species of *Plocamia*. That the "dumbbell" spicules of the last-named genus are derivatives of the accessory megascleres, the indication afforded by *P. plena*[5] leaves scarcely any room to doubt; and this species also, by reason of its possession of stunted abnormal forms of the principal megascleres, renders it probable

1 Examples of such are provided by *Homœodictya dendyi* (Whit.); *Desmacidon plicatum* (= *D. stelliderma*, Carter); *D. psammodes* and *Batzella inæqualis*. (Hentschel, Fauna Sudwest-Australiens, Bd. iii., 1911); and by *Amphilectus ceratosus*, R. and D.

2 Lundbeck—Porifera Danish Ingolf-Expedition, Pt. 2, 1905, p. 150.

3 Lundbeck—*Loc. cit.*, p. 149.

4 Dendy—Rept. Pearl Oyster Fisheries, Gulf of Manaar, Pt. 3, 1905, p. 175.

5 Sollas—Ann. Mag. Nat. Hist. (4), v., p. 44.

that in *P. clopetaria*, Schmidt,[1] with its "pegtop-shaped" styli we have a species in which there are present two kinds of principal and two kinds of accessory spicules. The differentiation of the auxiliary megascleres into two groups, as in *Rhaphidophlus*, appears to have occurred but seldom.

An interesting point in connection with the microscleres, and one which possesses considerable classificatory importance is the rarity of the occurrence of sigmata and toxa in the same species. These two microscleres are found together in certain Mycalinæ, but not to my knowledge in any species of the Myxillinæ. Furthermore, in the latter sub-family, the microscleres which occur in association with toxa are (except in *Plocamiopsis*) isochelæ palmatæ, whilst those associated with sigmata are isochelæ arcuatæ, isancoræ, or rhaphides (usually in dragmata). Thus we have on the one hand the genera *Hymeraphia*, *Microciona*, *Clathria*, *Rhaphidolphus*, *Ophlitaspongia*, *Echinoclathria*, *Heteroclathria*, *Plocamia*, *Acarnus*, *Microtylotella*, *Fusifer*, *Cornulum*, and *Artemisina* in which the microscleres are toxa and (or) isochelæ palmatæ but not sigmata; and, on the other hand, *Leptosia*, *Stylostichon*, *Ectyodoryx*, *Lissodendoryx*, *Clathrissa*, *Crella*, *Grayella*, *Paramyxilla*, *Forcepia*, *Leptobasis*, *Hamigera*, *Dendoricella*, *Histodermella*, *Histoderma*, *Hymenancora*, *Myxilla*, *Ectyomyxilla* and *Melonanchora* in which the microscleres are sigmata and isochelæ arculatæ or isancoræ with or without trichodragmata, but not toxa. There can scarcely be any doubt that these groups of genera are representative of two distinct lines of evolution in the Myxillinæ; and since they comprise between them the majority of the species the question naturally arises as to whether they can be utilised as a basis for the division of the sub-family. The probability is that they can. In the former group, the accessory megascleres, when present, are well distinguished from the principal, and the auxiliary spicules are typically stylote; whereas in the latter, principal and accessory spicules as a rule are not widely different in form, and often graduate insensibly one into the other, and the auxiliary spicules are typically more or less diactinal. This is not only significant in itself, but it provides a means whereby one is enabled to arrive at an opinion concerning the allotment of most of the remaining genera. Thus the genera *Raspailia* and *Clathriodendron* (and with them *Syringella*); *Echinodictyum*, *Trikentrion* and *Cyamon*; *Aulospongus*; and *Spanioplon*—all of which are lacking in microscleres—are evidently to be assigned to the former group; *Acheliderma*, *Tedania* and *Dragmatyle*; *Hymetrochota*, *Iotrochota* and *Amphiastrella*; and perhaps also the somewhat aberrant *Iophon* and *Pocillon*—to the latter. To the former group

1 Ridley—Jour. Linn. Soc., Zool., xv., 1881, p. 479.

also, one is inclined to refer: *Mesapos*, *Tethyspira*, *Hymerhabdia* and *Cerbaris* (which appear to be lacking in auxiliary megascleres) on account of the analogy which their spicules bear to principal and accessory spicules; *Echinochalina*, which seems to be related to *Echinoclathria; Suberotelites*, regarded by Topsent as allied to *Plocamia;* and the aberrant genus *Agelas* (including *Ectyonopsis*) the affinities of which appear to be rather with the toxa-bearing Myxillinæ. On the other hand, one would assign rather to the latter group: *Pseudoclathria*, which presents some analogies with *Grayella; Stylotellopsis*, on account of its resemblance in many respects to *Clathrissa;* and (necessarily) *Tylosigma*, because of its sigmata.

A few genera still remain to be accounted for, the position of which is not quite clear; but sufficient has been adduced, I think, to indicate the feasibility of such a subdivision of the Myxillinæ as has been suggested. It is clearly evident, however, that no wholly satisfactory grouping of the species and genera of the *Desmacidonidæ* can be arrived at, until other characters, in addition to those which the spicules afford, are taken into account in classification.

Genus Clathrissa, *Lendenfeld.*

1888. *Clathrissa*, Lendenfeld, Descr. Cat. Sponges, Austr. Mus., 1888, p. 217.

The genus *Clathrissa* was introduced by Lendenfeld for three Port Jackson sponges which he named *C. arbuscula*, *C. elegans*, and *C. pumila* respectively; of these, the first mentioned possesses chief claim to be regarded as the type-species, and is here so considered. They were defined as "Desmacidonidæ with a skeleton composed of dense bundles of slender oxea with very little spongin, echinated by spined styli." Concerning the precise nature of *C. elegans*, nothing can be said with certainty, since in the existing collection of the Museum, no sponges identifiable as such have so far been met with. An examination of the type-specimens of the other species shows that in both the structure of the main skeleton is similar to that of *Plumohalichondria*, and that microscleres are present in the form of chelae arcuatae. In *C. pumila*, however, there is, in addition, a dermal skeleton of acanthostyles, so that this species belongs to the genus *Crella*. The other, *C. arbuscula*, agrees essentially with many species at present included in *Plumohalichondria*, viz, those with arcuate chelae. If, however, the microscleres of *P. microcionides* (the type of *Plumohalichondria*) be ancoræ, as Thiele's figures of the spicules of *P. neptuni*[1] and his statement concerning the

[1] Thiele—Archiv. Naturg., 1903, i., Heft 3, p. 387, pl. xxi., fig. 19.

likelihood of the latter species' identity with *P. microcionides* would lead one to suppose, the retention in *Plumohalichondria* of the species referred to, will be contrary to established practice. If this supposition be correct, the genus *Clathrissa* will be a valid one, standing in the same relation to *Leptosia* as *Plumohalichondria* to *Hymenancora*.

I was at first in doubt whether the specimens which are labelled as the types of *Clathrissa arbuscula* were genuine examples of the species, partly because the lengths of their spicules do not agree very well with those which Lendenfeld has given, but mainly on account of their lack of resemblance to the figure (*Loc. cit.*, pl. v., fig. 2). I am now, however, quite sure in my own mind that this figure is wrongly represented as illustrating *Clathrissa arbuscula*, inasmuch as it bears a striking likeness to ordinary specimens of *Clathiodendron arbuscula*, a species which is described in the same Catalogue; and I would therefore go so far as to say that the latter species has been figured in mistake for the former. One can the more easily conceive the possibility of such an error in connection with these two species owing to the sameness of their specific names and of the initial letters of their generic names. It is confirmatory also of the opinion here expressed that the example of *Clathrissa arbuscula* in Prof. Dendy's donation of pieces of British Museum sponges agrees with the Australian Museum specimens so labelled. The other discrepancy mentioned—that in regard to the lengths of the spicules—is of negligible import, since Lendenfeld seems usually to have taken the mean length of spicules into account, rather than their maximum.

A brief description of *Clathrissa arbuscula* may not be out of place. The sponge grows in the form of a tussock of numerous, prolifically multiplying, erect slender branches with highly uneven, warty surface. Lendenfeld's description of the external features is fairly satisfactory, but requires some slight emendation. It reads, "Small, irregular, lobose or digitate sponges wih erect processes, attaining a height of 150 mm. The living sponge is very soft and resilient, orange-red in colour. Spirit specimens are brownish-grey. The whole of the surface is covered with densely-situated villous, distally rounded or thickened outgrowths, which are about 1.5 mm. thick and from 2-8 mm. long." The description might suggest that the sponge has a more massive basal portion, but this is not so; though the sponge is sessile and occupies an extended base, the primary branches, except for occasional anastomoses, are independent almost to the subtratum. The

1 Ridley—Zool. Coll. H.M.S. "Alert," 1884, p. 430, pl. xl., fig. G, pl. xlii., figs. a-a″.

warty out-growths of the surface are probably incipient or abortive branches; in fact, the longer ones ("8 mm. long") mentioned by Lendenfeld are more correctly described as young branches. This species is closely allied to, if not actually identical with, Ridley's *Myxilla arborescens*[1] which also comes from Port Jackson. The spicules are asymmetrical straight oxea, acanthostyles of two sizes and isochelæ arcuatæ. The oxea, when more fully developed, show a very faint sub-terminal constriction at both extremities, so that the end portions appear somewhat lanceolate in shape. This feature is usually more distinct at one extremity than the other, and is often confined to one end. Sometimes one extremity is much more rounded than the other, and then the spicule may appear monactinal. In young spicules the asymmetry is more pronounced, and the end which corresponds to the lanceolate extremity of older spicules usually bears an elongated slender tylosis. The spicules vary in length from about 160 to 285 μ, though comparatively few exceed 220 μ; the stoutest are 5 μ in diameter. The acanthostyles are conical and tapering, and almost invariably curved; the spines are densely crowded on the basal end (the spicule appears in consequence somewhat tylote), and decrease in abundance progressively from base to tip; more than one-third of the length distally, particularly in the case of the larger spicules, may be free from spines. Their length varies from about 85 to over 200 μ; the largest actually seen was 225 μ long. Individuals between 120 and 160 μ in length are extremely rare. The spicules accordingly appear to conform to two sizes, the odd ones of intermediate length being possibly stunted individuals of the larger kind. Both kinds echinate the fibres. The largest acanthostyles are, at most, 8 to 9 μ in diameter immediately above the base. The chelæ are abundant and measure 20 to 26 μ in length. Their end parts are relatively small and the shaft may reach 4.5 μ in thickness. A peculiar feature of the skeleton is the occurrence of elongated tufts of oxea, often standing off from the main fibres as if they were short branches from them, which have been left unprovided with echinating spicules.

Stylostichon conulosum, Whitelegge,[1] is sufficiently closely related to *Clathrissa arbuscula* to be regarded as a variety of it. The oxea are similar in shape to those of the latter, and exhibit in some degree the same peculiarity. The sponge is not encrusting in the proper sense of the word, but from an encrusting base numerous miniature crumpled lamellæ with conulated surface arise vertically. The oxea vary in length from about 165 to 215 μ; the stoutest are 6 μ in diameter.

1 Whitelegge—Austr. Mus. Mem., iv., 10, 1907, p. 492.

The acanthostyles bear a close resemblance to those of *C. arbuscula* and like them are divisible into two sizes. Their lengths lie between 90 and 210 μ, but individuals between 120 and 180 μ in length have not been observed; the stoutest are 12 μ in diameter. The isochelæ arcuatæ differ from those of *C. arbuscula* only in their slightly larger size; they measure from 21 to 28 μ in length, with a maximum stoutness of shaft of slightly more than 4.5 μ. Whitelegge's description would imply that the oxea do not occur as coring spicules, and that the larger acanthostyles do not to any notable extent echinate the fibres. The fact that he placed the species in the genus *Stylostichon* would imply the same. However, I find that wherever the fibres are not so densely echinated as to obscure the coring spicules, oxea in small numbers are usually to be seen; at the same time, the larger acanthostyles occur plentifully as echinating spicules. Nevertheless, it must be confessed that the occurrence of oxea in the fibres appears to be more or less sporadic, and accordingly it would seem that no hard and fast distinction can be drawn between *Clathrissa* and *Stylostichon*.

Plumohalichondria cæspitosa (Carter), as identified by Dendy,[1] is another species sufficiently closely related to *C. arbuscula* to admit almost of its being regarded as a variety of it. I have examined a slide of this sponge, presented to the Australian Museum by Professor Dendy, and find that the spicules are of the same general character as those of *C. arbuscula*. The oxea are slightly smaller, rarely reaching quite as much as 4 μ in stoutness and varying in length from 150 to 200 μ. Acanthostyles of all lengths from 84 to 240 μ occur, there being no actual separation into two sizes, although spicules of intermediate lengths are of less frequent occurrence. The isochelæ arcuatæ are 27 to 32 μ in length. It will be noticed that the lengths of the two last-mentioned spicules are much greater than those given by Carter, viz., 20-6000ths and 3½-6000ths of an inch respectively.

Ysesia commensalis, Whitelegge[2] is possibly a *Stylostichon*, that is to say, the main skeleton consists of stout vertical columns composed solely of acanthostyles. The acanthostyles are, however, arranged plumosely, making an acute angle with the direction of the fibres, and are not differentiated into coring and echinating spicules. The dermal skeleton is a layer of a closely packed isochelæ arcuate, beyond which the outer ends of divergent tufts of smooth oxea project slightly. The

1 Dendy—Proc. Roy. Soc. Vict., viii., 1896, p. 41; Carter—Ann. Mag. Nat. Hist. (5), xvi., 1885, p. 352.

2 Whitelegge—Austr. Mus. Mem., iv., 9, 1906, p. 483.

dermal, or rather sub-dermal, tufts are sometimes prolonged below into strands which may descend for a moderate distance towards the base of the sponge. A remarkable feature of the species is the occurrence of small irregularly monilated rods, scattered in the ground substance. The rods are apparently proper to the sponge—at any rate they are siliceous; they are possibly homologous with the forcipes of *Forcepia*. The acanthostyles vary in length from about 80 to 240 μ and may attain a diameter of 17 μ. They are covered, except for a varying distance from the pointed end, with relatively short and stout recurved spines. The microscleric rods are 20 to 50 μ long and, even in their most swollen portions, rarely as much as 5 μ in diameter. The oxea are very abruptly and often acuminately pointed spicules ranging in length from about 80 to 180 μ, though rarely less than 100 μ, or more than 160 μ long; the stoutest are 8 μ in diameter. The chelæ are very abundant; they usually have a much curved shaft, so that the extremities of the anterior teeth approach each other very closely and sometimes overlap or fuse; size variable, the length ranging from 10 to 24 μ. The dimensions of the spicules given above differ slightly from those given by Whitelegge, so that probably some amount of variation in their size occurs in different specimens.

It is of interest to note that *Microciona scabida*, Carter,[1] differs from *Clathrissa* mainly through the possession of stylote, instead of diactinal auxiliary spicules. The microscleres are chelæ apparently of three or four kinds, viz.:—(i.) a stout isochela arcuata, 30 μ long; (ii.) a smaller slender isochela with curved shaft and very sharply pointed flukes, which occurs in great abundance; (iii.) a cheloid with much curved shaft, which appears to be an abnormality of the first-mentioned; and (iv.) a peculiar cheloid also with much curved shaft and of smaller size than the others, which apparently belongs to the same category as certain of the forms termed bipocilla, but which may be a derivative of the second kind. As my object in referring to this species is merely to draw attention to its relationship with *Clathrissa* on the one hand and with *Stylotellopsis* on the other I have not undertaken the possibly difficult task of determining the precise nature of these cheloids. The fibres are echinated and to some extent cored, by acanthostyles of two orders of size, the smaller rarely exceeding say 110 μ in length, the larger reaching to 220 x 7 μ. The coring spicules are chiefly straight slender subtylostyli, of which the

1 Dendy—Proc. Roy. Soc. Vict., viii. (n.s.), 1896, p. 31; Carter—Ann. Mag. Nat. Hist. (5), xv., 1885, p. 112, figs. 4, 5.

largest measure about 270 x 4 μ. Beneath the surface of the sponge and running perpendicularly towards it are numerous wispy strands of the same spicules. With regard to the arrangement of the skeleton *Microciona scabida* stands precisely in the same relation to the type-species of *Stylotellopsis*—*S. amabilis*[1]—as does *Crella incrustans* var. *levis to C. incrustans* var. *pumila*; and, in compliance with the present scheme of classification, should accordingly be placed in Thiele's genus.

Another interesting species whose systematic position appears to be somewhere in the vicinity of *Clathrissa* and *Stylotellopsis* is *Echinodictyum ridleyi*, Dendy.[2] The skeleton is made up almost entirely of slender longitudinal wispy fibres and is consequently rather of the dendritic than of the reticulate type. Accompanying the slender oxeote or rather tornotoxeote spicules (size about 270 x 4 μ) which chiefly compose these fibres, are a few conical smooth styli (190 x 7 μ) and acanthostyles (100 x 6 μ), both kinds of which occasionally project from the fibres somewhat in the manner of echinating spicules. There are no microscleres. The diactinal spicules of the fibres evidently correspond to the auxiliary megascleres of normal Myxillinæ, and the species accordingly possesses no claim to a place in the genus *Echinodictyum* in which the fibres are formed by principal spicules and in which the auxiliary spicules are represented by interstitial or dermal styli. Also, it is scarcely to be doubted that the smooth conical styli are homologues of the larger acanthostyles of *Clathrissa arbuscula*, *Stylotellopsis amabilis* and *S.* (*Microciona*) *scabida* and to the principal styli of normal Myxillinæ. *C. arbuscula* and *S. amabilis* differ in generic characters mainly in this respect, that in the latter the auxiliary megascleres are pointed at one end only, whilst in the former they are pointed at both ends. But this difference cannot be regarded as of much importance since the probability is that the tornotoxea of *C. arbuscula* are, strictly speaking, just as truly monactinal as the tornostrongyles of *S. amabilis*. Consequently *Echinodictyum ridleyi* owing to the perfect smoothness of its principal styli, stands farther removed from either of the two last mentioned species than these do from each other, and is thus fairly entitled to distinction under a new generic name. In *E. ridleyi*, as already mentioned, the principal and accessory styli are both comparatively rare in their occurrence; if the former spicules were to disappear, such a species as *Echinodictyum spongiosum*, Dendy,[3] would result; whilst if both kinds were lost, there would be scarcely anything in the struc-

1 Thiele—Fauna Chilensis, Bd. 3, p. 456, fig. 72 a-d.

2 Dendy—Proc. Roy. Soc. Vict., viii., 1896, p. 44.

3 Dendy—Proc. Roy. Soc. Vict., viii., 1896 p. 45.

ture of the skeleton to distinguish it generically from certain species at present included in the genus *Axinella*.

The three sponges described by Lendenfeld[1] under the name of *Echinonema anchoratum*, Carter, have, according to their description, the spiculation of *Clathrissa*, but the skeleton is reticulate. The best plan to adopt in regard to these sponges is to regard them as *species dubiæ* of *Wilsonella* (*q.v.*).

Genus Crella, *Gray*.

Thiele[2] has expressed the opinion that *Plumohalichondria incrustans*, Carter, should be placed in the genus *Pytheas* which, as Lundbeck has recently shown, must now be called *Crella*. Accordingly I employ the latter name for the sponges about to be described. These agree so closely in the characters and dimensions of their spicules that, despite considerable differences in some other respects, they might very well be treated—in contrast with other species of the genus—as varieties of a single species, *Crella incrustans*. In this species, as in *Clathrissa arbuscula* the smooth oxeote spicules are secondarily diactinal.

Crella incrustans, *Carter*, et varr.

(Plate xxiii., figs. 2, 3; Plate xxiv.; and figs. 28-34.)

General diagnosis: External form various; encrusting, massive or ramose. Oscula present in probably all the varieties. Typically (unless in encrusting varieties) the branching ascendent fibres of the main skeleton are sinuous and interosculate so as to form a kind of loose reticulation (pseudo-reticulation); connecting fibres, in small number, may occur. The fibres are fairly closely, sometimes extremely densely, echinated with straight conical acanthostyles; the coring spicules may be exclusively smooth oxea, or exclusively acanthostyles, or a mixture of both. Foreign particles are in some cases included in the fibres. The dermal skeleton is a layer of shorter (usually slightly curved) acanthostyles, with a reticulate or more or less confused arrangement, rarely accompanied by relatively few smooth oxeotes. All three kinds of megascleres occur interstitially, the dermal acanthostyles typically in greatest abundance. The microscleres are of a single kind, isochelæ arcuatæ, scattered interstitially and in the dermal layer in moderate abund-

1 Lendenfeld—Cat. Sponges Austr. Mus., 1888, p. 219. The three sponges referred to bear the varietal names, *ramosa*, *dura* and *lamellosa*. Their type-specimens appear to have been lost, since the specimens which Whitelegge regarded as such cannot at all be reconciled with Lendenfeld's descriptions (*vide* Appendix).

2 Thiele—Archiv. Naturg., 1903, p. 388.

ance. The smooth oxeotes are asymmetrical, and when they attain in the fullest degree their characteristic shape are tornotoxea with a slight flexion at the tip of the oxeote extremity. The extremes of the maximum dimensions of the spicules in the known varieties are as follows:—Tornotoxea: Length, 160 to 220 μ; diameter, 4.5 to 6 μ. Echinating acanthostyles: Length, 145 to 200 μ; diameter, 8 to 12 μ. Dermal acanthostyles: Length, 80 to 100 μ; diameter, 5 to 8 μ. Isochelæ arcuatæ: Length, 16 to 25 μ.

The several sponges now to be described agree so closely in the form and dimensions of their spicules that—despite considerable differences in some other respects—it has been considered preferable to treat them as varieties of a single species. Any differences that there may be in the shapes of the spicules in the different varieties are too slight to be of diagnostic value, and a single description will therefore suffice for all. The megascleres are smooth oxeotes, and acanthostyles of two kinds; the microscleres are isochelæ arcuatæ of a single kind. The oxea are slender, asymmetrical, slightly fusiform straight spicules which in their very earliest stages of growth appear to be monactinal. Their characteristic peculiarity—which is usually, however, to be observed only in small proportion of them—is a slight bending to one side of the tip of one extremity. This peculiarity as it appears when most highly developed, is illustrated in text-figure 29, where it is also to be observed that the spicule is most correctly described as a tornotoxea. Throughout the descriptions they will be referred to merely as the *oxea*, or sometimes as the *auxiliary spicules*. The extent to which they enter into the formation of the fibre-core varies greatly in the different varieties; in the variety *digitata* they are pretty well the sole constituents; in the varieties *perramosa* and *levis* they are mingled with a variable proportion of acanthostyles; in the varieties *arenacea* and *rubra* they are usually more or less completely supplanted by acanthostyles. An interesting condition is found in the variety *pumila*, where columns of oxea, descending downwards from the surface without admixture of acanthostyles, form a common and characteristic feature of the skeleton. The oxea also occur as interstitial spicules, but except in the variety *digitata* are outnumbered as such by the accessory acanthostyles; in the last named variety also, they participate in the formation of the dermal skeleton. The acanthostyles, as previously mentioned, are of two kinds. Those which predominate as echinating spicules and often in addition core the fibres are straight conical spicules of variable length, provided with more or less recurved spines which are usually

absent, for a short distance, from the distal extremity. These spicules will be referred as the *principal* acanthostyles. The acanthostyles of the second kind are the characteristic and usually the sole elements of the dermal skeleton and at the same time the predominant spicules of the ground substance. From the evidence afforded chiefly by the varieties *perramosa* and *digitata*— in which, owing to the absence of crowding, the echinating spicules are, with greater advantage than in the other varieties, individually discernible in detail—I am convinced that spicules, similar in all respects to these dermal acanthostyles, may also occur quite commonly both as echinating and coring spicules. Accordingly, I will not in general use the terms "*echinating*" and "*dermal*" to distinguish the two forms of acanthostyles, but instead "*principal*" and "*accessory*." One sees also in the different varieties that there is a perfect gradation between the extremes of form shown by the accessory spicules on the one hand and the principal spicules on the other. Accordingly in determining the dimensions of the accessory acanthostyles I have measured those spicules only which are situated actually *in* the dermal skeleton, and as regards the principal acanthostyles, have taken account of their maximum size alone. The accessory acanthostyles are slightly curved and slightly fusiform spicules covered, almost or quite to the distal extremity, with spines which stand perpendicularly to the axis of the spicule. The isochelæ arcuatæ are rather abundant and show a tendency, which is strongly marked in some varieties, to become differentiated into two sorts, a larger and a smaller. The arrangement of the skeleton shows appreciable differences in the different varieties, though not always to an extent that permits of distinction in a verbal description. In the non-encrusting varieties with the exception of *levis*, the fibres, owing to their undulating courses and anastomoses, often form a kind of pseudo-reticulation; in the variety *perramosa*, actual transverse fibres in moderate number are developed. This last-mentioned variety is therefore of considerable interest, since it shows that a reticulate type of skeleton may be developed directly from a dendritic type—a fact which lessens the importance of a generic distinction based solely on such a difference in the character of the skeleton. In all the varieties the fibres are rich in spongin. The typical variety of the species is Carter's *Echinonema incrustans* from Port Phillip, which has been described as "massive incrusting, thick, covering the whole of a Pecten." I have not so far met with any specimen in the Australian Museum collection of Port Phillip sponges which admits of identification with Carter's species, but I have before me two mounted sections prepared by Mr. Whitelegge from pieces of British Museum specimens,

labelled "*Echinonema incrustans* Carter *type*," and "*Plumohalichondria mammillata*, Carter" respectively. These do not satisfactorily corroborate Dendy's assertion of the synonymy of the two names, since the latter slide shows a skeletal structure rather resembling that of the var. *levis*, and chelæ varying from 13 to 26 μ in length; whilst in the former the structure is much looser—somewhat similar to that of the var. *digitata*—and the chelæ are only 12 to 22 μ long. Without wishing to attach any great importance to this discrepancy, I simply point to the possibility of a varietal difference between the sponges of Carter's two species. The point can only be settled by a re-examination of the original specimens. In view of the existence of so many distinct but closely allied varietal forms of this species,[1] it is necessary to proceed cautiously in introducing synonymy; unless a complete connecting series between two forms is known to exist, it is far better—because less liable to lead to confusion—to treat them as distinct varieties, each with a distinguishing name. Accordingly I would recommend that the *Plumohalichondria mammillata* of the "Challenger" Report be still considered a variety distinct from the *Echinonema incrustans*, Carter. In their description of this variety, Ridley and Dendy state that the dermal skeleton is a reticulation made up exclusively of acanthostyles; they also refer to their examination of a small piece of the type-specimen of Carter's *Plumohalichondria mammillata* and mention concerning it that the dermal acanthostyles are intermingled with smooth oxea and not reticulately arranged. These differences in the dermal skeletons of the two sponges, they allowed, might very well prove distinctive; but the other characters showed so close a correspondence that, under the circumstances, taking into account the small size of the piece examined, and the possibility of some amount of variation with age they did not consider it advisable to distinguish the two by the introduction of a new name. Of the varieties whose descriptions follow there is only one, viz., *digitata*, in which the oxea have been found to enter into the formation of the dermal skeleton; accordingly, there is good reason to believe that the presence or the absence of dermally situated oxea may be a characteristic which is constant for any given variety. The variety from Oyster Bay to which I

1 In addition to the varieties described in this Report, I have before me three others which are unquestionably quite distinct. Owing to the scantiness of the material and its unsuitable state of preservation, I do not venture to describe them. One is probably identical with a British Museum sponge bearing the manuscript name "*Clathrissa membranacea*, Lendenfeld." Another bears a label in Lendenfeld's writing with the name, "*Clathrissa arbuscula*," a species to which it bears some external resemblance. The third is a ramose sponge of irregular growth with the oscula situated singly at the extremities of branches.

give the name *digitata* is probably identical with the typical variety, but in the absence of sufficiently full information concerning the latter, I do not feel justified, on mere assumption, in naming it as such.

CRELLA INCRUSTANS, *Carter*, *var.* DIGITATA, *var. nov.*

(Plate xxiii., fig. 2, and figs. 28, 29.)

Sponge, so far as known, growing upon the shells of bivalve molluscs in the form of a thick encrusting layer from which arise shorter lobes or longer digitations. Texture loose; consistency soft, though moderately tough. Oscula? Fibres sinuous, anastomosing, cored solely by smooth oxea, and plentifully, though by no means densely echinated. The dermal skeleton comprises oxea in addition to acanthostyles; the latter spicules do not form a definite reticulation. Megascleres, maximum sizes:—(i.) Oxea 220 x 4.5 μ; (ii.) principal acanthostyles 170 x 9 μ; (iii.) dermal acanthostyles 90 x 8 μ. Isochelæ arcuatæ 13 to 20.5 μ long.

This variety is represented by six specimens which were obtained by the "Endeavour" from a single locality. Each of them grows upon the shell of a *Pecten*, forming a thick cushion-like layer which spreads over the entire exterior surface of both valves, the two portions being in continuity only across the hinge-line. Though the shells are now empty, it is evident that the animals must have remained alive until the sponge grew to considerable proportions. At the free margin of the valves further growth is effected by the formation of processes which vary in form from short thick blunt lobes to elongated branch-like digitations (Plate xxiii., fig. 2). Similar processes may also arise from other parts of the surface. The condition presented in some specimens indicates that the sponge may attain to a considerable size without any formation of outgrowths; in others, the total mass of the branches may exceed that of the encrusting portion. Anastomoses of the branch-like processes occasionally occur. The surface may be glabrous and even, or may exhibit minute conuli at the points where the fibres impinge. The oscula, which in the typical variety have been described by Carter as large and scattered, are not with certainty discernible in the present specimens: the dermal membrane is, however, ruptured in places, and thus, on account of its elastic tension, rounded openings result, which might easily be mistaken for oscula. The non-appearance of oscula in the present instance is possibly due to their closure whilst the sponges were being dragged in the trawl-net. The dermal membrane is thin, yet

tough, and when dry forms an obscure whitish incrustation; in alcohol it is translucent and of light greyish colour. Beneath the membrane, the sponge is dull yellow. The texture is much looser and the consistency much softer than in the varieties *arenacea* and *levis*. In a dry state the consistency varies according to the extent to which the sarcode has been removed, from firm, yielding to pressure and slightly brittle, to soft, spongy and elastic.

The main skeleton consists of exceedingly tortuous branching fibres running longitudinally. In the deeper parts they might almost be described as curled, but towards the surface they straighten out somewhat, though still remaining sinuous. The spicular axis of the fibres, consisting of oxea only, is surrounded by a thick sheath of transparent spongin in which the echinating spicules are deeply imbedded with their bases quite in contact with the spicules of the core. The winding courses which the fibres pursue, result in the frequent crossing and apposition of adjoining fibres, and where contact occurs connections are frequently formed by the fusion of their spongin-envelopes. There are no proper connecting fibres, though occasionally the union of fibres in the manner described produces the appearance of such. The fibres might be said to form a pseudo-reticulation, in which the meshes are for the most part of elongated form. In sections prepared from dry specimens it is seen that the spongin—or what appears to be spongin—in addition to its envelopment of the fibre-spicules, extends as thin films or membranes between the fibres, dividing the interior of the sponge into incomplete compartments, as it were. The interstitial spicules, consisting of acanthostyles and oxea in about equal number, appear to be entirely restricted to these membranes. The echinating spicules are never so abundant as to obscure the axial spicules.

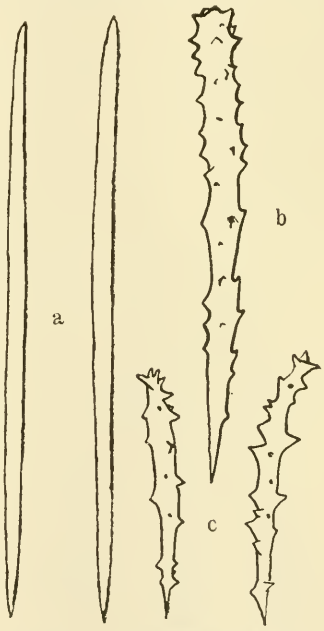

Fig. 28—*Crella incrustans* var. *digitata*. a Oxea. b Principal acanthostyle. c Dermal acanthostyles.

The dermal skeleton consists of acanthostyles and oxea. The proportion in which each occurs is variable, but the smooth spicules are always present, and in places—particularly where the membrane overlies large subdermal spaces—are more numerous than the spined spicules. Occasionally, over small areas, an approach to the reticulate arrangement is met with; or the acanthostyles may be clustered in small patches so as to give a mottled appearance, but there is never (in any observed case) a parallel arrangement of spicules to form the sides of meshes of a distinct reticulation such as is found in the varieties *arenacea* and *levis*.

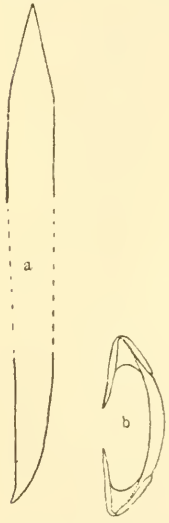

Fig. 29—*C. incrustans* var. *digitata*. a Oxea (showing the extreme of asymmetry in these spicules). b Isochela arcuata.

Megascleres.—

(i.) The oxea vary in length from 160 to 220 μ; the stoutest are probably never more than 4.5 μ in diameter. The characteristic end-flexure is only of occasional occurrence, it may, however, be developed quite as highly as in any of the other varieties, as the spicule shown in Text-figure 29 bears witness. The oxea are characterised in comparison with those of the other varieties by a slight elongated subterminal constriction which occurs at both ends. In this respect the spicules resemble those of *Clathrissa arbuscula*. The feature is occasionally observed in the spicules of some of the other varieties of *Crella incrustans* but is never so well marked as in the present one.

(ii.) The principal acanthostyles reach a maximum size of 170 x 9 μ.

(iii.) The dermal acanthostyles vary in length from 60 to 90 μ; the stoutest are 7 or 8 μ in diameter. Very rarely acanthoxea are met with in the dermal skeleton; these are sometimes over 100 μ in length.

Microscleres.—

The chelæ, which vary in length from 13 to 20.5 μ, but are rarely more than 18 μ, show a scarcely appreciable differentiation into two forms.

As already pointed out this variety is probably identical with the typical variety which comes from Port Phillip. But there

is nothing in what has been written concerning the latter except the reference to its habit of growing over Pecten shells, which furnishes any warrant for regarding the two as identical. Accordingly, after some hesitation, I have decided to introduce a distinguishing varietal name for the Oyster Bay sponges, perceiving that although such a step may prove to be incorrect, it cannot at any rate give rise to confusion.

Loc.—Oyster Bay, Tasmania, 30 fms. ("Endeavour.")

CRELLA INCRUSTANS, *Carter*, VAR. PERRAMOSA, *var. nov.*

(Plate xxiv., and fig. 30.)

Sponge ramose, erect, stipitate; with long and relatively slender cylindrical branches which multiply dichotomously and occasionally anastomose. Oscula? The main skeleton is reticulate, though connecting fibres are relatively few in number. The fibres are not densely echinated and contain a stout compact core of oxea mingled with a moderate number of acanthostyles. Dermal skeleton? Megascleres, maximum sizes:—(i.) Oxea, 195 x 7.5 μ; (ii.) principal acanthostyles, 160 x 12 μ; (iii.) dermal acanthostyles about 100? x 7 μ. Isochelæ arcuatæ, 13 to 25 μ long; imperfectly distinguishable into two kinds, a larger and a smaller.

This variety is represented by a single specimen 520 mm. in height (Plate xxiv.). The branches are cylindrical, except in places where they broaden out prior to bifurcation. The specimen is preserved in a dry state, and so affords no information concerning the oscula or the arrangement of the dermal skeleton. The main skeleton bears a considerable resemblance to that of the variety *digitata*, but differs owing to the rather frequent occurrence of transverse connecting fibres. The main fibres are sinuous, and interosculate to form a loose pseudo-reticulation. They contain a compact core of spicules 20 to 80 μ in stoutness which as a rule is almost entirely formed of oxea; occasionally, however, acanthostyles—both principal and accessory—become the predominating elements of the core. Echinating acanthostyles are only of moderate abundance; the fibres are sometimes lacking in them for quite considerable distances, and even when most abundantly developed these spicules stand, on an average, probably not less than 20 μ apart.

Megascleres.—

(i.) The oxea vary in length from 160 to 190 μ; the stoutest occasionally reach a diameter of 7 μ. A greater proportion of them than in any of the other varieties

herein described, display the characteristic end-peculiarity—perhaps 20 per cent. of them being thus affected.

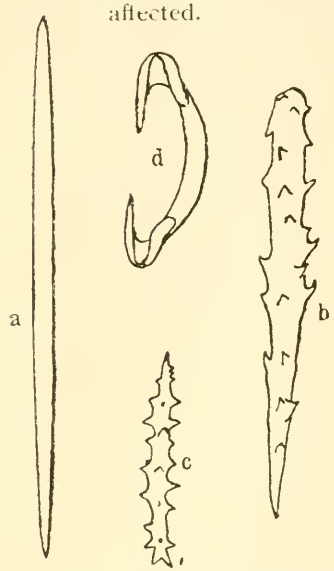

Fig. 30—*C. incrustans* var. *perramosa*. a Oxea. b Principal acanthostyle. c Dermal acanthostyle. d Isochela arcuata of the larger kind.

(ii.) The principal acanthostyles attain a maximum size of 160 x 12 μ.

(iii.) The dermal acanthostyles, owing to the damaged state of the dermal layer, are not with certainty determinable in respect to their maximum size. Referring only to those which exhibit the characteristic curvature of form, it may be said that the length varies from 60 to about 100 μ, and that the usual size is about 80 x 7 μ.

Microscleres.—

The chelæ vary in length from 13 to 25 μ. There is an appreciable difference of form between the larger and smaller; the former are similar to that shown in the accompanying text-figure, the latter bear a closer resemblance to those which are found in the preceding and two following varieties.

Loc.—Coast of New South Wales, Shoalhaven Bight, 15-45 fms. ("Endeavour.")

CRELLA INCRUSTANS, *Carter*, *var.* ARENACEA, *Carter*.

(Plate xxiii., fig. 3, and fig. 31.)

1885. *Plumohalichondria arenacea*, Carter, Ann. Mag. Nat. Hist. (5), xvi., 1885, p. 367.

1896. *Plumohalichondria arenacea*, Dendy, Proc. Roy. Soc. Vict., viii. (n.s.), 1896, p. 43.

1901. *Plumohalichondria australis* (pars), Whitelegge, Rec. Austr. Mus., iv., 2, 1901, p. 90, pl. xl., fig. 14b.

Clathria australis, Whitelegge, *Loc. cit.*, p. 90.

[1888. Not *Clathria australis*, Lendenfeld, Cat. Sponges Austr. Mus., 1888, p. *222*.]

Sessile to substipitate; sometimes rather massive, but usually growing in the form of a thick erect plate which may either remain simple or become variously modified by proliferation, e.g., by partial or complete bifurcation into parallel plates, by the development of variously disposed lamellar outgrowths, or by the formation of lobes. Oscula small, mostly marginally situated. Both surfaces of the plate or plates traversed, immediately beneath the dermal membrane, by sub-parallel longitudinal canals which terminate in the oscula. Fibres very densely echinated; the coring spicules chiefly acanthostyles. Foreign bodies, chiefly sand grains, occur in variable amount in the fibres, and occasionally also in the ground substance. Interstitial megascleres, consisting chiefly of accessory acanthostyles, are extremely abundant. Dermal skeleton reticulate, without admixture of oxea. Megascleres, maximum sizes:—(i.) Oxea, 200 x 6 μ; principal acanthostyles, 160 x 11 μ; dermal acanthostyles, 100-110 x 8-9 μ. Isochelæ arcuatæ, not distinguishable into two groups, 12 to 18 μ long.

Introductory Remarks.—The sponges described by Whitelegge under the name of *Plumohalichondria australis*, Lendenfeld, are separable into two varieties—the one, corresponding to those which he identified with *Clathria australis*, Lendenfeld; the other, to those which he regarded as representing three of Lendenfeld's species, viz., *Echinonema levis*, *E. rubra* and *Clathria macropora*. In the case of none of the four species mentioned, does Lendenfeld's description agree with that of Whitelegge, since for each of them the coring spicules were stated to be styli, whereas in *Plumohalichondria australis*, Whitelegge, they are oxea. What were the sponges which Lendenfeld had before him, will probably never be known with certainty, but after taking all the evidence into account, I am inclined to believe that Whitelegge's identifications of *E. levis* and *E. rubra* are correct, those of *C. australis* and *C. macropora* wrong. The two former as well as Whitelegge's *C. macropora* I will describe as *Crella incrustans*, var. *levis*: Lendenfeld's *C. australis* and *C. macropora* are unknown to me. Whitelegge's *C. australis*, the subject of the following description, I regard as identical with Carter's *Plumohalichondria arenacea*. *Clathria australis*, Lendenfeld, would appear to resemble this last-mentioned only in external form; for according to its description, the skeleton is reticulate, the main fibres are entirely

filled with (stylote) spicules, the connecting fibres are without spicules and echinating acanthostyles are rare; its locality is Port Phillip. In Whitelegge's *Clathria australis* on the other hand, the skeleton is dendritic, the fibres are in part loaded with sand particles, and are so densely echinated that even where the fibres are free from inclusions, the relatively few coring spicules (oxea and acanthostyles) are usually hidden from view; moreover, the specimen which Whitelegge regarded as the type-specimen was obtained (according to the information supplied by the Museum Register) from Port Jackson.

Crella incrustans var. *arenacea* bears a certain amount of resemblance, so far as habit of growth is concerned, with the variety *mammillata*, R. and D. The chiefly marginal location of its oscula and, in correlation with this, the arrangement of the main excurrent canals, as well as the presence of foreign particles in the skeleton, will, however, afford a ready means of distinguishing it from the latter. As an example of the sponge in one of its simpler forms of growth, the specimen figured by Whitelegge will serve, though a much more regularly flabellate form is sometimes attained. The specimen figured herein (Plate xxiii., fig. 3) shows to how great an extent this simplicity of form may be departed from. The specimens which I have examined are the same as those which formed the subject of Whitelegge's description together with several which have since been added to the Museum Collection. With three exceptions they are beach-worn dry specimens collected in the vicinity of Port Jackson. The exceptions are from the southern coast of Australia; two from Port Phillip, the other was obtained by the "Endeavour" off the coast of South Australia, and is well preserved in alcohol. So far as the difference in their state of preservation enables one to judge, there is no essential difference between the Port Jackson and the southern specimens, although it should be mentioned that whereas the latter are simply leaf-shaped, the former are without exception lobed or otherwise proliferate.

Description.—The original specimen, according to Carter's description, was irregularly club-shaped and lobed, with a contracted base; and measured about 230 mm. in height, by 60 mm. in diameter in its widest part. Dendy, who had a number of specimens before him, describes the external form in general terms as "massive to flabellate." The two Port Phillip specimens which I have seen are simply leaf-shaped and substipitate, the larger being 150 mm. in height, 85 mm. in greatest breadth and 15 to 25 mm. thick. The "Endeavour" specimen is similarly shaped, but has the margin of the plate

or frond, throughout about one-half its circumference, produced outwards on one side so as to form a wide flange; it measures 150 mm. in height, 100 mm. in breadth and 10 to 15 mm. in thickness. The specimens from the New South Wales coast—all of which, it should however be mentioned, were derived from very shallow water—are almost invariably of irregular growth owing to the proliferation in various ways of the original or primary frond. In spirits, the surface is even and glabrous, the consistency firm, tough, compressible and resilient, and the colour light greyish-brown. The rather thick dermal membrane is semi-translucent and enables one to discern the outlines of the more superficial exhalant canals lying close beneath. These canals, which occur on both sides of the sponge, are roofed by little more than dermal membrane only. They run upwards in a slightly radiating fashion from the base of the sponge usually to the margin, and terminate in small oscula $\frac{1}{3}$ to 1 mm. in diameter. Their number increases by occasional branching as they ascend, so that the distance separating them remains about the same throughout. In the dry state, the dermal membrane forms a dense whitish incrustation, and through shrinkage, often conforms more or less to the inequalities beneath. The partitions between the canals then appear on the surface as faint ridges. Where the incrustation is more or less denuded the surface presents the appearance shown in Whitelegge's figure;[1] the ridges are, however, sometimes much more, sometimes much less strongly pronounced. The texture is extremely dense and compact, and the sponge when dry is particularly hard and tough. The main skeleton consists of stout sinuous ascending fibres, repeatedly branching and anastomosing. There are no true connecting fibres, although the intercrossing of the longitudinal fibres often produces the appearance of such. The echinating acanthostyles are so densely crowded on the fibres that the coring spicules are usually concealed from view, but when discernible they prove to be chiefly acanthostyles.

Fig. 31—*C. incrustans* var. *arenacea*. Modifications of the opposite extremities of the oxea.

1 Whitelegge—*Loc. cit.*, pl. xi., fig. 14b.

Foreign bodies, chiefly large sand grains, occur at usually irregular intervals in the fibres, and sometimes in small patches in the ground substance. Different specimens exhibit considerable differences in regard to the amount of foreign material included. The ground substance is densely strewn with megascleres which consist almost entirely of accessory acanthostyles. The dermal skeleton is for the greater part a well-defined reticulation of acanthostyles with polygonal (usually five or six-sided) meshes, but in places (particularly on the margin of the sponge) the spicules become so closely packed that the insterstices of the meshwork are almost, if not entirely obliterated. Oxea are absent from the dermal skeleton.

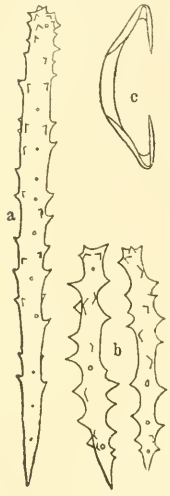

Fig. 32—*C. incrustans* var. *arenacea*. a Principal acanthostyle. b Dermal acanthostyles. c Isochela arcuata.

Megascleres.—

(i.) The oxea vary in length from about 160 to 200 μ; the stoutest are 7 or (rarely) 8 μ in diameter.

(ii.) The principal acanthostyles reach a maximum size of 160 x 10-11 μ.

(iii.) The dermal acanthostyles vary in length from 65 to 110 μ, or even slightly longer; they are usually between 75 and 100 μ in length; acanthoxea occur among them as rarities. The longest are usually straight spicules with slightly recurved spines and more closely resemble the *principal* acanthostyles than is usually the case. The stoutest are about 8-9 μ in diameter.

Microscleres.—

The chelæ, which are about 12 to 18 μ long, show no appreciable separation into two groups.

Locs.—Port Phillip, Victoria (*Carter*, *Dendy*, Austr. Mus. Coll.); southern coast of South Australia, eleven miles N.N.W. of Cape Martin, 21 fms. ("Endeavour"); eastern coast of New South Wales (Austr. Mus. Coll.).

CRELLA INCRUSTANS, *Carter*, *var.* LEVIS, *Lendenfeld*.

(Figs. 33, 34.)

1888. *Echinonema levis*, Lendenfeld, Cat. Sponges Austr. Mus., 1888, p. 220.

Echinonema rubra, Lendenfeld, *Loc. cit.*, p. 221.

1901. *Plumohalichondria australis* (*pars*), Whitelegge, Rec. Austr. Mus., iv., 2, 1901, p. 90, pl. xl., figs. 14, 14a.

(*Echinonema lævis*), Whitelegge, *Loc. cit.*, p. 91, p. 212.

(*Clathria macropora*), Whitelegge, *Loc. cit.*, p. 91.

[1888 ? Not *Clathria macropora*, Lendenfeld, Cat. Sponges Austr. Mus., 1888.]

Form variable, ranging from sub-massive and plate-like to clumsily ramose. Oscula small, distantly scattered, often situated (singly) on the apices of conical prominences. A distinctive feature is the arrangement of the subdermal oscular canals; these become conspicuous only in the vicinity of the oscula, each of which forms a common orifice for several canals running more or less radiatingly towards it. Texture dense. Fibres cored by oxea and acanthostyles, and moderately densely echinated by the latter. Dermal skeleton reticulate. Megascleres, maximum sizes:—(i.) Oxea, 190 x 6 μ; (ii.) principal acanthostyles, 180 x 8 μ; dermal acanthostyles, 100 x 6 μ. Isochelæ arcuatæ, 16 to 22 μ long.

Introductory Remarks.—The original descriptions state that the coring spicules of the fibres are styli; but with this exception, the descriptions accord fairly well on the whole with requirements, and there can scarcely be the slightest doubt that the sponges under consideration are identical with those to which Lendenfeld referred. The variety is well represented in the Museum Collection, and among the specimens are quite a number bearing labels in Lendenfeld's writing. The specific name *rubra*, however, occurs in connection with only one of these and, even so, in association with the generic name *Clathrissa*. But Whitelegge has already pointed out that a co-type specimen of *E. rubra* in the British Museum is of the same species as *E. levis*, and the original descriptions also point to the identity of the two. Moreover, one is led to conclude that Lendenfeld himself subsequently recognised their identity, since, included among the specimens labelled by him *E. levis*, there are some which, like the original specimens of *E. rubra* retain in alcohol a bright scarlet colour. It is pretty certain, therefore, that *E. rubra* is correctly a synonym of *E. levis*.

On the other hand, the identification of *Clathria macropora*, Ldf., with this species is slightly beyond reason, and one can only assume, for the present, that the "type" specimens of

C. macropora referred to by Whitelegge are mislabelled. The chief reasons for the rejection of *C. macropora* as a synonym of *E. levis* are two in number:—(i.) Lendenfeld perceived the specific identity of the different specimens of *E. levis* on the one hand and of those of *E. rubra* on the other, throughout their many variations; and it is therefore most unlikely that he would assign other examples of the same species to a different genus. (ii.) Lendenfeld says of *C. macropora* that "the oscula are very conspicuous and scattered over the whole surface" and "are on an average 5 mm. wide and fairly abundant." The inference to be drawn from Whitelegge's remarks in this connection, viz., that Lendenfeld may have mistaken for oscula holes produced by a boring Isopod, is highly improbable, and the more so since, as Whitelegge himself points out, *E. levis* sometimes exhibits holes of the same kind—but Lendenfeld was evidently not deceived by these. Oscular canals, the peculiar arrangement of which has been referred to in the diagnosis, are not discernible in specimens which have been denuded of dermal covering, and in their case accordingly, the most important feature for their identification is absent. This is the condition of many of the specimens before me which I assign to the present variety; although a number of these depart very considerably in form from such of the specimens as are with certainty identifiable, the occurrence of seemingly intermediate forms nevertheless renders it pretty certain that they all belong to the one variety. Moreover, Lendenfeld's account of the external form covers all these cases.

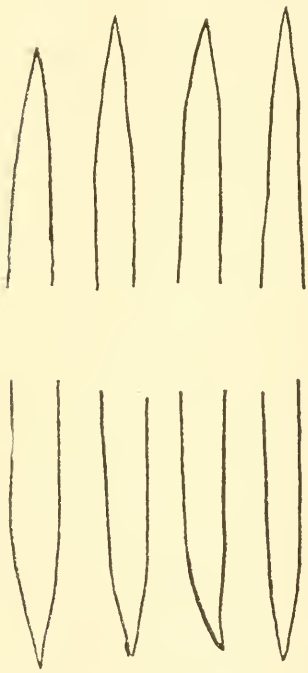

Fig. 33—*C. incrustans* var. *levis*. Modifications of opposite extremities of the oxea.

Description.—The sponge consists of a compressed trunk-like or (rarely) more cylindrical and stalk-like basal portion from which arise few or many short branches which are typically massive and irregular (Whitelegge, Plate xi., fig. 14) but may vary from cylindrical to much compressed or even

frond-like In some cases the trunk may grow to a considerable size—even assuming the form of a broad, erect plate—whilst the "branches" may be reduced to the proportions of marginal lobes, or may be wholly absent (Whitelegge, Plate xi., fig. 14a). In consistency the sponge is hard and tough, resembling in this respect the variety *arenacea*.

The fibres do not to any appreciable extent form a pseudo-reticulation, as in the preceding varieties, but as a rule run side by side in close parallelism, and are sometimes fused several together for considerable distances, forming what might be termed "compound" columns. The acanthostyles are much less densely crowded on the fibres than in the variety *arenacea*, and as a consequence the coring spicules are always visible and show themselves to consist both of oxea and acanthostyles, the former predominating. The ground substance is densely strewn with acanthostyles and oxea, of which the former are in the greater abundance. Owing to the close arrangement of the fibres and the multitude of spicules, the skeleton is much more compact and dense than in any other variety herein described with the possible exception of *arenacea*. The dermal skeleton resembles that of the last-mentioned variety.

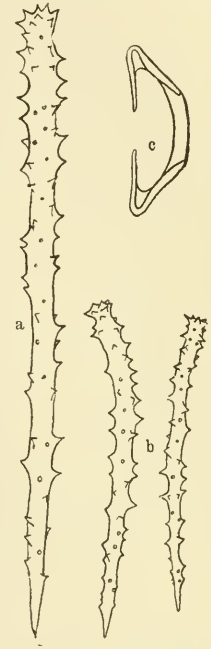

Fig. 34—*C. incrustans* var. *levis*. a Principal acanthostylus. b Dermal acanthostyli. c Isochela arcuata.

Megascleres.—

(i.) The oxea vary in length from 160 to 200 μ; the stoutest are 6 μ in diameter.

(ii.) The principal acanthostyles attain a maximum size of 180 x 8 μ.

(iii.) The dermal acanthostyles are rarely less than 80 μ long, and commonly exceed 100 μ; their greatest length is about 120 μ and the greatest diameter 5 or (rarely) 6 μ.

Microscleres.—

The chelæ, which vary in length from 13 to 18 μ, show no appreciable separation into two groups.

Loc.—Port Jackson (Austr. Mus. Coll.).

CRELLA INCRUSTANS, *Carter, var.* PUMILA, *Lendenfeld.*

1888. *Clathrissa pumila*, Lendenfeld, Cat. Sponges Austr. Mus., 1888, p. 218.

> *Sponge encrusting, thin; surface uneven or irregularly conulated. Oscula small, scattered. Main skeleton consisting of ascending columns of acanthostyles and descending columns of oxea. Acanthostyles of the dermal skeleton scattered without order. Megascleres, maximum sizes:—(i.) Oxea, 170 x 5.5 μ; (ii.) principal acanthostyles, 145 x 10 μ; (iii.) dermal acanthostyles, 80 x 5.5 μ. Isochelæ arcuatæ, of a single kind, 12 to 10 μ long.*

Introductory Remarks.—Lendenfeld described the outward appearance of the typical variety of his *Clathrissa pumila* in the following terms:—"Small, incrusting, conulated sponges, of a light rose colour in the fresh state and grey when preserved in spirit. The conuli are on an average 2 mm. high and 4 mm. apart. Small oscula .8 mm. wide are scattered irregularly over the surface." His complete description of the variety *rubra* is exceedingly brief:—"Massive or incrusting sponges with small conuli 1 mm. high which are very close together. The largest specimens attain a height of 20 mm. The colour of the living sponge is bright scarlet. The skeleton is similar to that of the species." It will be observed that, so far as the description informs us, the variety is distinguished only by the slightly lesser height of its conuli, and by the deeper shade of its colour—neither of which differences possesses in itself any importance. An examination of the type-specimens, however, renders it exceedingly probable that Lendenfeld's descriptions have reference to two quite distinct varieties. The type specimens of *E. pumila* and its variety are separately represented each by a bunch of stout seaweed roots that are almost completely over-grown with encrusting sponges of quite a number of different kinds. It was necessary to examine several of these before it could be said with certainty which were the actual examples of the species, and as a result it has been found that there are among them two varieties which accord very well with the descriptions so far as external features are concerned; that is to say, one of them appears to be invariably of encrusting habit, whilst the other may assume a massive form, becoming cake-shaped. In regard to their inner structure, however, they do not comply with the descriptions inasmuch as their skeletons are not similar, and there is a notable difference in the size of their megascleres; furthermore the variety which

agrees in outward features with *C. pumila* var. *rubra* happens to be that one of the two which accords with the typical *C. pumila* in internal features. One must conclude, therefore, either that Lendenfeld did not examine the structure of the skeleton in his two varieties sufficiently closely to detect their difference, and inadvertently ascribed to the typical variety the skeletal features which belong to the variety *rubra*; or that the descriptions are really correct, that his two varieties consequently were merely different growth stages of one and the same variety, and that the sponge which agrees externally but not internally with *C. pumila* is a new variety which Lendenfeld overlooked. The former conclusion is the more probable and the one which I therefore adopt. Both *C. pumila* and *C. pumila* var. *rubra* are capable of being regarded as varieties of *Crella incrustans* since their spicules exhibit all the features characteristic for the species. They may accordingly be named *C. incrustans* var. *pumila*, and *C. incrustans* var. *rubra*, respectively. The following is a description of the the former.

Description.[1]—The sponge, as far as known; is encrusting, forming a layer (usually of about 1 mm. thickness) which may spread over a considerable area. The surface is minutely rugged or papillated and, in parts, conulose. The colour is greyish white in spirit; in life, according to Lendenfeld, it is of a rose-tint. Small rounded openings, which may be oscula, occur here and there at wide intervals.

The basal layer of spongin, with which the sponge covers the substratum, is densely echinated with vertically-standing acanthostyles. The main skeleton consists of both ascending and descending spicular columns, which might be termed respectively *principal* and *auxiliary* columns. The principal columns are single or once or (rarely) twice branched fibres running upwards from the base of the sponge, and composed of a spongin-axis with embedded and echinating acanthostyles, and sometimes in addition containing a few coring smooth oxeotes. The auxiliary columns, which proceed downwards from the dermal layer, consist entirely of smooth oxeotes without visible cementing material. As a rule, the ascending and descending columns meet at varying distances from the surface, so that there results in consequence composite columns, in the lower portion of which the spicules are acanthostyles, in the upper portion, oxea. Frequently, however, the auxiliary columns are not encountered by principal columns, and then sometimes reach to the very base of the

1 In many respects this sponge resembles the recently described *Crella incrustans*, var. *Thielei* (Hentschel Fauna Südwest-Australiens, Bd. 3, p. 345.

sponge; at the surface they are penicillately spread out, forming sub-dermal brushes with the points of the spicules impinging on, but not piercing, the dermal membrane. The principal columns appear never to quite reach the surface but to be invariably capped with a column or a brush of oxea. The interstitial megascleres are almost exclusively acanthostyles: in the upper part of the sponge they are sometimes very numerous, and form a conspicuous feature of the skeleton; but this is not a constant feature, and generally speaking, scattered spicules are of no great abundance. The dermal skeleton consists solely of irregularly and fairly closely scattered accessory acanthostyles.

Megascleres.—

(i.) The oxea vary in length from 130 to 170 μ and are thus shorter than in any other of the known varieties. They are slender spicules, rarely exceeding 4.5 μ and never more than 5.5 μ in diameter.

(ii.) The principal acanthostyles attain a maximum size of 145 x 10 μ.

(iii.) The dermal acanthostyles vary in length from about 60 to 80 μ; the stoutest are less than 6 μ in diameter.

Microscleres.—

The chelæ are of a single kind, similar to those of the variety *levis*, and 12-16 μ long.

Loc.—Port Jackson (Austr. Mus. Coll.).

CRELLA INCRUSTANS, *Carter*, VAR. RUBRA, *Lendenfeld.*

1888. *Clathrissa pumila* var. *rubra*, Lendenfeld, Cat. Sponges Austr. Mus., 1888, p. 219.

Very small, encrusting or cake or dome-shaped sponges with smooth or papillated surface. Main skeleton consisting of branching, ascending, occasionally anastomosing, fairly densely echinated fibres often with a distinct core of oxea, but usually with acanthostyles in addition and sometimes containing acanthostyles alone. There are no descending columns of smooth oxea as in the preceding variety. The dermal skeleton consists of scattered accessory acanthostyles. Megascleres, maximum sizes:—(i.) Oxea, 200 x 5 μ; (ii.) principal acanthostyles, 160 x 8 μ; (iii.) dermal acanthostyles, 80 x 5 μ. Isochelæ arcuatæ, 12 to 16 μ long.

The original description of the external features of this sponge was as follows:—"Massive or incrusting sponges with small conuli about 1 mm. high which are very close together.

The largest specimens attain a height of 20 mm. The colour of the living sponge is bright scarlet." To this it may be added that the surface is sometimes free from conuli, and that the colour in alcohol is brownish-grey. The largest which I have seen is 15 mm. in diameter and 5 mm. in height. Oscula have not been observed.

The diagnosis contains pretty well all which need be said concerning the skeleton. The basal layer of spongin is densely echinated with erect acanthostyles. Columns of oxea, free from echinating acanthostyles, such as are characteristic of the preceding variety, have not been observed. Occasionally the coring oxea at the extreme upper extremity of the fibres spread out penicillately and form a sub-dermal tuft, but as a rule the character of the fibre remains unaltered quite to its point of arrival at the dermal membrane. The interstitial megascleres, which are almost exclusively acanthostyles, are fairly abundant. Oxea external to the fibres are extremely rare except (occasionally) immediately beneath the dermal membrane. The dermal skeleton is similar to that of the variety *pumila*.

Megascleres.—

(i.) The oxea vary in length from about 160 to 200 μ; the stoutest are 5 μ in diameter.

(ii.) The principal acanthostyles attain a maximum size of 160 x 8 μ.

(iii.) The dermal acanthostyles vary in length from about 60 to 80 μ and do not exceed 6 μ in diameter.

Microscleres.—

The chelæ, which resemble those of the variety *levis*, are 12 to 16 μ long.

Loc.—Port Jackson (Austr. Mus. Coll.).

Genus Echinodictyum, *Ridley*.

Echinodictyum elegans, *Lendenfeld*.

(Plate xxiii., fig. 1, and fig. 35.)

1888. *Kalykenteron elegans*, Lendenfeld, Austr. Mus. Cat. Sponges, 1888, p. 216.

Kalykenteron silex, Lendenfeld, *Loc. cit.*, p. 217.

1901. *Thalassodendron typica*, Whitelegge (*non* Lendenfeld), Rec. Austr. Mus., iv., 2, 1901, p. 86.

Sponge lamellar, usually vasiform, subsessile. Surfaces rarely quite even, the outer, and sometimes to a

slight extent the inner, usually raised into few or many mammiform, or more or less irregular elevations. Oscula small, confined to the inner surface (fide Lendenfeld). Skeleton-fibres stout; both main and connecting, almost entirely composed of closely-packed oxeote spicules. Spicules:—(i.) Somewhat angulately curved oxea of very variable proportions, usually with the extremities somewhat blunted, and often slightly monilated; their greatest size varies in different specimens from 410 x 13 μ to 620 x 18 μ; (ii.) sub-cylindrical acanthostyles with distal extremity strongylotely rounded; spines more or less compressed transversely to the length of the spicule, and recurved; at both extremities of the spicule the spines are smaller and more crowded; the maximum size of the spicule varies in different specimens from 105 x 10 μ to 130 x 12.5 μ; (iii.?) slender styli of variable diameter up to about 5 μ which are possibly young stages of the first-mentioned.

The previous accounts of this species are so misleading in regard to the dimensions of the spicules that a re-description which will render further reference to them unnecessary, is desirable. Owing, however, to the imperfect preservation of the available specimens—six in number, all dry, and more or less macerated—an entirely satisfactory description is not at present possible. With regard to external features, the original description of *Kalykenteron elegans*, says:—"A very elegant, conical, cup-shaped sponge attaining a height of 220 mm. The margin of the cup is circular and has a diameter of 120 mm. Both surfaces are very irregular and covered with numerous projections of varying size and shape. The outer surface is somewhat rougher than the inner. The small circular oscula are confined to the latter." Concerning *Kalykenteron silex*, Lendenfeld states:—"The sponge consists of a meandriform lamella which grows up from a small base of attachment; it is somewhat flower-shaped, often caliculate. The whole sponge attains a height of 120 mm. The lamella is pretty uniformly 6 mm. thick and rounded at the margin."

The specimens before me, with the exception of that labelled *Kalykenteron silex* (type), range in form from conical cup-shaped to shallow saucer-shaped, and are attached by a narrow base not prolonged into a stalk. The largest example is the type-specimen (Plate xxiii., fig. 1) which measures 225 mm. in height, and has the cup wall 6 to 10 mm. in thickness. It is now much compressed, but this is probably due to artificial influences; in the others, the cup-margin is circular. The type specimen agrees with one other, in having the outer surface

covered with numerous prominences of somewhat irregular shape, but of fairly uniform size, whilst the inner surface is uneven, though devoid of any pronounced inequalities. In the remaining specimens the inner surface is quite free from irregularities of any kind, whilst the outer surface is merely lumpy or provided with rounded tubercular elevations of larger size and relatively lesser number than in the type. Finally in the type specimen (*sic*) of *K. silex*, both surfaces are plain. This last-mentioned is merely a small piece of the original including portion of the margin, which is sinuous; it was evidently taken from a "meandriform lamella" about 6 mm. thick. The "minute circular oscula" confined to the inner surface, which Lendenfeld mentions for *K. elegans*, are not discernible in the present condition of the specimens. The consistency is very hard and firm, and the texture coarse and fibrous. The statement of Whitelegge that the sponge (as represented in a macerated specimen) resembles a "washed-out *Chondropsis*" is meaningless. Lendenfeld's description of the main skeleton is fairly correct, though slight amendments are necessary. He says:—"The skeleton consists of a dense network of exceedingly thick fibres. The main fibres, which extend longitudinally from the base of the sponge to the margin of the cup are .2 mm. thick. The connecting transverse fibres have an average diameter of .07 mm. The meshes of the network are .48 mm. wide. The fibres consist of dense masses of oxea which are all parallel and disposed longitudinally." His description of the skeleton in *K. silex* is very slight, and moreover (if the ostensible type-specimen is, as all the evidence indicates, genuine) inaccurate. It is as follows:—"The skeleton consists of spicule-bundles .2 mm. thick, composed of large and stout styli. There is hardly any spongin discernible. The fibres are echinated by spined styli .09 mm. long and .008 thick." The use of the word "styli" in the latter connection is evidently an error, since Lendenfeld defines the genus *Kalykenteron* as being distinguished in the

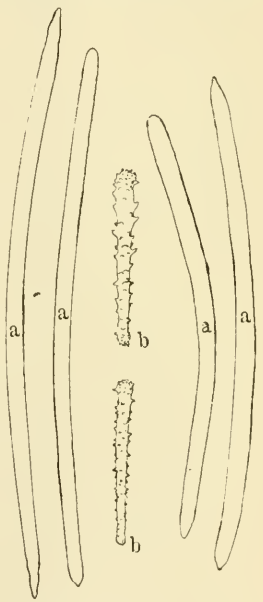

Fig. 35—*E. elegans*. a Oxea (showing various stages in their passage into strongyla). b Acanthostyli.

possession of spined strongyla. It is therefore only necessary to assume that the same word in its first occurrence is miswritten for "oxea," and the description throughout becomes perfectly congruous. In correction of the quoted description of the main skeleton, it is necessary to mention that the main fibres do not, strictly speaking, extend from the base to the margin of the cup; but as they ascend, trend towards and terminate at the lateral surfaces, whilst new directive fibres branching off from these, continually arise to take their place. In specimens in which the surface is even, the skeleton reticulation is very regularly subrectangular, even though the connecting fibres often form interreticula of small extent between the main ones. With increase of surface irregularity however, the reticulation tends to become confused. The measurements which are given for the fibres and mesh, so long as they are regarded as conveying an approximate idea, may be allowed to stand. It is impossible with no better material than the present, to speak with certainty of the dermal skeleton, though the indications render it fairly safe to say that anything of a special nature is absent. The errors of previous descriptions in regard to the dimensions of the spicules are partly due to the fact of their great variability in size. The frequency of occurrence of a spicule of given size decreases rapidly as its length recedes from the average, so that one can never make quite sure of the maximum attainable size. This is more particularly true of the principal spicules. Whenever, in any species such great variability in the size of spicules is found in a single given specimen, it is, generally speaking, fairly safe to assume that considerable variations in their maximum size are likely to occur in different specimens. I have made such an assumption in the present instance. The largest spicules were found in the type specimens of *K. elegans* and *Thalassodendron typica*, Whitelegge, in both of which the oxea vary in length from 150 to 620 μ and may attain a diameter of 18 μ. In the type-specimen of *K. silex*, which departs most widely from these in regard to the size of the spicules, the length of the oxea varies from 130 to 410 μ, whilst the maximum diameter is only 13 μ. Among the slenderest spicules a small proportion of styli are found; but as these are of equal length with the slender oxea and are frequently curved in the same way, it is difficult to say whether they are to be regarded as abnormalities or as representing the auxiliary spicules of other species. It is perhaps significant, however, that they do not attain to more than 5 μ in diameter, and that what appear to be transitional forms between them and the oxea are very rare. Their maximum length, which varies in different specimens concomitantly with that of the other

spicules, is about two-thirds to three-fourths of the length of the principal spicules.[1]

This species will probably prove to be identical with *E. bilamellatum*, Lamarck.[2]

Locs.—Lendenfeld records the species from Western Australia, and the type-specimen is labelled to that effect. All the remaining specimens, however, are from the eastern coast, Port Jackson (Austr. Mus. Coll.); Coast of Queensland, seven miles south-south-east of Double Island Point, 32-33 fms. ("Endeavour.")

Genus Rhaphidophlus, *Ehlers.*

1870. *Rhaphidophlus*, Ehlers, "Die Esper'schen Spongien" (Erlangen), 1870, pp. 19, 31.

1870. *Tenacia*, O. Schmidt, "Grundzüge einer Spongien-Fauna des Atlantischen Gebietes," 1870, p. 56.

1875. *Echinonema*, Carter, Ann. Mag. Nat. Hist. (4), xvi., 1875, p. 185.

1888. *Clathriopsamma* (pars), Lendenfeld, Cat. Sponges Austr. Mus., 1888, p. 227.

> *As in Clathria, the main skeleton is a reticulation of well-developed horny fibres cored by (principal) styli and echinated by (typically spined) accessories; and the microscleres are palmate isochelæ and toxa. The distinctive feature is the presence of a dermal skeleton of vertically arranged styli, which are derivatives of, and are typically shorter than, the auxiliary styli. The chelæ are of one or two kinds, and the toxa, which are sometimes of great length, may lose their distinctive character and may either assume the form of indefinitely-shaped trichitoidal spicules or become indistinguishable from ordinary oxea.*

The abandonment of the genus *Rhaphidophlus* has been recommended on the ground that the single feature distinguishing it from *Clathria* shows such varying degrees of development in different species that no hard and fast line can be drawn between the two genera. It should, however, be pointed out that, whereas in some species of the *Rhaphidophlus-Clathria* group the dermal skeleton is composed of

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1 Whitelegge mentions the occurrence in this species of "straight smooth styli, size .8 to 1 by .0015 mm." As I have failed to find any such, I am of the opinion that the spicules observed by Whitelegge were intrusive.

2 Since writing the above I have seen Hentschel's description of *E. bilamellatum* (Fauna Südwest-Australiens, Bd. iii., 1911, p. 385), and have now no reason to doubt that *E. elegans* is identical with that species.

undifferentiated auxiliary spicules yet in many of the species which have been assigned to *Rhaphidophlus* (including among them—I have reason to believe— the type-species) the dermal spicules are of a special kind. It would seem therefore that the basis for a distinction between the two genera is to be sought for, not to any extent in the degree of development of the dermal skeleton, but rather—in what is essentially of greater systematic importance— in the nature of the spicules composing it. It is quite probable that this distinction also will be found to break down; but in the absence of any well established evidence in proof of this, it seems to me not improper to still employ, tentatively, the name *Rhaphidophlus* for such species as those herein described, viz., *R. typicus*, *R. paucispinus*, and *R. reticulatus*.

It cannot be regarded as other than a fact of considerable significance that in *R. typicus* and in *R. paucispinus* the constitution of the dermal skeleton is precisely the same; yet the difference in the characters of their microscleres show the two species, considered as members of a single genus, to be rather widely separated. Thus, although in *R. typicus* the chelæ have become differentiated into two groups and the individual toxa replaced by toxodragmata, whilst in *R. paucispinus* neither of these changes has occurred; yet in both species we find that the dermal skeleton consists of reticulating lines of upright shorter styli underlain by horizontally disposed longer styli. This type of dermal skeleton would therefore appear to be phylogenetically one of long standing, and on that account to confer on these and related species[1] no slight claim to congeneric distinction. On the other hand, since the vertically disposed or *special dermal* styli as they may be termed, are (as is evident from a study of the two species referred to) nothing more than a section of the auxiliary spicules which have become slightly modified in correlation with their fulfilment of a special function, it follows that species in which the transitional types of dermal skeleton have persisted, may reasonably be expected to occur. This consideration points to a possible difficulty in the way of satisfactorily defining and so justifying the maintenance of *Rhaphidophlus*, but it does not, in itself, provide a sufficient reason why the genus should be rejected.

Among the species, which must be taken into account in devising a suitable definition for the genus, is the interesting

1 By "related species" I do not imply merely those which possess a similar type of dermal skeleton, but would also include any which might afford proof of their derivation therefrom, even though their special dermal styli had become secondarily non-existent.

Clathriopsamma reticulata, Lendenfeld.[1] The character of its microscleres leaves scarcely any room to doubt that this species is lineally related to *R. typicus*; and the disposition of its dermal spicules accordingly indicates that the reticulate arrangement of the latter as described for *R. typicus* and *R. paucispinus* is not to be regarded as an essential generic feature. Of the species whose descriptions indicate that they belong to *Rhaphidophlus* rather than to *Clathria*, I have been able to obtain information of the following in addition to those herein described:—*R. cratitius*, Esper, *R. filifer*, Ridley and Dendy, *R. spinifer*, Lindgren, *R. seriatus*, Thiele, *R. topsenti*, Thiele, *R. erectus*, Thiele, *R. cervicornis*, Thiele, *R. coralliophilus*, Thiele, *Tenacia clathrata*, O. Schmidt, *Clathria jugosa*, Wilson, *Clathria acanthodes*, Hentschel, and possibly also *C.* (*Rhaphidophlus*) *Spiculosa*, Dendy.[2] In the description of *Clathria acanthodes* the interstitial auxiliary spicules have probably been confused with the principal spicules owing to their close resemblance to them. A number of these species are scarcely to be regarded as more than varieties. The peculiar *Rhaphidophlus bispinosus*, Whitelegge,[3] is probably a *Clathria* of the *C. caelata-C. clathrata* series; unfortunately the type-specimen, which was very small, appears to have been lost.

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1 Lendenfeld—Cat. Sponges Austr. Mus., 1888, p. 227. This species is represented in the Australian Museum Collection by a number of specimens, one of which, labelled as the type, is poorly preserved in alcohol. The specimens appear to be incomplete, though they are sufficient to show that the sponge is of ramose habit, but that frequent anastomosis of the branches (which may attain a diameter of 10 mm. or more) often results in the formation of a "reticulate mass." The main skeleton is a loose irregular reticulation of mostly longitudinal fibres which are profusely strewn, rather than cored, with spicules, and for the most part also with foreign bodies, and are echinated by rather abundant acanthostyles. Spicules occur in the ground substance in fair abundance; they comprise auxiliary subtylostyli, extremely long slender oxea (toxa) often occurring in loose dragmata, and numerous palmate isochelæ of two sizes, the smaller of which are chiefly contort. There is a well-developed loosely attached dermal membrane; but, unfortunately, even in the spirit specimen, only the merest damaged tatters of it remain, so that it is impossible to speak with certainty concerning the arrangement of the dermal skeleton. The special dermal spicules, so far as can be judged, stand more or less vertically and appear to be gathered into tufts and ill-defined tracts. The principal styli are characterised by a basal tylosis which has a spinose or rugged surface, and is separated off from the rest of the spicule by a slight constriction; they are straight conical spicules varying in length from about 150 to 320 μ, and attaining a diameter of 12 μ. The auxiliary styli (and subtylostyli) are straight spicules nearly always provided with a distinct spination on the extreme basal end; those which occur interstitially reach a maximum size of 300-320 x 5-5.5 μ, whilst those which constitute the special dermal spicules rarely if ever (apparently) exceed a size of 250 x 4 μ. The accessory acanthostyles are conical spicules with fairly large recurved spines scattered over their whole length; size 60-90 x 8 μ. The larger isochelæ are 12 to 17.5 μ in length and are rarely contort, the smaller are 6 to 9.5 μ long and as a rule contort. The toxa are long and slender, straight or curved spicules without any trace of the mid-flexure so characteristic of toxa, and consequently resemble oxea; they occur singly and in dragmata; the very largest of them are at least 700 x 3 μ in size.

2 Dendy—Ann. Mag. Nat. Hist. (6), iii., 1889, p. 86, Pl. iv., fig. 4.

3 Whitelegge—Mem. Austr. Mus., iv., 10, 1907, p. 503.

Rhaphidophlus paucispinus, *Lendenfeld.*

(*a*) Typical Form.

(Plate xxv., fig. 1; Plate xxvi., fig. 1; and figs. 36, 36a.)

1888. *Thalassodendron paucispina*, Lendenfeld, Austr. Mus. Cat. Sponges, 1888, p. 224.

Thalassodendron rubens, var. *dura* (pars), Lendenfeld, *Loc. cit.*, p. 224.

Thalassodendron rubens, var. *lamella* (pars), Lendenfeld, *Loc. cit.*, p. 224, pl. vii.

1901. *Thalassodendron rubens* (pars), Whitelegge, Rec. Austr. Mus., iv., 2, 1901, p. 87.

(*T. rubens*, var. *dura*; *T. rubens*, var. *lamellosa*; *T. paucispina*), Whitelegge, *Loc. cit.*, p. 87.

(*b*) *Var.* Multipora, *Whitelegge.*

(Plate xxv., fig. 2.)

1907. *Clathria multipora*, Whitelegge, Austr. Mus. Mem., iv., 10, 1907, p. 496, pl. xlv., fig. 23.

General Diagnosis.—Sponge variable in habit, uniflabellar, multiflabellar or ramose; usually attached by a more or less extended disc-like foot, with or without the intervention of a stalk. In all cases the form assumed is the outcome of a more or less distinctly expressed tendency to the restriction of growth to one plane. No oscula. Dermal membrane strongly developed, appearing in the dry sponge as a white pellicle or incrustation. The surface exposed by the removal of the dermal skin is closely dotted with pinhole-like punctures. The main skeleton is a fairly regular, small-meshed reticulation of stout fibres; the main fibres contain a semi-diffuse core, the connecting fibres are short and invariably enclose one or a few spicules. The dermal skeleton is a well-defined reticulation of lines of crowded styli of two sizes, the smaller standing vertically, the larger lying horizontally beneath these and supporting them. Megascleres:—(i) Stouter, usually slightly curved (principal) styli, chiefly confined to the fibres, varying in maximum size in the different forms from 200 x 9 to 350 x 16 μ; (ii.) conical tapering acanthostyli, most densely spined on the basal end, occurring sparsely as echinating spicules and scattered in the ground-substance; length 90-100 μ; (iii.) slenderer, usually straight (auxiliary) styli (or subtylostyli) of the same length as, or slightly shorter than the principal, occurring horizontally in the dermal membrane

and scattered in the ground-substance; (iv.) shorter subtylostyli (or styli) of scarcely one-half the length of the preceding, almost entirely restricted to the dermal layer. A larger or smaller proportion of the megascleres (i.), (iii.) and (iv.), are provided with a minute basal spination; this spination is the normal condition of dermal styli and is of least frequent occurrence amongst the principal styli. Microscleres:—(i.) Palmate isochelæ of a single kind varying in maximum length in the different forms of the sponge from 20 to 25 μ; (ii.) angulately curved toxa 60 to 80 μ in length, and 2 to 2.5 μ in diameter.

Introductory Remarks.—As the result of an examination of the figured specimen of *Thalassodendron rubens* var. *lamella*, and of undoubted specimens of *T. rubens* var. *dura* (=*Clathria rubens*), I find that Lendenfeld has confused the descriptions of these two sponges. The descriptions of their external characters are proper, but those of their skeletal characters should be interchanged. To further add to the confusion, Whitelegge, overlooking the essential points of difference between the two, united them, together with *T. brevispina*, as a single species, *Clathria rubens:* of the five specimens whose spicular characters he has separately described—though not quite accurately—the second (labelled "*Thalassodendron rubens* var. *dura*, No. 343"), as well as the third and fifth, belong to the present species (*vide* Whitelegge, *Loc. cit.*, pp. 86, 87).

Description.—

(*a*) *Typical variety.*

The sponge is frequently—except for the presence of marginal digitations—perfectly lamelliform. More usually, however, growth proceeds by the rapidly-repeated multiplication—always chiefly or entirely in one plane—of ascendant, cylindrical or slightly compressed, anastomosing branches, and results in the formation of a reticulated or fenestrated flabelliform expansion. From this, a more or less continuous lamella may in some cases be secondarily produced, through the gradual obliteration of the interspaces by vertical ingrowth. It is either owing to this latter mode of origin or because an actual separation into branches is not quite fully accomplished, that the surface in lamelliform examples is often, as Lendenfeld states, "slightly grooved." In some instances the sponge shows a marked disposition towards a freely branching habit, but in no observed case is there, as is usual in the variety *multiporus*, an entire absence of anastomosis or of confluence of branches. The specimen of *T. rubens* var. *lamella*, figured

by Lendenfeld, will serve as an example of the sponge in its more (secondarily attained) lamelliform condition; whilst the one shown herein (Plate xxv., fig. 1) represents a condition intermediate between the preceding and that which is exhibited by the most ramose examples of the variety. The former specimen, it should be mentioned, is somewhat abnormal on account of its rugged surface, and the number of digitiform

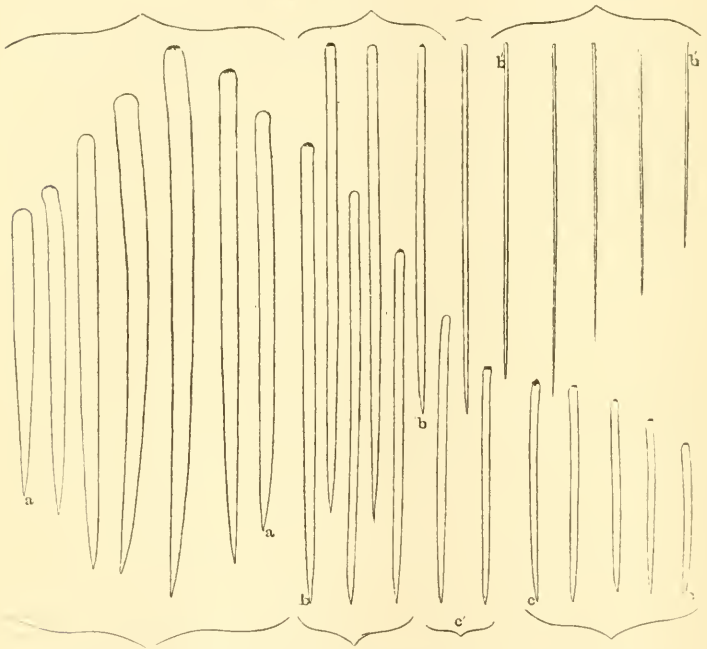

Fig 36—*Rhaphidophlus paucispinus.* a Principal styli. b, b' Auxiliary styli. c Special dermal styli. c' Styli intermediate between the auxiliary and dermal.

processes which arise from both its sides. Though some of these processes are probably of adventitious origin, others appear to be branches which have deviated from the plane of growth and so become excluded from participation in the formation of the main body. The maximum of sub-division into separate parts amongst the present specimens is shown by the specimen figured in Plate xxvi.; in this case the primary lamella has broken up into a number of sub-lamellæ, which come to lie in overlapping planes. The sponge, even in those rare cases in which a stalk is formed, is usually attached by a broad, often spreading disk, from which additional upgrowths

may arise. These latter are, in all the observed instances, simply digitiform, and they quite frequently become united above with the main body. The consistency in alcohol is firm and tough, and in the dry state rather hard and stiff. In some specimens preserved in alcohol, the colour throughout is purplish red; in others the dermal membrane is milky white, the internal parts light brownish yellow. In dry specimens, as far as known, the colour, except of the dermal incrustation, varies from straw yellow or rusty brown; the darker hue belongs to those in which probably the life-colour was purplish, although the type-specimen of *T. rubens* var. *lamella*, contrary to the implication of the specific name, shows no trace either of red or brown. The sponge grows to a considerable size. The largest specimen measures 265 mm. in height and 380 μ in breadth. The thickness of the lamella, and of branches perpendicular to the plane of growth, varies in different specimens or in different parts of a single specimen from 5 to 10 mm.

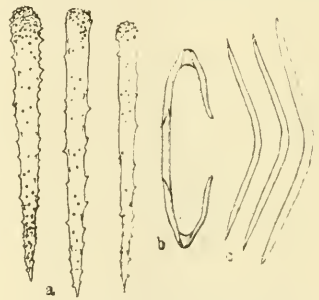

Fig. 36a. *R. pau ispinus.* a Acanthostyli. b Chela. c Toxa.

The main skeleton is a compact reticulation of strongly developed horny fibre which, even in the distal portions of the sponge, frequently attains a thickness of 160-200 μ. The pattern of the reticulation is subject to a considerable amount of variation, and the same is true with regard to the development of the spicular core and to the size of the smooth megascleres. As a matter of fact, the type-specimen of *T. rubens* var. *lamella* departs to such an extent, in all three respects, from the normal, that some hesitation was at first felt in identifying it with the typical form. As a rule, the reticulation is distinguished by a marked regularity, so that, in section, to the naked eye, it appears quite rectangular. Under the microscope, however, owing to the comparatively small size of the mesh in relation to the thickness of the fibres, the apertures of the reticulation are slightly rounded to sub-circular. In vertical transverse section of a lamella or median longitudinal section of a branch, the main fibres gradually trend outwards to the surface on either side of the middle line in a pinnate manner, dichotomosing repeatedly. The transverse fibres connecting these are often further united by secondary connectives parallel to the main fibres. Towards the surface these secondary connecting fibres frequently become continuous and

thus give rise to supplementary main fibres. The main fibres are occupied by a stout core of loosely packed spicules, which usually do not lie parallel to the axis of the fibre, but are inclined outwards from it at a small angle. As the extremity of the fibre is approached the spicules become more plumose in the arrangement, and more and more free from enveloping spongin and finally form a sheaf supporting, and to some extent piercing, the dermal membrane. The connecting fibres are never aspiculous, though they often contain but a single spicule. Acanthostyles occur in relatively small number scattered within the fibres, through the intermediate tissues, and as widely spaced echinating spicules. Smooth megascleres scattered through the ground substance are moderately abundant. This description of the main skeleton, as already pointed out, has reference to the condition which is most typical. In the type-specimen of *T. rubens* var. *lamella*, on the other hand, there is an absence of any marked regularity in the arrangement of the fibre-reticulation, the fibres are only sparsely cored, and the smooth styli of the sponge interior are on the whole notably smaller than in most other examples. Still, the probability is that these differences are nothing more than individual variations, and for the following reasons:—(i.) The sponges are apparently identical in all other essential respects. (ii.) The pattern of the main skeleton reticulation and the degree of development of the spicule-core of the fibres are sufficiently variable in all cases to render them untrustworthy as a basis for separation. (iii.) The size of the smooth styli always varies considerably in any given specimen, and the number of those which attain to the maximum size is also variable and as a rule proportionately small. (iv.) The same cause which accounts for the reduction in the size of the spicules might very well be responsible also for their diminution in number.

The accounts which have hitherto been given of the spicules are most incomplete, and in regard to their measurements entirely misleading. Lendenfeld mentions, in addition to acanthostyles, styli of one kind only, whilst Whitelegge recognises two. There are, however, three kinds which, though connected by intermediate forms, are clearly distinguishable by differences of shape or of situation. Firstly, there are the principal styli, which are predominatingly the spicules of the fibre core, and occur only in relatively small number in the ground substance; secondly, there are the auxiliary styli, which constitute the horizontal spicules of the dermal skeleton, which are, further, the most abundant megascleres of the ground tissues, and which, to a small though rarely appre-

ciable extent, may also invade the fibres; and, thirdly, there are the special dermal styli (much smaller in size than either of the preceding), which are arranged at the surface, but which, like the others, are also to be found in the ground tissues. In the dermal skeleton the auxiliary styli (proper) are disposed horizontally in broad lines (in which they lie roughly parallel) forming a reticulation, the mesh of which averages about 160 μ in diameter. The special dermal styli stand perpendicularly upon the sides of this meshwork, echinating them, as it were. The special dermal styli usually exhibit a small area of spination on the basal extremity; a similar, though more minute, spination is also of occasional to frequent occurrence on the auxiliary spicules; but it is always of more or less rare occurrence in the case of the principal styli. The drawings in the text-figure have been arranged so as to show the very perfect gradation of one spicule form into another.

Megascleres.—

(i.) The principal styli are usually slightly curved. Their maximum size varies in different specimens from 280 x 10.5 to 300 x 11 μ. (In the divergent specimen of *T. rubens* var. *lamella*, spicules larger than 220 x 8 μ are exceedingly rare. A single spicule 280 x 10.5 μ was observed, and several others of intermediate length, in some of which the diameter exceeded 9 μ.)

(ii.) The acanthostyles are rather minutely spined; the spines are recurved and either scattered closely over the whole length of the spicule or are more or less reduced in number on the region extending from the neighbourhood of the very densely spined head towards the middle of their length. They are conical tapering spicules which rarely exceed a size of 95 x 7 μ, though individuals up to 105 x 7.5 μ have been observed.

(iii.) The auxiliary styli (proper) are straight. Those in those in the ground substance vary greatly in diameter, owing to the admixture of immature individuals. The latter are frequently tylostyli, but, as their development proceeds, their basal enlargement is gradually effaced, though traces of it are often retained by full-grown spicules. Those of the dermal skeleton are very uniform in stoutness, and being unmixed with principal styli allow their size, as distinguished from that of the latter, to be readily determined. They may attain to the length of the principal styli, but are usually slightly shorter. Maximum size, 270-295 x 8 μ. (In the abnormal specimen they attain to 280 x 7.5 μ.)

(iv.) The special dermal styli are connected by a perfect gradation of forms with the auxiliary styli. Those which stand perpendicularly to the surface are rarely, if ever, more than 150 x 5 μ in size. The majority of them are provided with a few basal spines which are relatively larger than those of the auxiliary and principal styli. Unlike the corresponding spicules of *R. typicus*, the dermal styli are here usually quite straight.

Microscleres.—

(i) The isochelæ palmatæ reach a maximum length varying in different specimens from 20 to 24 μ, whilst in any given specimen there may be a difference of as much as 6 μ between the longest and the shortest. The shorter length is usually associated with some degree of curvature of the shaft. The palms when viewed from the front are somewhat triangular in outline, with rounded corners; they are longer than broad.

(ii.) The toxa are simply angulately curved, and resemble a bent microxea. Size: 55 x 1.7 μ up to 75 x 2.5 μ. They are relatively few in number, and are sometimes apparently absent.

Loc.— Port Jackson (Austr. Mus. Coll.; ten specimens).

RHAPHIDOPHLUS PAUCISPINUS, *var.* MULTIPORUS, *Whitelegge*.
(Plate XXV., fig. 2.)

This variety differs from the typical form in its elongately branched habit and the somewhat greater size of its megascleres. All the specimens so far obtained are stipitate. The branches are given off in one plane, and may or may not anastomose. The specimen originally figured does not give a correct idea of the usual form of the sponge, owing to the fact that in it the branches, either through growth in a confined space or as a result of drying are bunched together. A specimen obtained by the "Endeavour" (Plate XXV., fig. 2) is peculiar in the wide separation of its branches. Whitelegge's statement of the spicule-dimensions stands in need of correction; their maximum values are as follows:—

Megascleres.—

(i.) Principal styli, 300-360 x 12-16 μ.

(ii.) Acanthostyles, 90-105 x 8-9 μ.

(iii.) Auxiliary styli, 300-360 x 8-10 (rarely more than 9) μ.

(iv.) Special dermal styli, rarely more than 160 x 6 μ.

Microscleres.—

(i.) Chelæ, 19-26 μ long.

(ii.) Toxa, 60-80 x 2-3 μ.

The megascleres exhibit the basal spination more commonly than do those of the typical variety. Practically all the auxiliary and special dermal styli are thus provided, as well as a considerable proportion of the principal styli. The acanthostyles are usually more or less deficient in spines over part of their proximal moiety.

Locs.—Coast of New South Wales off Botany Bay, 20-23 fms. ("Thetis"); Shoalhaven Bight, 15-45 fms. ("Endeavour").

RHAPHIDOPHLUS TYPICUS, *Carter*, et VARR.

(Plate xxvii., Pl. xxviii., figs. 1-4, Pl. xxix., and figs. 38-42.)

(*a*) *Typical Variety.*

1875. *Echinonema typicum*, Carter, Ann. Mag. Nat. Hist. (4), xvi., 1875, p. 195.

1881. *Echinonema typicum*, Carter, *Op. cit.* (5), vii., 1881, p. 378.

1896. *Clathria typica* (pars), Dendy, Proc. Roy. Soc. Vict., viii. (n.s.), 1896, p. 32.

[1904. Not *Clathria typica*, Kirkpatrick, Marine Investigations in South Africa, ii., 1904, p. 148.]

(*b*) *Var.* PROXIMUS, *var. nov.*

(*c*) *Var.* GEMINUS, *var. nov.*

(*d*) *Var.* BREVISPINUS, *Lendenfeld.*

1888. *Thalassodendron brevispina*, Lendenfeld, Austr. Mus. Cat. Sponges, 1888, p. 225.

1901. *Thalassodendron brevispina*, Whitelegge, Rec. Austr. Mus., iv., 2, 1901, p. 87.

(*e*) *Var.* ANCHORATUS, *Carter.*

1881. *Echinonema anchoratum*, Carter, Ann. Mag. Nat. Hist. (5), vii., p. 379.

1885. *Echinonema flabelliformis*, Carter, *Op. cit.* (5), xvi., 1885, p. 352.

Echinonema pectiniformis, Carter, *Loc. cit.*, p. 353.

1886. *Phakellia ventilabrum*, var. *australiensis*, Carter, *Op. cit.* (5), xviii., 1886, p. 379.

1896. *Clathria typica* (pars), Dendy, Proc. Roy. Soc. Vict., viii. (n.s.), p. 32.

[1888. Not *Echinonema anchoratum*, Lendenfeld, Austr. Mus. Cat. Sponges, 1888, p. 219.]

(*f*) *Var.* OBESUS, *nom. nov.*

1901. *Clathria typica*, Whitelegge, Rec. Austr. Mus., iv., 2, 1901, p. 80, p. 117.

(*g*) *Var.* STELLIFER, *var. nov.*

(*h*) *Var.* FAVOSUS, *Whitelegge.*

1907. *Clathria favosa*, Whitelegge, Austr. Mus. Mem., iv., 10, 1907, p. 498.

General Diagnosis.—Sponge, in the different varieties, ramose, lamelliform or sub-massive. Oscula absent? Dermal membrane strongly developed, appearing in the dry sponge as a whitish pellicle or incrustation. Texture, as revealed by the removal of the dermal covering, rather loose and porous. The moderately stout fibre forms a rather wide-meshed reticulation. The main fibres contain a dense spicular core, the connecting fibres, with rare exception, are devoid of axial spicules. Smooth styli are extremely abundant in the ground tissues. Acanthostyles occur not only as more or less deeply imbedded echinating spicules, but also scattered within and between the fibres. They are more abundant on the outer extremeties of the fibres than elsewhere. The dermal skeleton is precisely of the same type as in the preceding species. Megascleres:—In addition to acanthostyles there are three kinds of stylote spicules, principal, auxiliary, and special dermal, occurring in the same relations as in the preceding species. A certain proportion of the last-mentioned exhibit a minute basal spination. (i.) The principal styli are the stoutest spicules; they are, for the most part, slightly curved; they vary in maximum size in the different known varieties from about 200 x 6 μ to about 300 x 13 μ. (ii.) The acanthostyles are distinguished by the absence or marked reduction of spines over a considerable portion of their basal moiety. (iii.) The auxiliary styli are straight or flexed, and are always longer and slenderer than the principal. (iv.) The special dermal styli are usually curved and slightly sub-fusiform; The greatest curvature is in the basal half of their length; in size they are rarely above 130-150 x 4-5 μ. Microscleres:—These are of three kinds:—(i.) Larger palmate isochelæ, 15-20 μ long; (ii.) smaller palmate isochelæ of which a certain proportion are contort, 7-11 μ long; (iii.) hair-like toxa of indefinite length, frequently passing into amorphous forms, occurring both singly and in bundles.

Introductory Remarks.—The intimate relationship to one another of the sponges here regarded as varieties[1] of *Rhaphidophlus typicus*, Carter, is revealed by their possession in common, of a considerable number of well-defined characteristics, of which five may be considered as possessing special value. These are:—(1) The non-occurrences of coring spicules in the connecting fibres; (2) the reduction of spination in the subbasal region of the acanthostyles; (3) the presence of two kinds of chelæ; (4) the torsion of the smaller chelæ; (5) the peculiarities shown by the toxa. This assemblage of characters distinguishes the sponges of the present series from any hitherto described,[2] although it is only in their possession of contort chelæ of a special kind that they stand unique. It is particularly on account of this last-mentioned peculiarity, therefore, that their association under one specific name seems advisable. The occurrence of two kinds of chelæ is implied in Wilson's description[3] of *Clathria* (*Tenacia*) *clathrata*, (O. Schmidt), a species which is evidently very closely related to the present, since it moreover possesses acanthostyles and toxa of a similar kind. *Clathria jugosa*, Wilson, likewise, agrees in regard to the latter two kinds of spicules. Acanthostyles in which the spination is reduced over portion of their basal moiety have also been described for *R. ridleyi*, Lindgren, and *R. filifer*, R. and D., var. *spinifera*, Lindgren, although in *R. filifer* itself the acanthostyles are said to be entirely spined. The spicules of the type-species of *Rhaphidophlus*, *R. cratitius* (Esper), described by Ehlers as "sehr feine haarformige Kieselfaden welche ungleich lang und mannigfach gekrummt sind" are almost undoubtedly identical in nature with the toxa of *R. typicus*, and not sigmata as Ridley and Dendy have suggested.

Although the present species and *R. paucispinus* differ markedly in respect to their microscleres, yet, as regards their megascleres they show a very close agreement. In *R. typicus* we again find principal, auxiliary, and special dermal styli occurring in the same relationships as described for the other, whilst the acanthostyles, besides acting as echinating spicules, are also similarly scattered within the fibres and through the ground tissues. Further, the special dermal styli and, less frequently, the auxiliary spicules, likewise exhibit a minute spination and are similarly connected, the one kind with the other, by a perfect series of intermediate forms. But whereas

1 Hentschel (Fauna Südwest-Australiens, Bd. iii., Lief. 10, 1911) has recently described, under the name of *Clathria typica*, at least one other variety.

2 In speaking thus I assume that the descriptions of other species of *Rhaphidophlus* are correct in detail.

3 Wilson—Bull. U.S. Fish. Comm., xx. (1900), 1902, p. 397.

in *R. paucispinus* the auxiliary spicules approximate in length to the principal styli they are here very much longer. The absolute dimensions of both the principal and auxiliary styli differ to a notable extent in the different varieties, but it is a peculiar circumstance, that their variation in the matter of stoutness proceeds, throughout the series, with a certain degree of concomitance, the range of variability of the auxiliary spicules in this particular being relatively somewhat less than that of the principal spicules. For example, in the variety *favosus*, where the spicules attain their greatest size, the principal styli are 13 μ, the auxiliary 9 to 10 μ in diameter, a difference in stoutness of 3 to 4 μ separating them; whereas at the other end of the series in the variety *anchoratus* the principal styli are 6 μ, the auxiliary, 5 μ in diameter, with a difference of only 1 μ between them. The correlation of the two spicule-forms in this way would seem to imply a kind of genetic relationship between them—an implication which is further heightened by the fact that spicules similar to those within the fibres are also of frequent occurrence scattered amongst the auxiliary spicules in the ground substance, and by the fact, moreover, that in *R. paucispinus* the two spicule-forms agree in the matter of length. The argument that the spicules, here termed auxiliary, are derivatives of the principal spicules, cannot however, be sustained, although instances are not wanting of sponges in which the latter spicules show a tendency to resolve into two forms, *e.g.*, *Ophlitaspongia axinelloides*, Dendy. Their independence is proven in the present species not only by their difference in shape, but also by their different modificational tendencies. Abnormalities of the principal styli appear to be invariably strongylote, whilst those of the auxiliary (and special dermal) styli are oxeote. As in *R. paucispinus*, so also in this species, it is obvious that the dermal styli are simply specialised auxiliary spicules.

Echinonema typicum, Carter, has not yet been sufficiently described to enable one to recognise it with certainty, though Dendy has pointed out its close agreement with other sponges of the present series. Concerning those specimens referred to by Dendy, in which he failed to observe toxa, nothing can be said with certainty, but in view of the fact that toxa are abundant in all the varieties here described, it is highly probable that they represent another species. *Echinonema typicum* was recorded by Carter from South and South-West Australia, and in regard to external form was described as "shrubby, cauliculate, more or less compressed, bunch-like or clustral, consisting of a great number of digital more or less branched stalks spreading upwards from a contracted sessile base; branches cylindrical, round, or slightly compressed, more or less sub-divided, terminating in obtuse round ends."

This description was, it seems, based upon a large number of specimens. Two ramose varieties herein described come from the same region as the type, viz., one from St. Vincent's Gulf, South Australia, the other from Western Australia, but in both cases the specimens representing them are stipitate; moreover, their spicules do not exactly accord with those mentioned by Carter. Under the circumstances, they have been recorded as new. *Echinonema typicum*, Carter, is urgently in need of re-description. The South African sponge identified with it by Kirkpatrick is quite a different species from that to which the present sponges belong, and in certain features departs widely from typical species of the *Clathria-Rhaphidophlus* group. The varieties of *Echinonema anchoratum* described by Lendenfeld appear to be species assignable to *Wilsonella* (*q.v.*).

In order to avoid needless verbal repetition, it is advisable, before proceeding to the description of the several varieties, to render a more particular account of those features which characterise the species as a whole, and are of no diagnostic value so far as the varieties themselves are concerned. It is necessary at this point, to mention that all the specimens at my disposal are in a dry state of preservation, and with the exception of those of the var. *anchoratus*, retain only traces of the dermal layer. Nevertheless, it is doubtful, even if spirit-specimens had been available, whether any additional criteria for the discrimination of the varieties would have been forthcoming, except, perhaps, in three particulars, viz., the width of the mesh of the dermal reticulation, the deportment of the main fibres in their approach to the surface, and the maximum size of the special dermal styli.

The most striking skeletal features are:—(i.) the absence of spicules from almost all the connecting fibres, and their abundance in the main fibres, in which they form a comparatively stout, rather compact core; and (ii.) the profusion of scattered spicules in the tissues between the fibres. In a thin longitudinal section mounted in balsam and viewed with the naked eye, the loosely branched main fibres, on account of their contained spicules and greater stoutness, stand out conspicuously; whilst between them is to be seen only a dim haziness due to the individually imperceptible transverse fibres and scattered spicules. The appearance thus presented is very characteristic and enables one to readily recognise mounted sections of the species without microscopical examination. Where the main fibres lie close together, they are directly joined by short transverse fibres and the intervening meshes are rectangular, but where, owing to their divergence, the main fibres become widely separated, the connecting fibres may form

a loose plexus or inter-reticulum between them, and the mesh is of irregular shape. The principal styli are usually slightly curved; the auxiliary styli are usually straight; and the special dermal styli are slightly subfusiform, usually curved, with the curvature restricted to, or most pronounced in, their basal half. The dermal styli are of very nearly the same size in all the varieties, but, owing to the fact that spicules occur of all sizes and shapes intermediate between them and the accessory styli, it is impossible—at any rate in the present specimens, owing to the damaged state of the dermal layer—to determine the exact upper limits of their size. One can therefore only quote the size below which they are usually to be found. The microscleres offer no assistance in the discrimination of varieties. The chelæ may differ slightly in different varieties, but since they are also slightly variable in one and the same, the difficulty of fixing upon their distinctive peculiarities is too great to render them of service. The degree of torsion of the smaller chelæ is usually not more than 90°. The toxa appear to be absolutely identical in form in the different varieties. They are hair-like spicules usually with a central flexure of fairly definite form, but otherwise extremely variable in shape. They would seem to be capable of indefinitely continued growth, and in some cases, at least, attain a length of more than 400 μ. As growth proceeds the arms become irregularly flexuous and twisted in various planes, and in many cases the spicules lose all semblance to toxa. The colour in the living condition of all the varieties previously described is some shade of red; that of the new varieties is unknown. The colour in dry specimens, is some shade of yellow or light brown.

Rhaphidophilus typicus, *var.* proximus, *var. nov.*

(Plate xxviii., figs. 3, 4, and fig. 37.)

Of this variety the museum possesses two specimens. Both are stipitate, ramose sponges, with short and relatively stout irregular branches, which divide frequently and often anastomose, and are either restricted entirely to the one plane or come to lie in overlapping planes. The branches are either circular in cross section or compressed in the plane of branching, and measure from 6 to 10 mm. in their lesser diameter. The two specimens are very nearly equal in size; the slightly larger is 90 mm. in height. The texture is denser than in any other of the varieties here described. The main fibres are rarely less than 80 μ in stoutness and often attain to from 120 to 150 μ. Acanthostyles are fairly abundant; those which echinate the fibres are often very deeply implanted in the

spongin. The principal and auxiliary styli are usually characterised by a barely appreciable sub-basal constriction. The auxiliary styli are occasionally, the special dermal styli frequently, provided with a minute basal spination. The acanthostyles are stout, with relatively few large spines, and without basal enlargement. The maximum dimensions of the spicules are as follows:—

Megascleres.—

(i.) Principal styli, 200-230 (rarely 240) x 11-13 μ.

(ii.) Acanthostyles, 60-75 x 7-8 μ.

(iii.) Auxiliary styli, 260-280 x 7-9 μ.

(iv.) Special dermal styli, usually less than 130 (or perhaps 120) x 4.5 μ.

Microscleres.—

(i.) Larger chelæ, (apparently) rather rare, 15-19 μ long.

(ii.) Smaller, usually contort, chelæ, 7-12 μ long.

(iii.) Toxa: observed lengths, 90-260 μ.

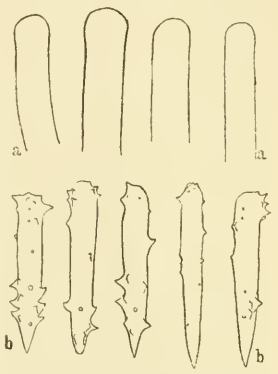

Fig. 37—*R. typicus* var. *proximus*. a Basal extremities of principal styli. b Acanthostyli.

This variety differs from the typical form in regard to the acanthostyles, which, for the latter, have been described as "clavate."

Loc.—Henley Beach, St. Vincent's Gulf, South Australia (Austr. Mus. Coll.).

Rhaphidophlus typicus, *var.* geminus, *var. nov.*

(Plate xxviii., fig. 4, and fig. 38.)

In regard to external form, there is not much to distinguish this variety from the preceding. The single specimen, which measures 220 mm. in height, is a luxuriantly branched stipitate sponge with rarely anastomosing branches, which divide dichotomously, and extend with more or less overlapping approximately in one plane. A peculiar feature of the sponge, and one which will probably prove to be characteristic is the unevenness of the surface of the branches, due to concave depressions and short obliquely longitudinal undulations. As a consequence the cross-section of a branch varies from

point to point in outline and in area. The thickness of the branches perpendicularly to the plane of branching varies from 3 to 6 mm.; in the transverse direction they are of variable breadth, sometimes appearing to a slight extent irregularly moniliform, and almost invariably becoming much expanded prior to bifurcation. The encrusted appearance of portions of the surface of the figured specimen is due to a stoloniferous Alcyonarian.

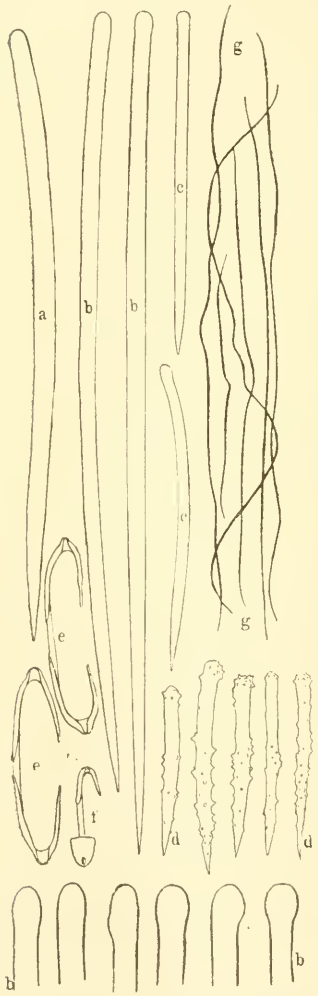

Fig. 38—*R. t.* var. *geminus*. a Principal stylus. b Auxiliary styli. b' Basal extremities of ditto. c Special dermal styli. d Acanthostyli. e Larger chelæ. f Smaller contort chela. g Toxa.

The fibres are of about equal stoutness to those of the preceding variety. Also, the echinating acanthostyles are of approximately equal abundance, and are often deeply imbedded in the spongin. In regard to their spicular characters, however, the two varieties are well distinguished. In the present variety, the megascleres are much slenderer; the auxiliary spicules are much longer, and approach more nearly to the principal styli in point of stoutness; both auxiliary and special dermal spicules are tylostylote or subtylostylote, and appear to be entirely devoid of the characteristic basal spination of other varieties; and finally, the acanthostyles are clavate or subclavate, and have smaller and more numerous spines. The greatest dimensions of the spicules are as follows:—

Megascleres.—

(i.) Principal styli, 220-240 x 7·5-8·2 μ.

(ii.) Acanthostyli, 70-80 (rarely 85) x 5-6 μ.

(iii.) Auxiliary tylostyli, 320-365 x 6·5-7 μ.

(iv.) Dermal tylostyli, usually less than 150 x 4·5 μ.

Microscleres.—

(i.) Larger chelæ, 15-19 μ long. Usually their "palms" as seen in profile, are parallel to the shaft or slightly deflected inwards.

(ii.) Contort chelæ, 7-10 μ.

(iii.) Toxa: observed lengths, 45-370 μ.

This variety agrees with the typical in possessing clavate acanthostyli, but no mention of tylostylote smooth spicules in the latter occurs in Carter's description.

Loc.—Western Australia (Austr. Mus. Coll.).

RHAPHIDOPHLUS TYPICUS, *var.* BREVISPINUS, *Lendenfeld.*

(Fig. 38*a*.)

Whilst the agreement between this variety and the preceding—var. *geminus*—is not so perfect that one can with certainty assert their identity, yet it has been found impossible to establish any wholly satisfactory points of difference. Seeing, however, that the present sponge has already been described as a distinct species and is accordingly already in possession of a name, and since, moreover, it is known only from a locality widely distant from that of the other, no objection can be raised if, for the present, and until more and better material from various localities is available it is retained as an independent variety. The material which I have at my disposal consists of one small imperfect specimen, together with a small piece derived from a British Museum example labelled *Thalassodendron brevispina*. The former is that which formed the basis of Whitelegge's short account. The original description speaks of the sponges of this variety as "large branched

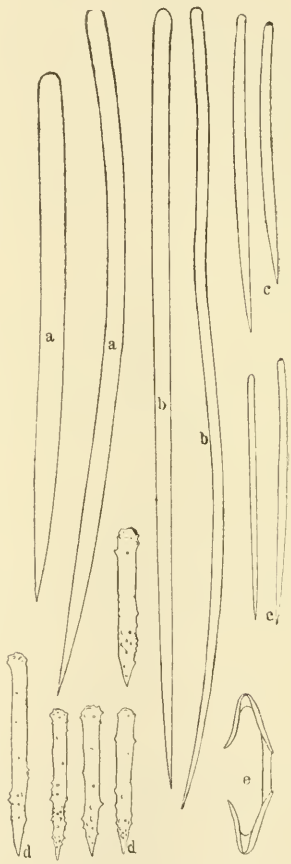

Fig. 38a—*R. t.* var. *brevispinus*. a Principal styli. b Auxiliary styli. c Special dermal styli. d Acanthostyli. e Larger chela.

sponges, with very irregular digitate processes." From the fragmentary material at my disposal all that I am able to say is that they are ramose, and, in some cases at least, stipitate; with branches which exhibit somewhat the same peculiarity as shown by the var. *geminus*, and which attain a thickness of as much as 15 mm. The main fibres are usually between 70 and 150 mm. in stoutness, but may attain to 200 μ. The only tangible differences between this variety and the preceding, are afforded by the spicules. The auxiliary spicules are only slightly enlarged basally, and are somewhat shorter; the special dermal spicules are usually simple styli without tylosis, and quite commonly exhibit a very minute basal spination; the chelæ appear not to display the peculiarity mentioned for the preceding. The maximum size of the spicules is as follows:—

Megascleres.—

(i.) Principal styli, 220-240 x 7-8.5 μ.

(ii.) Acanthostyli, 60-85 x 6-7 μ.

(iii.) Auxiliary subtylostyli, 280-310 x 6-7 μ.

(iv.) Special dermal styli, usually less than 130 x 4.5 μ.

Microscleres.—

(i.) Larger chelæ, 12-16 μ long.

(ii.) Contort chelæ, 7-11 μ long.

(iii.) Toxa: observed lengths, 60-230 μ.

Loc.—Port Jackson (*Lendenfeld*).

RHAPHIDOPHLUS TYPICUS, *var.* ANCHORATUS, *Carter.*

(Plate xxix., and fig. 39.)

This variety is represented by three specimens of thin flabelliform habit. One is regularly ovate in outline with even or crenulated margin, and with shallow grooves on both faces, radiating to the distal border. This specimen exhibits an exact correspondence in habit to Carter's *Echinonema pectiniformis*. The grooves are such as to suggest that neighbouring marginal processes, at first distinct, have subsequently become united by intergrowth, or that superficial demarcation occurs between processes prior to, or without, their actual separation. A second specimen (Plate xxix.) is abundantly provided with cylindrical marginal digitations, and similar processes in lesser number arise from its faces; it is slightly larger than the others, measuring 230 mm. in height. The third differs from either of the preceding in the absence of a stalk; otherwise it

more closely resembles the first-mentioned, but is devoid of surface grooves; it is attached to a large water-worn stone by an extensive basal disc. The lamina in all three is from 6 to 8 mm. in thickness. The sponge is very loose-textured; near the surface, adjoining main fibres are often 0.5 to 0.8 mm. apart. The fibres are comparatively slender—probably never exceeding 100 μ in diameter. In the present specimens the dermal membrane is intact, and shows that the dermal skeleton is precisely similar in its formation to that of *R. paucispinus*. The polygonal meshes of the reticulation are very uniform in size and average 120 μ in width.

The following resumé of its spicular characters (omitting for the moment the actual dimensions of the spicules) shows this variety to be unquestionably distinct from any of the others. The smooth megascleres are slenderer than in all other cases, and are basally neither expanded nor contracted; the principal and auxiliary styli approximate in stoutness and in shape and no longer permit of their ready differentiation; oxeote modifications of the auxiliary and dermal styli are of common occurrence; and acanthostyles are comparatively rare and of small size. On account of the great difficulty in distinguishing between the principal and auxiliary styli, I am unable to give the maximum length of the former; the difficulty is further increased by a certain amount of variability in respect to the stoutness of spicules in different specimens. The dimensions are as follows:—

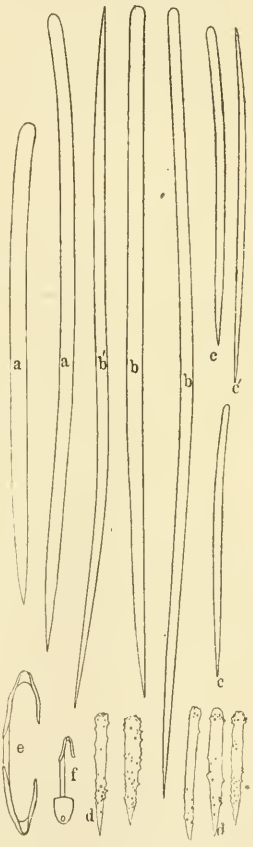

Fig. 39—*R. t.* var. *anchoratus*. a Principal styli. b Auxiliary styli. b' Oxeote modification of ditto. c Special dermal styli. c' Oxeote modification of ditto. d Acanthostyli. e Larger chela. f Smaller contort chela.

Megascleres.—

(i.) The stoutest styli are 5.5 μ in diameter in one specimen, 7 μ in a second, and of intermediate stoutness in the third.

(ii.) The longest styli are 290-320 μ in length; 5 μ in maximum diameter in the first specimen, 6.5 in the second.

(iii.) Acanthostyli, 45-56 x 5-6 μ.

(iv.) The special dermal styli are usually less than 130 x 4 μ.

Microscleres.—

(i.) Larger chelæ, 14-18 μ long.

(ii.) Contort chelæ, 8-11 μ.

(iii.) Toxa: observed lengths, 40-415 μ.

Dendy's identification of this variety with those quoted as synonyms is confirmed by an examination which I have made of pieces of their type-specimens.

Loc.—Port Phillip (*Carter; Dendy;* Austr. Mus. Coll.).

RHAPHIDOPHLUS TYPICUS, *var.* OBESUS, *nom. nov.*

(Plate xxviii., fig. 1, and fig. 40.)

The sponges described by Whitelegge under the name of *Clathria typica* agree among themselves and differ from those of the other varieties by virtue of their low stature, and their non-branching stoutly proportioned lamellar, or, at times, submassive habit. They comprise nine specimens, all of which are in a dry, macerated, and dermally denuded condition. The specimen of most symmetrical shape has the form of a thick sessile plate, sub-circular in outline, thinnest along the slightly and irregularly notched margin, and with both surfaces rendered very uneven by incipient outgrowths. This specimen, which is greater in height than any of the others, makes some approach in habit to the variety *anchoratus*, though it is well distinguished from any known example of the latter by virtue of its much more massive proportions. It measures 150 mm. in height and breadth, and varies in thickness from 10 to 15 mm. near the margin, to 25 mm. in the central portion. Although such simplicity of form is rarely attained, the dominant growth-tendency of the sponges of this variety is always in the direction of plate-formation. But almost invariably the primary plate undergoes proliferation in various ways, occasionally by bifurcation, sometimes by means of additional upgrowths from a slightly expanded base, but most usually by means of lamellar outgrowths from the side, which

either remain attached to it along vertical lines, or become, distally separated from it as growth proceeds. The external appearance of the sponge is accordingly subject to considerable variation, but in no case is there positive evidence of a tendency to form linear branches or processes. The degree of variability of the spicules is such that doubt might reasonably be held as to whether all these forms really belong to a single variety; and consequently, in the absence of sufficient evidence upon which to base a positive conclusion, but being compelled, one might say, to take cognisance of them, I adopt the pre-

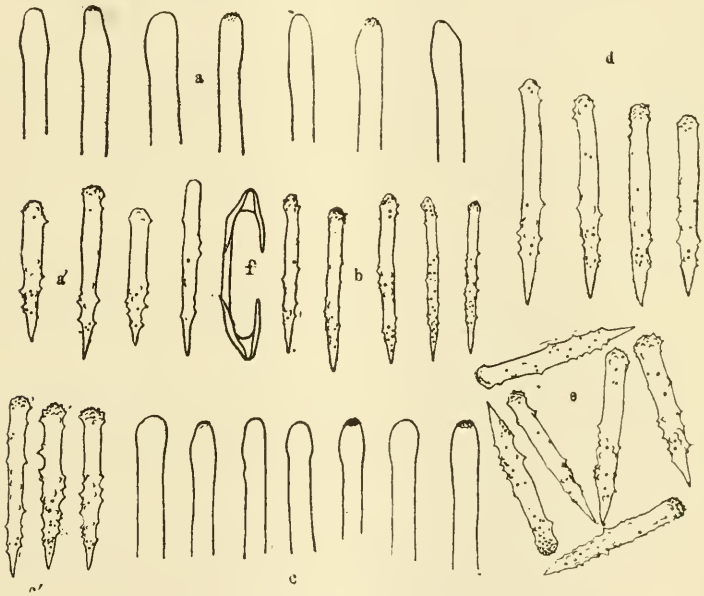

Fig. 40—*R. typicus* var. *obesus*. a Basal ends of auxiliary spicules of a typical specimen. a' Acanthostyles of ditto. b Acanthostyles from a co-typical specimen. c Basal ends of accessory spicules of a non-typical specimen. c' Acanthostyles of ditto. d, e Acanthostyles from two other non-typical specimens. f Larger chela from a typical specimen.

caution of specifying which of them are to be regarded as typical, viz., those which Whitelegge evidently had under consideration when he wrote,[1] "This species has a superficial resemblance to *Clathria australis*, Lendenfeld." One of the characteristics of the sponge to which Whitelegge thus refers and which is described in the present paper (p. 160) as *Crella incrustans* var. *arenacea*, is the presence on the surface of

1 Whitelegge—Rec. Austr. Mus., iv., 2, 1901, p. 80.

longitudinal grooves; and since grooves of very similar appearance (though of quite different morphological character) occur in a number of specimens of the present series, one feels convinced that it is these latter which Whitelegge would have selected as typical. These grooves, which are of the same nature as those occurring in the var. *anchoratus*, provide an additional feature by which the present variety, in its strictest sense, may be identified; they are well pronounced in the specimen herein figured. Confining our attention to the specimens which agree in this character, the following diagnosis based on the spicules is obtained:—Principal and auxiliary spicules approximating in stoutness, the latter subtylote in the manner shown in the text-figure (fig. *a*), the former without any basal peculiarity. Acanthostyles moderately abundant, scub-clavate (figs. *a'*, *b*), with comparatively small spines; those which echinate the fibres are usually very deeply implanted, and increase considerably in abundance towards the outer end of the main fibres. The dimensions of the spicules are as follows:—

Megascleres.—

(i.) The principal styli attain, in all the specimen, a maximum length of 230 to 240 or (very rarely) 250 μ, but the diameter of the stoutest varies in different specimens from 7 to 9 μ.

(ii.) The greatest length of the acanthostyles lies, in all the specimens, between 70 and 76 μ, but their greatest diameter varies in different specimens from 5.5 to 8 μ. The stoutest were found in the specimen fixed upon as the type.

(iii.) The auxiliary subtylostyli, in the specimen selected as the actual type (Z. 936)[1] and in some others bearing an extremely close external resemblance to it, never exceed a length of 310 μ and very rarely reach beyond 290 μ; in the remaining specimens much higher values were obtained, viz., 340 to 360 μ.

The special dermal styli and the microscleres are, so far as one can judge, of practically similar dimensions, not only in all the specimens here in question, but also in those presently to be considered. The first-mentioned are probably with few exceptions less than 150 μ in length. The larger chelæ vary from 12 to 17 μ in length, whilst the largest contort chelæ appear never to exceed a length of 12 μ. The toxa are no different from those of other varieties.

1 In order to mark the actual specimens investigated so that, if need be, they may be used for future reference, I quote their Register Numbers.

The remaining specimens of the collection—the non-typical specimens—fall into three groups. The first group is represented by a single specimen (Z. 935) which in texture and appearance is quite unlike the typical specimens, and which, on that account, might have been expected to yield tangible points of difference in the spicule characters. Except, however, that the acanthostyles are more spiny (fig. *c'*), and that the tylosis of the auxiliary spicules is more strictly terminal (fig. *c*), there is nothing to distinguish its spicules from those of the type-specimen. These differences are not so great that they might be considered as due to individual variation.

The second group is represented by the specimen (Z. 939) which received particular mention at the outset, on account of its larger size and simpler form. Whilst in this also, the smooth spicules show a correspondence in size with those of the type-specimen, the tylosis of the accessory spicules is much reduced, and, for the majority of them, inappreciable; furthermore, the acanthostyles (fig. *d*) are markedly larger, often 9 μ in diameter, and, though usually between 75 and 85 μ long, may actually attain to 105 μ. This group may, for the present, be regarded as a sub-variety.

In the third group, of which a specimen (Z. 940) bearing a close resemblance in texture and even in general appearance to the large specimen of the second group, may be quoted as an example—the spicule dimensions again accord with those of the type, except that the acanthostyles (fig. *e*) are slightly stouter, 8 to 9.5 μ in diameter, and more abundantly spined, like those of the second group. But in one respect at least, the members of the present group differ from the others of the variety—the auxiliary spicules are simply stylote, *i.e.*, entirely devoid of any trace of basal enlargement; they ought, accordingly, to be regarded for the present as constituting a second sub-variety.

Loc.—Port Jackson and neighbourhood (Austr. Mus. Coll.).

Rhaphidophlus typicus, *var.* stellifer, *var. nov.*

(Plate xxvii., and fig. 41.)

This variety is represented by a single specimen. The sponge is stipitate, flabelliform, with lobate margin, and with a couple of digitiform upgrowths flanking the lamina. It measures 300 mm. in height, 160 mm. in breadth, and about 6 mm. in diameter. Scattered at intervals over the surface are radiate groups of short obscure ridges forming "asterisks" 15 to 20 mm. in diameter. Towards the distal margin, the

surface is vertically furrowed, conveying the idea of an incomplete separation into lobes and digitations. Where the dermal incrustation has been abraded the surface is extremely harsh to the touch, owing to the dense crowding of acanthostyles at

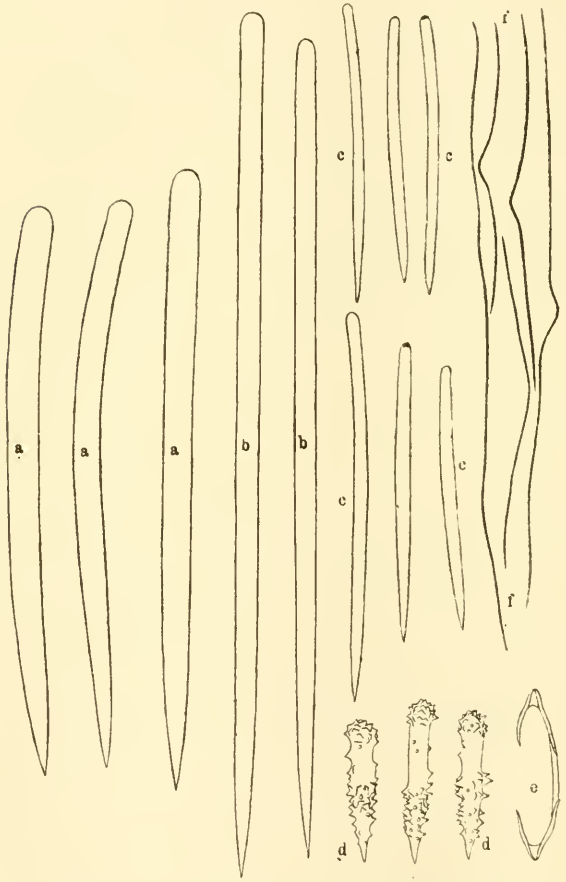

Fig. 41—*R. typicus* var. *stellifer*. a Principal styli. b Auxiliary styli. c Special dermal styli. d Acanthostyli. e Chela. f Toxa.

the ends of the fibres. The main fibres are 80 to 120 μ in diameter. This variety is characterised by the extreme abundance of its acanthostyles, which are closely arranged on all the fibres, and, at the superficial extremities of the latter, so

densely packed that the fibre becomes practically a fused mass of acanthostyles. The acanthostyles are stout in proportion to their length and are furnished with large and numerous spines. The principal and auxiliary styli are devoid of any basal enlargement or reduction; the latter are occasionally, the dermal styli usually, basally spined. The greatest dimensions of the spicules are:—

Megascleres.—

(i.) Principal styli, 240 x 12 μ.

(ii.) Accessory styli, 300-330 x 9 μ.

(iii.) Dermal styli, usually less than 130 x 4·5 μ.

(iv.) Acanthostyles, 50-68 μ long, and up to 8.5 μ in diameter.

Microscleres.—

(i.) Larger chelæ, 15-20 μ long.

(ii.) Contort chelæ, attaining to 11 μ in length.

(iii.) Toxa: observed lengths, 55-260 μ.

Loc.—Bass Strait, East Coast of Flinders Island. ("Endeavour.")

RHAPHIDOPHLUS TYPICUS, *var.* FAVOSUS, *Whitelegge.*

(Text-fig. 42.)

This variety, which is so far known only from a few fragmentary specimens, is well distinguished from the others by (i.) its long slender cylindrical branches which do not exceed

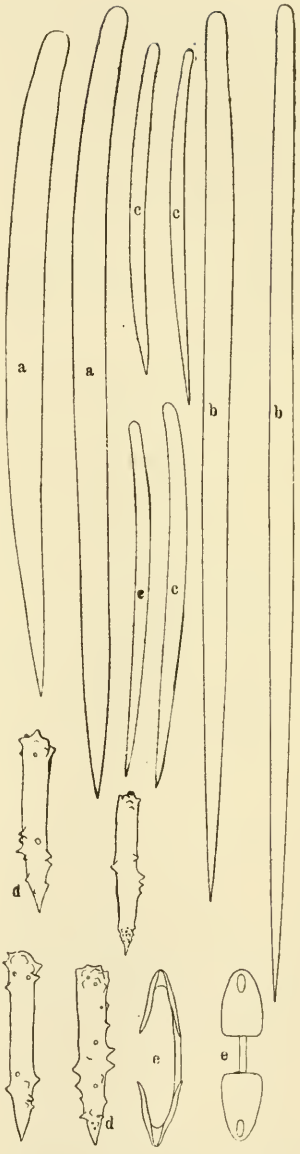

Fig. 42—*R. typicus* var. *favosus.* a Principal styli. b Auxiliary styli. c Special dermal styli. d Acanthostyli. e Chelæ.

7 mm. in diameter; (ii.) by the gauziness of its texture; (iii.) by the slenderness of its fibres, which do not exceed 80 μ in diameter; (iv.) by the large size of its megascleres; (v.) by the "manubriation" of the basal end of the principal styli; and (vi.) by the paucity of numbers of its stout acanthostyles which, when echinating, are only slightly embedded in spongin. The original description says, "surface minutely honeycombed; the cells are from 1-2 mm. in diameter, etc." This statement appears to me entirely misleading, since except for the gauzy looseness of the texture, there is nothing particularly of the kind thus suggested. The maximum dimensions of the spicules, some of which are not quite correctly stated in the previous account, are as follows:—

Megascleres.—

(i.) Principal styli, 300-305 x 13 μ. (Spicules "15 μ" in diameter have not been observed).

(ii.) Auxiliary styli, often basally spined, 350-370 x 7-10 μ.

(iii.) Special dermal styli, usually basally spined, and, as a rule, less than 135 x 5 μ.

(iv.) Acanthostyli, 70-80 x 10 μ.

Microscleres.—

(i.) Larger chelæ, 14-18 μ long, occasionally (though very rarely) contort.

(ii.) Smaller contort chelæ, 8-12 μ.

(iii.) Toxa: observed lengths, 70-255 μ.

Locs.—Off Port Jackson, 49-50 fms. ("Thetis"); Oyster Bay, Tasmania, 60 fms. ("Endeavour.")

Genus Thalassodendron, *Lendenfeld.*

1888. *Thalassodendron*, Lendenfeld. Descr. Cat. Sponges Austr. Mus., 1888, p. 222.

The genus *Thalassodendron* was proposed for "Desmacidonidæ with a supporting skeleton composed of horny fibres partly without spicules in the interior and echinated by scarce, pretty smooth styli." The definition attached no importance to the nature of the coring spicules and regarded as essential a feature which we now know to be lacking in systematic value. As a consequence it happens that the six species described—*T. digitata*, *T. typica*, *T. rubens*, varr. *dura* et *lamella*, *T. paucispina*, *T. brevispina* and *T. viminalis*—fall into several different genera. Thiele[1] has already pointed out that *T. digitata* possesses the requisite characters of his genus

1 Thiele—Kieselschwamme von Ternate, ii., 1903, p. 962.

Echinochalina, and at the same time has fixed upon *T. typica* as the type of *Thalassodendron*. Unfortunately no specimens identifiable with either of these species occur in the present collection of the Australian Museum, and since the description of *T. typica* is insufficient, we are left in doubt as to the precise connotation of the name *Thalassodendron*. Whitelegge[1] has indeed published a short account of a sponge regarded by him as the type-specimen of *T. typica*, but it is so little in agreement with the original description that hesitation might well have been felt in accepting its implication as a final verdict. An examination of this specimen has shown—what is indeed immediately obvious even from external comparison—that it is an example of *Echinodictyum* (*Kalykenteron*) *elegans*, Lendenfeld,[2] a sponge with which Whitelegge was apparently not well acquainted. One can therefore only conclude that the specimen investigated by Whitelegge was mislabelled, as was also the specimen which he at first mistook[3] for *Thalassodendron viminalis*. So far as one can judge from Lendenfeld's description of *T. typica*, *Thalassodendron* may for the present be looked upon as a synonym of *Wilsonella* (*q.v.*).

T. viminalis is an *Ophlitaspongia*.[4] With regard to the remaining species I find, in disagreement with Whitelegge who regarded them as individual variations of a single species, that *T. brevispina* is a variety of *Rhaphidophlus typicus*, Carter; that *T. rubens* var. *lamella* and *T. paucispina* are identical (*Rhaphidophlus paucispinus*); and that *T. rubens* var. *dura* is a *Clathria* (*C. rubens*). Owing to the unsatisfactory nature of the descriptions of these species, a further and more extended account of them has been included in the present paper.

Genus Plectispa, *Lendenfeld*.

1888. *Plectispa*, Lendenfeld, Descr. Cat. Sponges Austr. Mus., 1888, p. 225.

The description which Whitelegge has given of Lendenfeld's three species of *Plectispa*, viz., *P. elegans*, *P. arborea*, and *P. macropora* are so little in agreement with those of Lendenfeld as to render inevitable the conclusion that the specimens invesigated were mislabelled. How completely at variance are the two accounts of these species, will be evident from a comparison of the following summaries of them.

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1 Whitelegge—Rec. Austr. Mus., iv., 2, 1901, p. 86

2 Lendenfeld—Cat. Sponges Austr. Mus., 1888, p. 216. This species, which is probably identical with *E. bilamellatum*, Lamk., is described herein, p. 171.

3 Whitelegge—Rec. Austr. Mus., iv., 2, 1901, p. 87; and 5, 1902, p. 214.

4 *O. subhispida*, Carter, var. *viminalis*, Lendf. (*q.v.*)

(*a*) According to Lendenfeld:—

P. elegans. A reticulate mass of regularly cylindrical branches on an average 5 mm. thick; spicules, smooth styli 160 x 6 μ and 70 x 5 μ, the latter echinating. (Loc., Port Jackson.)

P. arborea. Dendritically ramifying, with clearly-defined stem. The styli measure 80 x 4 μ and 50 x 4 μ respectively. (Loc., Port Jackson.)

P. macropora. Small and tender, reticulate, honeycomb-like, incrusting or massive; smooth styli 200 x 4 μ; echinating spined styli 70 x 6 μ. (Loc., Torres Strait.)

(*b*) According to Whitelegge:—

P. elegans. With erect, rarely coalescent branches, generally with distinct peduncle; spicules, styli 100 x 6 μ and 80 x 5 μ respectively. (Loc., Port Jackson and neighbourhood.)

P. arborea. A *Clathria*; reticulately branched in one plane; spicules, styli 180 x 8 μ, subtylostyli 200 x 2 μ, acanthostyles 85 x 6 μ. (Loc., Port Jackson and neighbourhood.)

P. macropora. Forming low densely-branched clumps, with abundant anastomoses of branches. Spicules, smooth styli 100 x 4 μ and 75 x 4 μ respectively. (Loc., neighbourhood of Port Jackson, common.)

A comparison of the descriptions of *P. arborea*, Lendf., and *P. elegans*, Whitelegge, points almost incontestably to the conclusion that they are one and the same. *Clathria* (*Plectispa*) *arborea*, Whitelegge, is therefore quite a different sponge from Lendenfeld's species and requires a new specific name, for which I propose *multipes*. *Echinoclathria* (*Plectispa*) *macropora*, Whitelegge, is, as mentioned, a common local sponge, and must have been familiar to Lendenfeld. It evidently affords no grounds for its identification with *P. macropora*, Lendf., which, moreover, is recorded from a widely distant locality. Neither does it show sufficient agreement with *P. elegans* to warrant its identification to that species. There is no other course open but to regard it as a new species; it is described in the present paper under the name of *Echinoclathria ramosa*. *P. arborea*, Lendf., is likewise a species of *Echinoclathria*, and there can be little doubt that *P. elegans*, Lendf., belongs to the same genus. The genus *Plectispa* is accordingly left with a single species, *P. macropora*, which may therefore be considered as the type.

According to its description this species possesses the external structural characteristic of *Echinoclathria* but differs from the latter in respect to its echinating spicules, which are spined, and in respect to its coring spicules, which appear to be *auxiliary*. It accordingly possesses the spiculation of *Wilsonella*, of which genus *Plectispa* may therefore be regarded as a synonym. Lendenfeld himself,[1] shortly after his establishment of this genus, recognised the necessity of restricting the name to forms with acanthostyles and thereby tacitly indicated the type-species.

Genus Clathria, *O. Schmidt* (*emend.*).

The main skeleton is a reticulation of well-developed horny fibres which are cored with smooth or, less frequently, partly spined principal styli, and echinated by spined or (*rarely*) *smooth accessory styli. Auxiliary monactinal or* (*rarely*) *diactinal megascleres of a single kind, smooth or terminally spined and typically slenderer than the principal styli, occur in the ground and dermal tissues and occasionally also, though rarely in any considerable number, within the fibres themselves; they are usually most abundant in the superficial tissues where they may become so closely aggregated as to constitute a definite dermal skeleton. There are no special dermal styli. Microscleres, when present, are typically isochelæ palmatæ or toxa.*

The above emended diagnosis is intended to exclude not only such species as are referable to the genus *Rhaphidophlus*, but also a number of others which might conveniently be united under Carter's genus *Wilsonella* (*vide infra*). At the same time an attempt has also been made to render the definition more precise in regard to the characters of the spicules. It is, for instance, no longer correct to say that the coring styli are smooth; in many species they are basally tipped with spines, whilst in *Clathria clathrata*, Whitelegge,[2] they are provided with moderately large spines over a considerable portion of the basal region and usually, in addition, with extremely minute spines on the remaining portion of their length. Neither is it any longer permissible in the face of such species as *C. transiens*, sp. nov. to speak of the echinating spicules as if they were invariably spined. If the genus *Wilsonella* be accepted in the sense in which I define it, a number of species which up till the present have been included in *Clathria* will need to be removed from the genus,

1 Lendenfeld—Monograph of the Horny Sponges, 1889, p. 99.

2 *Vide infra*, p. 209.

and those which remain will be characterised by the possession of auxiliary megascleres which are almost invariably stylote. It may be questionable whether the retention within the genus of species with diactinal auxiliaries is strictly proper, but so far as I know, there is no urgent reason for their removal, provided that they satisfy the definition in other respects.[1] Allowance must be made also for the fact that many so-called diactinal spicules are only apparently diactinal.

The distribution of the auxiliary megascleres is subject to a certain amount of variation. In general, they are scattered without apparent order through the soft tissues, increase in abundance in the more superficial layers, and are sometimes so crowded at the surface—though possibly never with any distinct regularity of arrangement—that there results in consequence a definite dermal skeleton. It must be allowed, however, that in particular cases, the auxiliary megascleres may play an appreciable part in the formation of the spicular axis of the fibres, or may actually, as in *C. inanchorata*, R. and D.,[2] become almost or even quite entirely restricted to an intra-fibral situation. An instance of such invasion of the fibres by auxiliary megascleres is probably afforded by the genus *Echinochalina*, some species of which, *e.g.*, *E. glabra*,

1 Hentschel (Fauna Südwest-Australiens, Bd. iii., 1911) has recently without sufficient justification, placed such a species in the genus *Spanioplon*.

2 I have examined the specimen recorded by Whitelegge under the name of *Clathria inanchorata*, R. and D. (Austr. Mus. Mem., iv., 10, 1907, p. 495), and although the dimensions of the spicules do not agree with the "Challenger" description I cannot do otherwise than agree with Whitelegge in regarding them as genuine examples of the species. Not only do they agree perfectly with the "Challenger" specimen in external appearance, but also in regard to the shape of the acanthostyles and the (smaller) toxa. I believe, therefore, that we have in the case of this species an instance of one of the very few inaccuracies to be found in the descriptions of the "Challenger" Monaxonida. The spicules within the fibres (the main fibres only) are of two kinds, viz.: (i.) Stouter, usually curved styli; the stoutest are 24-25 μ in diameter, and their maximum length varies in the different specimens from 480 to 560 μ; and (ii.) slenderer straight subtylostyli (or tylostyli) probably never of greater size than 450 x 13 μ. These spicules I regard as representing respectively the principal and auxiliary stylotes of other species. Both kinds are basally tipped with a very minute spination which is more conspicuous in the auxiliary spicules. Neither principal nor auxiliary spicules appear ever to occur scattered between the fibres, though the former—but rarely or never the latter—occur abundantly as exteriorly directed echinating spicules, along with acanthostyles, on the superficial transverse fibres. The acanthostyles are extremely variable in size. The smallest may be less than 60 μ long; but it is impossible to attach any precise upper limit to their length. The greater number by far are less than 200 μ long, and of the remainder the majority are less than 240 μ; but as the length increases the spicule becomes curved and more and more free from spines and gradually passes into the form of the principal styli. Thus the echinating spicules show a complete transition from accessory spined to principal smooth spicules. The toxa are of two kinds: one, similar in form to that figured in the "Challenger" Report, ranges in length from less than 20 μ to about 120 μ and reaches a diameter of 4 μ; the other is very long and slender, with straight arms inclined at a small angle, and reaches a length, in some cases, of 560 μ, with a diameter of about 2 μ. Chelæ have not been observed. (*Vide* remarks on *C. caelata*.)

convey irresistibly the impression that they have been evolved from forms related to existing species of *Echinoclathria* through the replacement in the fibres of principal by auxiliary megascleres.

The principal and accessory styli in *Clathria* likewise exhibit differences in regard to their mode of distribution. The principal styli, whilst invariably functioning as coring spicules in the main fibres and usually also in the transverse, occur also in many species as interstitial spicules, and in some as supplementary echinating spicules along with the accessory spicules. In the latter case it not infrequently happens that the principal and accessory styli are connected by an unbroken series of intermediate spicule-forms. The accessory styli, which with rare exceptions are spined, are not as a rule exclusively restricted to the office of echinating the fibres, but also occur in limited numbers intrafibrally[1] and interstitially. The particular mode of occurrence of the several spicules is, in all probability, characteristic for any given species and should accordingly be taken account of in any description which aims at completeness. The microscleres of *Clathria* are typically isochelæ palmatæ and toxa, but one or both forms may be absent. It is a question wheher species in which the chelæ are other than of the palmate type should be allowed in the genus. Whilst there can be little doubt that palmate chelæ and arcuate chelæ represent two distinct lines of development, and are likely to serve as valuable aids for the separation of genera, the fact that it is not possible in all cases to say whether a particular chela is more strictly palmate or more strictly arcuate, renders it inadvisable at present to depend upon them solely for the generic separation of species; although eventually no doubt, other characters not hitherto employed in classification will be found to provide a means of deciding in doubtful cases. In connection with the genus *Clathria* (minus *Wilsonella*), however, it is quite possible that no species with intermediate or ambiguous chelæ occur, and accordingly a new genus might well be established for those species which possess chelæ arcuatæ; meanwhile, such species must, I suppose, be allowed in the genus. Kirkpatrick[2] has described two species from South Africa, one of which, *C. mollis* is scarcely capable of being retained in the genus, since not only does it possess auxiliary tornota and isochelæ arcuatæ, but is also characterised by the absence of

1 The occurrence of acanthostyles in considerable numbers in the fibres is extremely well exemplified in *Clathria Hartmeyeri*, Hentschel (1911).

Kirkpatrick—Marine Investigations in South Africa, ii., pp. 248, 249.

principal styli. The other, wrongly identified as *Clathria typica*, Carter, is anomalous, if its description be correct, in possessing sigmata in addition to palmate isochelæ and toxa.

In none of the species of *Clathria* which I have examined have I observed unmistakable oscula.

The following species, of which I have examined the type-specimens, call for remark:—

Clathria (?) *chartacea*, Whitelegge,[1] is an unusual type of sponge for which perhaps a new genus must be established. The skeleton consists of a renieroid reticulation of acanthostyles traversed by multispicular primary lines of spicules in the mid-plane of the sponge-lamina, and by paucispicular secondary lines running off from these to the surface. The spicules forming these lines are of two kinds, viz., acanthostyles similar to those of the intervening meshwork, and smooth styli of a larger size; those of the primary lines are chiefly of the latter kind, whilst those of the secondary lines are chiefly of the former. The terminal spicules of the secondary lines are, however, exclusively of the smooth kind, and project considerably beyond the surface, rendering it hispid. There are no echinating spicules. The meshes of the renieroid reticulation are triangular or quadrangular with sides of a spicule's length usually formed by a single spicule. All the foregoing spicules are distinctly ensheathed in spongin. Slender (auxiliary) styli are sparsely scattered through the tissues, becoming more abundant towards the surface. Microscleres are absent. The species is possibly related to the genus *Suberotelites*, from which it appears to differ mainly in possessing stylote instead of strongyliform accessory spicules.

Clathria pellicula, Whitelegge,[2] which from its description would appear to be a *Microciona*, is really a *Hymeraphia*. The description states that the skeleton is columnar "consisting of whisp-like multispicular fibres, with little or no spongin," which "are made up of irregularly disposed smooth styli or subtylostyli and accompanied by spined styli." It is further stated that "there are but few spicules between the fibres." I have prepared a number of sections from different parts of the type-specimen, but in none can I find columns of principal styli. Of quite frequent occurrence, however, are short strands of auxiliary syli running in various

1 Whitelegge—Austr. Mus. Mem., iv., 10, 1907, p. 497.

2 Whitelegge—The Sponges of Funafuti (Austr. Mus. Mem., iii., 5, 1897, p. 327).

directions—vertically, obliquely and horizontally—through the sponge-body, and it is these, I presume, which Whitelegge refers to as "columns." The principal spicules (tylostyli) which are relatively very few in number stand singly perpendicularly to the base of the sponge with their heads almost in contact with the substratum; they occur in no other situation. The accessory styli (acanthostyli), which also are by no means abundant, are, with the exception of a few scattered individuals, arranged similarly to the principal spicules. The auxiliary megascleres (tylostyli) are relatively very numerous and are divisible into two sizes, viz., those of lesser length forming the dermal tufts, and those of greater length scattered within the tissues and forming the strands already referred to. The species accordingly appears to have a closer relationship to *Rhaphidophlus* than to *Clathria*. The principal tylostyli vary in length from 180 to 440 μ, but only occasionally exceed 360 μ; the stoutest are 8 to 9 μ in diameter. They are characterised by a basal region of spination which may be limited to the surface of the tylosis merely, or may extend—particularly in the case of the shorter spicules—over the greater portion of the length of the spicule. The largest accessory acanthostyles are 120 μ long and rarely exceed 6 μ in diameter The auxiliary tylostyli may attain a size of 480 x 4.5 μ; the dermal tylostyli are apparently never much in excess of 200 μ in length. The slender isochelæ palmate vary in length from 16 to 20 μ; the toxa are not more than 1.5 μ in diameter and range in length from about 200 to 380 μ.

Microciona clathrata, Whitelegge,[1] though peculiar in some respects, is distinctly a *Clathria*. The statement in the original description that "the skeleton consists of stout horny fibres arranged in plumose columns" is a remarkable error which can only be explained by supposing that the description was based upon a section through the terminal portion of a branch in which transverse fibres were not conspicuously developed. The skeleton is an irregular reticulation of stout and densely horny fibres, which, except in newly-formed branches are so strongly developed that the interstices of the meshwork may become reduced almost to the point of obliteration. The sponge is, consequently, exceptionally hard and tough. In the interior of the sponge the fibres are plentifully echinated with large accessory acanthostyles; the superficial fibres are densely echinated both with accessory acanthosyles and principal styli which together hispidate the surface. Amongst

1 Whitelegge—Austr. Mus. Mem., iv., 10, 1907, p. 493. The name *Clathria clathrata* is at present also used for the sponge originally described by O. Schmidt as *Tenacia clathrata*, but as this may be placed in the genus *Rhaphidophlus*, I refrain from changing the name of Whitelegge's species.

these superficial echinating spicules, a transition of forms intermediate between the accessory and principal styli are met with. In this respect the species resembles *C. inanchorata*, R. and D. The arrangement of the principal styli in the inner skeleton is to a great extent independent of that of the fibres. The principal styli are curved spicules of very variable length ranging from less than 200 to upwards of 450 μ long; it is rarely that they exceed a size of 400 x 25 μ; they are typically provided at the base with larger spines for about 20 to 40 μ of their length and beyond that with very minute sparsely scattered spines. The accessory acanthostyles, which also are curved, vary in length from about 100 to 200 μ and the stoutest are about 15 μ in diameter; it is impossible, however, to affix any precise upper limit to their length since they gradually pass into the form of the principal styli; their basal end is closely covered with clavate spines whilst the shaft is provided with sharp-pointed recurved spines. The auxiliary spicules are straight subtylostyli which are basally tipped with a few minute spines. They are plentifully scattered through the tissues and are particularly abundant in the dermal layer where they lie for the most part horizontally; they are 150 to 240 μ in length and may reach a diameter of 8 μ. Palmate chelæ, 7 to 10 μ long. Slender tricurvate toxa, 80-150 μ long.

Somewhat related to *Clathria clathrata*, though of quite different habit, is the sponge which Whitelegge[1] regarded as *Echinonema anchoratum*, var. *lamellosa*, Lendenfeld, and for which I now propose the name *Clathria spicata*. Whitelegge's description is misleading in several respects. The species is known from a single dry specimen of flabelliform shape. The surface which is bare of any traces of a dermal investment is ornamented by minute discontinuous longitudinal ridgings with frequent transverse connections; and is dotted with numerous small rounded holes which probably represent the openings leading into the incurrent canals. The skeleton reticulation is very irregular and the connecting fibres are destitute of a spicular core. The coring spicules, which include both accessory and auxiliary spicules in addition to the principal, are for the most part disposed plumosely in a rather disorderly manner and often project beyond the spongin-sheath. Fascicles of spicules also occur independently of the fibres. The accessory acanthostyles echinating the fibres of the interior may reach a length of 120 μ or more, but

1 Whitelegge—Rec. Austr. Mus., iv., 2, 1901, p. 82.

are usually less than 100 μ. The superficial fibres are echinated by spicules showing all gradations of form between the shortest accessory and the longest principal spicules. In this species therefore, as in the preceding, there is no line of separation between these two classes of spicules, so that it is impossible to assign any upper limit to the length of the former or lower limit to the length of the latter. Both kinds are typically curved, with the greatest curvature in the basal moiety. The principal spicules may attain a size of 410 x 12 μ; they are conical tylostyli in which the surface of the tylosis is rugged or obscurely spined; in the larger individuals the shaft is, with rare exceptions, free from inequalities. The auxiliary spicules are subtylostyli usually basally tipped with a minute spination; they vary in length from 130 (or less) to about 340 μ, and the stoutest are 4.5 μ in diameter. The isochelæ are fairly abundant and reach a length of 13 μ. Very slender toxa, with straight arms and only a slight median flexure, are rare; they reach a maximum length of at least 260 μ. The slender hair-like spicules mentioned by Whitelegge are incipient auxiliary spicules. The locality of the specimen, according to its label, is Western Australia. The *Echinonema anchoratum* var. *lamellosa*, Lendenfeld, which from its description is possibly a species of *Wilsonella*, was recorded from Port Chalmers, New Zealand.

Whitelegge has, accordingly, described in all nine new species of *Clathria*, viz., *C. tenuifibra*, *C. multipes*,[1] nom. nov., *C. striata*, *C. calopora*, *C. arcuophora*, *C. clathrata* (as *Microciona*), *C. diechinata*, nom. nov., *C. tenebrata* (as *Rhaphidophlus*), and *C. bispinosa*[2] (as *Rhaphidophlus*).

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1 In the remarks on the genus *Plectispa*, Lendf., it was pointed out that the *Clathria (Plectispa) arborea* Whitelegge, is distinct from Lendenfeld's species of that name. Since the specific named *arborea* is based on a mistaken identification and is, moreover, quite inappropriate, its retention is undesirable, and I therefore propose for this sponge the name *tuae* in reference to its habit of forming a number of attachment-stalks. A sponge in the British Museum bearing the manuscript name "*Thalassodendron reticulata*, Lendenfeld" (a small portion of which is included in Prof. Dendy's loan to the Australian Museum), is, as Whitelegge has already stated, identical with this species. A fuller description than that which has been given is desirable, but the material in hand is not sufficiently well-preserved for the purpose. I may merely mention that Whitelegge has overlooked the presence of very slender palmate isochelæ 6-7 μ long; that the principal styli are straight or slightly curved subfusiform spicules which may attain a size of 192 x 12 μ; and that the cylindrical auxiliary subtylostyli vary in length from 170 μ or less to 250 μ and may attain a diameter of 4.5 μ.

2 A doubt may be said to exist concerning this species, since the type-specimen and slides have apparently been lost. Judging from its description, the species is remarkable in that the accessory acanthostyles have become differentiated into two groups. The probability is, however, that the slender forms mentioned are only early developmental stages. If this is so, the species is almost certainly another of the series to which belong *C. inanchorata*, *C. caelata*, *C. clathrata*, and *C. spicata*.

Clathria cælata, *sp. nov.*

(Plate xxxiii., fig. 4; and fig. 43.)

Sponge erect, stipitate; with a tendency, more or less well expressed towards a restriction of growth to one plane, but otherwise variable in habit. Surface characteristically ornamented by close-set processes with deep intervening sulci. Dermal membrane exceeding thin, or apparently absent. Main skeleton a close reticulation of well-developed horny fibres; the main fibres with longitudinally and divergingly disposed skeletal spicules, the connecting fibres vacant. The echinating spicules range in form, gradationally, from small straight (accessory) acanthostyles to large curved smooth principal styli; those of intermediate and larger size are mostly to be found on the outer aspect of the superficial fibres. Auxiliary spicules in moderate number occur both within the fibres and scattered between. Megascleres:—(i.) Smooth principal styli, 140-320 x 10 μ; (ii.) entirely spined acanthostyli, about 110 x 5.5 μ; (iii.) auxiliary subtylostyli, 375 x 5 μ. Microscleres:—Toxa of two sizes; the shorter, abundant, rarely exceeding 90 μ; the longer, very rare, attaining to at least 275 μ in length.

This species—represented by six specimens—is an erect stipitate sponge, somewhat variable in habit, but of very characteristic external aspect owing to the extreme inequality of its surface. The inequality, which is such that the surface might be described as deeply sulcated or sculptured, is due to the close apposition over its entire extent (including the stalk) of short erect processes of variable shape but fairly uniform height. The appearance of the sponge, viewed at a distance, is suggestive of that of certain corals of the genus *Madrepora*.

In its simplest form the sponge is probably ramose, with short repeatedly divided branches disposed in one plane and more or less inter-united by means of their laterally situated processes. An approach to a formation of this kind is shown in some parts of several of the present specimens; but, in general they are irregularly flabellate and more or less proliferous. The largest specimen is 125 mm. in height (exclusive of the stalk), 100 mm. broad, and 7 to 15 mm. thick.

The texture is fibrous; the consistency tough, compressible, resilient. The colour (in alcohol) varies from honey-yellow

to deep brown; the darker colour is due to the presence of pigmented cells. In some specimens an exceedingly thin dermal membrane is visible on the less exposed parts.

The main skeleton is an irregular small-meshed reticulation of well-developed pale horny fibres, the stoutest of which may attain a diameter of 100 μ. The main fibres are provided with a somewhat meagre, discrete, semi-plumose spicular core which comprises both *principal* (stylote) and *auxiliary* (subtylostylote) megascleres; the connecting fibres are destitute of contained spicules, but, like the main fibres, are rather scantily echinated by slender *accessory* acanthostyles. The principal styli of the main fibres are, in general, set more or less obliquely to the direction of the fibre, sometimes at such an angle that they become, in effect, echinating spicules. On the outer aspect of the superficial transverse fibres, echinating principal styli occur in considerable number; in this situation they stand quite perpendicularly to the fibre. Between the principal and accessory spicules, however, it is impossible to draw a hard and fast line of separation, since—although the transition between them is fairly abrupt—the one form graduates into the other. The interstitial spicules are auxiliary subtylostyli and toxa, together with occasional principal and accessory styli; the toxa are fairly plentiful in the deeper parts, but become particularly abundant in the immediate neighbourhood of the surface. The dermal membrane contains a few horizontally-disposed auxiliary spicules and numerous scattered toxa. Chelæ are absent.

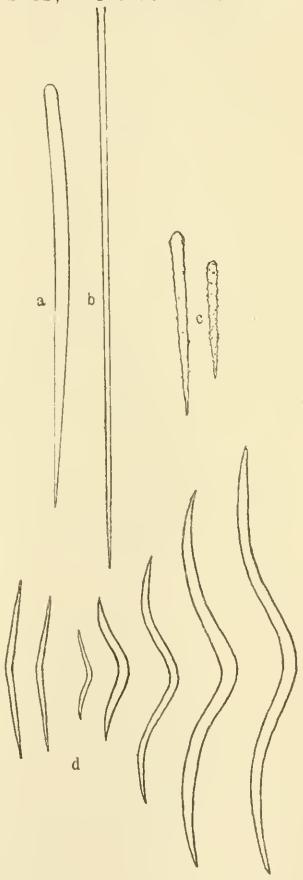

Fig. 43.—*Clathria caelata*. a Principal style. b Auxiliary style. c Acanthostyles. d Toxa.

Megascleres.—

(i.) The principal styli are sub-conical and slightly curved spicules, occasionally exhibiting a faint sub-basal constriction, and attaining a maximum size of 320 x 10 μ. Although the smallest of them are indistinguishable from the largest accessory styli; the lower limit of their length may be fixed at about 120 μ, since neither do individuals of lesser length than this exhibit the curvature of form typical of the principal spicules; nor individuals of greater length, the minute spination typical of the accessory. Their only inequality of surface is an obscure ruggedness which, in the case of the shorter spicules, may affect the entire surface, but which becomes less and less distinct and more restricted to the basal region as the length of the spicule increases, and finally disappears; spicules of greater length than 180 μ are, with rare exceptions, quite smooth.

(ii.) The accessory acanthostyles are straight sub-conical spicules, frequently with a slight basal enlargement (subtylote) and with a minutely spined or, less frequently, merely rugged surface. Their length varies from about 40 to 120 μ, but seldom exceeds 95 μ; they are rarely more than 5 μ in diameter.

(iii.) The auxiliary spicules are straight subtylostyli (or tylostyli) varying in length from 190 to 390 μ, and in diameter up to 5 μ. They sometimes show an obscure spination of the extreme basal end.

Microscleres: Toxa of two kinds.—

(i.) Shorter, typically tricurvate forms, with well-arched median flexure; rarely, angulately bent and with straight arms. They range from less than 20 μ to upwards of 100 μ (rarely more than 90 μ) in length, and up to 3 μ in diameter.

(ii.) Extremely rare, long slender forms,[1] with fairly straight arms, ranging in length from 150 μ or less to at least 275 μ, and in diameter up to 1.5 μ. The shortest make some approach in form to the first-mentioned and indicate that the two forms are modifications of a single original form.

Locs.—Tasmania (Austr. Mus. Coll.); forty miles west from Kingston, South Australia, 30 fms.; fifteen miles east-north-east from Cape Barren, Tasmania, 53 fms. ("Endeavour").

1 Owing to their rarity these toxa were at first overlooked, and have consequently been omitted from the text-figure. Their presence would have remained unsuspected had not the existence of similar spicules in the closely allied *C. inanchorta* prompted me to undertake a special search for them.

In regard to skeletal structure and the incomplete differentiation of principal and accessory spicules, this species agrees with *C. inanchorata* (p. 206), *C. clathrata* (p. 209), *C. spicata* (p. 210), and *C. costifera*, sp. nov., and is perhaps sufficiently closely related to the first-mentioned to be regarded as a variety of it. It is strange that, although four of these species have been previously described, their peculiarity in spiculation has hitherto been overlooked. The five species constitute a well-marked group characterised, as regards skeletal features, not merely by (i.) the imperfect differentiation of the principal and accessory megascleres, and (ii.) the participation of the former in the echination of the fibres—for these features are found also in otherwise quite different species—but also (iii.) by the peculiar mode of disposition (obliquity relatively to the axis of the fibre) of the principal spicules of the main fibres, more particularly towards their outer extremities, and the consequent "semi-plumose" or "spicate" character of these fibres; (iv.) by the absence of axial spicules from the connecting fibres; and (v.) by the relatively dense echination of the superficial transverse fibres, *chiefly or entirely on their outer aspect.* Another character which appears to be of common occurrence, is the inclusion of auxiliary megascleres amongst the intrafibral spicules; this, however, is not shown by *C. clathrata*. To the same group, in all probability, *Clathria coppingeri*, Ridley,[1] *Rhaphidophlus bispinosus*, Whitelegge,[2] and *Ophlitaspongia membranacea*, Thiele,[3] also belong. This group of species might be called, after one of its species, the *spicata*-group—a name which also calls to mind one of its characteristic features

CLATHRIA COSTIFERA, *sp. nov.*

(Plate xxxi., fig. 2; and fig. 44.)

Sponge flabelliform, moderately thin, stipitate, with radially corrugated surface. The dermal membrane, owing to the abundance of its contained (auxiliary) spicules, forms a whitish encrustation in the dry state. The main skeleton is a close reticulation of well-developed horny fibres. The fibral spicules (principal styli)—which are absent from the connecting fibres—are arranged in a disorderly fashion and, particularly in the more superficial parts of the sponge, often project far beyond, or are situated upon, the fibre, in the manner of echinating spicules. A gradational series of spicules of intermediate

1 Ridley—Report Zool. Coll. of the "Alert," 1884, p. 445, pl. xl., figs. F, F'; Pl. xlii., figs. i, i'.

2 Whitelegge—Austr. Mus. Mem., iv., 10, 1907, p. 503.

3 Thiele—Fauna Chilensis; Zool. Jahrb. Suppl. vi., Bd. iii., Heft 3, 1905, p. 450, figs. 67a-e, 105.

form connects the accessory with the principal styli. Megascleres:—(i.) Smooth principal styli; maximum size, 300 x 10 μ; (ii.) acanthostyles, minutely spined, seldom exceeding 90 x 6 μ; (iii.) auxiliary subtylostyli; maximum size, 380 x 6 μ. Microscleres:—Flexuous hair-like spicules (modified toxa), fairly abundant; maximum length, at least 250 μ.

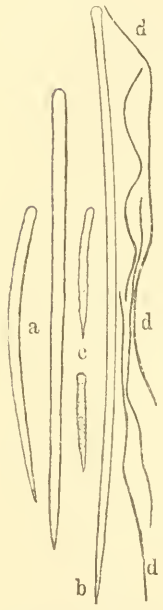

Fig. 44—*C. costifera*. a Principal styles. b Auxiliary subtylostyle. c Acanthostyles. d Trichitoidal microscleres (modified toxa).

This species is represented in the collection by a single dry washed-out specimen, of leaf-like form. The lamina is elliptical in outline, and measures 300 mm. in breadth, by 200 mm. in height; the stalk is short, stout, and proximally swollen. Both surfaces of the lamina are elegantly ridged and furrowed, over their entire extent, along lines which radiate curvately from the junction of stalk and lamina. The grooves are 2 to 5 mm. in width; the intervening "ridges," which are much compressed (septiform) and somewhat jagged, measure 1 to 4 mm. in height. Between the ridges the lamina is comparatively thin and, in the present condition of the sponge, perforated by frequent rounded openings up to 2 mm. in diameter. The consistency is firm and tough; the texture fibrous.

The main skeleton is a close-meshed network of strongly-developed horny fibres, the stoutest of which attain a diameter of about 100 μ; the connecting fibres are free from contained spicules. Echinating acanthostlyes are scarce. In the central region of the sponge, *i.e.*, in the lamina proper, the reticulation is irregular and confused; intrafibral spicules are here comparatively few in number, and the distinction between main and connecting fibres is often obscure. In the surface "ridges," on the other hand, the main fibres run in close and fairly regular sub-parallelism, and, owing to their contained spicules, stand out rather conspicuously in comparison with the short aspiculous transverse fibres. The fibral spicules, though almost exclusively *principal* styli, may yet at times include a considerable proportion of *auxiliary* tylostyli. Between the fibres, more particularly in the central region of the sponge-lamina, megascleres occur in great profusion; they consist chiefly of *auxiliary* spicules, which are often clustered

in short strands. In other respects the main skeleton agrees with that of the preceding species, *C. cælata*; that is to say, the *principal* styli of the fibres are arranged more or less semi-plumosely and frequently assume the attitude of echinating spicules; the superficial transverse fibres are closely echinated on their outer aspect by both *accessory* and *principal* styli; and, finally, the *principal* and *accessory* megascleres are connected by a series of spicules of intermediate form. The passage between the two kinds of megascleres is, however, more abrupt than in *C. cælata*, and transitional forms are rarely met with except amongst the spicules which echinate the superficial fibres. In two respects the species differs markedly from *C. cælata*; firstly, in the absence of tricurvate toxa; and, secondly, in the presence of a well-developed dermal skeleton in the form of a thin layer of closely packed horizontally-disposed auxiliary subtylostyli, which in the dry state forms a whitish incrustation similar in appearance to that shown by species of *Rhaphidophlus*.

Megascleres.—

(i.) The principal styli are curved or (less frequently) straight subconical smooth spicules, varying in length from about 120 to 300 μ and in diameter up to 10 μ; the stoutest are usually those of intermediate length, say from 220 to 250 μ. The shortest often exhibit a slight degree of ruggedness or other surface inequality, which rarely extends for more than a short distance from the basal extremity and is seldom met with in individuals of greater length than 160 μ. A certain proportion show a slight basal knob marked off by a faint constriction; this is of relatively larger size in smaller and slenderer individuals, which are then subtylostyli sometimes scarcely distinguishable from the shorter auxiliary spicules.

(ii.) The accessory acanthostyles are straight or slightly curved subconical spicules occasionally with a slight basal knob. In length, they range from 40 μ to 120 μ though usually less than 90 μ. Individuals above 100 μ long are comparatively rare, and are intermediate in form between the accessory spicules *proper* and the principal spicules. The accessory spicules proper are minutely spined over their whole length or, like those of intermediate form, are merely rugged.

(iii.) The auxiliary subtylostyli (or, less frequently, simple styli) are straight or curved spicules, varying in length from less than 160 μ to 380 μ and in diameter up to 6 μ.

Microscleres.—

These are of one kind only, viz., long very slender, hair-like sinuous spicules of indefinite form, which are undoubtedly modified toxa. They are scattered singly and are moderately abundant, and may attain a length of (at least) 260 μ.

Loc.—East coast of Flinders Island, Bass Strait ("Endeavour").

Clathria rubens, *Lendenfeld.*

(Plate xxxii., fig. 1, and fig. 45.)

1888. *Thalassodendron rubens*, var. *dura* (pars), Lendenfeld, Cat. Sponges Austr. Mus., 1888, p. 223.

Thalassodendron rubens, var. *lamella* (pars), Lendenfeld, *Loc. cit.*

1901. *Clathria rubens* (pars), Whitelegge, Rec. Austr. Mus., iv., 2, pp. 85, 86, pl. xi., fig. 13.

(*Thalassodendron rubens*), Whitelegge, *Loc. cit.*, p. 86.

Sponge profusely ramose, stipitate, branching polytomously with anastomosis. Branches cylindrical except at nodes. "Asterisks" (of radiately-disposed grooves), sometimes associated each with a conical process, occur at intervals over the otherwise even surface. Dermal membrane very thin, indistinct; containing scattered horizontally-lying (auxiliary) spicules. Main skeleton an irregular reticulation of well-developed horny fibres, all of which contain slender axial spicules (principal styli). those in the main fibres arranged in a fairly compact thin core. Principal styli of stouter proportions than those within the fibres, occur sporadically as echinating spicules and are scattered interstitially along with a few (auxiliary) tylostyli. Accessory (echinating and scattered) acanthostyles are somewhat scarce, and spicules occur (although rather rarely) which are intermediate in form between them and the principal styli. Megascleres:—(i.) Principal styli (proper), straight, smooth, subfusiform, rarely 165 x 10 μ; (ii.) accessory acanthostyli (proper), small-spined, rarely 80 x 6 μ; (iii.) auxiliary subtylostyli, 170 x 3·5 μ. Microscleres:—(i.) Scarce isochelæ palmatæ, 8-12 μ long; (ii.) slender toxa of characteristic form, 160 to 260 μ long.

Introductory Remarks.—I have already pointed out (p. 179) that the two sponges (not three as Whitelegge supposed) described by Lendenfeld under the name of *Thalassodendron rubens* and distinguished as varieties *dura* and *lamella* respectively, belong to different species, and that in their original descriptions the two were confused. This I have been enabled to establish owing to the fortunate circumstance that the actual specimen figured by Lendenfeld under the latter name is still in existence. This specimen, strangely enough, is labelled, in Dr. Lendenfeld's handwriting, "*Thalassodendron rubens*, var. *dura*;" and thus it appears certain that the name *dura* was purely a manuscript one used in connection with the latter variety, and that its application to the former, for which it is extremely inappropriate, was due to inadvertence. Luckily, however, there are nomenclatural reasons why this name should be rejected.

Description.—The sponge is profusely ramose and attains to a considerable size. Its chief external characteristics lie in the mode of branching and in the occurrence at irregular intervals over its surface of stellate groove-groups ("asterisks").

The branches, which in their internodal portions are—roughly speaking—cylindrical (6 to 12 mm. in diameter) or only slightly compressed, become at intervals much broadened, forming nodes of more or less triangular shape. The formation of such a node is almost invariably followed by a division of the branch into a number (two to five or more) of secondary branches. The secondary branches arise from the distal side of the nodal region either on the same level or consecutively in close succession; the mode of branching might in either case—though less correctly so in the latter—be described as polytomous. The resultants of any one polytomy, but usually not of successive polytomies, lie in the same plane. Owing to the rapid multiplication of branches in this way, the transverse dimensions of the sponge increase rapidly upwards. The branches are usually crooked, and this, in conjunction with their frequent anastomoses tends to bring about the formation of a tangled and reticulate mass in which the mode of branching may become more or less obscured. The "asterisks"—groups of radiately-disposed, shallow, sharply-incised furrows—occur chiefly on the more compressed parts of the branches; as a rule their centre-points lie on or near the margins of the branches. Quite commonly the central region of the area occupied by such a group is raised up into a conspicuous conical process, to the apex of which the grooves ascend. The number of furrows which arrive at the centre of an asterisk varies from about six to ten; each of these *main* furrows usually results from the confluence of a number of

tributary furrows. Often, a single furrow is continuous between the centres of two adjoining asterisks. That some special significance attaches to these furrows is indicated by the occurrence along them of "pores" of distinctly larger size than any to be found elsewhere on the surface. Although

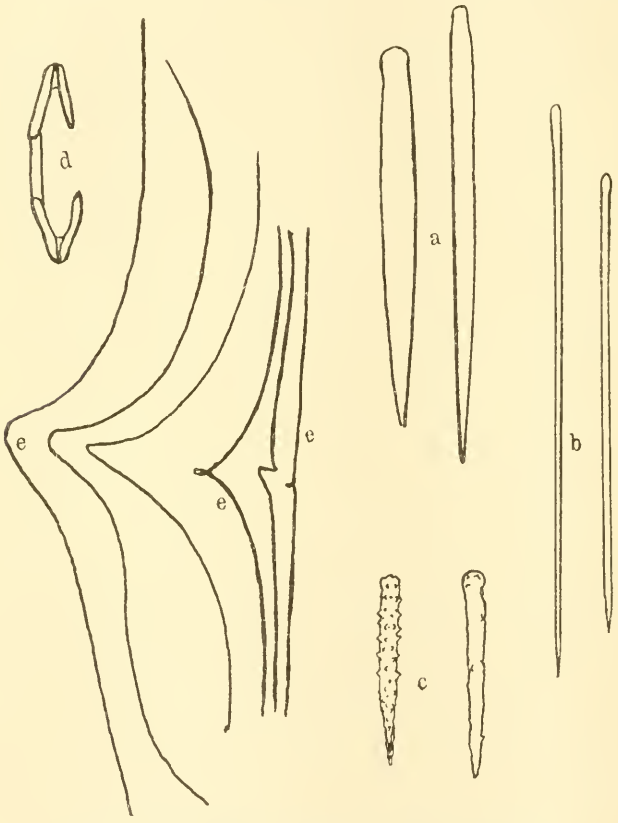

Fig. 45– *Clathria rubens.* a Principal styles. b Auxiliary styles c Acanthostyles. d Chela. e Toxa.

these "pores" are probably exhalant openings, it would appear (from a single specimen rather imperfectly preserved in alcohol) that, in the living condition, they are roofed over by dermal membrane

The largest specimen—that which is figured herein—measures 450 mm. in height and 250 x 130 mm. in its greatest transverse dimensions. The older portions of the sponge are

firm and tough, and of compact texture; the younger portions are fine-textured, and, in the dry sponge, of almost silky softness. The colour in alcohol is dark brown; in the dry state it varies from greyish yellow to brown.

As seen under moderately low powers of the microscope, the main skeleton, except in the vicinity of the surface of the sponge, bears a striking resemblance to that of a *Chalinine* sponge. This is mainly due to the comparatively small size and only moderate abundance of the spicules; to the aggregation of the intrafibral spicules into a well-defined axial core; and to the fewness of the echinating acanthostyles. Generally speaking, the skeleton reticulation consists chiefly of closely approximated and frequently inosculating longitudinal main fibres, which contain a somewhat meagre, fairly compact spicular core, and are joined at irregular intervals by short usually unispicular connecting fibres.

In the superficial parts of the sponge-branches, however, the pattern of the skeleton is of a somewhat different character. Thus, the "excurrent" main fibres (*i.e.*, those which run obliquely outwards to the surface of the branches) become somewhat widely separated as the surface is approached, and between them the connecting fibres form an interreticulation or plexus. Moreover, the spicules of these main fibres become reduced in number and more dispersed, whilst those of the connecting fibres increase in number. The distinction between main and connecting fibres consequently tends to become obscure, and the general pattern of the skeleton approaches that which is characteristic rather of *Myxilla*. It is to be noted also that the fibral spicules (principal styli) of this portion of the skeleton are of distinctly stouter proportions than those which core the main fibres of the interior.

Irrespective of this contrast between its inner and outer portions, the skeleton may yet present quite different appearances in different parts of the sponge, owing to disparity in the stoutness of fibres. Thus, in the denser parts—especially in the internodal regions of the branches—the fibres are composed chiefly of spongin and may attain a diameter of 80 μ; whilst in the younger portions of the sponge—especially in the nodal regions of the branches—spongin is much reduced in amount—often to such an extent that it forms but a scarcely perceptible sheath enclosing the spicules—and even the stoutest fibres may be less than 20 μ in diameter. There is in this connection a further difference also, due to the fact that those fibres which are deficient in spongin likewise show a reduction in the number of their axial spicules. In regions of greater density, accordingly, the inner or deeper skeleton is a close

reticulation of fairly stout fibres with well-marked differences in spiculation between the main and connecting fibres; whereas, in regions of least density, it is a very loose reticulation of fine fibres, and the main fibres, in point of stoutness and spiculation, are but slightly distinguished from the connecting.

Echinating acanthostyles are irregular in occurrence, and, on the whole, comparatively scarce; they are sometimes completely enclosed within the fibres. Principal and auxiliary spicules, the former in greater number, are somewhat sparingly scattered between the fibres, and with them occur also a few acanthostyles. A notable proportion of the "extrafibral" principal styli are disposed perpendicularly to the fibres in such a way that they appear to echinate the fibres; on careful examination many of these prove to be ensheathed in an exceedingly thin layer of spongin continuous with that of the fibre, but very few indeed are actually imbedded in the fibre. A further point worthy of notice is the fact that the interstitial and quasi-echinating principal styli (like those, already mentioned, which form the superficial fibres) are, in general, much stouter than those which core the longitudinal main fibres.

The dermal membrane contains numerous horizontally disposed scattered auxiliary spicules. These are not so abundant as to give rise to a visible incrustation in the dry state of the sponge.

Megascleres.—

(i.) The principal styli are typically straight subfusiform spicules, often with a slight waist-like sub-basal constriction. They are usually quite smooth, though a very appreciable proportion, particularly among those of intermediate and lesser length, carry a few low spines at or near the basal end. Their maximum size is 160 x 10 μ. Spicules below a length of 120 μ are rare and usually bear a greater or less number of spines scattered over their whole length; amongst these shortest spicules are some which, in form, bridge over the gap between the principal and accessory spicules.

(ii.) The accessory acanthostyles are sub-conical spicules, provided over their whole length with small spines. They vary in length from 55 to over 100 μ; but individuals of greater size than 70 x 6 μ are rather rare, and usually show a reduced spination.

(iii.) The auxiliary spicules are straight subtylostyli, sometimes basally tipped with a minute spination; size 120-170 x 3.5 μ.

Microscleres.—

(i.) Scarce isochelæ palmatæ, 8-12 μ long.

(ii.) Long slender toxa, tolerably plentiful, of characteristic though somewhat variable shape, 160-260 μ in length and, at most, 1.5 μ in diameter.

Loc.—Port Jackson (Austr. Mus. Coll.).

CLATHRIA PARTITA, *sp. nov.*

(Plate xxxii., fig. 3; and fig. 46.)

Sponge stipitate, with few, broad, much compressed, free or coalescent branches spread fanwise in one plane. Branches transversely furrowed. The dry sponge is covered with a whitish incrustation of dermal spicules, beneath which the surface is dotted with pinhole-like "pores." Main skeleton a very irregular reticulation of horny fibres with loosely (and, in the connecting fibres, usually uni- or bi-serially) arranged spicules. Inwardly the fibres are fairly stout, but superficially they become slender and paucispicular, and form a web-like meshwork in which main and connecting fibres are not distinguishable. Echinating spicules scarce, comprising both accessory and principal styli, as well as occasional intermediate forms. Megascleres: (i) Principal styli, smooth, slightly curved, 240 x 9 μ; (ii.) acanthostyles, seldom more than 85 x 6 μ; (iii.) auxiliary styli, smooth, straight, 350 x 4.5 μ. Microscleres: Hair-like toxa about 200 μ long.

The single specimen is a tall flabellate sponge with an elongated cylindrical stalk and a small number of dichotomous much compressed, strap-shaped branches; in shape it bears some resemblance to a deeply incised palmatipartite leaf. The branches usually increase slightly in breadth upwards, thus becoming spathulate; lateral union between them sometimes occurs, and it is possible that in some instances the separated branches may be represented or replaced by a continuous lamina. The specimen measures 400 mm. in total height; the thickness of the branches at right angles to the plane of branching is about 6 mm. The surface is ornamented with shallow furrows and narrow intervening ridges, running, as a rule, transversely to the margins of the branches. They are never a very conspicuous feature and are sometimes obscure. They are most clearly defined towards the lateral borders of

the branches, over the edges of which they pass from one surface to the other; traces of them are also to be seen upon the stalk. There is nothing to indicate that the furrows have any special morphological value.

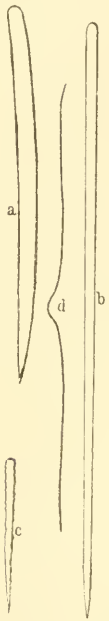

Fig. 46—*C. partita*. a Principal style. b Auxiliary style. c Acanthostyle. d Toxon.

The specimen, which is a dry one, bears the remains of a whitish spicular encrustation. The exposed surface is irregularly, though fairly closely, dotted with roundish pinhole-like (subdermal) "pores." The consistency is firm and tough; the texture, very finely fibrous at the surface, more coarsely so within; the colour, brownish yellow.

In its general pattern the skeleton somewhat resembles that of *C. rubens*, inasmuch as in its superficial parts the fibres are uniformly very slender, with pauci- or, more frequently, uni-serially arranged spicules, and form a reticulation in which the main and connecting fibres lose their distinctiveness, whilst in its more central parts the fibres attain to relatively stout proportions, reaching a diameter of 80 to 120 μ. The two species also agree in the comparative scarcity of their acanthostyles, in the circumstance that these spicules are often entirely enclosed within the fibre-spongin, and in the presence of echinating principal styli and of occasional spicules intermediate in form between them and the accessory styli. The present species, is, however, well distinguished in this respect that the intrafibral spicules, which include an appreciable number of auxiliary, as well as occasional accessory, megascleres, are not collected into an axial strand, but have a loose disorderly arrangement; and, further, the principal styli, which are much larger than in *C. rubens*, show no difference in stoutness between those of the main longitudinal fibres and those which occur extra-fibrally and in the superficial fibres. Except in the main longitudinal fibres, cross sections of which would usually intersect three or four spicules, the coring spicules are most frequently uniserially arranged. Owing to the way in which the connecting fibres inter-reticulate between the main fibres, the skeleton is of a most irregular pattern—particularly in its superficial parts, where the fibres form a web-like meshwork in which as a rule main fibres are not recognisable, and in which the sides of the meshes are usually of but a spicule's

length. Echinating principal styli are of fairly common occurrence, and are frequently, as also are occasionally the echinating acanthostyles, surrounded over a greater or less portion of their length by a sheath of spongin. Scattered auxiliary spicules are moderately abundant, other interstitial megascleres comparatively scarce.

A peculiar feature of the skeleton is the occasional occurrence of short slender fibres, attached at one extremity only. These "semi-detached" or "floating" fibres, which appear to be most frequent in the superficial portion of the skeleton, rarely contain more than two or three (almost invariably uniserially arranged) spicules and are often reduced to a single spongin-ensheathed spicule. There is accordingly in this species a transition from echinating spicules to "echinating" fibres.

The dermal skeleton is a layer of crowded auxiliary spicules arranged without order; in the dry condition it forms a whitish encrustation.

Megascleres.—

(i.) Smooth, usually more or less curved, subconical principal styli ranging from about 100 to 280 μ, though seldom exceeding 230 μ, in length; those of intermediate length are the stoutest, attaining to 9 μ in diameter.

(ii.) Straight subconical acanthostyli, with very small spines, or with merely rugged surface, ranging in length from about 50 to 100 μ, though rarely exceeding a size of 80 x 6 μ. Spicules of length in the neighbourhood of 100 μ graduate in form between principal and accessory styli.

(iii.) Straight or sometimes slightly curved auxiliary subtylostyli or styli ranging in length from probably less than 180 μ to 350 μ, with a maximum diameter of 4·5 μ. The shorter are usually indistinguishable from the slenderer principal styli, and so it is impossible to determine the lower limit of their length.

Microscleres.—

Slender hair-like toxa, of which the longest observed was 210 μ in length. They appear to be moderately abundant, but, owing to their tenuity, are visible *in situ* only with great difficulty. Their normal shape is that shown in the text figure, but departures from this, due to flexion and torsion of the arms, are frequent.

No chelæ have been observed, but specimens from which the sarcode has not been removed are needed in order to enable one to say positively that they are absent.

Loc.—Southern coast of Australia ("Endeavour").

It is necessary to point out that, in this species, the occurrence of spicules intermediate in form between the principal and accessory spicules, is extremely rare—so rare, indeed, that in some sections I have failed to observe them. The fact of their presence, however, in this species and in *C. rubens*, is important, since it not only shows that these spicules are not peculiar to the species of the *C. spicata* group (*vide* p. 214), but also suggests that their occurrence may be more widespread than previous descriptions of *Clathria* species would lead one to suppose.

Clathria transiens, *sp. nov.*

(Plate xxxiii., figs. 1, 2, 3; Plate xxxiv., fig. 2; and figs. 47-48*a*).

Sponge stipitate, ramose or sub-lobate; branches free or inter-uniting, often more or less restricted to one plane, distinguishable into several orders. Surface warty. Dermal membrane exceedingly thin or apparently absent. Surface with closely scattered small sub-dermal pores. Main skeleton a regular sub-rectangular reticulation of moderately stout fibres. Main fibres with a discrete, somewhat paucispicular slightly plumose core of relatively large (principal) styli which at the extremity of the fibre form a spongin-free tuft; transverse fibres of a spicule's length, usually with one or two axial spicules. Echinating accessory styli, fairly abundant. Megascleres.—(i.) Smooth, curved, sub-conical principal styli; maximum size variable, say at least 300 x 11 μ; (ii.) straight conical styli with smooth or (more usually) slightly roughened surface, in size rarely more than 80-90 x 4-5 μ; (iii.) smooth, typically straight, auxiliary tylostyli; maximum size varying from about 280 x 3 to 360 x 6 μ. Microscleres:—(i.) Palmate isochelæ, sometimes rare or absent, 14-26 μ long; (ii.) geniculate toxa with straight or recurved arms, varying in maximum length from about 130 to 170 μ, and in maximum diameter from 1 to 3 μ.

Introductory Remarks.—The four specimens which I assign to this species differ considerably in general habit of growth and also in the sizes of their spicules; but in regard to the conformation of the skeleton and the forms of their spicules, they are practically identical. Consequently, whilst there can

be no question of the admissibility of their inclusion in one species, one finds it impossible, with so few specimens, to form any opinion as to whether they ought to be considered as mere "metamps," or as representing two or three independent varieties. For convenience of description I divide them into four *forms*, distinguished as (*a*), (*b*), (*c*) and (*d*) respectively; the first of these is chosen to represent the typical form. A general description will first be given embracing the features common to all, and then each will be described separately with regard to the points in which it differs from the others.

General Description.—The sponge is stipitate and more or less ramose, with branches which, in general, are distinguished into several successive orders of rapidly decreasing length; in some cases, owing to an excessive abbreviation of the branches the habit might be described as sub-lobate. Anastomosis of some of the branches usually occurs. There is, as a rule, a more or less well-expressed tendency on the part of the derivative branches of one and the same branch to confine their outgrowth to a single plane, and this tendency may sometimes affect the entire sponge in a uniform way so that a flabellate arrangement of the branches results. The most characteristic external feature, and one which appears to be constant in occurrence, though variable in degree, is a nodular or warty appearance of the surface, due to the presence everywhere of short, rounded or slightly compressed outgrowths or processes. In appearance and character these processes usually bear a close resemblance to rudimentary branches; and, indeed, it is often difficult to distinguish between what on the one hand should be regarded as incipient branches, and on the other, as processes of larger size than usual. They are thus apparently quite of the nature of *abortive* branches. In some cases they are so closely crowded that the intervals between them are reduced to narrow sulci; in others, they are sometimes widely separated. Occasionally they take the form of short ridges.

The dermal membrane is, at the best, only faintly developed, and is usually indistinct. In the latter case the surface exhibits a minute hispidity, due to the projecting terminal spicules of the main fibres. This hispidity is most pronounced in the typical specimen, in which the spicules are of greatest size. There seems to be an inverse relationship between the degree of hispidity of the surface and the degree of development of the dermal membrane.

The surface is closely though somewhat irregularly dotted with small sub-dermal pores of slightly variable size which are the more clearly distinguishable the less evident is the dermal membrane. These pores appear frequently to be of larger size when situated in the sulcar parts of the surface.

There are apparently no oscula. The consistency in alcohol is firm and fairly tough; specimens which have been dried after initial preservation in alcohol are rather brittle for a species of *Clathria*.

The skeleton is a fairly regular sub-rectangular reticulation consisting of (i.) semi-plumose main fibres which run longitudinally with gradually increasing trend outwards from the axis of the branch to the surface, where they terminate in a tuft of spongin-free spicules; and (ii.) simple connecting fibres of a spicule's length which cross these at right angles and contain, each of them, one or (less frequently) several axial spicules. The pattern of the skeleton might therefore be described as scalariform. On the whole, the fibres are not rich in spongin, and the chief part in the composition of the skeleton is played by the spicules. The directive spicules of the main fibres, *i.e.*, the principal styli, which are very loosely associated and generally number less than five in a cross-section of the fibre, are for the most part disposed obliquely with regard to the axis of the fibre; and consequently their distal or pointed extremities frequently project beyond the spongin. Towards the outer extremity of the fibres, the obliquity of the spicules increases and the amount of spongin in the fibre diminishes; in this portion of their length the fibres present an appearance which recalls that which is characteristic of the *C. spicata* group of species (*vide* p. 214). Accessory styli are rather plentiful, and occur only as echinating spicules. Auxiliary tylostyli are scattered between the fibres, increasing in numbers in the vicinity of the surface; their mode of arrangement in the dermal layer is similar to that described for *C. arcuophora*. Principal styli also occur interstitially in noteworthy number; these lie in close proximity to, and parallel with, the fibres, and frequently point in the direction opposite to that of the spicules within the fibres.

Megascleres.—

(i.) The principal styli are curved sub-conical smooth spicules which not only vary greatly in maximum size in the different forms of the species, but also exhibit a considerable range in size in any given specimen. The smallest are never much larger than the longest accessory spicules, and in one of the forms of the species there appears to be an unbroken continuity in regard both to size and form between the megascleres of the two kinds. The largest spicules are invariably to be found amongst those which form the surface-tufts; but their maximum size, owing to the relative fewness of the spicules which approach it, is

not readily determinable. For example, in a preliminary examination of a slide preparation of the spicules of the *typical form*, the largest spicule observed was 360 μ long, though subsequently others up to 430 μ in length were met with; whereas measurements of the spicules *in situ* in the surface-tufts revealed individuals some of which attained to 480 μ.

(ii.) The accessory spicules are characterised by the fact that they seldom exhibit more than a slight roughness of the surface and are frequently quite smooth. They are straight sub-conical styli often with a slight basal knob and a slight sub-basal constriction.

(iii.) The auxiliary spicules are typically straight smooth tylostyli varying in size in the different forms of the species.

Microscleres.—

The general information concerning the microscleres is given in the diagnosis.

Of the species of *Clathria* described in the present paper, *C. transiens* approaches most nearly to *C. arcuophora* in the conformation of its skeleton. It differs, however, from the latter species in this respect, that the main fibres are not distinguishable into an axial series of longitudinal fibres, and a series of secondary fibres running off from these to the lateral surfaces.

Description of the Several Forms.—

(1). Form (*a*); *typical form* (Pl. xxxiii., fig. 1, and figs. 48, 48*a*).

In the single specimen the main branches are very short and much compressed, whilst the secondary branches are reduced to mere lobes. The surface processes are small, often indistinct, and are sometimes elongated into short narrow ridges. Branching is not confined to one plane, although the secondary branches are for the most part marginally situated on the primaries. The habit of the sponge is lobate rather than ramose. It measures 75 mm. in height.

The surface is densely, though minutely, hispid with the projecting points of the principal styli which terminate the fibres. There is no semblance of a dermal membrane. The colour in alcohol is pale yellowish grey.

Megascleres.—

(i.) The principal styli vary in length from (apparently not less than) 130 to 480 μ; their maximum diameter rarely exceeds 17 μ, but may attain to 20 μ.

(ii.) The accessory styli are rarely quite smooth, and often show distinct though very minute spines. They range in length from 60 μ to very rarely more than 85 μ, and in diameter up to about 6 μ; occasional individuals up to 98 μ in length have been observed.

(iii.) The auxiliary tylostyli vary in length from about 130 to 365 μ, and in diameter up to 6 μ. They are comparatively few in number.

Microscleres.—

(i.) Chelæ, tolerably plentiful, 16 to 20 μ long.

(ii.) Toxa, moderately abundant, varying in length from 10 to 150 μ, and in diameter up to 3 μ.

Loc.—North coast of Tasmania, off Devonport ("Endeavour").

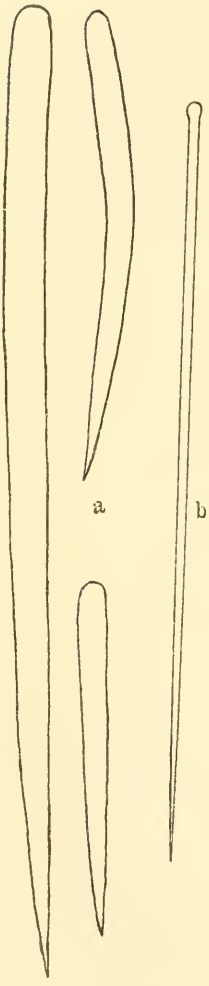

Fig. 47—*C. transiens* (typical form). a Principal styles. b Auxiliary style.

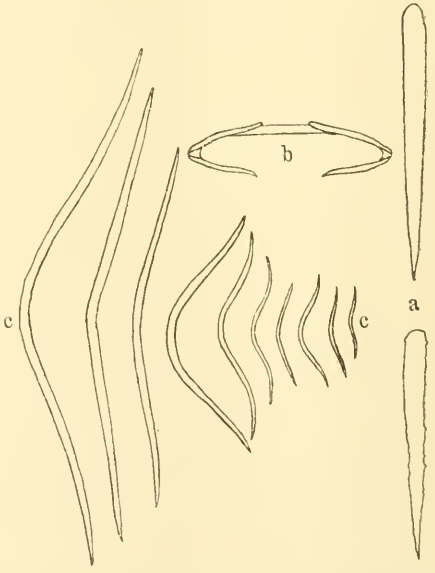

Fig. 47*a*—*Clathria transiens* (typical form). a Accessory styles. b Chela. c Toxa.

(2). Form (*b*). (Pl. xxxiii., fig. 2, and figs. 49, 49*a*).

The branches are sub-cylindrical or but slightly compressed, 5 to 7 mm. in diameter, and lie in a single plane. The main branches divide dichotomously and occasionally anatomose; the secondary branches often extend across the interval between adjoining main branches and effect a connection between them. The sponge is accordingly flabellate, and consists of a reticulation of branches; it measures 120 mm. in height and 130 mm. in breadth. Wart-like prominences of irregular size and shape are scattered over the surface. As in the typical form, there is no appearance of a dermal membrane, and the colour in alcohol is pale yellowish grey; owing to the smaller size of the principal styli, however, the surface is much less distinctly hispid.

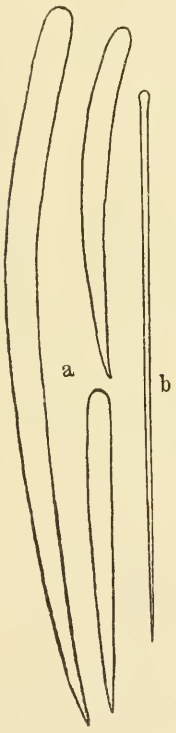

Fig. 48—*C. transiens* (form *b*). a Principal styles. b Auxiliary tylostyle.

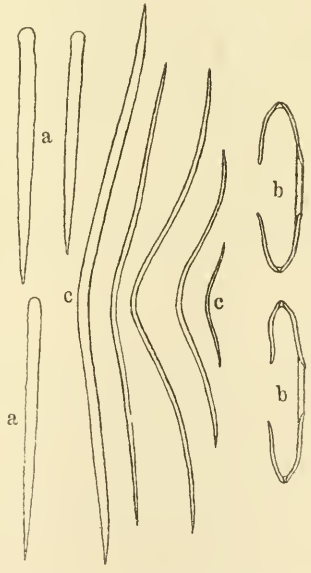

Fig. 48*a*—*Clathria transiens* (form *b*). a Accessory styles. b Chelæ. c Toxa.

Megascleres.—

(i.) The principal styli vary in length from 110 to 430 μ, but very seldom exceed 320 μ; their maximum diameter is 13 μ.

(ii.) The accessory styli are commonly quite smooth, and are never distinctly spined. They range in length from 55 μ to very rarely more than 80 μ, and in diameter up to 5 μ; occasional individuals up to 95 μ in length have been observed.

(iii.) The auxiliary tylostyli vary in length from less than 120 to 355 μ, but only in extremely rare cases exceed 300 μ; maximum diameter, 4.5 μ.

Microscleres.—

(i.) Chelæ, somewhat scarce, 14 to 20 μ long.

(ii.) Toxa, fairly plentiful, 12 to 132 μ in length, and rarely slightly more than 2 μ in diameter.

Loc.—Coast of South Australia, forty miles west of Kingston, 30 fms. ("Endeavour").

(3). Form (*c*). (Pl. xxxiii., fig. 3).

The specimen is a broken one; the largest piece of it—the subject of the figure—measures 210 mm. in length. The primary branches, which appear to have been confined more or less to one plane, are slightly compressed, and measure about 15 mm. broad by 10 mm. thick. The secondary branches usually arise along the lateral borders of the primaries.

The characteristic surface elevations are closely approximated; in the sulci between them are the traces of an extremely thin dermal membrane. The colour in alcohol is light greyish brown.

Megascleres.—

(i.) The principal styli range in length from 120 to 365 μ; the stoutest are 16 μ in diameter.

(ii.) The accessory styli are commonly quite smooth and are never distinctly spined. They vary in length from 50 to 85 μ, and up to 5 μ in diameter.

(iii.) The auxiliary tylostyli vary in length from less than 110 μ to rarely more than 280 μ; the largest observed measured 320 x 4.5 μ. They occur in considerable abundance.

Microscleres.—

(i.) Chelæ, rather scarce, 16 to 19 μ long.

(ii.) Toxa abundant, 25 to 172 μ in length, and up to 2 μ in diameter.

Loc.—Coast of South Australia, forty miles west of Kingston, 30 fms. ("Endeavour").

(4). Form (*d*). (Pl. xxxiv., fig. 2).

The specimen now to be described is perhaps sufficiently distinguished in several respects from the three preceding to permit of its being regarded as representing a variety of the species, or even (if its differences be constant), as representing an independent species. Its chief distinctive characters are: (i.) The absence of chelæ; (ii.) a minute wartiness of the basal ends of the auxiliary tylostyli; and (iii.?) a restricted range of length of the toxa.

The specimen, from which the stalk (save for a small portion) is missing, measures 90 mm. in height. The branches are, for the most part, irregularly cylindrical, and average 7 mm. in diameter. The primary branches, as in the specimen of form (*c*), exhibit a kind of bilaterality expressing itself in a tendency towards a distichous arrangement upon them of the short secondary branches. The characteristic surface-elevations sometimes assume the form of short ridges, but usually they are rounded and somewhat wart-like. There is a distinct but very thin dermal membrane. The colour (in alcohol) is purplish pink; this colour, however, is confined to a thin superficial layer of the sponge, the inner parts being yellowish grey. In life, the specimen was brick-red.[1]

Megascleres.—

(i.) The principal styli vary in length from 100 to 340 μ, and in diameter up to 11 μ. The smallest approximate extremely closely in size and shape to the accessory styli. A fair proportion of them are slightly expanded at the base to form a faint knob.

(ii.) The accessory spicules vary in form from simple styli to tylostyli. Under ordinary powers of the microscope they appear quite smooth; but under higher powers a barely perceptible roughening of portions of the surface, more especially towards the basal extremity, is occasionally to be observed. Their length varies from (rarely so small as) 45 μ to somewhat over 90 μ, but seldom exceeds 80 μ; the stoutest may attain to 4 μ, though a very considerable proportion of them are less than 2 μ in diameter.

(iii.) The auxiliary tylostyli, though normally straight, are very often more or less curved. A peculiarity which appears to be characteristic occurs in connec-

1 The specimen is one of a large number of sponges collected in Port Phillip and presented, together with a list of their colours in life, by the late J. Bracebridge Wilson, M.A.

tion with the basal extremity, which in a large proportion of cases displays either a rugged surface or some kind or other of tubercular deformity. They vary in length from less than 120 up to 180 μ; and in diameter up to (rarely) 3 μ.

Microscleres.—

Chelæ appear to be absent. Toxa, agreeing in shape with those of the preceding forms, but very slender (never quite attaining a diameter of 1 μ), are very scarce. The longest observed was 180 μ in length; the shortest (apparently) are between 50 and 60 μ long, and are of extreme tenuity.

Loc.—Port Phillip, Victoria (Austr. Mus. Coll.).

Clathria arcuophora, *Whitelegge.*

(Text figs. 49, 49*a*).

1907. *Clathria arcuophora*, Whitelegge, Austr. Mus. Mem. iv., Pt. 10, 1907, p. 500, pl. xlv., fig. 29.

Sponge flabelliform, thin, stipitate. Surface very closely dotted with minute pinhole-like (sub-dermal?) pores. Skeleton arrangement semi-axinelloid. In the middle region of the sponge-lamina (occupying about one-fourth to one-third its thickness) is an irregular reticulation of fairly stout spongin fibres, with a discrete spicular core; and from this mid-region, on either side, stout strands of loosely and somewhat plumosely arranged spicules, held together by a relatively small or even inappreciable amount of spongin, run perpendicularly outwards to the surface in a regularly pinnate fashion. These "secondary" fibres are joined at short intervals by connectives of a spicule's length, each consisting of one to several spicules. Echinating acanthostyli moderately abundant. Megascleres.—(i.) Smooth, curved, subconical principal styli, varying in size from 100 x 12 μ to 620 x 25 μ; (ii.) straight, sub-conical acanthostyles with small spines or merely rugged surface, 60-100 x 8 μ; (iii.) straight auxiliary sub-tylostyli, often with minute basal spines, 120 to 360 μ in length, and up to 6.5 μ in diameter. Microscleres.—(i.) Isochelæ palmatæ 20-22 μ long; (ii.) tricurvate bow-shaped toxa, 10 to 135 μ in length, and up to 4 μ in diameter.

Five specimens of this species were obtained, which agree in all respects with the original, except that the lamina,

although sometimes slightly subdivided, shows no appearance of having resulted from a coalescence of branches. In some cases, however, a few rope-like thickenings of the lamina, radiating from its junction with the stalk, and calling to mind the main ribs of a palmate foliage leaf, can be traced for a short distance. Scattered over the surface at irregular intervals are (sometimes but faintly perceptible) groups of radiately-arranged short ridges, somewhat resembling the "asterisks" of *Rhaphidophlus typicus* var. *stellifer*, but of smaller size; these do not appear to have any special morphological significance. The largest specimen measures 400 mm. in height, 230 mm. in breadth, and 3 to 5 mm. in thickness.

The original description stands in need of correction in regard to the occurrence of oscula, the dimensions of the spicules and the mode of arrangement of the auxiliary megascleres at the surface.

The surface of the (dry) sponge is everywhere closely dotted with roundish pinhole-like "pores," which are rarely more (and usually much less) than .5 mm. in diameter, and stand, on the average, somewhat less than 1 mm. apart. In the type specimen, but not in the present ones, there are in addition to these pores a number of larger openings up to 2 mm. in diameter; the latter, however, are due merely to the incomplete coalescence of perhaps originally separated parts. Both kinds of openings appear to have been regarded by Whitelegge as oscula; but the latter, as I have just indicated, are purely adventitious, whilst the former are probably of the nature of "subdermal pores."

The corrected measurements of the spicules are as given in the above diagnosis. It is perhaps scarcely correct to say that the toxa are of two kinds, since there is no difference in shape between the largest and the smallest; nevertheless individuals of length between 40 μ and 60 μ are rare. The statement that the auxiliary

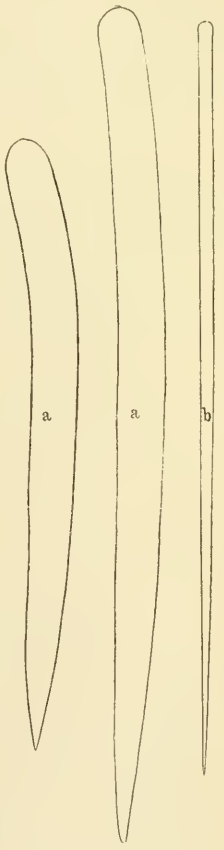

Fig. 49—*C. arcuophora*. a Principal styles. b Auxiliary subtylostyle.

spicules occur in the dermal layer as "radiating tufts" is misleading, since it would imply some degree of regularity in their arrangement and might suggest that the "tufts" are disposed vertically. As a matter of fact these spicules lie more or less horizontally, and although penicillate groups and parallel bundles occur, they are, on the whole, scattered without order. Chelæ and toxa are plentifully distributed throughout the sponge; but in the dermal layer, in which the chelæ are particularly abundant, toxa are rare or absent. An interesting point in connection with the megascleres is the extreme variability of size, not only of the principal, but also of the auxiliary, spicules; although the former may attain to a length of over 600 μ, individuals exceeding 400 μ are comparatively rare.

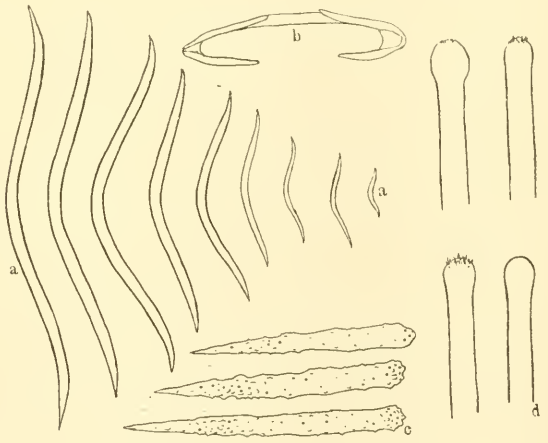

Fig. 49*a*—*Clathria arcuophora*. a Toxa. b Chela. c Acanthostyles. d Basal ends of auxiliary tylostyles.

This species is distinguished from all the preceding species herein described on account of the very conspicuous part which the megascleres play, in comparison with the spongin, in the composition of the skeleton.

Locs.—Coast of New South Wales; Shoalhaven Bight, 15-45 fms. ("Endeavour"); off Barranjoey, 25-28 fms. ("Thetis").

C. arcuophora is of interest on account of the light which it throws on the relationship of *C. frondosa*, Lendenfeld.[1] In the latter, the principal spicules are styli, strongyla and oxea; the accessory spicules are sub-tylotiform; and microscleres are absent. Accordingly it might seem doubtful whether the species should not be placed in *Echinodictyum* rather than in *Clathria*. However, in almost all other respects, including the pinhole-like punctation of the surface, its agreement with *C. arcuophora* is so striking, and its lack of resemblance to typical species of *Echinodictyum* so marked, as not only to put beyond question the propriety of its inclusion in *Clathria*, but also to preclude any likelihood that it forms a connecting link between the two genera.

In *C. frondosa* the more sponginous fibres which ramify in the axial plane of the sponge, are much less strongly developed than in *C. arcuophora*, and the lateral or "secondary" main fibres run, not perpendicularly as in the latter, but obliquely (*i.e.*, upwards and outwards) to the surface. Indeed, in the arrangement of its skeleton, as well as in the form of its principal spicules, *C. frondosa* approaches so closely to species like *Axinella symbiotica*, Whitelegge, and *Phakellia flabellata*, Carter, that, if it were not for its possession of spined accessory spicules, probably no one would hesitate in regarding it as congeneric with these species; even as it is I think that the relationship between them is by no means remote.

Genus Wilsonella, *Carter*.

1885. *Wilsonella*, Carter, Ann. Mag. Nat. Hist. (5), xvi., 1885, p. 366.

1888. *Clathriopsamma* (pars), Lendenfeld, Cat. Sponges Austr. Mus., 1888, p. 227.

The main skeleton is a reticulation (in which connecting fibres may be relatively few) of well-developed horny fibres echinated by acanthostyles. Dermal skeleton

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1 *Antherochalina frondosa*, Lendenfeld, "Die Chalineen des australischen Gebietes," Zool. Jahrb., 1886-1887, p. 765, pl. xxii., fig. 43; and Cat. Sponges Austr. Mus., 1888, p. 90; *Clathria frondosa*, Whitelegge, Rec. Austr. Mus., iv., No. 7, 1902, p. 288.

The fact that the Australian Museum specimen labelled (by Lendenfeld) *Antherochalina frondosa* is specifically identical with the British Museum (type?) specimen similarly labelled, together with the fact that the former bears a scarcely less than perfect resemblance to the original figured specimen, fixes the identity of this species beyond the possibility of question, and shows the original description to be most unsatisfactory. A re-description of the species of *Antherochalina*, and indeed of all the species described in "Die Chalineen des Australischen Gebietes"—the types of which are in the British Museum—is urgently needed. Whitelegge's description of the spicules is in some respects misleading, and he has overlooked the presence of scarce slender styli (about 120 to 180 μ in length and up to 4 μ in diameter) which, no doubt, represent auxiliary megascleres. The principal megascleres—styli, strongyla and oxea—are not, as he indicates, separable into three forms. They are curved or less frequently uni-angulate or bi-angulate spicules varying in length from 220 to 340 μ, and in diameter up to 24 μ. The oxea and strongyla (or rather, substrongyla) are usually asymmetrical with regard to opposite extremities.

various. The megascleres are of two kinds only; in addition to acanthostyles there are smooth or terminally spined, typically slender, monactinal, or oxeote or tornote quasi-diactinal, spicules which occur interstitially and dermally and usually also within the fibres as coring spicules. The microscleres (if present) are isochelæ and (or) toxa or sigmata.

I propose to revive the generic name *Wilsonella*, and to include thereunder, provisionally, a somewhat heterogeneous assemblage of species which hitherto have been wrongly assigned to *Clathria*. The single characteristic common to all of these, which distinguishes them from species proper to the latter genus, is a deficiency in spiculation due to the absence of those megascleres apparently, which, in the case of normal Myxillinæ, are termed the *principal*.

The proposal is the outcome of an attempt to secure the removal from *Clathria* of certain species (*e.g.*, *Wilsonella curvichela*, sp. nov.) which are peculiar not only in the lack of principal megascleres but also in the possession of *arcuate* chelæ. Palmate isochelæ, varying but slightly in form, are so characteristic of *Clathria* and related genera, that the occurrence in the species referred to, of strictly arcuate chelæ, is in itself satisfactory proof of their rather wide separation phylogenetically from typical members of the genus. Of the propriety of the removal of such species, therefore, there can be no question; but, unfortunately, owing to the existence of species devoid of microscleres and of species in which the chelæ are of apparently intermediate or ambiguous form, this difference in the character of the chelæ proves to be lacking in practical value for the purpose of generic definition. Consequently, so long as generic distinctions continue to be based solely upon skeletal and spicular characters, the separation from *Clathria* of *W. curvichela* and its allies can be effected only by taking advantage of their peculiarity in the first-mentioned respect—a peculiarity, however, which is also exhibited by a number of unrelated species, including amongst them several with palmate isochelæ; and the question thus arises as to which alternative has most to recommend it, (i.) the association together in a single genus apart from *Clathria* of *all* the species distinguished by the absence of spicules identifiable with principal megascleres, or (ii.) the continued retention of all such species within the genus *Clathria*. So far as I have been able to obtain information of species thus distinguished, it seems to me, inasmuch as each of them differs also in other important respects from typical species of *Clathria*, that the former course (until a more extended knowledge points the way to a better scheme for their disposal) is to be preferred; hence the proposal to unite them under

Carter's genus *Wilsonella*, of which they include the type-species, *W. australiensis*.

The following is a list, together with a resumé of the chief characters, of the hitherto described species known to me which the genus *Wilsonella* (as defined) will include. Of these, *Wilsonella australiensis*, *Clathriopsamma lobosa*, *Clathria pyramida*, *C. alata* and *C. dura* are species with which I have a direct acquaintance.

Wilsonella australiensis Carter,[1] as identified by Dendy and by Whitelegge, is a massive or sub-massive sponge, with or without lobations, often becoming somewhat compressed and flabelliform in outline. The oscula are sometimes as much as 5 mm. in diameter. The skeleton is reticulate; the fibres are charged with abundant foreign particles. The non-accessory megascleres are short slender styli, with a small area of spination at either extremity,[2] and measuring 120-160 μ in length; and 4.5 μ (though in some specimens much less) in maximum diameter. They occur sparsely and sporadically in the fibres, more plentifully in the ground substance, but are not so numerous in either situation as the (accessory) acanthostyles. The microscleres are rather abundant slender isochelæ palmatæ 12 to 16 μ long, and comparatively rare slender tricurvate toxa about 50 to 80 μ long, which often (at any rate in Port Phillip specimens) occur in small clusters.

Clathriopsamma lobosa, Lendenfeld[3] is a synonym of the preceding.

Clathria decumbens, Ridley.[4] According to description, the sponge is massive and sessile, with scattered oscula 1 to 4 mm. in diameter. The coring spicules are slightly fusiform basally spined styli, 150 to 175 x 5.5 μ in size: the largest acanthostyles measure 90 x 8 μ. The chelæ are of two kinds, a larger and a smaller, both palmate, but the latter with a more curved shaft; lengths 21-32 μ, and 11 μ, respectively.

Clathria australis, Lendenfeld,[5] is, according to its description, a *Wilsonella*. The sponge is flabelliform with a thick lamella. The skeleton is a network in which only the main

1 Carter—Ann. Mag. Nat. Hist. (5), xvi., 1885), p. 366; Dendy—Proc. Roy. Soc. Vict., viii. (n.s.), 1896, p. 33; Whitelegge—Rec. Austr. Mus., iv., 2, 1901, p. 84, pl. xi., fig. 12.

2 The spicule is exactly similar to those of *Clathria australiensis* var. *spinulata*, Hentschel (Fauna Südwest-Australiens, iii., 1911, p. 375, fig. 47a, b).

3 Lendenfeld—Cat. Sponges Austr. Mus., 1888, p. 227.

4 Ridley—Rep. Zool. Coll. "Alert." 1884, p. 612, pl. liii., fig. K, pl. liv., figs. g, g'.

5 Lendenfeld—*Loc. cit.*, p. 222. See also p. 161 of the present Report.

fibres are cored. The coring spicules are styli measuring 150 x 6 μ. (Microscleres are not mentioned; nor is there any reference to oscula).

Clathria macropora, Lendenfeld,[1] judging from its description, is very probably a *Wilsonella*. The sponge is "irregular, massive, lobose. The oscula are very conspicuous, and scattered over the whole of the surface; they are on an average 5 mm. wide and fairly abundant. The skeleton consists of a network of mostly longitudinally disposed fibres .13 mm. thick, which contain an axial bundle .07 mm. thick of slender oxea and styli, the former being more numerous. These spicules are .14 mm. long and .4 mm. thick." (The "oxea and styli" are very probably different forms of one and the same spicule. Microscleres are not mentioned).

Clathria pyramida, Lendenfeld.[1] The Australian Museum specimen labelled as the type of this species is of massive form, and has a slightly lumpy surface which is here and there raised up into large mammiform or conical prominences. Oscula are not apparent. The skeleton is composed of coarse fibres (sometimes exceeding 300 μ in thickness), with a stout spicular core (up to 160 μ in diameter), and a thick spongin sheath which appears coarsely stratified and sometimes has a rugged surface. Connecting fibres, which are usually short and stout, and without axial spicules, are of comparatively rare occurrence; so that the skeleton is much more of the dendritic type characteristic of *Crella* than of the reticulate type of *Clathria*. Acanthostyles occur fairly abundantly as echinating spicules, whilst both kinds of megasclere are plentifully scattered through the ground tissues. The smooth styli are straight, slightly fusiform, spicules varying in length from 190 to 240 μ and sometimes attaining a diameter of 7 μ. The acanthostyles are provided with relatively few, fairly large spines; they vary in length from 80 to 140 μ, whilst the stoutest are 9 μ in diameter. The microscleres are stout isochelæ palmatæ[2] in which the shaft is provided with a wing-like expansion along each side. The species might therefore be considered to include *Clathria alata*, Dendy (*vide infra*), as a variety. The chelæ are moderately abundant and vary in length from 20 to 25 μ.

(The "Endeavour" obtained at a depth of 33-40 fathoms, off the north coast of New South Wales, two specimens of a

1 Lendenfeld—Cat. Sponges Austr. Mus., 1888, p. 221. See also p. 165 of the present Report.

2 The chelæ are identical in form with those figured by Hentschel (*loc. cit.*, p. 376) for the West Australian sponge described by him under the name of *Clathria alata*, Dendy. Hentschel himself draws attention to the probability of an identity between *C. pyramida* and *C. alata*. The West Australian sponge should, I think, receive a varietal name, since the smooth megascleres are tylostylote in their young stages.

digitate sponge,[1] somewhat resembling *Spirastrella alcyonioides* in habit of growth, which agrees exactly with *C. pyramida* in the form of its spicules. The spicules are, however, slightly larger than in the typical form; the smooth styli reach a size of 260 x 8 μ, the acanthostylies a size of 160 x 12 μ, and the chelæ a length of 28 μ. The fibres also are slenderer and much less richly provided with spongin.)

Clathria alata, Dendy.[2] From an examination of a slide presented to the Australian Museum by Prof. Dendy, I find that this species differs from the *C. pyramida* in the following respects. Fibres are more abundantly developed and much less rich in spongin; the coring spicules are much less closely packed, giving somewhat of a "whisp-like" appearance to the fibres; and connecting fibres are relatively fewer in number and much less distinct, so that it requires close inspection to detect that the arrangement of the fibres is not exclusively dendritic. The smooth styli reach a size of about 230 x 4 μ and are usually provided at the basal end with a faint elongated tylosis. The acanthostyles vary in length from about 60 to 140 μ and rarely attain a diameter of 8 μ. Chelæ are extremely abundant; they differ slightly from those of *C. pyramida* in this respect that the distal ends or "lobes" of their alae, as seen in profile, project beyond the posterior border of the shaft; they are also shorter and less robust, never exceeding 22 μ in length.

Clathria elegantula, Ridley and Dendy. Skeleton "a well-defined reticulation of horny fibre," of which the main fibres alone are cored by sybtylostylote spicules, 200 x 3 μ in size. The microscleres are "palmate isochelæ of rather unusual form, with very slender shaft, rather strongly curved and making an unusually wide angle with the front palm;" they are about 20 μ long.

Clathria piniformis, Carter.[3] According to description the sponge is erect, lobo-digitate or flabellate, with corrugated surface. Oscula (?). Oxeote modifications of both the smooth coring styli and the echinating acanthostyles occur; the smooth styli attain a size of 200 x 3 μ. Microscleres are said to be absent, but the presence of chelæ has probably been overlooked.

1 The specimens, which are preserved in a dry state, were inadvertently overlooked in selecting the sponges intended for description, and their discovery came too late to permit of their being figured and described in detail.

2 Dendy—Proc. Roy. Soc. Vict., viii. (n s.), 1896, p. 34.

3 Carter—Ann. Mag. Nat. Hist. (5), xvi., p. 354; Dendy—Proc. Roy. Soc. Vict., 1896, p. 34.

Clathria indica, Dendy.[1] Except in habit of growth this species appears to bear a certain amount of resemblance to the last-mentioned. The spicules are "smooth slender styli (verging upon the tylostylote form) or unequal-ended oxea," which measure about 140 x 3 μ, and "small straight entirely spined styli, gradually and sharply pointed at the apex and frequently narrowing somewhat at the base." There are no microscleres.

Clathria dura, Whitelegge.[2] Sponge ramose; branches compressed, ramifying and usually reticulating in one plane. Oscula marginal. The skeleton is a reticulation of stout, rather densely echinated pale horny fibres, of which both the main and connecting contain a compact spicular core. There is a dermal skeleton of scattered acanthostyles. The coring spicules are slightly curved, fusiform styli, with a tendency to pass into forms resembling tornotoxea, varying in length from 75 to 100 μ, and not more than 4.5 μ in diameter. The acanthostyles are often strongyliform and attain a size of 65 x 8 μ, but rarely exceed 6 μ in diameter. The microscleres are slender isochelæ arcuatæ 16-19 μ long.

Clathria myxilloides, Dendy.[3] According to description this sponge is massive, depressed, cake-like. Oscula (?). The skeleton is a very loose and irregular reticulation of stout, mostly longitudinal, whisp-like fibres. Smooth styli, 300 x 4.2 μ; acanthostyles 130 x 5 μ; microscleres, arcuate isochelæ 25 μ long.

Clathria imperfecta, Dendy.[3] Sponge compressed, cake-like, crumbling. Oscula (?). Skeleton resembling that of the preceding species. Smooth styli 200 x 6.2 μ; acanthostyles 100 x 5 μ. No microscleres.

Thalassodendron typica, Lendenfeld (*vide* p. 203). A subcaliculate or flabelliform sponge, with longitudinally ridged surface. According to description, the skeleton is reticulate, with aspiculous connecting fibres and stout main fibres filled with straight styli 200 x 5 μ in size. The echinating styli are scarce, smooth or slightly spined and attain a size of 70 x 8 μ. Microscleres are not mentioned.

Plectispa macropora, Lendenfeld (*vide* p. 205). Small massive or incrusting honeycomb-like sponges with a reticulate

1 Dendy—Ann. Mag. Nat. Hist. (6), iii., 1889, p. 84, pl. iv., fig. 10.

2 Whitelegge—Rec. Austr. Mus., iv., p. 83; pl. xl., fig. 11. Hentschel has recently described a West Australian sponge under the name of *Clathria dura*, Whitelegge, var. *mollis*, which possesses isochelæ palmatæ and toxa, as well as principal styli. The sponge, which is therefore distinct from the present species, will probably require a new specific name, since the name *Clathria mollis* has already been used by Kirkpatrick for a South African sponge.

3 Dendy—Proc. Roy. Soc. Vict., 1896, p. 35.

skeleton of slender fibres cored by straight or curved styli 200 x 4 μ in size, and pretty abundantly echinated by slightly spined styli 70 x 6 μ in size. Microscleres are not mentioned.

Clathria mollis,[1] Kirkpatrick. A sub-caliculate sponge of soft consistency, with scattered oscula. Skeleton a reticulation of thick soft fibres echinated and sometimes cored by acanthostyles, 130 x 11 μ in maximum size. Foreign bodies present in the fibres and ground substance. Asymmetrical amphitornota, 165 x 5.5 μ, occur in the dermal layer. Microscleres: tridentate isochelæ, sigmata, and [?] toxa.

The last-mentioned species differs from all the preceding in the fact that the non-accessory megascleres are diactinal, but this does not provide sufficient reason for excluding it from the genus, since in a number of the other species a diactinal tendency on the part of these spicules is frequently to be observed.

The sponge described by Carter under the name of *Wilsonella echinonematissima*[2] might perhaps also, for the present, be included amongst the species of *Wilsonella*. It is, however, peculiar in the fact that the acanthostyles are differentiated into two kinds, a larger and a smaller; the former attain a size of 145 x 8.3 μ. The sponge is massive, with a reticulate skeleton of horny fibres which are echinated by the acanthostyles, and in the deeper parts of the body cored with smooth sub-basally constricted smooth styli, about 210 x 4 μ in size, but which towards the surface become almost exclusively occupied by foreign bodies. Oscula (?). The microsclere is "an equianchorate somewhat bent upon itself, rather obtuse at the ends, *i.e.*, not navicularly shaped," measuring 25 μ in length.

Also it might be well to include provisionally, as *species dubiæ*, under the genus *Wilsonella*, Lendenfeld's three so-called varieties of *Echinonema anchoratum*, Carter. The type-specimens of these three sponges appear to have been lost, and since their descriptions are very brief, it is possible that they may never be re-identified. It is strange that although Carter clearly indicates in his description of *E. anchorata* that the megascleres are styli, Lendenfeld in his description of the "varieties" states that they are oxea; but inasmuch as the latter has described the non-accessory megascleres of his *Echinonema levis* and *E. rubra* as styli, whereas

1 Kirkpatrick—"Marine Investigations in South Africa," ii., Sponges iii., p. 249, pl. v., fig. 15, pl. vi., figs. 16a-d.

2 Carter—Ann. Mag. Nat. Hist. (5), xvi., 1881, p. 366.

they are actually oxea, it is not beyond possibility that, in the present instance, he has inadvertently written "oxea" when "styli" was intended. In either case, whether their spicules be styli or oxea, the three sponges are, according to their descriptions, capable of being included in the genus *Wilsonella* as I have defined it.

The species of Wilsonella of which I have a first-hand acquaintance, appear to represent perhaps four or five generic types, in accordance with the following division:—(i.) *W. australiensis;* (ii.?) *W. conectens*, sp. nov.; (iii.) *C. pyramida*, *C. alata*; (iv.) *W. curvichela*, sp. nov., *W. oxyphila*, sp. nov.; and (v.?) *C. dura*. Of these the first-mentioned two species are distinguished from the rest by the possession of isochelæ palmatæ of typical form, and of toxa.

In group (iii.) the chelæ, whilst conforming rather to the palmate shape, are peculiar in that they have an alate shaft and undergo in the course of development a considerable change of form.[1] To what extent their peculiarity in the latter respect is important one cannot say, since so little information concerning the growth-stages of chelæ is available; but it seems to be the case that in *Clathria* proper, the youngest visible forms of the chelæ are not materially different (except in the tenuity of their parts) from those which are fully developed. It may be that the chelæ of this group are modified arcuate chelæ; for there is nothing objectionable in the supposition that arcuate chelæ may secondarily come to resemble palmatæ chelæ, and in this connection it may be remarked that the immature forms of the chelæ of *C. pyramida* are much like those of the arcuate chelæ of *Lissodendoryx stipitata*, Lundbeck.[2] Chelæ bearing a close resemblance in both their immature and final stages to those of *C. pyramida*, but lacking in any perceptible modification of the shaft, occur in *Amphilectus ceratosus*, R. and D.[3]; so marked, indeed, is the resemblance between the chelæ of these two species, that the likelihood of its being merely an accidental one is remote.

The species of groups (iv.) and (v.) agree among other respects in possessing arcuate chelæ which, moreover, develop along similar lines. These chelæ commence as a slightly curved rod,[4] upon which the rudiments of the alæ appear before there is any sign of the formation of the front palm.

1 *Vide* Hentschel—*Loc. cit.*, pp. 376, 377, and figs. 48e, f, g.

2 Lundbeck—Porifera, Danish Ingolf Expedition, ii., 1905, pl. xvii., fig. 2e.

3 Ridley and Dendy—"Challenger" Monaxonida, 1887, p. 125, pl. xix., fig. 10a; Whitelegge, Austr. Mus. Mem., iv., 9, 1906, p. 473.

4 The development of the chelæ of *Ectyodoryx maculatus*, Hentschel (1911), and of the ancoræ of *Iotrochota raridens* and *I. oxeata*, Lundbeck (1905), commences in a similar manner.

C. dura differs from the species of group (iv.) in the strong spiculation of its fibres (both main and connecting) and in its dermal skeleton of acanthostyles; except that its fibres are echinated, it approaches rather closely to *Pseudoclathria compressa*, Carter.[1]

WILSONELLA CONECTENS, *sp. nov.*
(Plate xxxii., fig. 2, and fig. 50.)

Sponge a sessile amorphous reticular mass of moderately thin mostly erect lamellæ. Oscula absent (?). No distinct dermal membrane. Skeleton an irregular reticulation of thin fibres with a loose meagre core of smooth slender styli; in the connecting fibres the spicules are usually uniserially arranged. Accessory acanthostyles rare. Spicules similar to the intrafibral styli, are scattered interstitially in moderate abundance. Megascleres:—(i.) Smooth sometimes tornotely-pointed styli or subtylostyli, up to 240 μ in length and at most 4 μ in diameter; (ii.) acanthostyles, obscurely spined or rugged, 70 x 4.5 μ. Microscleres:—(i.) Isochelæ palmatæ, 8 μ long; (ii.) rare toxa, of moderate size, with arms sometimes inclined at right angles.

Two specimens were obtained, both of which are preserved in a dry state. The sponge is a low-spreading reticulate subcellular mass of irregular rumpled lamellæ which as a rule are disposed more or less vertically. An idea of the general external appearance of the sponge is best obtained from the figure (Pl. xxxii., fig. 2). The lamellæ have an uneven surface and are frequently irregularly fenestrate; they average 2 to 3 mm. in thickness. The larger specimen measures 120 mm. in length, 80 mm. in breadth, and 60 mm. in height. The specimens afford no certain evidence of their mode of attachment; but, judging from adhering fragments, it is highly probable that they grew upon branching calcareous bryozoans to which they were attached at many points. The colour in life was bright orange yellow; it is now light brown. The texture is finely fibrous and compact. As regards consistency, the sponge is, in its present state, moderately tough, compressible and resilient.

Owing to the damaged state of the surface nothing can be said concerning the arrangement of the spicules in the dermal layer. The main skeleton is an irregular reticulation of thin fibres, the stoutest of which rarely exceed 50 μ in diameter. Both main and connecting fibres are cored with slender smooth straight styli, and similar spicules, in considerable number,

1 Carter—Ann. Mag. Nat. Hist. (5), xviii., 1886, p. 450; Dendy—Proc. Roy. Soc. Vict., ix. (n.s.), 1897, p. 259.

are scattered between them. The spicules of the main fibres, which are seldom more, and usually much less than ten in number in a cross section of the fibre, are sometimes collected into a slender compact axial strand, and sometimes spread dispersedly; in the connecting fibres they are arranged uniserially or, less frequently, pauciserially. Acanthostyles are of rather rare occurrence; mostly they echinate the fibres, but a small proportion occur within the fibres and an occasional one is met with interstitially. The meshes of the reticulation are very variable in size and shape; their angles are usually well rounded off, and the apertures of the smallest meshes are consequently oval in outline. The pattern of the skeleton, as seen in section, differs to a great extent according to the direction in which the section has been cut. The minimum degree of irregularity is shown in sections cut perpendicularly to the plane of a lamina and in the direction of growth; in such sections the repeatedly branching main fibres run longitudinally in a very irregular manner and are joined by single transverse fibres or by interreticulations (of lesser or greater extent) of connecting fibres, according as they lie close together or farther apart. The meshes of the reticulation are tympanised by filmy membranes to which the interstitial spicules appear to be entirely confined. Possibly these membranes are capable of being perceived only in sections prepared from dry specimens, such as the present are.

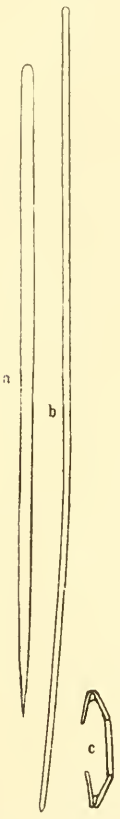

Fig. 50—*W. conectens* a, b Styli, showing the extremes of form exhibited by these spicules. c Chela. (Toxa not figured.)

Megascleres.—

(i.) Smooth, normally straight, cylindrical styli or less frequently subtylostyli, varying in length from about 130 to 250 μ, and in diameter up to 4 μ. They show a barely appreciable degree of differentiation into two orders: those which exceed 200 μ in length are seldom more than 3 and never more than 3.5 μ in diameter, and are usually tornotely pointed; whilst a considerable proportion of those below 180 μ in length may attain a diameter of 4 μ, and commence to

taper to a point at a distance from the distal extremity of as much as 15 μ. There is, accordingly, a remote possibility that the spicules belong to two different categories equivalent to the principal and auxiliary spicules of normal Myxillinæ; but inasmuch as the two kinds graduate insensibly the one into the other, and are promiscuously intermingled in the skeleton, whether within the fibres or scattered interstitially—it is impossible to arrive at any other conclusion than that they are but different forms of a single category.

(ii.) Very minutely spined or rugged acanthostyles, 55 to 70 μ in length and at most 4.5 μ in diameter.

Microscleres.—

(i.) Relatively stout isochelæ palmatæ 8 μ long, moderately abundant in the interstitial membranes.

(ii.) Rare toxa;[1] in the few individuals which have been observed, the arms are straight, or slightly reflexed towards their extremities, are inclined at an angle varying from 20° to as much as 90°, and vary in length from 40 to 80 μ, and in diameter up to 3 μ.

Loc.—East coast of Queensland, nine miles east of Fraser Island, 24-26 fms. ("Endeavour").

In many respects *W. conectens* so closely resembles *Clathria angulifera*, Dendy,[2] that there is high probability of a near relationship between the two. In the case of the latter it would seem that the non-accessory megascleres comprise both principal and auxiliary spicules, for according to description, they are of two kinds: (*a*) smooth, straight, gradually sharp-pointed styli (up to about 180 x 4.2 μ in size), *occurring in the fibres*; and (*b*) straight styli or subtylostyli (up to about 250 x 3.5 μ), *occurring in the dermal tufts*. The opinion which I have expressed that the (non-accessory) megascleres of *W. conectens* belong to a single category, is therefore open to question.

WILSONELLA CURVICHELA, *sp. nov.*

(Plate xxxiv., fig. 4; and fig. 51.)

Sponge stipitate with erect compressed branches. Oscula small, marginal. Surface even. Dermal membrane distinct, thin. Main skeleton an irregular reticulation of stout densely echinated fibres; the main fibres

1 Owing to their rarity these spicules were at first overlooked and were thus omitted from the text-figure.

2 Dendy—Proc. Roy. Soc. Vict., viii. (n.s.), 1896, p. 32.

only, with a thin core of skeletal styli. Interstitial spicules rare. Megascleres of both kinds (the acanthostyles in lesser number) occur sparsely in the dermal membrane, together with scattered chelæ. Megascleres:—(i.) Skeletal, smooth substyli, 160 x 4 μ; (ii.) accessory acanthostyli, 96 x 8 μ. Microscleres:—Isochelæ arcuatæ 18 to 27 μ long.

The single specimen, preserved in alcohol, consists of a sub-cylindrical stalk (about 80 mm. long by 15 mm. in diameter) from which by two dichotomies there arise four erect slightly compressed branches. The branches are closely appressed and coalescent. Distantly separated oscula, seldom more than 1 mm. in diameter, occur in an irregular series along the edges of the branches. The surface is free from inequalities.[1] There is a very thin but quite distinct dermal membrane. The texture is dense; the consistency, firm and fairly tough; the colour, yellowish-brown. The total height of the specimen is 325 mm.

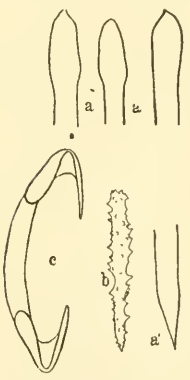

Fig. 51—*W. curvichela.* a Showing basal ends of the styli à Distal extremity of same. b Acanthostyle. c Chela.

The main skeleton is an irregular, relatively small-meshed reticulation of rather stout spongin fibres (sometimes exceeding 200 μ in diameter) somewhat densely echinated by short acanthostyles. In general, the area occupied by the fibres themselves is greater than that of the intervening spaces. A small proportion of the fibres are provided with a slender compact spicular core, but except in this respect there is no evident distinction between main and connecting fibres. A notable feature of the skeleton is the almost entire absence, except in close vicinity to the surface, of interstitial scattered megascleres. The dermal membrane contains scattered megascleres of both kinds (the acanthostyles in lesser number) and fairly numerous chelæ; the last-mentioned, also, are somewhat scarce in the choanosomal tissues.

Megascleres.—

(i.) The (auxiliary) smooth spicules are sharp-pointed cylindrical subtylostyli (or less frequently simple styli) with an elongate tylosis which usually tapers

1 The transverse ridges shown in the figure were produced by an entwining sea-weed.

more or less towards its extremity. Quite commonly the basal extremity of the spicule is either abruptly or acuminately pointed, and the spicule accordingly sometimes passes into an asymmetrical oxea. The length varies from 140 to 170 μ and the maximum diameter is 4 μ.

(ii.) The (accessory) acanthostyles are sub-conical, with moderately large, irregularly scattered, recurved spines. They are rarely less than 60 μ long and attain a size of 96 x 8 μ.

Microscleres.—

The chelæ (isochelæ arcuatæ) vary from about 18 to 27 μ in length; except for a greater curvature of the shaft in the case of the shorter spicules there is no appreciable difference in form between the longest and the shortest. In their earliest stage of development they appear as a slender, slightly curved rod; the alæ are well advanced in development before the rudiment of the front palm makes its appearance. At a certain stage of their growth many bear a rather close resemblance to the longest of the three chelæ shown in text-figure 52a for *Wilsonella oxyphila*.

Loc.—Coast of South Australia; (?) fifteen miles south of St. Francis Island ("Endeavour.")

Wilsonella oxyphila, *sp. nov.*

(Plate xxxiv., fig. 3; and figs. 52, 52*a*.)

Sponge flabellate, simple or proliferous. (?) Oscula small, marginal. Surface even, or with faint radiating grooves, or areolately pitted. Dermal membrane distinct, thin. Main skeleton an irregular reticulation of moderately slender, closely echinated fibres, with a slender core of skeletal spicules. Interstitial spicules scarce. Megascleres of both kinds (the accessory in lesser number) are sparsely scattered in the dermal membrane, together with frequent chelæ. Megascleres:— (i.) Skeletal smooth substyli, 200 x 3 μ; (ii.) accessory acanthostyli and (occasional) acanthoxea, 80 x 4.5 μ. Microscleres:—Isochelæ arcuatæ, approaching the palmate form, 16 to 26 μ long.

Introductory Remarks.—There are two specimens which I assign to this species. In their external appearance there is nothing that would suggest a specific identity, but they agree so perfectly in their spicular characters that one hesitates to separate them even as different varieties. Accordingly I have thought it best, whilst uniting them under a single name, to

keep their descriptions separate. The specimen which, on account of its better preservation, I select as typical of the species, is divided longitudinally into two equal portions; one portion has been retained in spirits, the other was removed and preserved in a dry state. As a result of its drying the latter has undergone a remarkable amount of shrinkage, being now scarcely more than one-half its former size.[1] The second specimen is both macerated and dry.

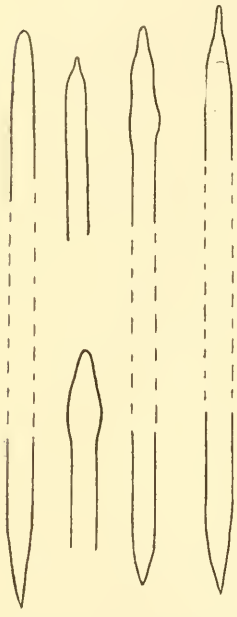

Fig. 52—*W. oxyphila.* Showing variations of the opposite extremities of the smooth megascleres.

Description.—

(*a*) *Typical Specimen.* The specimen, when complete, had the form of an oval leaf-shaped plate, with the narrower end drawn out into a short stalk, and measured 120 mm. in height, 90 mm. in greatest breadth and 8 to 10 mm. in thickness. Both surfaces exhibit a number of obscure, longitudinal, somewhat radiately disposed grooves which become more distinct towards the margin. These grooves are apparently due to the presence of canals lying immediately beneath the thin dermal membrane which have caused the latter to undergo a slight collapse. Owing to the somewhat damaged state of the surface, it is impossible to speak with certainty regarding oscula; it appears that the canals terminate along the margin of the plate in small circular openings.

The main skeleton is a reticulation of slender fibres which are fairly closely echinated by small acanthostyles. The main fibres contain a slender compact spicular core; the connecting fibres interreticulate to a slight extent and are destitute of axial spicules. Owing to the paleness of the spongin, the main fibres, by reason of their axial spicules, stand out rather conspicuously in comparison with the connecting fibres, so that at first glance the skeleton might appear to be dendritic; the false impression is, however, immediately corrected by the presence of echinating spicules on the connecting fibres. Both

1 The piece was subsequently returned to alcohol and expanded again almost to its original size.

kinds of megascleres, in very small number, are scattered through the ground tissues and dermal membrane. Chelæ are fairly abundant in the dermal membrane, or at least in some portions of it; but are rare in the interior.

Megascleres.—

(i.) The smooth (auxiliary) spicules show all gradations in form between elongately-"headed" subtylostyli and asymmetrical oxea; they are rarely less than 140 μ, and usually between 160 and 170 μ in length, whilst their maximum size is about 200 x 3 μ.

(ii.) The spined accessory spicules are styli and oxea of similar dimensions, the latter occurring in relatively small number. The spines are small, and scattered over the whole length of the spicule. The maximum size is 80 x 5 μ; the length is rarely less than 50 μ and seldom more than 70 μ.

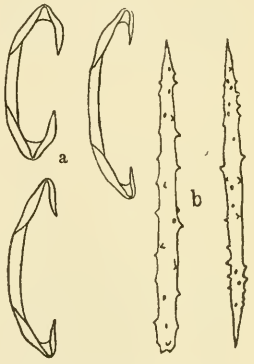

Fig. 52a—*W. oxyphila*. a Chelæ. b Acanthostyli.

Microscleres.—

Isochelæ of slightly variable shape, ranging in length from 20 to 26 μ. As a rule, as seen in profile their form approaches that of palmate isochelæ, but the shaft is slightly curved and makes a rather wide angle with the front palm; a small proportion bear a close resemblance to arcuate isochelæ. Their mode of development, however, indicates that their relationship is rather with the arcuate type of chela. In their earliest developmental stage they appear as a slender, slightly curved rod; the rudiments of the alæ next make their appearance, extending along the shaft at either end for about one-third of its length; and finally the front palm is added. In the case of quite an appreciable number of the chelæ—which otherwise attain to full proportions and indeed are usually somewhat longer than the average—the palm remains relatively small and the spicule then often bears a striking resemblance to incompletely developed chelæ of *Wilsonella curvichela*. The normal form is that of the shortest of the three chelæ shown in the adjoining text figure, though the spicule is usually not so robust.

Loc.—Near Kangaroo Island, South Australia, 17 fms. ("Endeavour").

(*b*). *H. oxyphila*, var.? (Plate xxxiv., fig. 3).

The different appearance presented by the second specimen is partly due to its intense purplish colour, and perhaps partly also to its dry macerated condition. The colour difference is of little consequence since it probably results from the presence of a symbrotic alga similar to that which affects certain other Australian species, notably *Chalina polychotoma*, Carter, *Arenochalina mirabilis* (Lendf.), Whitelegge,[1] and *Echinoclathria ramosa*, sp. nov.

In shape (Pl. xxxiv., fig. 3) it is not materially different from the typical specimen. It consists of a stipitate flabelliform plate (170 mm. in height and about the same in breadth, and 6 to 8 mm. thick) to which are added, mainly on one side, a few lamelliform outgrowths, joined to it along vertical lines.

The washed-out condition of the specimen is most unsatisfactory from many points of view for the purpose of full and accurate description, but in this case it possesses the advantage of permitting the rather characteristic gross structure of the skeleton to be readily perceived. I have not been able to convince myself that the type specimen, if macerated, would show a similar structure. The surface is everywhere irregularly covered with shallow, roughly polygonal or rounded honeycombcell-like pits on an average 2 mm. in diameter, and more or less distinctly arranged in longitudinal series running from the base to the margin of the plate. Where the sponge is thin, the "cells" may completely perforate it; when the

1 From an examination of a section which I have prepared of a fragment of a British Museum specimen labelled "*Arenochalina mirabilis* Lendenfeld, Torres Straits," and a comparison of its skeletal structure with that figured by Lendenfeld (Zool. Jahrb., 1887. taf. xxvii., fig. 28). I feel sure that this specimen is truly representative of Lendenfeld's species. I find, also, that Whitelegge's *Arenochalina mirabilis*, from Port Jackson, is closely allied to, if not identical with, the same species. Lendenfeld's description is accordingly wrong in stating that the megascleres are oxea; they are slightly fusiform subtylostyli with relatively large axial canal. Whether the typical *A. mirabilis* possesses chelæ or not I am unable to say, since, in the fragment referred to, owing to its washed-out condition, interstitial spicules are entirely absent. However, in the Port Jackson sponge there occur scattered anisochelæ palmatæ of simple form, and, since the close relationship of this sponge to Lendenfeld's is beyond doubt, one can therefore say that the genus *Arenochalina* possesses the spiculation of *Mycale*, and that it will probably form one of the sub-genera into which the latter genus will no doubt ultimately be subdivided. The external resemblance of *Arenochalina mirabilis* to *Spongelia elegans* (*c.f.*, Whitelegge—Rec. Austr. Mus., iv., pl. x., fig. 7, and Lendenfeld—Monogr. Horny Sponges, pl. xxxix., fig. 2) is so striking that it almost casts doubt on Lendenfeld's record of the occurrence of the latter species in the same area as the former, viz., at Broken Bay, New South Wales.

sponge is held up before the light, the partition between the rows of "cells" appear as ribs traversing the sponge longitudinally in a slightly radiating fashion. The consistency is fairly soft and slightly brittle.

The fibres are so densely surrounded by pigmented matter that the section required to be decolorised in order to bring them into view. The colour dissolves out in nitric acid as a bright carmine which soon disappears, particularly on warming. The skeleton differs from that of the preceding specimen in its much greater irregularity, but this is probably more apparent than real and due to the fact that the connecting fibres—owing to the dry state of the specimens and the consequent absence of interfibral substance—are no less conspicuous than the connecting fibres. In all other respects the two sponges appear to be identical.

Loc.—Oyster Bay, Tasmania, 30-40 fms. ("Endeavour").

Assuming the descriptions of *Clathria elegantula*, Ridley and Dendy, and *Clathria piniformis*, Carter,[1] to be correct in detail, it might be said that *W. oxyphila* forms a connecting link between them. The three species agree very closely in their characters; but oxeote modifications of the megascleres have not been mentioned for *C elegantula*, nor have chelæ been recorded for *C. piniformis*. It is, however, quite possible that the typical specimen of *W. oxyphila* may prove to belong to Carter's species, and the varietal specimen, to Ridley and Dendy's.

Genus Ophlitaspongia, *Bowerbank.*

In view of the existence of such a species as *Clathria transiens*, sp. nov.—in one of the forms of which, the accessory styli are smooth—the definition of *Ophlitaspongia*, as proposed by Dendy,[2] needs amendment so as to restrict the genus to species whose echinating and coring spicules (if both be present) are similar or, at any rate, not definably different. The amendment will probably necessitate the removal of *O. membranacea*, Thiele (*vide* p. 215), to *Clathria;* but, so far as I know, it affects no other species of the genus. The definition requires also to be modified in such a way as to clearly distinguish the genus from *Echinochalina* (*q.v.*). *Ophlitaspongia* has commonly been spoken of as differing from *Clathria* in the

1 Carter—Ann. Mag. Nat. Hist. (5), xvi., 1885, p. 354; Dendy—Proc. Roy. Soc. Vict. (n.s.), viii., 1896, p. 34.

2 Dendy—Proc. Roy. Soc. Vict., viii. (n.s.), 1896, p. 36.

smoothness of its echinating spicules; in its restricted sense, it will be more correct to say of the genus that it differs from *Clathria* in the absence of accessory spicules. The genus is, however, a very generalised one and such species as might be included in it are capable of derivation from a number of different genera.

Owing to such species as *Clathria transiens*, *Echinochalina intermedia*, Whitelegge, *O. tenuis*, Carter, *O. tubulosa*, sp. n., and *O. nidificata*, Kirkpatrick,[1] the task of satisfactorily defining *Ophlitaspongia* is rendered rather difficult. With the exception of *O. nidificata* (for which almost unquestionably a new genus should be established) the species of which I have information seem to require some such definition as the following: "External form various, but never regularly honeycombed. Skeleton a reticulation of usually well-developed horny fibre which is cored or echinated, or both cored and echinated by smooth basical[1] styli (sometimes accompanied by oxeote modifications). The basical styli, which are typically of a single kind, may exhibit some degree of differentiation into two kinds, but there is never any definable difference of form between those which core and those which echinate, the fibres. Monactinal auxiliary spicules, occurring interstitially and in the dermal layer, are typically present. Microscleres, if present, are isochelæ palmatæ and (or) toxa."

In *O. papilla*, Bowbk., the type-species, and in *O. seriata*, Bowbk., the fibres are said to be provided only with echinating spicules. In the species described in the present paper the echinating spicules are relatively few in number and, to some extent, accidental in the occurrence; they are, in fact, precisely analagous to the spicules (of common occurrence in the genus *Clathria*) which in the case of *C. partita* I have referred to as "quasi-echinating" spicules. That such spicules are, in some cases at least, to be regarded as, in a sense, accidental, is evident from the following considerations. (i.) In the species in which these occur, the (principal) spicules are not confined to the fibres only, but also occur in the ground substance; it is quite to be expected, therefore, that some proportion of them should be found to occupy an intermediate situation, *i.e.*, partly within, and partly projecting from the fibre. (ii.) The formation of spicules at the growing-point of the fibre precedes their envelopment by spongin, and since these terminal spicules are often spread penicillately, it follows that outlying

1 Kirkpatrick—Nat. Antarctic Exped., iv., 1908, Tetraxonida, p. 25.
2 *Vide* pp. 137, 138.

individuals may sometimes be left only partially included within the completed fibre. (iii.) Owing to the continued growth in stoutness of a fibre, spicules originally lying externally, but in close proximity to it, might secondarily come to be surrounded at their basal extremity by the fibre-spongin. (iv.) In the superficial regions of the sponge, spicules which appear as if echinating, are often nothing more than the axial spicules of incipient connecting fibres; this occurs most frequently when the connecting fibres are unispicular. (v.) It sometimes happens that the development of a connecting fibre —say, an unispicular fibre—proves abortive, the fibre then appearing as a process from its supporting main fibre; in such a case, if the process were very short, its axial spicule would appear to echinate the main fibre.

In the species of *Ophlitaspongia* described herein, the echinating spicules appear to arise in one or other of the ways indicated.

Dendy[1] has remarked that his *Siphonochalina bispiculata* resembles an *Ophlitaspongia* save in the fact that the spicules are oxea; perhaps this species should be placed in the genus *Diplodemia*, Bowerbank.

Ophlitaspongia confragosa, *sp. nov.*

(Plate xxxv., fig. 2, and fig. 53.)

Sponge small, delicate; of indeterminate habit; probably consisting, in most cases, of compressed upgrowths arising from a thin encrusting base. Oscula indistinguishable, perhaps absent. Skeleton an irregular sub-renieroid reticulation of thin pauci- or uni-spicular spongin-fibres, with meshes the sides of which are usually of not more than a spicule's length. Quasi-echinating spicules are of occasional occurrence. Auxiliary spicules are scattered interstitially—in some parts, sparsely; in others, in dense profusion. Megascleres:—(i.) Straight or (seldom) slightly curved principal styli, cylindrical throughout the greater portion of their length, slightly inflated at the base and gradually tapering to a point, attaining a size of 190 x 12 μ; (ii.) auxiliary subtylostyli with a maximum size of 300 x 5·5 μ. Microscleres:—(i.) Palmate isochelæ 10 μ long; (ii.) bow-shaped toxa, 80 x 3 μ in maximum size.

1 Dendy—Proc. Roy. Soc. Viet., vii. (n.s.), 1895, p. 246.

The single specimen, preserved in a dry state, is a small sponge of indefinite shape growing dispersedly over the fronds of a foliaceous calcareous Bryozoan. It consists in part of a thin spreading layer closely investing the surface of the fronds, and in part of irregular compressed outgrowths arising along their margins. The lamellar portions of the sponge (which constitute by far the greater portion of its bulk) have an uneven, irregularly undulating surface, and, owing to varying rates of growth at different points, an irregularly lobed and broken margin; they vary from 1 to 3 mm. in thickness, are indefinite in width, and attain, in the present instance, a maximum height of 50 mm. Owing to incomplete coalescence between the marginal lobes as growth proceeds, the lamellæ are frequently fenestrate. There are no certain indications of oscula. The surface is minutely porous. The colour is yellowish-grey; the consistency firm, compressible, slightly brittle; the texture, finely fibrous.

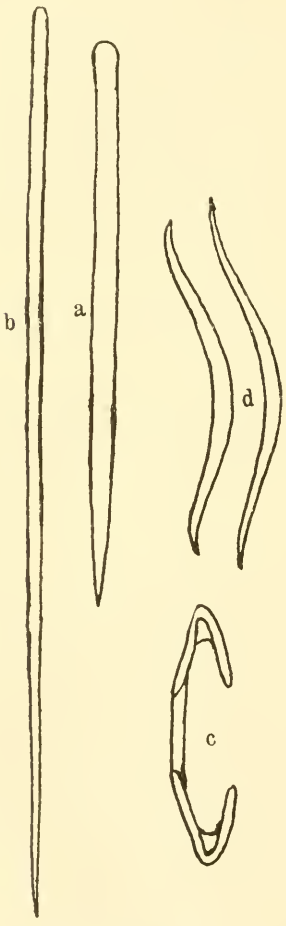

Fig. 53.—*O. contragosa*. a Principal styles. b Auxiliary style. c Chela. d Toxa.

The main skeleton is a web-like sub-renieroid irregular reticulation of pale slender horny fibres with pauciserially or uniserially arranged axial spicules (principal styli). The precise formation of the skeleton is difficult of determination; apparently there is a primary reticulation of stouter fibres, the meshes of which are occupied by a secondary interreticulum of mostly unispicular connecting fibres. The outlines of the stouter fibres are vague, and the arrangement of their spicules is disorderly; they seldom exceed 40 μ in diameter. The (usually single) spicules forming the sides of the angular meshes of the interreticulum are probably always surrounded

by a layer of spongin; but this is often so thin as to be indiscernible, and in such cases the spicules sometimes appear as if echinating. Quasi-echinating spicules are also of common occurrence on the more superficial fibres; these, in some if not all cases, mark the starting-points of new fibres. Scattered (auxiliary) subtylostyli occur interstitially, in some parts sparsely, in other parts in great abundance.

Megascleres.—

(i.) Principal styli straight, usually slightly expanded at the base, very nearly cylindrical throughout about three-fourths of their length and tapering thence to a sharp point, ranging in length from about 130 to 190 μ, and with a maximum diameter of 12 μ.

(ii.) Straight auxiliary subtylostyli or styli, 130 to 300 μ in length and 6 μ in maximum diameter.

Microscleres.—

(i.) Isochelæ palmatæ, fairly plentiful, 10 μ long.

(ii.) Toxa, comparatively scarce, in shape somewhat resembling the conventional bow of archery; length, 25 to 80 μ; diameter of the stoutest, 3 μ.

Loc.—Coast of New South Wales, Shoalhaven Bight, 15-45 fms. ("Endeavour").

Ophlitaspongia subhispida, *Carter.*

(Plate xxxvi., fig. 1; and fig. 54.)

1885. *Echinoclathria subhispida*, Carter, Ann. Mag. Nat. Hist. (5), xvi., 1885, p. 356.

Echinoclathria gracilis, Carter, *Loc. cit.*, p. 356.

1896. *Ophlitaspongia subhispida*, Dendy, Proc. Roy. Soc. Vict. (n.s.), viii., 1896, p. 36.

Sponge stipitate, with slender usually somewhat flattened branches which multiply dichotomously or (occasionally) polytomously, and extend, with or without anastomosis, in the same or in overlapping planes. Dermal membrane absent, or, at any rate, indistinct. Oscula not visible. Skeleton a regular scalariform reticulation of strongly developed horny fibres; the main fibres contain a discrete paucispicular core, the transverse fibres are without contained spicules. Principal styli are tolerably abundant in the ground substances and common as echinating

spicules. Scarce auxiliary spicules are scattered interstitially. Megascleres:—(i.) Principal styli, usually more or less curved, sub-fusiform, with a slight sub-basal waist, varying in length from about 50 (seldom less than 80) to 155 μ, and in diameter up to 5.5 μ; (ii.) auxiliary tylostyli, straight or in variable manner curved, 100 (or less) to 250 μ in length, and rarely as much as 1.5 μ in diameter. Microscleres:—Toxa, by no means scarce, 30 to 80 μ in length and never more than 1 μ in diameter.

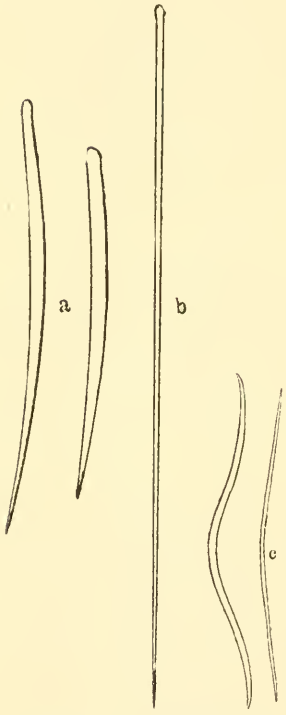

Fig. 54—*O. subhispida.* a Principal styli. b Auxiliary tylostylus. c Toxa.

The external form of this species has already been sufficiently well described, but no adequate account of the skeleton has so far been rendered; also, the information concerning the spicules is incomplete, and, to some extent, misleading. The specimen herein figured measures 100 mm. in height. The skeleton is a very regular reticulation of densely horny fibres, which are of a pale brownish tint and (except in proximity to the sponge-surface) rarely less than 70 or more than 100 μ in diameter; the main fibres contain a meagre wispy core of slender styli, the connecting fibres are vacant. As seen in median longitudinal section of a branch, the main fibres run longitudinally (in subparallelism, and from 80 to 120 μ apart) with a slight outward trend which gradually increases to a curvature as the exterior is approached, and arrive at the surface at an inclination to it varying (in different parts of the sponge) from about 45° to nearly 90°; they are joined at irregular intervals, in a scalariform fashion, by the short, stout transverse fibres. The meshes of the reticulation have their angles rounded off, and are usually elongated in the longitudinal direction; they vary in shape from circular to oblong. Owing to the absence of a dermal membrane, the free extremities of the main fibres give to the surface an appearance of hispidity.

Styli similar to those which core the fibres, *i.e.*, principal styli, occur in moderate number, both as echinating and as interstitial spicules; when interstitial, they are for the most part disposed parallely to the main fibres. Scattered between the fibres also, are a small number of very slender (auxiliary) tylostyli. The echinating spicules appear to be most abundant on the superficial fibres; but the majority of those which occur in that situation are partly or completely invested by a sheath of spongin and are evidently nothing more than the rudiments of developing new fibres. According to Carter's description the echinating spicules are of a different kind to those which core the fibres—but this is not so; for although the former are perhaps, on the average, of smaller size than the latter, yet between the two there is absolutely no difference of shape. Accordingly, it would be incorrect to suppose that *O. subhispida* bears any close relationship to such a sponge as *Clathria transita*, form (*d*), (p. 233), in which the echinating styli, although quite smooth, are quite distinct from the principal spicules.

Loc.—Port Philip, Victoria (*Carter; Dendy;* Austr. Mus. Coll.).

Ophlitaspongia subhispida, *Carter*, var. viminalis, *Lendenfeld.*

(Plate xxxvi., fig. 1, and fig. 55.)

1888. *Thalassodendron viminalis*, Lendenfeld, Cat. Sponges Austr. Mus., 1888, p. 225.

1902. *Thalassodendron viminalis*, Whitelegge, Rec. Austr. Mus. iv., 5, 1902, p. 214.

[1901. Not *Thalassodendron viminalis*, Whitelegge, *Op. cit.*, iv., 2, 1901, p. 87.]

My acquaintance with this sponge is limited to a single dry specimen (the one described by Whitelegge, and herein figured) which in outward form approaches, and in internal characters—except in regard to the size and, to some extent, to the shape of its spicules—exactly resembles *O. subhispida*. Indeed, the differences between the two are not so great that they might not be due to individual variation; but in order to establish this point further material is required.

The description which I have given of the skeleton pattern of *O. subhispida* is here again applicable without qualification, and as regards the external features, Whitelegge's account will suffice. The latter author's description of the skeleton is slightly misleading in one respect, inasmuch as it conveys the

impression that the fibres "which curve gracefully outwards and terminate at the surface" are *branches arising from* the stouter main fibres of the "axial plexus" (as for example in *Clathria arcuophora*), whereas, as a matter of fact, they appear rather to be *direct continuations* of those fibres. The description also errs in attempting to fix precise limits to the diameters of the axial, superficial and transverse fibres.

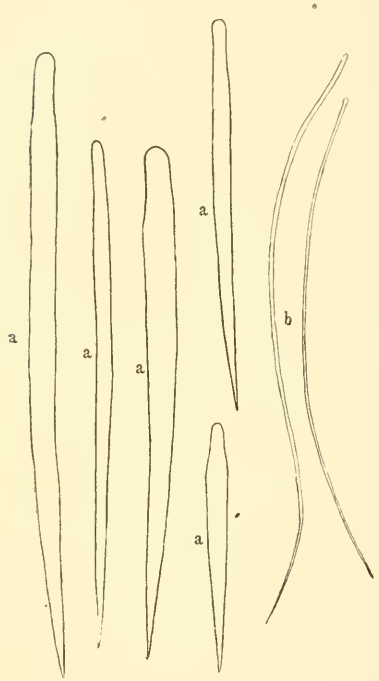

Fig. 55—*Ophlitaspongia subhispida*, var. *viminalis*. a Principal styli (selected) showing in varying degree the basal peculiarity. b Auxiliary tylostyli.

The principal styli vary in length from about 75 to 220 μ, and in diameter up to 8 or (very rarely) 9 μ; generally speaking, they agree in form with those of *O. subhispida* but are somewhat peculiar in the fact that a considerable proportion (usually of the stouter individuals) are wanting in the slight basal swelling or knob characteristic of the latter, and thus have the basal extremity shaped somewhat like the handle of an oar. However, I find that this peculiarity is also occasionally exhibited, though in a less marked degree, by the spicules of *O. subhispida*, and is therefore of doubtful value as a distinctive character of the variety.

The auxiliary spicules are slender, usually curved or flexuous tylostyli which seldom exceed 200 μ in length, and appear to be never more than 1 μ in diameter; the longest observed measured 240 μ. In *O. subhispida* also, it should be noted, the auxiliaries are sometimes flexuous.

The toxa are similar in form to, and (except for a slighter stoutness) of the same dimensions, as those of *O. subhispida*.

Loc.—Coast of New South Wales, Illawarra (Austr. Mus. Coll.).

Ophlitaspongia tenuis, *Carter.*

(Plate xxxv., fig. 1, and fig. 56.)

1885. *Echinoclathria tenuis*, Carter, Ann. Mag. Nat. Hist.(5), xvi., 1885, p. 355.

1886. *Phakellia papyracea*, Carter, *Op. cit.* (5), xviii., 1886, p. 379.

1896. *Ophlitaspongia tenuis*, Dendy, Proc. Roy. Soc. Vict., viii. (n.s.), 1896, p. 37.

[Not *Clathria tenuis*, Hentschel, Fauna Südwest-Australiens, Tetraxonida, ii., 1911, p. 377.]

[1887. (?) *Antherochalina tenuispina*, Lendenfeld, Zool. Jahrb. 1887, p. 789.]

Sponge flabelliform, thin, stipitate. Surface even. Oscula apparently absent. No dermal membrane. Skeleton: In young parts of the sponge, spongin being yet but scantily developed, the skeleton appears as a more or less "renieroid" reticulation which, in the mid-region of the lamina, is irregularly isodictyal, but which, in vicinity to the surface (owing to the presence there of outwardly-running paucispicular fibres), becomes generally rectangular; usually, also, longitudinally disposed sheaves of spicules, lying in the mid-region, produce an appearance of axial condensation. Later, there is developed in the mid-region a dense plexus of stout horny fibres which to some extent obscure, and perhaps in part ensheath, the spicules of the "isodictyal" meshwork; with increase of age, also, the lamina thickens, the excurrent fibres are correspondingly prolonged, and the rectangularly-meshed outer layer is consequently of greater width. Auxiliary tylostyli are scattered interstitially in variable number, generally singly, but also in bundles. Quasi-echinating (principal) styli are, as a rule, moderately scarce. Megascleres:—(i.) Curved tapering principal styli, typically more or less fusiform and basally manubriate or sub-basally constricted, showing signs of a slight differentiation into two kinds, ranging in length from about 75 to upwards of 240 μ, and varying in maximum diameter in different specimens from 8 to 12 μ; (ii.) auxiliary tylostyli, straight or flexuous, with a length of from 160 to upwards of 280 μ, and a maximum diameter of 3.5 μ. Microscleres absent.

This species is represented in the Australian Museum collection by eight specimens, the largest of which measures 250 mm. in height by about the same in breadth, and varies in thickness from 2 mm. at the margin, where it is thinnest, to a maximum of 5.5 mm. Smaller specimens are proportionately thinner. The lamina is, frequently, irregularly subdivided in a partite manner, and its margin is sometimes lobate. In most specimens, more or less distinct external indications of intermittent growth are noticeable; Carter no doubt refers to these when he describes the surface (of *Phakellia papyracea*) as "concentrically lineated."

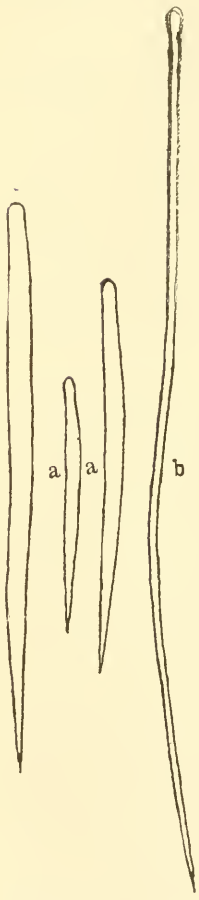

Fig. 56—*O. tenuis*. a Principal styli. b Auxiliary tylostylus. (From a Port Phillip specimen.)

The skeleton is condensed along radiating branched lines, and also, owing to continued development of spongin, greatly increases in density with increase of age; accordingly, sections taken from different portions of the same specimen may differ considerably in the pattern which they reveal. In consequence of the linear condensations of the skeleton, the marginal region of the sponge lamina, if sufficiently thin to be at all translucent, usually shows to the naked eye an appearance of subparallel venation—the "veins" being, on an average, rather less than 1 mm. apart. These veins are found to be due to the presence of abundant longitudinally disposed spicules, mostly arranged in bundles.

In the youngest, or marginal portions of the sponge, before any readily noticeable amount of spongin is developed, the skeleton (except in proximity to the surface) is an irregular "renieroid" reticulation with triangular to polygonal meshes, the sides of which are formed, as a rule, each of a single spicule enveloped in a minimum amount of spongin. Towards the surface, however, excurrent pauciserial spongin-ensheathed lines of somewhat plumosely arranged spicules (secondary fibres)

make their appearance, which become more distinct as the surface is approached and terminate each in a few projecting spicules. In longitudinal section, perpendicular to the sponge lamina, these fibres are seen to be arranged pinnately with regard to the mid-line of the section; and since they usually lie closely, and are then connected by short (mostly unispicular) transverse fibres, the skeleton in its superficial portions becomes for the most part rectangular in mesh. Thus, the pattern of the skeleton changes in passing outwards from the mid-plane to the surface, from more or less irregularly "isodictyal" to more or less "scalariform." The isodictyal pattern of the mid-region is, however, in most sections, to some extent obscured or interrupted by the dense spicular aggregations constituting the "veins" above referred to.

In older portions of the sponge, the skeleton presents a quite different aspect, owing mainly to the presence, in the mid-region of the lamina, of a dense plexus of stout horny fibres. These appear to be quite analogous to the *primary* fibres of such species as *Clathria arcuophora* and *C. frondosa*, and accordingly might be so designated, although they are subsequent in order of formation to those which have been termed "*secondary*" or excurrent fibres. In contrast with the latter fibres, which are pale-coloured, the primary fibres are of a deep yellowish tint and are generally aspiculous: as the latter fact indicates, they arise, for the greater part at least, independently of the "isodictyal" spicular meshwork occupying the same region. Apparently, they are earliest developed in connection with the radial venations above referred to—the intermediate belts remaining for some time unaffected; ultimately, however, the plexus which they form extends in the mesial plane continuously. In sections from the marginal region, it is seldom that primary fibres are sufficiently developed to be distinguished; but such sections often show, in the place of these, a yellowish colouration suggestive of diffused spongin.

The different appearance of the skeleton (as seen in longitudinal section perpendicular to the lamina) in the older portions of the sponge, is due also to the increased width (consequent upon the growth in thickness of the lamina, and in length of the secondary fibres) of the rectangularly-meshed superficial layer extending between the mesial or "plexal" region and the surface; and, furthermore, the secondary fibres and their connectives are here provided with a well-developed sheath of spongin. In the older parts of the sponge, therefore, there is nothing in the character of the skeleton to warrant the statement (which Dendy has made) that "The species is interesting because it shows a structure intermediate betweer

the Ectyoninæ and the Axinellidæ, so that it might, with almost equal justice, be placed in either group."

The principal megascleres are slightly differentiated (but are not separable) into two kinds as regards size, though not to any appreciable extent as regards shape. The larger—which are the less numerous—occur chiefly as coring spicules in the excurrent or secondary fibres and as longitudinally directed interstitial spicules in the mesial region of the sponge. Quasi-echinating spicules are most commonly met with in connection with the secondary fibres and their connectives; the frequency of their occurrence varies greatly in different specimens, and in some they are comparatively rare. The auxiliary megascleres (tylostyli) also vary in abundance, though they are never by any means scarce: they are, for the most part, scattered singly and lie parallel to the fibres; but parallel bundles—chiefly confined to the mid-region of the lamina and longitudinally disposed—also occur.

The spicule characters are as follows:—

(i.) The principal megascleres are straight to curved, gradually tapering; styli, of very variable length in any given specimen, and in different specimens differing to some extent in regard to their precise form and maximum size. In the specimen from which the spicules shown in the text figure were drawn, and in a mounted slide prepared from a piece of a British Museum specimen labelled *Echinoclathria tenuis*, they almost invariably exhibit a handle-like basal part (suggestive of the handle of an oar), about 10 to 20 μ in length, which may or may not expand slightly at the end of the spicule to form a faint basal knob. In some specimens obtained by the "Endeavour," on the other hand, the spicules approach very closely in form those of *O. inornata*, sp. nov. (text-fig. 57), and only a small proportion of them are marked by a "handle" which, even so, is usually not well defined. In the first-mentioned specimen, in which these spicules are of slenderer proportions than in any of the others, they range from about 70 to 280 (but are very seldom more than 240) μ in length, and are at most 8 μ in diameter; whilst in the last-mentioned specimens, in which their size is greatest, they range in length from 80 to 310 μ and attain a maximum diameter of 12 μ. The largest spicules are mostly to be found amongst those which project at the surface. Oxeote modifications, which appear to be always of lesser than the medium length, are of occasional occurrence. Usually, amongst the shorter spicules (of length below, say, 130 μ) there are some with a few (seldom more than one or two) spine-like prominences; these (vestigially spined?) spicules appear to occur most frequently in

stouter-spiculed specimens, but in any case they are scarce and in the first-mentioned two specimens have not been observed.

(ii.) The auxiliary tylostyli are normally straight, but in some specimens a considerable proportion, perhaps even a majority, are variously flexed. They range in length from less than 160 to (usually) slightly more than 300 μ; their greatest observed length in any specimen was 350 μ.

I have quoted *Antherochalina tenuispina*, Lendenfeld, as a probable synonym of *O. tenuis* on the evidence of a small piece of a British Museum specimen labelled with the name and locality (*viz.*, Western Port, Victoria) of Lendenfeld's species. As the fragment conforms in external features with Lendenfeld's description, I have but little doubt that the name attached to it is the correct one, and would say, therefore, that in respect of its spicular characters *A. tenuispina* has been wrongly described.

In some features of the skeleton *O. tenuis* resembles *Clathria* (?) *chartacea*, Whitelegge (*vide* p. 208)—a species from which, externally, it appears to be indistinguishable.

Locs.—Port Philip, 18-20 fms. (*Carter; Dendy;* Austr. Mus. Coll.); forty miles west of Kingston, South Australia, 30 fms. ("Endeavour").

Ophlitaspongia inornata, *sp. nov.*

(Plate xxxvi., fig. 2, and fig. 57.)

Sponge stipitate, ramose; branches short and crooked, mostly confined to one plane, sometimes anastomosing. No apparent dermal membrane. Oscula doubtfully present. Skeleton: In the older parts of the sponge, the axial region of the branches is occupied by a dense plexus of stout, generally aspiculous, horny fibres, by a profusion of longitudinally-disposed extrafibral spicules (principal styli) arranged in loose bundles and strands, and by single spicules which, though generally scattered without order, appear in places as if arranged reticulately. From the axial region there run outwards and upwards to the surface, fibres with divergingly disposed and frequently echinating spicules which, at the extremity of the fibre, form a projecting tuft; these fibres are joined by transverse and interreticulating paucispicular connecting fibres forming with them rectangular and polygonal

meshes with sides of a spicule's length. All the spicules afore-mentioned are principal styli; auxiliary tylostyli are scattered in moderate number in the ground substance of the interior, but become rather abundant in parts of the outermost layer. In the youngest portions of the sponge the skeleton differs from this mainly in absence of an axial fibre-plexus. Megascleres:—(i.) Principal styli curved, subconical to slightly fusiform, usually with a slight sub-basal waist and slight basal knob, ranging in length from 75 to 220 μ, and in diameter up to 12 μ; (ii.) straight auxiliary tylostyli, 140 to 240 μ in length, 2.5 μ in maximum diameter. Microscleres absent.

The single (spirit-preserved) specimen, the form of which is sufficiently indicated by the figure (Pl. xxxvi., fig. 2), measures 90 mm. in height, inclusive of the stalk. The colour is yellowish-grey; the consistency moderately firm and tough. Scattered over the surface at fairly close though irregular intervals, are minute rounded openings mostly less than $\frac{1}{3}$ mm. in diameter. These are scarcely discernible on some parts of the surface, very noticeable on others, being most pronounced where apparently maceration has occurred; it is therefore probable that they are subdermal. No dermal membrane, however, is observable; this may be due to imperfect preservation, yet the membrane, if originally present, must have been very thin. Towards the upper extremity of the branches a few larger openings (up to 1 mm. in diameter) occur, which are possibly oscula.

The appearance of the skeleton undergoes a marked change with increase of age owing to the formation in the axial region of the branches of a dense plexus of horny fibres. In this respect the species is quite analogous to *O. tenuis*, to which very probably it is related. The character of the skeleton in the older portions of the sponge is so similar in the two species, that what has been said in regard thereto in the case of *O. tenuis* is also applicable in the present instance, excepting that here the extrafibral spicules of the axial region are more abundant, the reticulation formed by the secondary and their connecting fibres is less regular, the coring spicules of the fibres are arranged in an axinelloid manner, echinating spicules are plentiful, and auxiliary megascleres are rather scarce. The formation of the axial plexus, however, appears to be much longer delayed in the present species, being clearly marked only in the stalk and the basal portions of the branches.

In the upper region of the branches, for a considerable portion of their length, the skeleton is composed chiefly of

abundant longitudinally-directed (principal) spicules for the most part arranged in close multispicular fibre-like strands, the appearance and disposition of which is such that, at first sight, they might be mistaken for main skeletal fibres, their resemblance to the latter being heightened by the fact that the spicules composing them are held together by some amount of yellowish sponginous material. In addition to these spicular strands, however, though more or less concealed by them except towards the surface, there is a reticulation of longitudinal (main) and transverse (connecting) slender horny fibres with paucispirally-arranged coring, and frequent echinating, spicules; the transverse fibres are usually of not more than a spicule's length. Owing to the partial concealment of the primary fibres proper, by the dense array of longitudinal spicules, it is with the strands which these spicules form, rather than with the main fibres, that the transverse fibres appear to reticulate. Finally, there are many irregularly scattered principal and auxiliary spicules, the former in greater abundance. The general appearance of the skeleton in this region of the sponge, as seen in longitudinal section, is not unlike that of *O. tenuis* as seen in a marginal section parallel to the plane of the sponge lamina—the multispicular strands in the present case taking the place of the less closely arranged "linear condensations" or "venations" of the latter species.

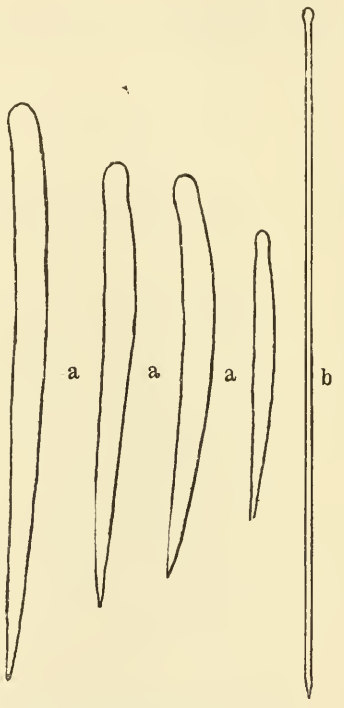

Fig. 57—*O. inornata.* a Principal styli. b Auxiliary tylostylus.

The auxiliary spicules increase in number in the superficial layer, and in some parts of it are very abundant; they lie generally parallel to the surface. Projecting beyond the surface at the extremities of the main fibres are tufts of divergently-arranged principal spicules—the terminal spicules of

the fibres; the number of spicules composing such a tuft is, however, frequently greater than that in a cross-section of the fibre.

The form and size of the spicules have been given in the diagnosis.

Loc.—Coast of South Australia, fifteen miles south of St. Francis Island, 30 fms. ("Endeavour").

Ophlitaspongia axinelloides (?), *Dendy.*

(Plate xxxvi., fig. 3, and fig. 58.)

1896. *Ophlitaspongia axinelloides*, Dendy, Proc. Roy. Soc. Vict., viii. (n.s.), 1896, p. 39.

> *Sponge erect, lobose, stipitate; the lobes compressed. Oscula covered by a membrane. Surface even, with a minutely reticulate appearance. Main skeleton composed of moderately stout horny fibres forming an irregular to subrectangular reticulation with meshes of greatly varying size, except superficially, where they are uniformly smaller. Main fibres provided with a meagre core of loosely arranged (principal) spicules, some of which are disposed echinatingly; connecting fibres generally with one or a few spicules uniserially arranged. Superficial skeleton consisting of closely arranged, outwardly projecting tufts of principal spicules. Auxiliary spicules (styli) are scattered interstitially in moderate numbers, together with less numerous principal spicules, and are rather abundant in the oscular membranes where they are arranged radiately. Megascleres:—(i.) The principal spicules are normally styli, straight, subconical to slightly fusiform, but an appreciable proportion (say 1 in 20) are secondarily diactinal (oxea); their length ranges from about 80 to 135 μ, whilst their maximum diameter (which is rarely attained by individuals longer than 120 μ) is 11 μ; (ii.) auxiliary styli, straight, cylindrical, rapidly tapering to a sharp point, 115 to 200 μ in length, and with a maximum diameter of 5 μ.*

A single specimen, in the collection of the Australian Museum, agrees so well, on the whole, with *O. axinelloides*, as to render it highly probable that its points of difference from the specimen described by Dendy are purely individual; accordingly I have refrained from bestowing upon it a distinctive name. The specimen (Pl. xxxvi., fig. 3), which measures 115 mm. in height, is incomplete, representing apparently about one-half of the original, and consists of a single

much compressed lobe, together with the longitudinally bisected stalk.

It differs from *O. axinelloides* as described, chiefly in regard to the situation of the oscula, in the larger size, and lesser abundance in the fibres, of the principal spicules, and in the much greater development of the superficial ("dermal") skeleton.

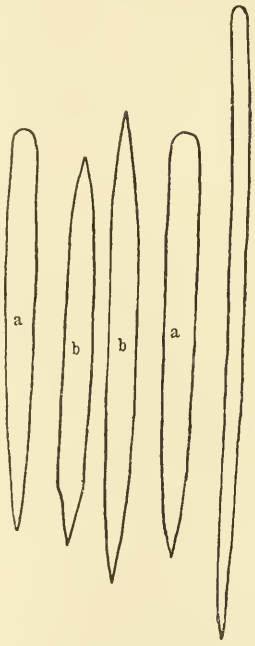

Fig. 58—*O. axinelloides* a Principal styli. b Oxeote modifications of same. Auxiliary stylus (unlettered).

On casual inspection, oscula appear to be absent; but along the margin and one side of the lobe are to be noticed, here and there, light-coloured rounded spots, 1.5 mm. or less in diameter, which prove to be concealed oscula-like openings covered only by a thin membranous diaphragm continuous with the (elsewhere very thin and scarcely discernible) dermal membrane.

The "oscular membranes" contain numerous radially disposed horizontally-lying auxiliary styli, which are absent from other parts of the dermal layer. A dermal skeleton proper can, therefore, hardly be said to be present. There is, however, a superficial skeleton of a special kind, formed of closely situated tufts of principal spicules; these tufts, to the presence of which is due a minutely reticulate appearance of the surface, are borne upon extremely short fibres, or rather processes, which arise from the superficial transverse fibres.

In the description of *O. axinelloides* the fibres are said to be about 70 μ thick and to be pretty abundantly cored by styli about 100 x 8 μ in size. In the present specimen, the fibres may attain a diameter of 100 μ, and are sparsely cored—the

spicules being seldom more than, or even as many as, three in a cross-section of the fibre; moreover, the spicules (*i.e.*, the principal spicules) are, as already indicated in the diagnosis, of notably larger size. Similar spicules in moderate number also occur interstitially; and scattered plentifully among them, as in *O. axinelloides*, are longer and slenderer (auxiliary) styli of variable size. The range in size of the auxiliary styli can be determined with certainty only by measurement of those which lie in the "oscula membranes" (from which principal spicules are always absent), since the shorter individuals are scarcely, it at all, distinguishable from the slenderer principal styli.

Loc.—Port Phillip (Austr. Mus. Coll.).

Ophlitaspongia chalinoides, *Carter.*

(Fig. 59.)

1885. *Axinella chalinoides*, Carter, Ann. Mag. Nat. Hist. (5), xvi., 1885, p. 358.

1886. *Axinella chalinoides*, var. *cribrosa*, Carter, *Op. cit.*, (5), xviii., 1886, p. 358.

Sponge stipitate, ramose; branches usually somewhat compressed, about 9 mm. in lesser diameter, multiplying dichotomously or sometimes polytomously, and occasionally uniting by anastomosis. Oscula, chiefly in two rows on opposite sides of the branches, usually more or less concealed by an extension across them of the thin dermal membrane. Skeleton composed of well-developed horny fibres (60 μ in diameter), forming a small-meshed irregular to subrectangular reticulation. Main fibres provided with a meagre core of loosely and somewhat plumosely arranged small (principal) styli; connecting fibres with one or a few spicules uniserially arranged. The terminal spicules of the main fibres project slightly beyond the extremity of the fibre, but there is no special development of superficial tufts of spicules as in O. axinelloides. Quasi-echinating spicules somewhat scarce. Auxiliary spicules (styli) are scattered interstitially in considerable number, accompanied by a few principal styli; they become more abundant close beneath the surface (here lying parallel with the main fibres), and in the dermal membrane, where they lie horizontally. Megascleres:—(i) Principal styli (rarely oxea) straight, cylindrical throughout the greater part of their length, and gradually tapering to a sharp point, 75 to 110 μ in length, and, in different specimens, from 3 to 5.5 μ in maximum diameter; (ii.) auxiliary styli straight or flexed, cylindrical to within a short distance of the pointed end, 120 to 195 μ long, and up to 2.5 μ in diameter.

This species has been written by Dendy[1] as a possible synonym of *O. subhispida*—though there is little in the descriptions of the two that would suggest an identity. However, in the Australian Museum collection of Port Phillip sponges there are five specimens, in external appearance much resembling a *Chalina*, which—if allowance be made for certain differences attributable to differences in condition of preservation—agree so well with the description of *Axinella chalinoides*, var. *cribrosa*, that I feel no hesitation in identifying them as such. These also agree equally well with the typical *A. chalinoides*, save that, concerning the latter, auxiliary megascleres have not been mentioned; but these spicules might easily be overlooked, and I therefore regard it as extremely probable that *A. chalinoides* and its so-called variety are the same.

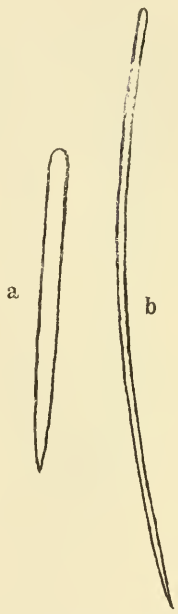

Fig. 59—*O. chalinoides*. a Principal stylus. b Auxiliary stylus.

One of the five specimens, which is dry and dermally denuded, has compressed dichotomous branches and many marginally-situated shallow crateriform oscula, each of which forms the common orifice of several (usually three or four) excurrent canals opening into its base. In the remaining specimens, preserved in alcohol, the branches are either cylindrical or compressed and, owing to rapidly repeated dichotomy, sometimes appear to divide polytomously; and the oscula which are not entirely confined to opposite sides of the branches, are more or less concealed from view by a covering membrane or diaphragm, continuous with the thin though well-defined dermal membrane. The oscula diaphragms may be (apparently) entire, or may have a small central circular aperture; sometimes, owing probably to collapse, they are depressed below the general surface, and are then in a few cases radially wrinkled. Immediately beneath the thin transparent dermal membrane are numerous subdermal spaces or lacunæ, which can be seen to lead by rather large circular pores into the incurrent canals. To these lacunæ and pores is due, probably, a

1 Dendy—Proc. Roy. Soc. Vict., viii. (n.s.), 1896, p. 36.

certain uneven and pitted condition of the surface in the dry specimen mentioned above; but when, as in the other specimens, the dermal membrane is intact, the surface is generally free from inequalities.

With regard to the oscula in the specimens examined by him, Carter says concerning *A. chalinoides*, that they are "often accompanied by a stelliform radiation," due to "collapse of the dermal sarcode over subjacent excretory canals" immediately surrounding them; and concerning *A. chalinoides*, var. *cribrosa*, that they are "deeply sunk into the tissue and rendered stelliform by grooves radiating from them to the surface." Although in the case of the present specimens no such appearance is exhibited, the facts concerning them to which I have referred, render it conceivable that this is due merely to difference in condition of preservation.

The arrangement of the fibres is very similar to that of *O. axinelloides*, but the meshes are of more uniform size. Oxeote modifications of the principal megascleres have been observed, but they are rare. The slenderer principal megascleres are scarcely or not at all distinguishable from the shorter auxiliary megascleres.

Loc.—Port Phillip, Victoria (*Carter*; Austr. Mus. Coll.).

Ophlitaspongia tubulosa, *sp. nov.*

(Plate xxxv., fig. 3, and fig. 60.)

Sponge with the habit and texture of Siphonochalina; sessile, with short erect tubes arranged in panpipe-like series. Surface even. Skeleton a tolerably regular reticulation of slender, though tough and dense, horny fibres; the main fibres only, are very sparsely cored with straight stylote and (very rare) oxeote spicules, cylindrical to within a short distance of the pointed extremity, and attaining to a maximum size of 120 x 4 μ. Quasi-echinating spicules of like kind are of occasional occurrence. Scattered interstitially, though chiefly or entirely confined to membranes stretched between the fibres, are (relatively) moderately abundant megascleres of perhaps two kinds, viz.: (i.) Straight styli (and rare oxea) of similar shape to those of the fibres, but usually much longer, and somewhat slenderer, with a maximum size of 220 x 3·5 μ; and (ii.) very slender flexuous styli and oxea attaining a maximum length of about 260 μ. Microscleres absent.

This species is represented by two dry and washed-out specimens. The sponge, which is attached by an encrusting basal disc, consists of a clustered mass of short erect tubes which multiply both by branching and by the upgrowth of new ones from the base. Branching takes place, typically, in such a way as to give rise to an arrangement of the tubes side by side in single, longer or shorter, series. The component tubes of each such series may fuse with each other laterally so as to form a plate with the tube-orifices in a single row along its upper margin, or they are more or less free from one another except at their bases. Anastomosis occurs freely wherever tubes of the same or different series come into contact. The two specimens are approximately equal in size: the slightly larger is 75 mm. high and 100 mm. by 65 mm. broad. The free terminal portions of the tubes in no case exceed 20 mm. in length, and are 6 to 10 mm. in external, and 3 to 5 mm. in internal, diameter. The pseudoscula are of the same diameter as the tubes internally. The texture, as shown by washed-out specimens, is similar to that of a Chalinine sponge. As regards consistency, the sponge is compressible and elastic, and fairly tough. The colour varies, even in different portions of the same specimen, from brownish-yellow to dark-brown.

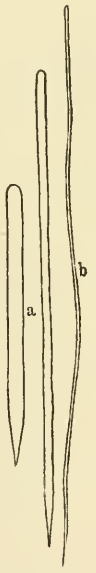

Fig. 60—*O. tubulosa*. a Principal styli—the shorter, intrafibral; the longer, interstitial. b (?) Auxiliary stylus.

The skeleton is a wide-meshed reticulation of densely horny fibres of a deep brownish-yellow colour, of which only the main fibres contain a slender core of paucispirally (or sometimes even uniserially) arranged small spicules. The main fibres may (rarely) attain to 80 μ in stoutness, but are usually less than 60 μ; the diameter of the connecting fibres varies from 10 to about 40 μ. The former are distinguishable into two categories which might be termed, respectively, *primary* and *secondary* (or *excurrent*) main fibres, viz.: (i.) those which ramify over the inner surface of the pseudoscular tubes and form, with the aid of connecting fibres, a strong, irregularly-meshed, supporting reticulation; and (ii.) those which, arising as branches from the preceding, traverse the tube-wall obliquely upwards and outwards to the exterior surface. The last-mentioned, or *secondary* main fibres, rarely branch; but,

towards the outer surface, they are supplemented by the interpolation of others which arise from their connecting fibres. Their connecting fibres either may be simple, forming direct transverse connections between them—in which case the reticulation is more or less rectangular—or, less frequently, may branch and interunite, thus forming between them an interreticulation, and rendering the pattern of the skeleton irregular. The fibres are here and there, at very wide intervals, echinated by spicules (similar to those within the fibres) which, as a rule, project but slightly beyond the spongin. The meshes of the reticulation are tympanized by very thin membranes (visible, perhaps, only in washed-out specimens) in which moderately abundant slender spicules lie scattered.

There is no indication, in the present condition of the specimens, of a dermal membrane or of a dermal skeleton. The main fibres terminate abruptly at the surface with their end-spicules projecting slightly beyond the spongin.

Spicules.—Microscleres are absent; the megascleres are, for the purpose of description, separable into three groups:—

(i.) The spicules of the fibres, straight styli, cylindrical to within a short distance of their pointed extremity, ranging in length from 80 to about 120 μ, and rarely slightly more than 4 μ in diameter; occasionally an oxea is found amongst them.

(ii.) Straight or but slightly flexed interstitial spicules, identical in form with the preceding, but mostly much longer, attaining to a length of 220 μ, and not more than 3.5 μ in diameter. Oxeote modifications of these occur more frequently than amongst the fibral spicules but are nevertheless comparatively rare.

(iii.) Variously curved and flexuous, very slender, interstitial spicules, about equal in abundance to those of the second group, frequently exhibiting oxeote modifications, seldom exceeding 1.5 μ in diameter, and of very variable length; the longest observed measured 264 μ.

The identity in form of the spicules of the first two groups and the complete transition between them in the matter of size, permit of no other conclusion than that they are but partially differentiated derivatives of an originally single spicule-form. I regard them as homologous with the *principal* megascleres of other species. Whether the spicules of the third group are merely variants of the same, or whether they are representative of *auxiliary* megascleres, I am unable to decide.

O. tubulosa, regarded as a species of *Ophlitaspongia*, seems to me rather divergent. In a number of respects it bears analogies with *Siphonochalina bispiculata*, Dendy,[1] and is possibly related thereto.

Loc.—South-east coast of Australia ("Endeavour").

Genus Echinoclathria, *Carter*.

External form various; sponge made up of a honeycomb-like mass of anastomosing flattened trabeculæ. Skeleton—except, perhaps, when foreign particles are included in excessive abundance—a reticulation of fibres usually well provided with spongin. Megascleres of two kinds, distinguishable into principal and auxiliary; the former are smooth styli, typically occurring in association with the fibres as coring or echinating spicules; the latter, which vary in form from tylotornota to amphistrongyla, occur interstitially. Microscleres may be present in the form of palmate isochelæ.

The above, which is an adaptation of the original diagnosis proposed by Ridley and Dendy, is designed so as to secure on the one hand the exclusion from the genus of such species as *E. glabra*, R. and D., and on the other the admission into it of the species of Lendenfeld's genus *Aulena*.[2] The modification of the definition in these respects introduces no innovation, for Thiele[3] has already expressed the probably correct opinion (*vide* p. 288) that *E. glabra* belongs to his genus *Echinochalina*, and Dendy,[4] by his inclusion in *Echinoclathria* of a species of *Aulena* has tacitly rejected the latter genus.

Speaking of *Echinoclathria* and *Aulena* in the sense in which they would be understood if maintained as separate genera, it may be said that although each of the species of *Aulena* departs in several noteworthy respects from those of *Echinoclathria*, yet they possess in common no single character of recognised systematic value by which they may be distinguished from the latter, unless it be their habit of including foreign particles in the skeleton. In other words, the separation of the two genera depends ultimately upon the presence or absence of extraneous skeletal elements. Similarly,

1 Dendy—Proc. Roy. Soc. Vict., vii. (n.s.), 1895, p. 246.
2 Lendenfeld—Monograph of the Horny Sponges, 1888, p. 91.
3 Thiele—Kieselschwamme von Ternate, ii., 1903, p. 962.
4 Dendy—*Echinoclathria arenifera*, Proc. Roy. Soc. Vict., 1896, p. 40.

Echinoclathria is ultimately separable from *Ophlitaspongia* only by virtue of its characteristic honeycomb-like structure; for although the auxiliary spicules of the former are typically quasi-diactinal, yet in *E. carteri*, as in the species of *Ophlitaspongia*, they are stylote. This structural peculiarity of *Echinoclathria* (and of *Aulena*) is, however, theoretically of questionable generic value, inasmuch as it is probably nothing more than the extreme specialisation of a not uncommon mode of growth, and is, in fact, actually attained in other genera in the case of *Plectispa macropora* and certain species of *Echinochalina*. Consequently, whether the proposal might be to merge *Echinoclathria* and *Aulena* in *Ophlitaspongia* or to keep all three genera distinct, no serious objection could in either case be raised, but the more reasonable course seems to be to regard the series of forms which they embrace as constituting two genera, with the line of division falling between *Ophlitaspongia* and *Echinoclathria* rather than between *Echinoclathria* and *Aulena*.

I might here remark that the peculiar genus *Allantophora*, Whitelegge,[1] which its author regarded as intermediate between *Ophlitaspongia* and *Echinoclathria*, offers no justification for its retention amongst the Myxillinæ, and perhaps had better be placed, provisionally, with the Mycalinæ. In its microscleric characters, the genus—which is represented by but a single species—stands unique; but of known forms it perhaps most nearly approaches the equally peculiar *Crambe crambe*, O. Schmidt.[2] Apart from a certain amount of similarity in the formation of their fibres, an argument in favour of a relationship between the two lies in the possibility of an homology between the desmoids of *Crambe* and the microstrongyles of *Allantophora*. I cannot agree with Whitelegge that in *A. plicata*, the so-called echinating spicules are in any way different from those of the fibre-axis.

Echinoclathria favus (*Carter*), Ridley and Dendy.

(Fig. 61.)

1885. *Echinoclathria favus*, Carter, Ann. Mag. Nat. Hist. (5), xvi., 1885, p. 292.

1887. *Echinoclathria favus*, Ridley and Dendy, "Challenger" Monaxonida, 1887, p. 160, pl. xxxi., figs. 4, 5, 5a.

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1 Whitelegge—Mem. Austr. Mus., iv., 1907, p. 505.

2 Thiele—Arch. f. Naturg., 1899, p. 87.

Sponge massive or branched, commonly growing upon the shell of a Pecten. The superficial lamellæ present their edges to the exterior, forming cells of irregular, often elongate and meandrine, shape; these cells vary in width, in any given specimen, from about 2 to 6 mm. The main fibres are sparsely cored; the connecting fibres are usually aspiculous. Echinating spicules are not wholly confined, as is usually the case in other species, to the external aspect of the superficial connecting fibres. Auxiliary spicules moderately abundant. Megascleres:—(i.) Principal styli straight, fusiform, with greatest diameter about the middle of their length—size, 75-105 x 5 μ; (ii.) auxiliary strongyla ranging in length from (rarely less than) 135 to 170 μ, and seldom as much as 1.5 μ in diameter. Microscleres:—Isochelæ palmatæ, scarce, of extreme tenuity, 8 to 12.5 μ long.

Four specimens of this species were obtained, all of which encrust the shells of living Pectens. They very closely resemble in external appearance the specimen shown in Pl. xxxi., fig. 4, of the "Challenger" Report. There is nothing of importance that I can add to Ridley and Dendy's description except that I have found the auxiliary spicules to be invariably strongyla.

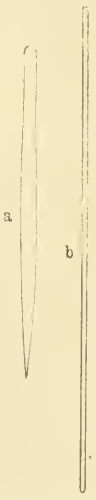

Fig. 61—*E. favus*. a Principal style. b Auxiliary strongyle. (Chela not figured.)

Locs.—Bass Strait, off Moncœur Island, 38 fm. ("Challenger"); off Devonport, Tasmania ("Endeavour").

Echinoclathria ramosa, *sp. nov.*

(Plate xxx., fig. 3, and fig. 62.)

1901. *Echinoclathria macropora*, Whitelegge, Rec. Austr. Mus., iv., 2, 1901, pp. 89, 117.

[Not *Plectispa macropora*, Lendenfeld, Austr. Mus. Cat. Sponges, 1888, p. 226.]

[Not *Echinoclathria macropora*, Whitelegge, Austr. Mus. Mem., iv., 10, 1907, p. 504.]

Shrubby substipitate sponges, with short cylindrical or but slightly compressed branches (averaging about 10 mm. in diameter) which multiply dichotomously and

usually anastomose freely. The superficial lamella present their edges to the exterior. The superficial "cell-apertures" are polygonal or slightly rounded, averaging about 2 mm. in diameter. Main fibres with a pauci-spicular core; connecting fibres usually vacant. Echinating spicules (apparently) confined to the superficial fibres. Auxiliary megascleres rather scarce. Megascleres:—(i.) Principal styli, straight, with a sub-basal waist or constriction, usually slightly fusiform, varying in size in different specimens from 70-95 x 5 μ to 90-120 x 8 μ; (ii.) auxiliary strongyla, with a maximum length of between 140 and 160 μ, and a maximum diameter of between 1.2 and 2 μ. Microscleres:—Isochelæ palmatæ, rare (or absent?).

Reasons for regarding this species as distinct from Lendenfeld's *Plectispa macropora* are indicated in the remarks on the genus *Plectispa*.

It is a low, generally profusely branched and shrubby sponge with a much abbreviated stalk, the base of which often is extended into a disc-like foot; the first-formed branches sometimes take origin from the disc, and the sponge may then appear as if provided with several stalks. The basal portion of the sponge, just as are the branches, is formed of reticulating lamellæ. Branching takes place by dichotomy which, as a rule, is rapidly repeated. The sponge, as growth proceeds, typically assumes the form of a hemispherical cluster of short freely anastomosing branches; occasionally, owing to a reduction of the tendency towards rapid branching, the branches become more elongated, anastomosis is less frequent and the sponge assumes a more erect and arborescent habit. The largest of a considerable number of specimens measures 150 mm. in height and 200 x 130 mm. in transverse dimensions. The longest unbranched branches met with in any specimen, measured 75 mm. in length. (The species recorded as *E. macropora* by Whitelegge in his report on the "Thetis" sponges, in which the branches sometimes attain a length of over 300 mm., and the sponge a height of 500 mm., is *E. carteri*, R. and D.)

The superficial lamellæ do not, as a rule, stand quite perpendicularly to the general surface, but are directed somewhat obliquely forwards, *i.e.*, in the direction of growth of the branches; their outer edges are usually somewhat jagged. The superficial "cell apertures" are normally hexagonal, but in some specimens, particularly when the branches are compressed, they show a tendency to become elongated in the direction of the branch-axis; they average slightly less than 2 mm., and rarely exceed 2.5 mm., in diameter.

Judging from the rather abundant material at my disposal, it would seem that decrease in the frequency of branching and anastomosis, increase in the length of branches and the assumption of a more erect habit, the tendency of branches to become compressed, of cell-apertures to become elongated, and of the external edges of the superficial lamellæ to become jagged—are concomitant variations.

The sponge is of fibrous texture, and, in the dry state, tough and resilient. Some specimens are of an intense purplish colour owing to the presence of a symbiotic alga; otherwise the colour of the dry sponge varies between yellowish-grey and pale brown.

The skeleton is a compact reticulation of slender horny fibres readily distinguishable into main and connecting. The main fibres, which run (in approximate parallelism) in the direction of growth of the lamellæ, contain a meagre core of (principal) styli; at the outer or growing edge of any lamella, their terminal spicules form a slightly projecting tuft. The connecting fibres to some extent interreticulate irregularly between the main fibres and are usually aspiculous. The echinating styli, which—contrary to the statement of Whitelegge—are in no way different from those within the fibres, appear to be entirely confined to the outer side of the fibres which lie immediately beneath the lateral surfaces of the lamellæ. The auxiliary megascleres are strongyla—not subtylostyli, as previously stated.

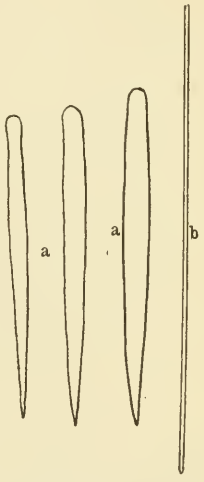

Fig. 62—*E. ramosa* a Principal styles. b Auxiliary strongyle.

In none of the specimens which I have examined have I been able to detect chelæ. Whitelegge, however, has observed "in well-preserved specimens" a few scattered isochelæ 10 μ in length.

A point worthy of special note is the relatively great variability in the maximum size (95 x 5 to 120 x 8 μ) of the principal megascleres; and in reference thereto I might mention that, between specimens which showed the opposite extremes in this particular, I have been unable to discern any difference whatever in external characters

Hab.—Coast of New South Wales, in shallow water (Austr. Mus. Coll.).

ECHINOCLATHRIA ARBOREA, *Lendenfeld.*
(Plate xxix., fig. 2, and fig. 63.)

1888. *Plectispa arborea*, Lendenfeld, Cat. Sponges Austr. Mus., 1888, p. 226.
[Not *Clathria* (*Plectispa*) *arborea*, Whitelegge, Rec. Austr. Mus., iv., 2, 1901, p. 88.]
1901. *Echinoclathria elegans*, Whitelegge, *Loc. cit.*, p. 90. [Not *Plectispa elegans*, Lendenfeld, Cat. Sponges Austr. Mus., 1888, p. 226.]

Sponge stipitate, arborescent, branching dichotomously; branches elongated, cylindrical, averaging 7 mm. in diameter, seldom anastomosing. The superficial cell-apertures are not bounded by lamellæ disposed edgewise to the surface: normally, they are circular or oval in outline, and, on the average, are less than 2 mm. in width and about the same distance apart; but in some specimens the trabeculæ are rod-shaped, and the structure is then no longer cellular, but clathrate. Main fibres with a paucispicular core; connecting fibres either with uniserially arranged spicules, or vacant. Echinating spicules most abundant upon, but not restricted to, the superficial fibres. Auxiliary megascleres variable in number, sometimes rather scarce. Megascleres (similar in form to those of E. ramosa):—(i.) Principal styli varying in maximum size in different specimens from 100 x 5·5 to 120 x 7 μ; (ii.) auxiliary strongyles, maximum size, 135 x 1·3 μ. Chelæ (apparently) absent.

Introductory.—I have already pointed out (p. 204) that the sponge identified by Whitelegge as *Plectispa elegans* is certainly not that species, and have indicated the chief reasons for regarding it as identical with Lendenfeld's *Plectispa arborea*. These reasons perhaps require to be more explicitly stated. Concerning *Plectispa arborea*, Lendf., one can draw the conclusion from what Lendenfeld has written, that the species is possessed of a structure in some way analogous to that which is characteristic of *Echinoclathria*—and, more particularly, of such species as *E. ramosa*: for the sponge is described as "dendritically ramifying;" and in the diagnosis of the genus *Plectispa* we are told that the sponges belonging thereto are "elegantly reticulate." The account of its spiculation also, lends support to the opinion that the species belongs to *Echinoclathria*. Consequently, considerable importance attaches to the statement that the sponge has—an unusual feature amongst the species of *Echinoclathria*—a "clearly-defined stem." As to the precise nature of the reticular structure of *P. arborea*, the description omits to inform us: the omission, however, affords reason for supposing that the external appearance of the sponge is, at any rate, not altogether

such as would suggest the term "honeycomb-like," inasmuch as Lendenfeld expressly uses this term, apparently in a distinctive way, in connection with another of his three species of *Plectispa* (viz., *P. macropora*). To sum up, we may say that the evidence is greatly in favour of the supposition that *P. arborea* is a species of *Echinoclathria*, peculiar in the possession of a well-defined stem and in the lack (owing probably to the manner of arrangement of the trabeculæ) of an external appearance resembling that of honeycomb. Since it is precisely in these respects that the specimens of Whitelegge's *Echinoclathria elegans* are distinguished from the sponges of the remaining known species of *Echinoclathria*, it is without hesitation that I here further describe them, with the addition of figures, under the name of *E. arborea*, Lendf.

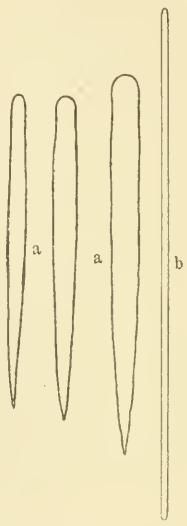

Fig. 63—*E. arborea*. a Principal styles. b Auxiliary strongyle.

Description.—In its skeletal characters generally, including the size and form of the spicules, this species shows no points of difference from *E. ramosa*. Like the latter, also, it is invariably of ramose habit; but the branches are relatively fewer and longer, and the sponge, therefore, is arborescent—not shrub-like. The essential differences between the two species lie in the character of the stalk and the form and disposition of the trabeculæ.

The stalk is peculiar in the fact that it is structurally different from the branches—being almost or, sometimes, even quite solid; its condition in certain cases, however, indicates that the non-trabecular structure is secondary. The foot of the stalk usually spreads out into a disc of attachment: in the specimen described by Lendenfeld, this would seem to have been unusually large—"an extensive basal plate, slightly compressed, and about 8 mm. thick."

The trabeculæ of the branches are normally more or less lamellar, but are relatively much stouter than in other species. Occasionally, in parts of a specimen, or even throughout an entire specimen, they are cylindrical, rod-shaped; and, accordingly, in such cases, the structural character typical of *Echinoclathria* is widely departed from. When the trabeculæ are lamellar, those which are situate at the surface of the sponge are not disposed edgewise to the exterior, as in other species, but are directed tangentially, and form wide

"borders" between perfectly rounded (circular or oval) "cell-apertures:" the effect is analogous to that which would be produced in a species (like *E. rotunda*) with large "cells" separated by *vertical* lamellæ, if the outer edge of the lamellæ were to expand into a broad horizontal flange, thus concealing the lamellæ themselves and reducing the size of the "cell-apertures."

Of the half-dozen specimens in the Australian Museum, the largest (shown in Pl. xxix., fig. 2) is that which Whitelegge (*loc. cit.*) mistakenly supposed to be the type of *Plectispa elegans*; it measures 230 mm. in height, and is thus not so tall as the largest of Lendenfeld's specimens, which measured 300 mm. In the dry state, the sponge varies in colour from brownish-grey to dark brown, and is of compressible and elastic consistency; there is some peculiarity in the texture of the sponge which produces a "soft" appearance, suggesting that of felt. Whitelegge's statement that the sponge is "rather brittle when dry," is true only of his "type" specimen, mentioned above; the brittleness in this case appears to be due to decay. Both Lendenfeld and Whitelegge have stated that the echinating styli are shorter than those which core the fibres; I fail, however, to find any difference between them. Also I find that the auxiliary megascleres are invariably strongyla—not subtylostyli, as stated by Whitelegge.

Locs.—The species is known only from two closely situated localities, Port Jackson and Tuggerah Beach.

Echinoclathria rotunda, *sp. nov.*

(Plate xxx., fig. 1, and fig. 64.)

Sponge oval or pear-shaped, unbranched, symmetrical. The lamellæ throughout are arranged parallely to the lines of growth of the sponge, and at the surface, accordingly, are disposed edgewise to the exterior; in the inner region of the sponge they are elongated and so form the partition-walls of radially disposed tubes. External "cell-apertures" hexagonal or (occasionally) elongate, on the average about 4 mm. in width. Skeleton consisting of subparallel multi- or pauci-spicular main fibres joined by interreticulating uni- and a-spicular connecting fibres. Echinating styli plentiful, confined to the outer aspect of the fibres. Scattered auxiliary spicules fairly abundant; interstitial principal styli scarce. Megascleres:—(i.) Principal styli, straight, with slight sub-basal waist when fully grown, subfusiform in younger stages, size 80 to 125 x 7·5 μ; (ii.) auxiliary amphistrongyla, or occasionally subtylostrongyla, size 120 to 170 x 2 μ. Microscleres:—Slender isochelæ palmatæ, moderately abundant, 9 to 12 μ long.

This species is represented by two specimens, the larger of which is 100 mm. high, 30 mm. in diameter at the base, and 65 mm. in diameter near its upper extremity where it is broadest. The lamellæ are thin and somewhat parchment-like, and, in keeping with the symmetrical shape of the sponge, display a marked uniformity of arrangement, being so disposed that their planes lie parallel to imaginary lines radiating upward with an outward curvature from the sponge-base to the free periphery. The superficial lamellæ enclose between them usually hexagonal "cells," averaging 4 mm. in diameter; occasionally, however, owing to the incompletion (or non-formation) of intervening lamellæ, several adjoining "cells" may, so to speak, run into one. In the interior of the sponge the lamellæ are relatively long and thus give rise to a tubular structure; in the outer portions of the sponge they are comparatively short and form a more open reticulation.[1]

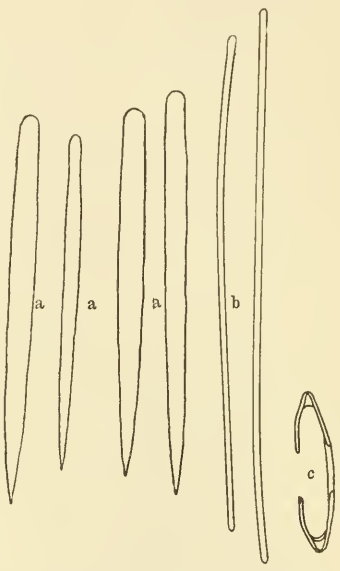

Fig. 64—*Echinoclathria rotunda*. a Principal styles. b Auxiliary strongyles. c Isochela palmata.

With regard to skeletal characters, there is nothing of importance which might be added to what has been mentioned in the diagnosis, except that the fibres within the lamellæ

1 The regularity of the arrangement of the lamellæ in this species enables one to perceive more readily than in the other species herein described, the mode of growth by which the characteristic *Ecihnoclathrian* structure is attained. The formation of new tissue appears to be confined chiefly, if not entirely, to the peripheral region of the sponge, and proceeds in two ways—(i.) by the outward growth, at their outer edge, of the superficial lamellæ; and (ii.) by the formation of new lamellæ. Growth of the first kind increases not only the external dimensions of the sponge, but also, owing to the convexity of its surface, the size of the superficial "cell-apertures." Outward growth of the edge of any given lamella appears to be limited, or, at least, intermittent; and this cessation of growth of now one, now another, of the superficial lamellæ, results in the confluence of adjoining "cells," and thus is also, indirectly, a cause of cell-enlargement. The formation of new lamellæ counteracts this increase in size of the "cell apertures;" each lamella arises, as a tongue- or strap-shaped process, at or near the outer edge of an older superficial lamella—particularly one forming the longer side of an elongated cell—and, growing across the cell aperture, forms at first a narrow septum, dividing it into two. Thereafter, its further increase of size is effected by outward growth along its exterior edge, i.e., in a direction at right angles to its earliest direction of growth.

appear, not to form a tri-dimensional reticulation, as in the preceding species, but, in keeping with the thinness of the lamellæ, to reticulate in a single plane.

Loc.—South coast of Australia; exact locality unknown ("Endeavour").

Echinoclathria carteri, *Ridley and Dendy.*

(Fig. 65.)

1887. *Echinoclathria carteri*, Ridley and Dendy, "Challenger" Monaxonida, 1887, p. 162, Pl. xxix., figs. 12, 12a; Pl. xxxi., figs. 3, 3a.

1907. *Echinoclathria macropora*, Whitelegge, Austr. Mus. Mem., iv., 10, 1907, p. 504.

[Not *Echinoclathria macropora*, Whitelegge, Rec. Austr. Mus., iv., 2, 1901, pp. 89, 117.]

Sponge (unless young) ramose, probably astipitate and basally encrusting; branches cylindrical, growing to a considerable length. Lamellæ thin; superficial lamellæ, as a rule, disposed edgewise to the exterior. Superficial "cell-apertures" rounded or polygonal, 2 to 3 mm. in width. Skeleton a very irregular small-meshed reticulation, apparently in one plane (as in E. rotunda), consisting of pauci- and uni-spicular (or, rarely, aspicular) spongin-fibres, together with a few multispicular fibres poor in spongin. The outlines of the fibres are indistinct, owing to interstitial membranes, and the pattern of the skeleton much obscured by the abundance of irregularly scattered (principal and auxiliary) spicules. Echinating styli plentiful, almost entirely restricted to the exterior aspect of the fibres. Megascleres:—(i.) Principal styli straight, subconical when fully grown, slightly fusiform in their early stages, 95 to about 150 μ in length, and at the most 10 μ in diameter; (ii.) somewhat tornotely pointed, cylindrical, auxiliary styli or subtylostyli, ranging in length from (rarely less than) 120 to 160 μ, and in diameter up to 2.5 μ. Microscleres:—Isochelæ palmatæ, fairly plentiful, 9 to 15 (usually not more than 13) μ long.

In the Australian Museum are some half-dozen specimens of a sponge which I identify as *Echinoclathria carteri*. These agree among themselves, but differ slightly in four respects from the original specimens as described. In the latter, the "anastomosing trabeculæ usually present a flat surface towards the outside," the maximum size of the principal styli is 132 x 9 μ, the auxiliary spicules are basally subtylote and the chelæ attain a length of 15 μ; in the present specimens the superficial trabeculæ (although often disposed obliquely to the

surface) present their edges to the exterior, the principal styli (although in some instances rarely exceeding 130 μ in length) are in no case less than 145 x 9 μ in size, only a very small proportion of the auxiliary styli are basally enlarged, and the chelæ are never more than 13 μ long.

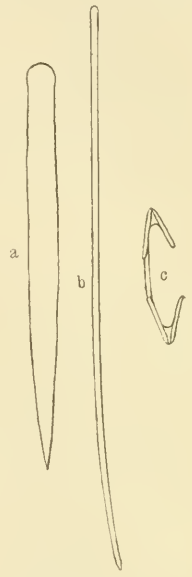

Fig. 65—*E. carteri*. a Principal style. b Auxiliary tornostrongyle. c Isochela palmata.

These specimens were obtained by the "Thetis" Expedition and were recorded —an inexplicable error—as *Echinoclathria macropora* (= *E. ramosa*, nom. nov.). They differ externally from specimens of the latter species in their relatively few and elongated branches, which in one case reach a length of 400 mm. Owing to incompleteness, none of them affords any clue as to the mode of fixation, whether by means of a stalk or otherwise. A single small specimen (obtained by the "Endeavour") encrusting, and growing between, the lower portions of the branches of a horny coral, agrees perfectly in skeletal characters with the "Thetis" specimens. It would appear, therefore, that this species, like *E. fœtus*, is of variable habit.

Locs.—Neighbourhood of Port Jackson, 15 to 52 fms. ("Challenger," "Thetis"); Shoalhaven Bight, 15 to 45 fms. ("Thetis," "Endeavour"); south-east Australia, 120 fms., and Bass Strait, 38 fms. ("Challenger").

ECHINOCLATHRIA GIGANTEA, *Lendenfeld*.

1886. *Halme gigantea*, varr. *macropora*, *intermedia*, et *micropora*, Lendenfeld, Proc. Linn. Soc. New South Wales, x., 1886, p. 847.

1888. *Aulena gigantea*, varr. *macropora*, etc., Cat. Sponges Austr. Mus., 1888, p. 228.

1889. *Aulena gigantea*, varr. *macropora*, etc., Lendenfeld, Monograph of the Horny Sponges, 1889, p. 97, pl. viii., figs. 3, 4, 7, 8, 18, 19; pl. ix., figs. 2-4.

1901. *Aulena gigantea*, var. *micropora*, Whitelegge, Rec. Austr. Mus., iv., 2, 1901, p. 93, and p. 118.

1907. *Aulena gigantea*, var. *micropora*, Whitelegge, Mem. Austr. Mus., iv., 10, 1907, p. 504.

From examination of numerous specimens of this species, brought together from many localities, I find that its subdivision into three varieties, as proposed by Lendenfeld, cannot be maintained. So far as I am able to judge, the specimens being without exception preserved in a dry state, Lendenfeld's very full account of the external and skeletal structure, is substantially correct; but it falls short in reference to the great variability displayed, not only in the size of the meshes formed by the reticulating lamellæ, but also in the degree of development of the spicules both in point of size and number. Thus, to take first the case of the spicules:

(i.) The styli vary in maximum size in different specimens from 70 x 3 μ to 115 x 7 μ, their range of length (*i.e.*, the difference between the longest and shortest) in any given specimen being about two-fifths of the length of the longest. The greater the size of these spicules, the greater apparently is their relative abundance; in some specimens in which they are of least size, their number is extremely small. In shape they are normally very similar to the styli of *E.* (*Aulena*) *crassa*, as depicted by Lendenfeld (*op. cit.*, pl. viii., figs. 20, 21), but as a rule they are not quite so abruptly pointed as these; always, however, a certain proportion of them approach more or less to the conical form represented by Lendenfeld (*loc. cit.*, pl. viii., fig. 18) as characteristic for the variety *intermedia* (and presumably, therefore, for the species). In none of the specimens that I have examined have I found a preponderance of conically-shaped spicules, and I therefore regard Lendenfeld's figures as misleading to the extent that they convey the impression of a difference between *E. gigantea* and *E. laxa* in the forms of their styli.

(ii.) The auxiliary spicules vary in different specimens from 140 to 195 μ in maximum length, and from 2 to 4 μ in maximum diameter. In some specimens they are rather rare; in others comparatively abundant: also, their number relatively to that of the styli varies greatly. They are, in general, stoutest in the case of specimens in which they are most abundant, and *vice versa*; their stoutness, however, varies, to some extent at least, independently of their length. A peculiar point in connection with these spicules is the fact that whereas in some specimens they are almost exclusively tornostyles, in others they are almost exclusively amphistrongyles; in this respect the species resembles *Echinochalina anomala*, sp. nov. From Lendenfeld's description one would suppose the spicule to be invariably a strongyle; but, as a matter of fact, specimens with strongyles appear to be the exception. So far I have met with no specimen in which there was any approach to equality in number of the two forms of the

spicule; but, as in *Echinochalina reticulata* (text-fig. 66), there usually occur in any specimen transitional forms between the tornostyles and strongyles.

In the three varieties (*macropora*, *intermedia* and *micropora*) distinguished by Lendenfeld, the greatest width of the meshes enclosed by the reticulating lamellæ were stated to be 7 mm., 5 mm. and 3 mm. respectively; but, as mentioned above, there is great variability in this respect, and even in single specimens I have found the meshes to vary in width so much as from 4 to 13 mm.

Lendenfeld has described in his Monograph two other species of *Aulena*, *A. laxa* and *A. crassa*. The sponges of the former species, regarded by Lendenfeld as embracing two varieties—the types of which, I suppose, are in the British Museum—will possibly prove to be merely growth-forms of *E. gigantea;* according to the original descriptions of the species, auxiliary megascleres are absent, but in two Australian Museum specimens which Lendenfeld has identified as *A. laxa*, and which presumably are two of those referred to by him under that name in his Catalogue (1888), I find scattered auxiliary strongyla.

Aulena crassa, of which I have examined specimens that come from the type-locality (Port Phillip) and agree very well with the description, is quite distinct from *E. gigantea* and presumably also from *E. arenifera*;[1] its chief distinguishing features are the concealment from external view of its "cell-apertures" by a covering membrane, and its brittleness and friability in the dry state. Its correct name may be accepted for the present as *Echinoclathria crassa*, Lendenfeld (*non* Carter); but the specific name perhaps should be altered, since the *Holopsamma crassa*[2] of Carter, with which Lendenfeld partly identified the species, is evidently more entitled to be identified with and to confer its name upon the sponge now known as *Psammopemma crassum*.

Locs.—The specimens in the Australian Museum Collection were collected from various parts of the New South Wales coast from Jervis Bay on the south to Sandon Bluffs on the north; a number of specimens were obtained by the "Endeavour" at the last-mentioned locality at a depth of 35-40 fms. Specimens are very commonly found upon the beaches after storms. Lendenfeld records the species also from Port Phillip, Victoria, and from Fremantle, Western Australia.

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1 Carter—Ann Mag. Nat. Hist. (5), xvi., 1885, p. 350; Dendy—Proc. Roy. Soc. Vict., viii. (n.s.), 1896, p 40.

2 Carter—Ann. Mag. Nat. Hist. (5), xv., 1884, p. 211.

ECHINOCHALINA, *Thiele* (*emend*).

1903. *Echinochalina*, Thiele, Kieselschwamme von Ternate, ii., 1903, p. 961.

Sponge of various habit; in some cases, like Echinoclathria, consisting of a honeycomb-like reticulation of thin lamellæ. Skeleton a reticulation of horny fibres cored by smooth cylindrical spicules—either monactinal or quasi-diactinal—and echinated by smooth conoidal styli. The former spicules represent the auxiliary, the latter the principal, megascleres of other Myxillinæ: no other kind of megasclere is present. Microscleres are typically absent.

The genus *Echinochalina* was introduced by Thiele for a species which he regards as identical with *Ophlitaspongia australiensis*, Ridley. In expressing the opinion that the species should be removed from the genus to which Ridley assigned it, Thiele says, "eher scheint sie mir sich an *Echinodictyum* anzuschliessen, da sie wie diese Gattung Züge von gleichendigen Nadeln enhalt, von denen ungleichendige abstehen; wahrend aber bei *Echinodictyum* die gleichendigen Spicula grosse Amphioxe sind, sind es hier schwache Amphistrongyle und die abstehenden Style sind hier glatt, bei *Echinodictyum* stachlig." Topsent is also of the opinion that *Echinochalina* is related to *Echinodictyum*, for he says,[1] "Il ne se distingue du genre *Echinodictyum* qu'en ce que les spicules qui hérissent les fibres sont de styles lisses, les *Echinochalina* étant, en somme, aux *Echinodictyum* ce que les *Ophlitaspongia* sont aux *Clathria*." Both writers, however, have disregarded certain very important differences in the spiculation of the two genera, which render it highly improbable that they are in any way closely related: as an example of such a difference it may be mentioned that, whereas in *Echinodictyum* there are typicaly three kinds of megascleres, there are in *Echinochalina* only two.

Besides *Echinochalina australiensis*, Thiele includes in his genus *Echinoclathria glabra*, Ridley and Dendy, and *Thalassodendron digitata*, Lendenfeld; Whitelegge has since added a fourth species, *Echinochalina reticulata*, and two others are described in the present paper. Of these *E. glabra* and *E. reticulata* are of special interest, since both in their honeycomb-like external structure and in the forms of their spicules they bear so striking a resemblance to species of *Echinoclathria* that their close relationship to the latter seems indisputable. One can therefore assert with some confidence concerning these two species that they differ from *Echinoclathria* only in the fact that their fibres are cored, not by principal spicules,

1 Topsent—Arch. Zool. Exp., Notes et Revue, 1904, p. xciii.

but by auxiliary; and as the remaining species are very analogous to *E. glabra* and *E. reticulata* in point of spiculation, it is extremely probable that in their case also, the axial spicules of the fibres are auxiliary. The supposed resemblance between *Echinochalina* and *Echinodictyum* is therefore a fictitious one, since in the latter genus it is unquestionably the principal spicules which core the fibres.

ECHINOCHALINA RETICULATA, *Whitelegge*.

(Pl. XXX., fig. 2, and fig. 66.)

Sponge of rounded massive form, consisting of a honeycomb-like reticulation of very thin, almost membranous, lamellæ; the superficial lamellæ, as a rule, present their edges to the exterior. Superficial "cell-apertures" averaging about 8 mm. in diameter. Skeleton (of each lamella) an irregular "bi-dimensional" reticulation of main and connecting fibres. Main fibres with a sparse core of slender cylindrical (auxiliary) megascleres varying in form from tornotely-pointed subtylostyli to amphistrongyla; connecting fibres vacant: all the fibres abundantly echinated by principal styli, conical in shape except for a slight sub-basal constriction. Auxiliary megascleres are abundantly scattered between the fibres. Megascleres, sizes of:—(i.) Principal styli, length 120 to 170 μ, maximum diameter 10 μ; (ii.) auxiliary spicules, length 180 to 230 μ, maximum diameter 4 μ. Microscleres absent.

An examination of the single specimen (the type-specimen, preserved in a dry state) which I have seen of this species, provides nothing of importance that might be added to the original description, except as regards the auxiliary megascleres. These—which are cylindrical, more or less basally expanded (*i.e.*, subtylote), monactinal spicules—are usually tornotely pointed; but in a small proportion of them—between which and the preceding are many individuals of intermediate character—the distal extremity is rounded off like the end of a strongyle. I am unable to support Whitelegge in his statement that these strongylotely-ended spicules, which he erroneously terms tylota, occur chiefly in the dermal layer; rather does it appear to me that they are intermingled with the others promiscuously.

In agreement with the thin membranous character of the lamellæ, the reticulation of fibres which forms the supporting skeleton of any given lamella extends only in two dimensions or, in other words, all the fibres composing it are parallel to the plane of the lamella.

As the original figure does not convey a sufficiently clear idea of the appearance of the sponge, a further figure on a

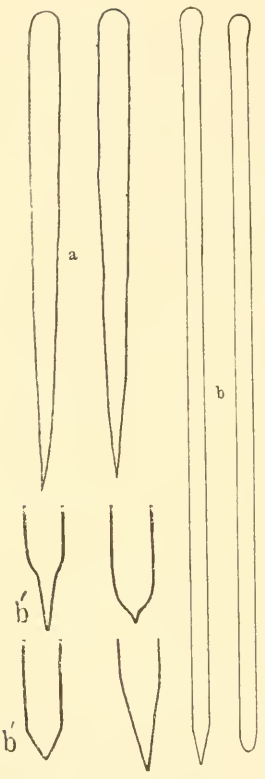


Fig. 66—*E. reticulata*. a Principal styles. b Auxiliary spicules. b' Showing variations of the distal extremity of same.

larger scale is included herein; this will the better enable one to perceive the difference in aspect between the typical form of the species and that described hereunder which for the present I regard as a variety.

Echinochalina reticulata var. (Pl. xxxi., fig. 1).

This variety, represented in the collection by five specimens of various irregularly massive form and comparatively large size—the largest specimen measuring 150 mm. in height, 230 mm. in length, and 180 mm. in breadth—is of much more compact structure than the typical variety, and has spicules of smaller size; the lamellæ, also, appear to be much less regularly interwoven than in the latter.

The meshes enclosed by the reticulating lamellæ average 4 mm. in width, which is only about one-half that of the meshes of the typical variety. The principal styli range from 80 to 130 μ in length, and attain to 8 μ in diameter; the auxiliary spicules are 160 to 200 μ in length, and in diameter not more than 3·5 μ.

Locs.—South-east coast of Australia; east coast of Flinders Island; off Devonport ("Endeavour").

ECHINOCHALINA GLABRA, *Ridley* and *Dendy*.

(Fig. 67.)

1887. *Echinoclathria glabra*, Ridley and Dendy, "Challenger" Monaxonida, 1887, p. 163, pl. xxix., figs. 11, 11a; pl. xxi., fig. 2.

1896. *Echinoclathria glabra*, Dendy, Proc. Roy. Soc. Vict., viii. (n.s.), 1896, p. 40.

[*Not Echinochalina glabra*, Whitelegge, Austr. Mus. Mem., iv., pt. x., 1907, p. 504.]

Sponge of rounded massive form, consisting of a honeycomb-like reticulation of thin lamellæ; lamellæ interwoven in a somewhat irregular manner, and at the surface indifferently disposed. "Cell-apertures," 3 to 5 mm. in diameter. Skeleton (of each lamella) an irregular "bi-dimensional" reticulation of main and connecting fibres. Main fibres with a sparse core of (auxiliary) subtylostrongyla; connecting fibres vacant: all the fibres rather plentifully echinated by (principal) styli. Auxiliary megascleres are rather abundantly scattered between the fibres. Megascleres: —(i.) Principal styli, sub-conical, slightly fusiform, generally with a well-marked subbasal constriction, varying in length from about 70 to 110 μ or slightly less, and attaining a maximum diameter of 6 or 7 μ; (ii.) auxiliary subtylostrongyla or (occasionally) amphistrongyla varying in maximum length in different specimens from 200 to 220 μ.

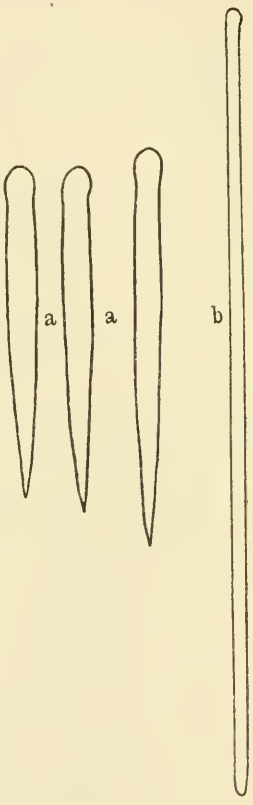


Fig. 67—*E. glabra*. a Principal styles. b Auxiliary tylostrongyle.

Several specimens which I identify as *E. glabra*, agree in all essential respects with Ridley and Dendy's description save that the auxiliary megascleres are not tylota, but subtylostrongyla and simple strongyla, the number of the latter being relatively very small. In this connection, however, the original description is almost undoubtedly wrong, since the spicule, as represented in Ridley and Dendy's figure, shows an enlargement only at one extremity, the other being simply rounded off like that of a strongyle.

In the two specimens which I have examined, and in a mounted section[1] presented to the Australian Museum by Prof. Dendy, the spicules agree in size; the auxiliary vary in

1 This section is not, as Whitelegge *(loc. cit.)* supposed, a portion of the type-specimen, but was cut from a specimen obtained in Port Phillip.

length from 160 to (rarely) 205 μ, and attain a maximum diameter (rarely) of 4 μ, whilst the principal vary in length from 75 to 110 μ, and reach a diameter of 7 μ. In the "Challenger" specimen the maximum dimensions of the spicules were 220 x 3.2 μ and 110 x 6.3 μ, respectively.

The specimens which Whitelegge, in his report on the sponges of the "Thetis" Expedition, recorded as *E. glabra*, prove to belong to a new species described below as *R. anomala.*

Locs.—Off Moncœur Island, Bass Strait, 38 fms. ("Challenger"); Port Phillip (*Dendy*); forty miles west of Kingston, South Australia, 30 fms. ("Endeavour").

Echinochalina anomala, *sp. nov.*

(Fig. 68.)

1907. *Echinochalina glabra* (err., non Ridley and Dendy), Whitelegge, Mem. Austr. Mus., iv., 10, 1907, p. 507.

External form massive, rounded. Sponge (in the dry macerated condition) somewhat of honeycomb-like structure, being formed of very thin membranous lamellæ which tympanize the (on an average 3 mm. wide) meshes of an irregular reticulation of stout (up to 250 μ in diameter) spiculo-spongin fibre; the lamellæ are themselves crossed only by a few (interreticulating) fibres of lesser stoutness. All the fibres are provided with a stout compact axial strand of (auxiliary) monactinally tapered amphistrongyla and (or) tornostyles, and are echinated—fairly abundantly in the case of the stouter fibres—by subconical (principal) styli, which, as a rule, are disposed more or less perpendicularly to them. Abundant auxiliary spicules are scattered interstitially, together with a few principal spicules. Megascleres, sizes of:—(i.) Principal, 160 to 200 μ in length, 9 to 10 μ in maximum diameter; (ii.) auxiliary, 180 to 240 μ in length, and about 5 μ in maximum diameter. Microscleres absent.

Having had the opportunity of examining undoubted examples of *Echinochalina glabra*, I am able to say that the five specimens recorded and briefly described as such by White-

legge, belong to another and new species, for which, on account of its structural peculiarity, I propose the name *anomala*. The fact that the species was mistaken for *E. glabra*, is sufficient indication of its external resemblance to species of *Echinoclathria*. Its structure, however, differs from that of *Echinoclathria* (and of *Echinochalina glabra*) in two readily noticeable respects: firstly—along the lines of junction of the reticulating lamellæ there runs (or, to put it in other words, along each of their joined edges the lamellæ are bounded by) a very stout strand of spicules thinly ensheathed by spongin; and, secondly—the lamellæ themselves, which are of membranous thinness, are destitute of any supporting reticulation of main and connecting fibres such as is found in the lamellæ of *Echinoclathria*, but are traversed merely by a very few irregularly interreticulating fibres similar, except in point of stoutness, to those which bound them. Consequently, in the case of dry macerated (and somewhat damaged) specimens such as the present are, the sponge appears as a loose irregular reticulation of stout fibres with meshes (which average about 3 mm. in width) tympanized by thin membrane. In their present condition, indeed, the specimens might easily pass for washed-out examples of some loosely reticulately-fibred *solid* (*i.e.*, not trabecular) sponge—such, for example, as many species of *Mycale*—with extraordinarily well-developed "interstitial membranes."

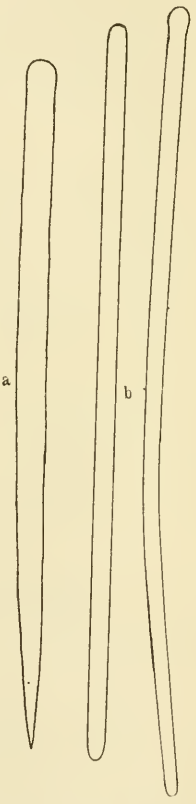


Fig. 68 — *Echinochalina anomala.* a Principal style. b strongylote auxiliary spicules.

Measurement of the spicules in all five specimens gave approximately identical values, the auxiliary spicules attaining a maximum size of 240 x 5 μ, and the principal, 200 x 9 μ (not 160 x 8 μ as stated by Whitelegge).

The auxiliary spicules are not quite cylindrical, but gradually taper from base to apex. At their apical extremity, they

are either tornotely pointed (tornostyles) or strongylotely rounded off (amphistrongyles); and, in this connection, it is rather remarkable that whereas in four of the specimens these spicules are almost exclusively amphistrongyles, in the fifth they are almost exclusively tornostyles. The name "tylota" used by Whitelegge in reference to the auxiliary spicules is quite inapplicable, since in no instance do they show any indication of a terminal enlargement, except occasionally at the basal extremity; the distal extremity of the tornostyles is variously modified in the same way as in *E. reticulata* (Fig. 66).

All the specimens are attached, as Whitelegge mentions, to the branches of gorgonaceans, hydrocorallines, or bryozoans, and also grow over and around these branches so as to enclose them. The sponge is without definite shape, but always assumes a more or less rounded contour. The largest specimen, which happens to be of compressed form, measures 110 mm. in height, 75 mm. in breadth, and 25 mm. in thickness.

Loc.—Coast of New South Wales, off Wollongong, 55-56 fms. ("Thetis").

Echinochalina intermedia, *Whitelegge*.

(Fig. 69).

1901. *Thalassodendron viminalis* (err., non Lendenfeld, 1888), Whitelegge, Rec. Austr. Mus., iv., 2, 1901, p. 87.

1902. *Echinoclathria intermedia*, Whitelegge, *Op. cit.*, iv., 5, 1902, p. 214.

Sponge sessile, of clathrate structure and erect massive form; composed of reticulating, erect and transverse, flattened trabeculæ of various size, 5 to 30 mm. long, 4 to 20 mm. wide, and 2 to 4 mm. thick. Skeleton an irregular reticulation of fibres which are comparatively poor in spongin and are mostly provided with a stout, often fairly dense, multispicular axial strand of (auxiliary) cylindrical tornostyles and (scarce) amphistrongyles; the connecting fibres sometimes contain few or no spicules. The fibres are echinated, at all angles of inclination, by comparatively few conical smooth (principal) styli. Auxiliary spicules are scattered interstitially in moderate abundance, together with a few principal spicules. Megascleres, sizes of:—(i.) Principal, 80 to 150 μ in length, 9 μ in maximum diameter; (ii.) auxiliary, 140 to 185 μ in length, 4 μ in maximum diameter. Microscleres absent.

The only available example of this species is that which Whitelegge has described. It is an incomplete dry specimen in a very imperfect state of preservation, and, as such, accords fairly well with Whitelegge's description except in regard to spiculation. I am unable, however, to confirm the statement that numerous small oscula are present, and regard the term "honeycomb-like," used to describe the external structure of the sponge, as misleading, since it tends to call to mind the cellular structure characteristic of *Echinoclathria*. In its present condition the specimen shows no semblance of a dermal membrane, nor of any specialised dermal layer.

The original account of the spicular characters, which is quite misleading, must have been based upon some portion of the specimen in which there were fibres of another sponge.

The locality of the specimen is unknown.

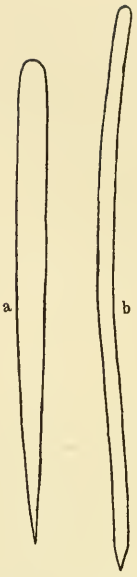


Fig. 69 — *Echinochalina intermedia*. a Principal style. b Auxiliary tornostrongyle.

Genus Clathriodendron, *Lendenfeld*.

1888. *Clathriodendron*, Lendenfeld, Descr. Cat. Sponges Austr. Mus., 1888, p. 215.

The three species for the reception of which Lendenfeld founded this genus, led him to propose for it the following definition:—"Desmacidonidæ with exceedingly large tylostylote megasclera scattered in the ground substance. The spongin-fibres of the supporting skeleton contain only a few spicules. Echinating spicules spined styli." In the description of the species we learn further that the arrangement of the fibres is reticular, and that microscleres are absent. The character of the spicules suggests that *Clathriodendron* may be related to *Raspailia*, and, indeed, in his recently described *R. paradoxa*, a somewhat aberrant species of the latter, Hentschel[1] has found reasonable grounds for supposing the two genera to be identical. It transpires, however, that *C. arbuscula* (the first-described of the three species, and, therefore, best entitled to rank as the genotype) whilst exhibiting

1 Hentschel—Die Fauna Südwest-Australiens, Tetraxonida, ii., 1911, p. 383.

points of resemblance to certain species of *Raspailia*, possesses characters sufficiently distinctive to justify the retention of *Clathriodendron* as an independent genus. As regards the two remaining species, I can offer no positive opinion, since in the existing collection of the Australian Museum no specimen occurs which satisfies the description of either; but, accepting Lendenfeld's statement that *C. irregularis* is similar, both in "skeleton and spiculations," to *C. arbuscula*, this one of them we may reckon provisionally as likewise belonging to *Clathriodendron*. As for the other, *C. nigra*,[1] there is reason to suspect that its description is inaccurate, and that its proper place is in the genus *Raspailia*.

I have examined well-preserved spirit-specimens[2] of *C. arbuscula*, and find that the surface of the sponge is perfectly

1 Included amongst the small pieces of British Museum sponges which Prof. Dendy has placed at the disposal of the Australian Museum, is one labelled *Clathriodendron nigra*, Lendenfeld. It is a small portion of a slender branch, quite black in colour, and in external attributes, accordingly harmonises with the species whose name it carries; moreover, its identification as such is understood to be due to Lendenfeld himself. One is quite at a loss, therefore, on finding that its spicular characters are not in accordance with requirements, to decide whether the specimen is wrongly named or the species wrongly described. In the description of *C. nigra*, the only spicules mentioned are the tylostyli, ".7 mm. long and .017 mm. thick," and the "comparatively very scarce" acanthostyli, ".1 mm. long and .01 mm. thick, with very small spines." In this reputed example of the species, I note, as regards the spicules, the following particulars:—The tylostyli attain a maximum size of 2000 x 25 μ, and the acanthostyli, which are fairly abundant and are provided with moderate-sized spines, have a range in length from 75 to 130 μ, with a maximum stoutness of 12 μ. Large tylostyli project singly beyond the surface of the sponge and are surrounded at their point of emergence each by a divergent tuft of slightly fusiform styli which vary in length from about 300 to 380 μ and attain a maximum stoutness of 9 μ but are seldom of greater size than 345 x 4.5 μ. Finally, slender asymmetrical oxea, 200 to 380 μ in length and at most 4.5 μ in diameter, are sparsely scattered in the ground substance. Owing to the dry, much-shrunken condition of the fragment, I am unable to determine what was the pattern of the skelton; but it appears to have been reticular and devoid of any well-marked "axial condensation," resembling in these respects that of *Clathriodendron* and of *Raspailia paradoxa*, Hentschel.

2 Although I consider it beyond doubt that these specimens are genuine examples (if not the actual type-specimens) of *C. arbuscula* I think it only right to mention—inasmuch as I have to remark the incorrectness, in some particulars, of Lendenfeld's description of the species—that the documentary proof of their identity is not complete. The specimens are labelled (in Lendenfeld's handwriting) only with the manuscript name, "*Ceraospina arbuscula*," and a reference number; and I find, on consulting the key-list of Lendenfeld's manuscript names (*vide* Whitelegge, Rec. Austr. Mus., iv., 2, 1901, p. 64), that, for this particular name (and number), no synonym is given.

I might here mention that the name "*Ceraospina arbuscula*" also occurs under number 307 of the key-list, and in this instance is stated to be a synonym of *Echinonema anchoratum* var. *ramosa*, Lendenfeld. This information, however, is wrong, and has led to an error on the part of Whitelegge; for the only specimen in the Australian Museum labelled "*Ceraospina arbuscula*, No. 307" that which Whitelegge (Rec. Austr. Mus., iv., ii., 1901, p. 81) has erroneously (and, I must add, not quite correctly) described under the name of *Echinonema anchoratum* var. *ramosa*—proves to be, in point of spiculation, skeleton pattern and surface conulation, the counterpart of *Clathriodendron arbuscula*. It differs to some extent from the other specimens of this species, however, in habit and texture, and so may be another species; but since it is of small size and is preserved in a dry state, the probability is that these differences are due merely to differences of age and state of preservation.

glabrous, there being an entire absence of the dermal brushes of spicules so characteristic of *Raspailia*, and, indeed, an absence of any dermally situated spicules whatsoever. The skeleton is a well-defined, moderately small-meshed, reticulation of horny fibres, and is without any trace of an "axial condensation." The main or longitudinal fibres, which lie rather widely apart, are sparsely cored with long tylostyles, whilst the connecting fibres are without axial spicules; both main and connecting fibres are fairly plentifully echinated by acanthostyles. Tylostyli, exceeding in number those within the fibres, occur also interstitially, disposed in approximate parallelism with the main fibres; and further, there are scattered between the fibres, though somewhat rare in their occurrence, slender asymmetrical oxea (auxiliary spicules) which lie either singly or in contiguous parallel pairs. The tylostyli, which are usually more or less curved, are rarely less than 500 μ long, and may reach a length of 1 mm.; the stoutest of them have a diameter of 16 to 20 μ. The largest acanthostyles measure about 110 x 8 μ; and the oxea, which are commonly between 270 and 320 μ in length and rarely more than 4.5 μ in diameter, attain a maximum size of 410 x 5.5 μ.

In external features the specimens are in close accord with the original description. Lendenfeld's statement, however, that the "sponge has the shape of a tree," is rather vague, and perhaps does not convey a correct idea of its habit of growth. The actual appearance of the sponge is exceedingly like that of the specimen which Lendenfeld[1] has figured as *Clathrissa arbuscula*, but which, as I have already ventured to assert, does really represent an example of the present species.

Having examined a slide of Carter's *Dictyocylindrus cacticatis*,[2] presented to the Australian Museum by Prof. Dendy, I am in a position to say that this is also a species of *Clathriodendron*, and that it approaches fairly closely both in the size and form of its spicules to *C. arbuscula*, with which it agrees also in habit of growth and in having a conulose surface. The maximum dimensions of the spicules prove to be as follows:—Tylostyli, 975 x 16 μ; acanthostyli, 120 x 10 μ; oxea, 320 x 3 μ. The last-mentioned spicules appear to be extremely rare.

1 Lendenfeld—*Loc. cit.*, pl. v., fig. 2.

2 Carter—Ann. Mag. Nat. Hist. (5), xvi., 1885, p. 354; Dendy—Proc. Roy. Soc. Vict., viii. (n.s.), 1896, p. 48. *Vide* also, Dendy—Rept. Pearl Oyster Fisheries, Gulf of Manaar, etc., 1905, p. 176.

III.—APPENDIX.

Below is given a list of synonyms, as far as I have been able to establish them, of the species of *Ectyoninæ* described by Lendenfeld in his "Catalogue of the Sponges in the Australian Museum" (pp. 214-227), and of the species wrongly identified with (some of) these by Whitelegge. The names are listed in the order in which they appear in the Catalogue, Lendenfeld's species being indicated by the letter "L," Whitelegge's by the letter "W;" along with the synonym of each is a reference to the page herein on which the species is dealt with. Species of which I have seen no specimens are marked by an asterisk.

Myxilla.—

M. jacksoniana, L.	*Lissodendoryx jacksoniana*, L.[1]

Clathriodendron.—

C. arbuscula, L.	*Clathriodendron arbuscula*, L. (p. 295).
**C. irregularis*, L.	*? Clathriodendron irregularis*, L. (p. 296).
C. nigra, L.	*? Raspailia nigra*, L. (p. 296).

Clathrissa.—

C. arbuscula, L.	*Clathrissa arbuscula*, L. (p. 146).
**C. elegans*, L.	*? Clathrissa elegans*, L. (p. 146).
C. pumila, L.	*Crella incrustans*, Carter, var. *pumila*, L. (p. 168).
C. pumila, var. *rubra*, L.	*C. incrustans*, Carter, var. *rubra*, L. (p. 170).

Echinonema.—

**E. anchoratum*, var. *ramosa*, L.	*? Wilsonella ramosa*, L. (p. 243).
**E. anchoratum*, var. *ramosa*, W.	*Clathriodendron arbuscula*, L. (p. 296).
	? Wilsonella dura, L., *non* Whtlg. (p. 243).

1 An examination of the type-specimen of *Myxilla jacksoniana* has shown that the chelæ are of the arcuate type, and that the species, therefore, belongs to *Lissodendoryx*.

E. anchoratum, var. *dura*, W.	*Clathria* (?) *indurata*, sp. nov.[2]
**E. anchoratum*, var. *lamellosa*, L.	? *Wilsonella lamellosa*, L. (p. 243).
E. anchoratum, var. *lamellosa*, W.	*Clathria spicata*, sp. nov. (p. 210).
E. levis, L. (and W.)	*Crella incrustans*, Carter, var. *levis*, L. (p. 164).
E. rubra, L. (and W.)	*Crella incrustans*, Carter, var. *levis*, L. (p. 164).

Clathria.—

**C. macropora*, L.	? *Wilsonella macropora*, L. (p. 240).
C. macropora, W.	*Crella incrustans*, Carter, var. *arenacea*, Carter (p. 161).
C. pyramida, L.	*Wilsonella pyramida*, L. (p. 240).
**C. australis*, L.	? *Wilsonella australis*, L. (p. 239).
C. australis, W.	*Crella incrustans*, Carter, var. *arenacea*, Carter (p. 161).

Thalassodendron.—

**T. digitata*, L.	? *Echinochalina digitata*, L. (p. 288).
**T. typica*, L.	? *Wilsonella typica*, L. (p. 203).
T. typica, W.	*Echinodictyum elegans*, L. (p. 203).
T. rubens, var. *dura*, L.	*Clathria rubens*, L. (p. 219).

1 For the sponge which Whitelegge (Rec. Austr. Mus., iv., 2, 1901, p. 81) mistook for Lendenfeld's *Echinonema achoratum* var. *dura*, I now propose the name *Clathria indurata*. Whitelegge's description is substantially correct except in regard to the dimensions of the spicules. His use of the term "honeycomb-like," in reference to the external conformation of the sponge, however, is inappropriate; and the statement that "the texture is . . . minutely porous throughout" is correct only so far as it applies to the surface, which is minutely porous over its entire entent. As a matter of fact, the texture (of dry specimens) is particularly dense and compact; and the consistency, in consequence, is unusually firm and hard. The available specimens (three in number) are destitute of any traces of a specialised dermal skeleton; but the information which they afford in this particular is unreliable, since their preservation is imperfect; and it is possible, therefore, that the species may prove to belong to *Rhaphidophlus*. Indeed, it is to be noted that in certain of its spicular characters, more particularly in regard to its auxiliary megascleres, it exhibits points of resemblance to *Rhaphidophlus typicus;* but toxa are absent, and the chelæ are of only a single kind. Thus, the auxiliary spicules (subtylostyli) are pretty abundant; they exhibit a very considerable range in length; the shortest of them—which are very slender—are curved; and a fair proportion are provided, upon their extreme basal end, with a minute spination; also, the acanthostyles, the spines of which are moderately large, show a tendency towards a reduction of their spination over the sub-basal portion of their length. The principal spicules are without special features, being more or less curved, subconical styli. The dimensions of the megascleres, taking into account their range in length and maximum stoutness, are as follows:—Principal, 120 to 200 x 13 μ; accessory, 55 to 70 x 7.5 μ; auxiliary, 95 to 220 x 5.5 μ. The greatest length of the chelæ is 12 μ. The "ill-defined and hair-like spicules mentioned in Whitelegge's description as being present in small number in the ground substance, were no doubt some of the very slenderest of the auxiliary spicules.

T. rubens, var. *dura*, W.	*Rhaphidophlus paucispinus*, L. (p. 179).
T. rubens, var. *lamella*, L. (and W.)	*Rhaphidophlus paucispinus*, (pp. 179, 219).
T. paucispinus, L. (and W).	*Rhaphidophlus paucispinus* (p. 179).
T. brevispina, L. (and W.)	*Rh. typicus*, Carter, var. *brevispinus*, L. (p. 193).
T. viminalis, L. (and W.)	*Ophlitaspongia subhispida*, Carter, var. *viminalis*, L. (p. 259).

Plectispa.—

**P. elegans*, L.	*? Echinoclathria elegans*, L. (p. 204)
P. elegans, W.	*Echinoclathria arborea*, L. (p. 280).
P. arborea, L.	*Echinoclathria arborea*, L. (p. 280).
P. arborea, W.	*Clathria multipes*, sp. nov. (p. 211).
**P. macropora*, L.	*? Wilsonella macropora* (*bis.*), L. (p. 205).
P. macropora, W.	*Echinoclathria ramosa*, sp. nov. (p. 278).

Clathriopsamma.—

C. lobosa, L. (and W.)	*Wilsonella australiensis*, Carter, (p. 239).
C. reticulata, L.	*Rhaphidophlus reticulatus*, L. (p. 177).

EXPLANATION OF PLATE XXI.

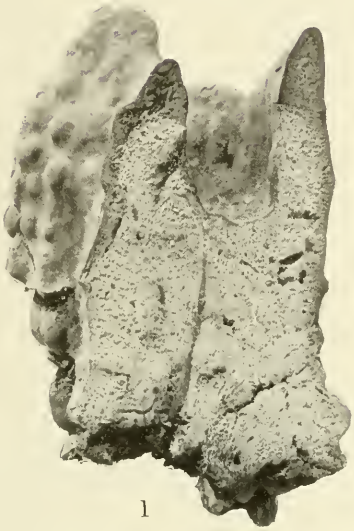
Fig. 1. *Spirastrella poculoides*, sp. nov.; x 7/10.

The specimen, which has been longitudinally bisected, is viewed from the inner surface.

Fig. 2. *Spirastrella alcyonioides*, sp. nov.; x 3/5.

Fig. 3. *Spirastrella montiformis*, sp. nov.; x 5/6.

The surface markings are traces left by an encrusting Cornulariid Alcyonarian.



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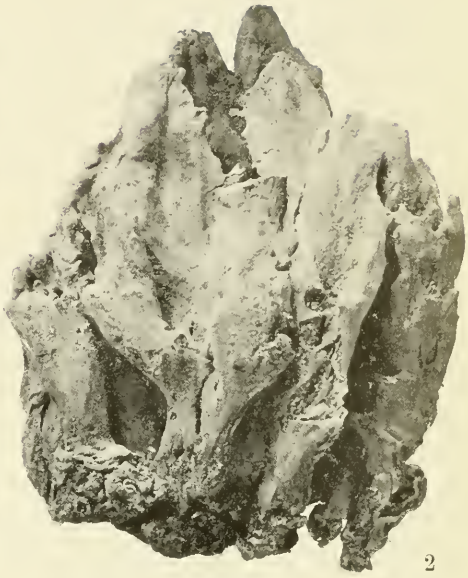

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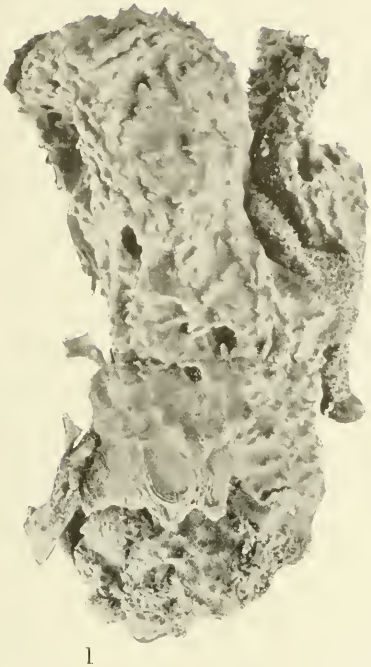
H. BARNES, JUNR., Photo.

EXPLANATION OF PLATE XXII.

Fig. 1. *Latrunculia conulosa*, sp. nov.; natural size.

Fig. 2. *Paracordyla lignea*, gen. et sp. nov.; x 2/3.
The specimen, which has been longitudinally bisected, is viewed from the inner surface.

Fig. 3. *Polymastia craticia*, sp. nov.; x 3/8.



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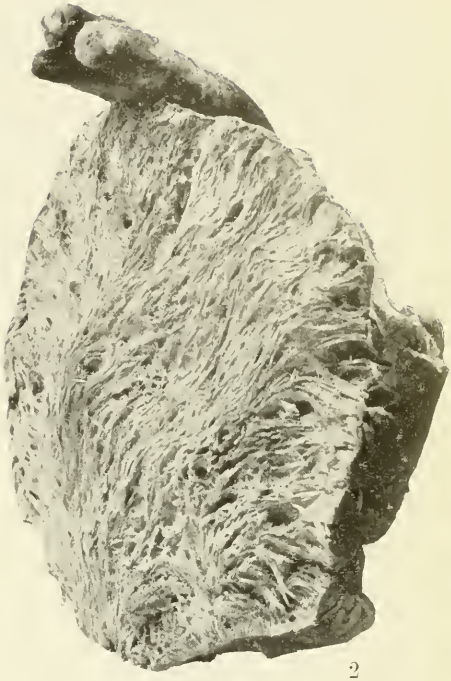

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H. BARNES, JUNR., Photo.

EXPLANATION OF PLATE XXIII.

Fig. 1. *Echinodictyum elegans*, Lendenfeld; x 1/3.

Fig. 2. *Crella incrustans*, Carter, var. *digitata*, var. nov., encrusting a bivalve; viewed from the side; x 1/2.

Fig. 3. *Crella incrustans*, var. *arenacea*, Carter; x 4/9.

Showing the irregularity of form assumed by the shallow-water New South Wales representatives of the species; the dermal encrustation is almost entirely denuded; the surface-grooves are less apparent in the figure than in the specimen itself.

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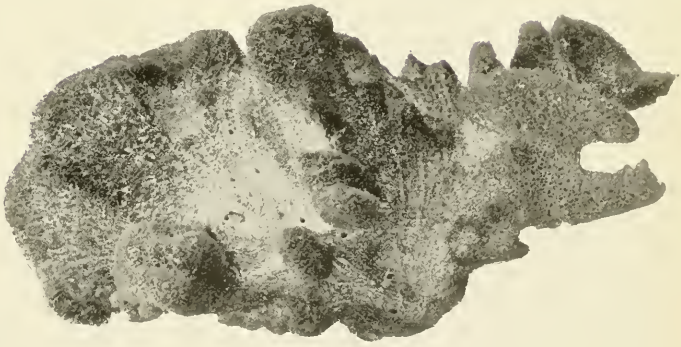

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H. BARNES, JUNR., Photo.

EXPLANATION OF PLATE XXIV.

Fig. 1. *Crella incrustans*, var. *perramosa*, var. nov.; x 1/3.

H. BARNES, JUNR., Photo.

EXPLANATION OF PLATE XXV.

Fig. 1. *Rhaphidophlus paucispinus*, Lendenfeld; x 1/2.

Fig. 2. *Rhaphidophlus paucispinus*, Lendenfeld, var. *multiporus*, Whitelegge; x 2/7.

H. BARNES, JUNR., Photo.

EXPLANATION OF PLATE XXVI.

Fig. 1. *Rhaphidophilus paucispinus*, Lendenfeld; x 1/3.

H. BARNES, JUNR., Photo.

EXPLANATION OF PLATE XXVII.

Fig. 1. *Rhaphidophlus typicus*, Carter, var. *stellifer*, var. nov.; x 3/5.

H. BARNES, JUNR., Photo.

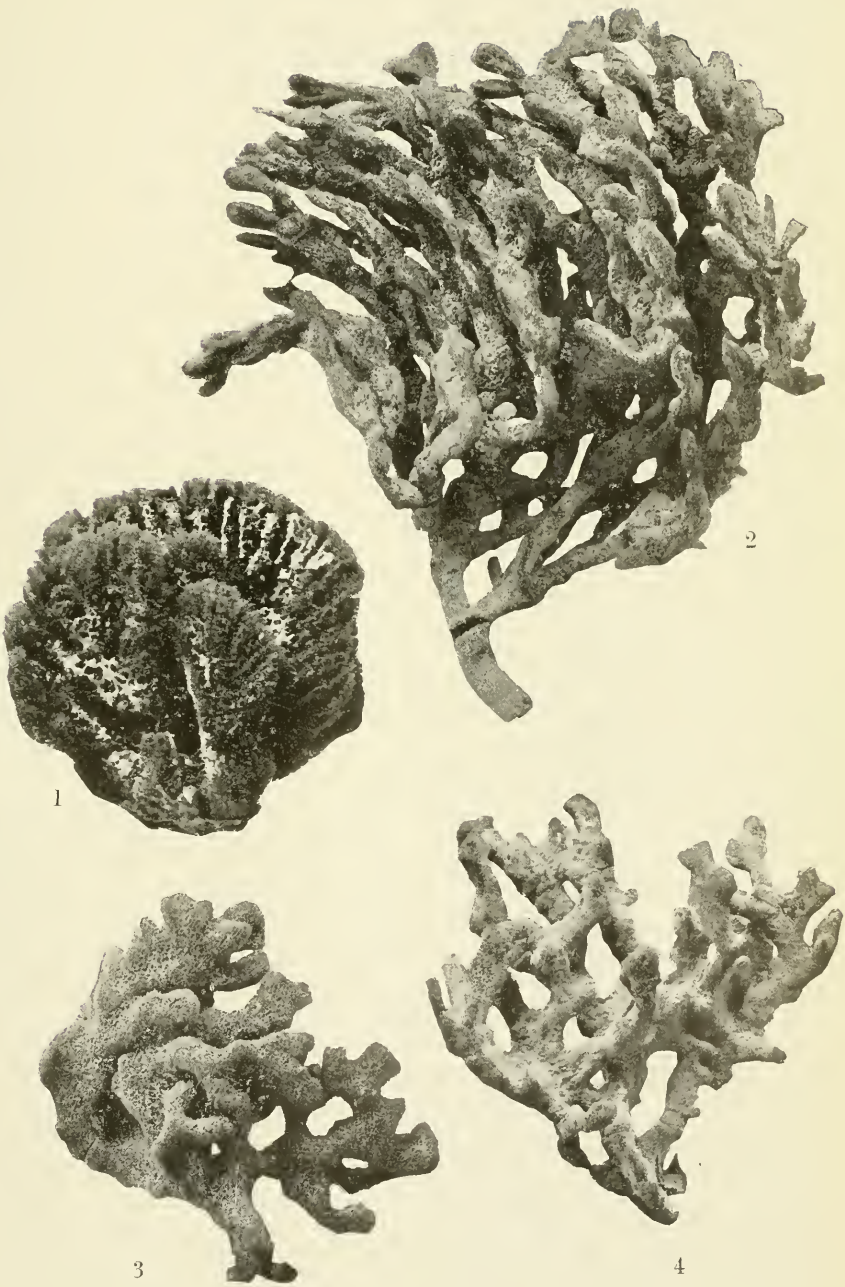
EXPLANATION OF PLATE XXVIII.

Fig. 1. *Rhaphidophlus typicus*, Carter, var. *obesus*, var. nov. ; x 5/8.

Fig. 2. *Rhaphidophlus typicus*, Carter, var. *geminus*, var. nov. ; x 1/2.

Fig. 3. *Rhaphidophlus typicus*, Carter, var. *proximus*, var. nov. ; x 1/2.

Fig. 4. *Rhaphidophlus typicus*, Carter, var. *proximus*, var. nov. ; x 1/2.



H. BARNES, JUNR., Photo.

EXPLANATION OF PLATE XXIX.

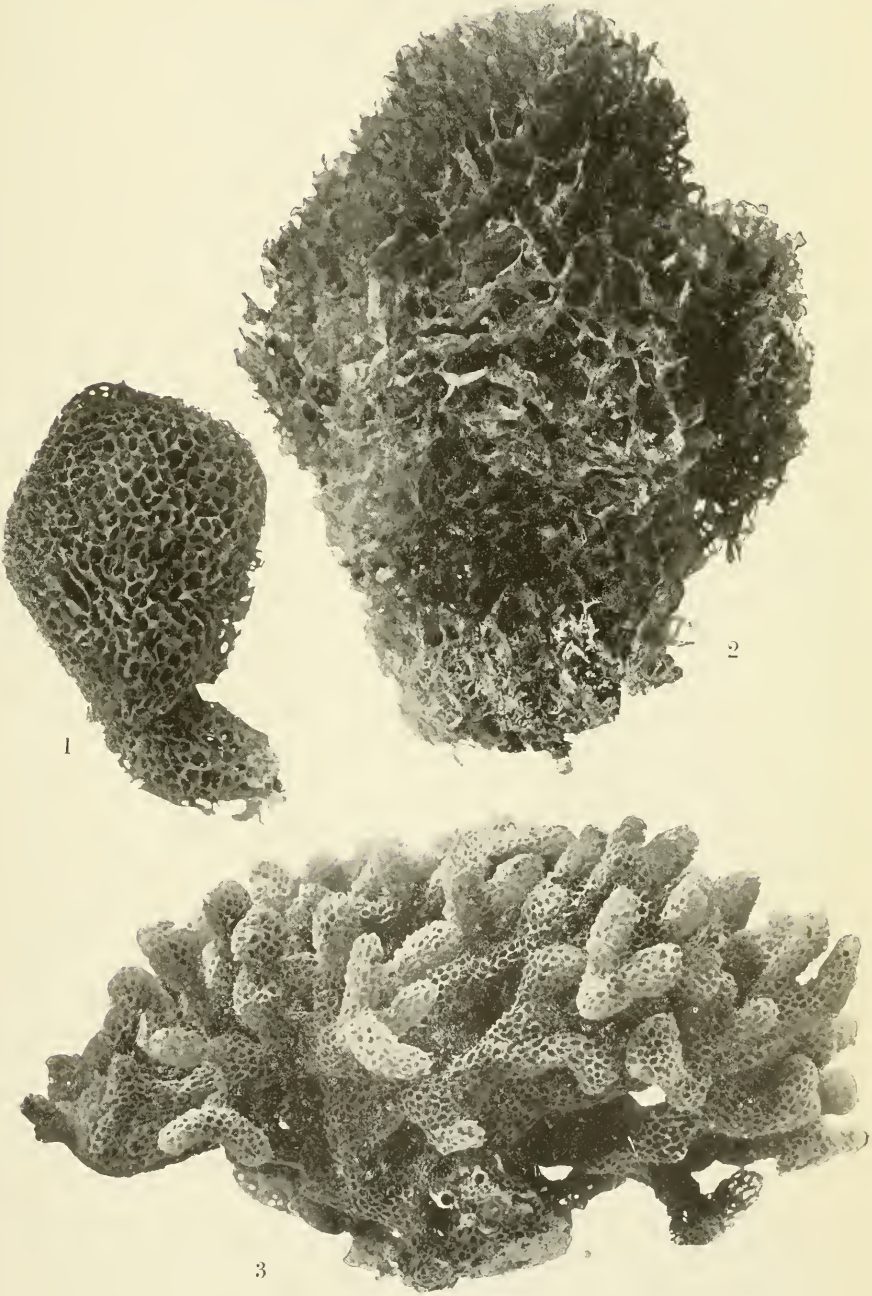
Fig. 1. *Rhaphidophlus typicus*, Carter, var. *anchoratus*, Carter; x 3/8.

Fig. 2. *Echinoclathria arborea*. Lendenfeld; x 1/2.

H. BARNES, JUNR., Photo.

EXPLANATION OF PLATE XXX.

Fig. 1. *Echinoclathria rotunda*, sp. nov. ; x 2/3.
Fig. 2. *Echinochalina reticulata*, Whitelegge; x 4/5.
Fig. 3. *Echinoclathria ramosa*, sp. nov. ; x 3/5.



H. BARNES, JUNR., Photo.

EXPLANATION OF PLATE XXXI.

Fig. 1. *Echinochalina reticulata*, Whitelegge, var.; x 3/7.
Fig. 2. *Clathria costifera*, sp. nov.; x 4/9.

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H. BARNES, JUNR., Photo.

EXPLANATION OF PLATE XXXII.

Fig. 1. *Clathria rubens*, Lendenfeld; x 2/7.
Fig. 2. *Wilsonella conectens*, sp. nov.; x 5/8.
Fig. 3. *Clathria partita*, sp. nov.; x 1/3.

H. BARNES, JUNR., Photo.

EXPLANATION OF PLATE XXXIII.

Fig. 1. *Clathria transiens*, sp. nov., typical form; x 2/3.
Fig. 2. *Clathria transiens*, form (*b*); x 3/5.
Fig. 3. *Clathria transiens*, form (*c*); x 3/5.
Fig. 4. *Clathria caelata*, sp. nov.; x 2/3.

H. BARNES, JUNR., Photo.

EXPLANATION OF PLATE XXXIV.

Fig. 1. *Ophlitaspongia subhispida*, Carter, var. *viminalis*, Lendenfeld; x 1/2.

Fig. 2. *Clathria transiens*, form (*d*); x 3/4.

Fig. 3. *Wilsonella oxyphila*, sp. nov.; ? var.; x 1/2.

Fig. 4. *Wilsonella curvichela*, sp. nov.; x 5/13.

H. BARNES, JUNR., Photo.

EXPLANATION OF PLATE XXXV.

Fig. 1. *Ophlitaspongia tenuis*, Carter; x 3/5.
Fig. 2. *Ophlitaspongia confragosa*, sp. nov.; x 2/3.
Fig. 3. *Ophlitaspongia tubulosa*, sp. nov.; x 3/5.

H. BARNES, JUNR., Photo.

EXPLANATION OF PLATE XXXVI.

Fig. 1. *Ophlitaspongia subhispida*, Carter; x 9/10.

Fig. 2. *Ophlitaspongia inornata*, sp. nov.; x 8/9.

The specimen is encrusted with a Cornulariid Alcyonarian.

Fig. 3. *Ophlitaspongia axinelloides*, Dendy; x 7/9.

1

2

3

H. BARNES, JUNR., Photo.