

A REVISION OF THE GENERA WITH MICROSCLERES
INCLUDED, OR PROVISIONALLY INCLUDED, IN
THE FAMILY AXINELLIDÆ; WITH DESCRIPTIONS
OF SOME AUSTRALIAN SPECIES. Part ii.

[PORIFERA.]

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(Plates xxix., fig.4; xxx.-xxxii.; xxxiii., figs.1-5; xxxiv.-xxxvii.;
xxxviii., figs.1-3: and Text-figs.10-16.)

Genus BIEMNA Gray (sens. lat.).

Definition.—Axinellidæ typically of massive or encrusting habit, occasionally tending to become lamellar or calicular, almost invariably provided with conuli or other surface-elevations of less regular form, or with digitate processes either solid or tubular; or, finally, consisting almost entirely of tubular processes. The skeleton varying, sometimes conforming more or less to a halichondroid type, but more frequently consisting of definite fibres, which sometimes are arranged reticulately. The spicules composing the fibres are sometimes (in the less typical species) arranged more or less plumosely, or even in part echinatingly. The megascleres are typically of a single order,—either styli alone, or styli together with oxea of similar dimensions; special dermal megascleres are absent. The microscleres are invariably sigmata and trichites (or microxea), the latter usually or perhaps always occurring (partly at least) in dragmata; and to these may be added commata, microstrongyla, or spherulæ.

Type-species, *B. peachi* Bowerbank.

The species for which the genus *Allantophora* was proposed by Whitelegge(58) differs in the combination of its characters so notably from any species known previously to it, and, in one important respect at least, so considerably also from any which

has since been described, that its true affinities were until recently(13) unsuspected, while the propriety of maintaining a separate genus for its reception has not hitherto been called into question. Whitelegge, disregarding the evidence afforded by the microscleres present, and attaching overmuch importance to the echinate arrangement of some of the spicules composing the skeletal fibres, arrived at the conclusion that *Allantophora* is intermediate between *Echinoclathria* and *Ophlitispongia*; whereas I, in my earlier remarks in reference to the genus(12), expressed the opinion that, provisionally at least, it should be placed in the Mycalinæ, and suggested the possibility of its relationship with *Crambe* (= *Tetranthella*). Since then, as I more recently have found occasion to remark(13), a second species possessing microstrongyla as microscleres in addition to sigmata and trichodragmata, has been described by Hentschel(15) under the name *Tylodesma microstrongyla*, which in spiculation accords so closely with *Allantophora plicata* as to leave no room for doubting the close genetic affinity of the two, yet the skeleton of which conforms, or at any rate closely approximates, to a halichondroid type. Hence it seems to follow that the essential feature to be taken into account in deciding as to the proper systematic position of these species is not, in either case, the precise configuration of the skeleton, but rather the constitution thereof from the point of view of the spicular elements composing it, both megascleric and microscleric: and accordingly one is led to suspect the probability of their relationship with such species as *Biemna megalosigma* Hentschel(15), and *Biemna chilensis* Thiele(42), the spiculation of which is essentially the same as theirs except only in this respect, namely, that instead of microstrongyla the microscleres include spherulæ, —and in which, furthermore, the skeletal arrangement is of a somewhat intermediate type. In support of this, there now comes to light a third species with microstrongyla (and, significantly, with spherulæ also), —described below as *Allantophora victoriana*, —which forms a definite and absolute connecting-link between *A. plicata* and *Sigmaxinella ciocalyptoides* Dendy, it being even questionable, indeed, whether both it and the last-named should not be looked upon merely as

varieties of *A. plicata*: and *Sigmaxinella ciocalyptoides*, in turn, is found to provide no feature definitely justifying its separation generically from the majority at least of the species at present included in *Biemna*. Accordingly it becomes necessary to decide upon what grounds, if any, the genera *Tylodesma*, *Allantophora*, and *Sigmaxinella* admit of being retained.

The distinction between *Tylodesma* (olim *Biemna*) and *Biemna* (olim *Desmacella*) deemed essential by Topsent(46),—to whom the separation of the species of Ridley and Dendy's group *Desmacellinæ* into these two genera is due,—was with respect to the mode of conformation of the skeleton, a halichondroid type of skeleton being regarded by him as characteristic of the former genus, a disposition of the megascleres in definite fibres as characteristic of the latter: whether the megascleres were styli or tylostyli was looked upon as of minor importance. The same distinction was emphasised by Lundbeck(30) in defining these genera, though at the same time he attached equal value to certain differences in their microscleric spiculation; other authors, however,—as Thiele(41), Dendy(8), and Hentschel(15),—seem disposed, like Topsent, to regard it as fundamental. Nevertheless, a critical survey of the species concerned renders it evident that the distinction is an arbitrary one, and incapable of being maintained; in proof of which one need only refer to the fact that in certain instances, as, for example, in the case of *Biemna microxa* Hentschel(14), and of the so-called *Biemna humilis* Thiele(41), the authors themselves show uncertainty as to the genus to which the species ought rather to be assigned. If, however, the species with tylostyli or subtylostyli as megascleres (typical of *Tylodesma*) be compared with those in which tylostylote megascleres are absent (typical of *Biemna*), it is found in the case of the former that the microscleres present frequently comprise toxa in addition to sigmata, but never trichites or microxea, whereas in the case of the latter, with one highly questionable exception—viz., *Desmacella fragilis* Kieschnick(24),—trichites or microxea are invariably present, but never toxa. Accordingly there is excellent ground for the retention of the genus *Tylodesma*, but its definition requires amendment.

The three species, for the reception of which Dendy(7) proposed the genus *Sigmaxinella*, agree in having both monactinal and diactinal megascleres and, as microscleres, sigmata and trichodragmata, but in a number of other important respects they differ very considerably; and, as already indicated, one at least of them equally admits of inclusion in *Allantophora* or in *Biemna* as hitherto defined. However, the first-described of the three, *S. australiana*, as well as several of the species which Kirkpatrick(20) and Whitelegge(60) have ascribed to *Sigmaxinella*, differ from all other known species possessing similar microscleres, firstly in being of ramose habit, and secondly in having an axially condensed skeleton. Consequently, with an amended diagnosis, the genus *Sigmaxinella* also admits of being retained.

The third species assigned by Dendy to *Sigmaxinella*—*S. flabellata*—is (among the species having sigmata and trichodragmata as microscleres) quite unique, not only as regards skeletal structure, but also in the fact that the megascleres are of two distinct kinds, viz., styli composing the fibres, and elongated flexuous strongyla (and tornota) occurring interstitially,—the latter of which are strikingly analogous to the spicules of similar form characteristic of many species of *Axinella*, *Phakellia*, *Acanthella*, and *Tragosia*. Were it not for the presence of sigmata, there would be no adequate reason, apart from the flexuous character of the interstitial megascleres, for excluding the species from the genus *Dragmacidon* (g.n.), which in turn comprises species hitherto assigned to *Thrinacophora*; whilst, if both kinds of microscleres were absent, it would almost certainly have to be included in the genus *Phakellia* as defined by Dendy(8). Being such as it is, however, the species undoubtedly deserves a new genus for its accommodation, and for this I propose the name *Sigmaxia*.

The question whether *Allantophora* admits of separation from *Biemna* is a much more difficult one, and at present cannot be satisfactorily decided; for although there exists with respect to skeletal structure a profound difference between the typical species of the two genera,—as is very obvious from a comparison of Topsent's figure of *B. peachi*(54; Pl. iv., fig.3) with mine of

A. victoriana (Pl. xxxi., figs. 1, 2),—yet the descriptions of other species seem to indicate that intermediate (as well as additional) types of skeleton occur, while in not a few instances, furthermore, the requisite information relating to the skeleton is lacking. At the outset, a satisfactory line of division between the two genera seemed to me possibly securable by taking into account the fact that in most if not all of the indubitable species of *Biemna* the microscleres include commata, but never microstrongyla, whereas in the remaining species commata are absent; but the serviceableness of this as a means of distinction appears to be ruled out of court by the circumstance, recently announced by Topsent(54), that in *B. peachi* commata are apparently sometimes missing. A further difficulty is created by Topsent's discovery (*loc. cit.*) that "commata" are present in his *Biemna fistulosa*, which have not the form of curved microstyli but "s'y montrent flexueux avec un bout renflé et l'autre un peu aminci," so that their form "rapelle un peu celle de sigmaspires déroulées"; and it is possible that these microscleres are a connecting-link between the styliform commata of *B. peachi*, etc., and the microstrongyla of typical *Allantophora*-species. Consequently, since one is unable so to define the genera as to render them mutually exclusive, there is no alternative for the time being but to combine them, and I have therefore formulated the diagnosis of *Biemna* accordingly. Inasmuch, however, as I am confident that the necessity for this is only temporary, and that a fuller knowledge of the species concerned will furnish occasion for the rehabilitation of the genus *Allantophora*, I have refrained for the present from discarding the name in the designation of the species described below, to which it must necessarily apply if the genus be ultimately readopted.

The amendment which I introduce in regard to the distinction to be drawn between the genera *Biemna* and *Tylodesma* affects the position only of five species, namely, of *Tylodesma microstrongyla* Hentschel, and *T. microxa* Hentschel, which (as their spiculation consists of styli, sigmata, trichites, and, in the former, also of microstrongyla) must be included in *Biemna*; and of *Biemna humilis* Thiele(41), *B. vulgaris* Topsent(45), and

B. truncata Hentschel(15), which (having a spiculation composed, in the case of the first, of subtylostyli, sigmata, and toxa, and in the others, of tylostyli and sigmata) must be transferred to *Tyloidesma*. In order to frame a satisfactory definition of *Biemna*, which will serve effectually to distinguish it from *Dracmacidon* and *Rhaphoxya* (gg.nn.), it is necessary to insist upon the presence of sigmata as an essential character of the genus: for this reason, if for no other, Topsent's *Desmacella aberrans* (with trichodragmata alone as microscleres), which Lundbeck has referred to *Biemna*, must be removed therefrom; and for its reception I propose a new genus, *Dracmatella*, which I provisionally regard as occupying a position between *Dracmacidon* and *Rhaphoxya*. Lundbeck is inclined to refer also Schmidt's imperfectly known *Desmacella vagabunda* and *D. pumilio* to *Biemna*. Of these two species I have not seen the descriptions; but judging from Schmidt's original diagnosis of *Desmacella*, quoted by Ridley and Dendy(53), the microscleres present are sigmata and (or) toxa, in which case the species cannot in my estimation be assigned to *Biemna*, but belong most probably to *Tyloidesma*. As regards Kieschnick's *Desmacella fragilis*, referred to above, it is impossible, owing to the unreliability of its description, to express any definite opinion. If it be true that its microscleres are sigmata, trichodragmata, and toxa, as stated, I think that this would render necessary the erection for it of a new genus; until rediscovered, however, the species must be regarded as *incertæ sedis*. The only other species about which there can be said to exist any occasion for doubt is *Desmacella cavernula* Bowerbank(1), in which the microscleric spiculation is described as consisting solely of sigmata; but as the megascleres are styli (and *not* tylostyli), and, furthermore, as there is ground to suspect, owing to the dried condition of Bowerbank's single specimen, that the occurrence of trichodragmata therein was overlooked, the probability is that the species is correctly to be assigned to *Biemna*. Nevertheless, the species is peculiar, regarded as a member of this genus, in the fact that the megascleres are distinguishable into two groups, the one kind composing the fibres, the other occurring inter-

stitially and also forming a dermal skeleton: and this peculiarity may possibly prove to be associated with other distinctive features of a character that would justify its exclusion from the genus. According to Thiele(40), a partial differentiation of the megascleres into several groups is exhibited in the case of *B. koreni* also, but apparently this occurs without relation to the particular position which the spicules occupy, since he makes no mention of the fact; and Lundbeck(30) further notes that in *B. capillifera* there are present, in addition to the skeletal spicules proper, smaller styli which are found only in the part of the sponge nearest to the substratum, where they form a thin layer. In all the remaining species of *Biemna*, so far as I am aware, the megascleres are definitely of a single order (though occasionally comprising both monactinal and diactinal forms).

Hentschel(15) has recently referred to *Biemna* (under the name *B. aruensis*) a species possessing neither sigmata nor trichodragmata, but having as flesh-spicules small slender curved tylostyli, which he terms "kommaformige Rhabdiden" and apparently regards as homologous with the commata of species like *B. peachi*. Inasmuch, however, as the remaining spiculation consists of megascleres (of two distinct kinds) in the form of (longer) subtylostyli and (very much shorter) tylostyli respectively, and as, furthermore, the sponge is regularly dome-shaped and prolongs itself upwards into a tubular process, it seems to me practically certain that the species is one requiring to be included in the family Polymastiidæ. Unfortunately Hentschel has neglected to investigate the structure of the skeleton, and one therefore lacks the information necessary to decide whether the species requires a new genus for its reception, or permits of inclusion in the genus *Polymastia* itself. But, for the present, I would recommend that the species be known as *Polymastia(?) aruensis*.

Of species referable to *Biemna* which have been assigned to genera other than *Biemna*, *Desmacella*, *Tylodesma*, or *Allantophora*, there is apparently only one, viz., *Sigmaxinella incrustans* Kirkpatrick(20).

A few fragments of a sponge have been recorded from Christ-

mas Island by Kirkpatrick(21) as *Desmacella* sp., in which the megascleres are oxea, fewer styli, and rare strongyla, all of approximately the same dimensions (viz, $180 \times 7\mu$, $150 \times 9\mu$, and $126 \times 6\mu$ respectively), and the microscleres are very rare sigmata, rare toxa, and rare trichites; but in which the skeleton is a unispicular renieroid meshwork, with triangular and quadrangular meshes. Obviously, if the microscleres are really proper to it, this species should be assigned, provisionally at least, to the genus *Gellius*.

The genus *Biemna*, as now defined, accordingly comprises the following species:—

i. With commata - typical species of the genus.

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| <i>B. peachi</i> Bowerbank(1; 30). | English Channel; Scotland;
off Norway; off Iceland. |
| <i>B. capillifera</i> Levinsen(28; 30). | E. Canada; Iceland; Kara
Sea. |
| <i>B. hamifera</i> Lundbeck(30). | Off Iceland. |
| <i>B. grænlandica</i> Fristedt(10; 30). | E. Coast of Greenland. |
| <i>B. stellifera</i> Fristedt(9). (With
asters?). | Sweden. |
| <i>B. fistulosa</i> Topsent(48; 54). | Amboina. |
| <i>B. sp.</i> Thiele(41). | Ternate. |

ii. Without commata (so far as known), and without microstrongyla; but apparently otherwise conforming rather to the species with commata.

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| <i>B. koreni</i> Schmidt(35; 40). | Off Norway. |
| <i>B. variantia</i> Bowerbank(1). | Bristol Channel. |
| (?) <i>B. (?)cavernula</i> Bowerbank(1). | Shetland Islands. |
| <i>B. trivhaphis</i> Topsent(48; 41). | Amboina; Ternate. |
| (?) <i>B. fortis</i> Topsent(48). | Amboina. |

iii. Without commata (so far as known), and without microstrongyla; but apparently otherwise conforming rather to the species with microstrongyla.

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| <i>B. incrustans</i> Kirkpatrick(20). | Cape Colony. |
| <i>B. tubulata</i> Dendy(8). | Ceylon. |
| <i>B. macrorhaphis</i> Hentschel(16). | Antarctic Ocean. |

- B. microxa* Hentschel(14). Sharks Bay, W. Australia.
B. sp. Hentschel(15). Arafura Sea.
B. chilensis Thiele(42). (With spherulæ). Chili.
B. megalosigma Hentschel(15). Arafura Sea.
 (With spherulæ).
B. megalosigma var. *liposphæra* Hentschel(15). Arafura Sea.
B. (Allantophora) ciocalyptoides Port Phillip, Victoria.
 Dendy.
 iv. With microstrongyla.
B. (Allantophora) plicata Whitelegge. New South Wales.
B. (Allantophora) victoriana, sp.n. Port Phillip, Victoria.
B. (?Allantophora) microstrongyla Arafura Sea.
 Hentschel(15).

ALLANTOPHORA PLICATA Whitelegge.

(Pl. xxix., fig.4; Pl. xxx., figs.1, 2, 3.)

1907. *Allantophora plicata* Whitelegge(60), p.505, Pl. xlv., fig.28.

Diagnosis.—Sponge consisting of a cluster of erect, proliferous lamellæ, sometimes interunited more or less by anastomosis, and frequently tending to become more or less pointed above or to divide distally into digitate processes. Surface irregular, and provided with many slender tapering conuli. Dermal membrane moderately thick, without contained megascleres, and without pores visible to the naked eye. Skeleton an irregular reticulation, of fairly uniform density throughout, consisting of ascending multispicular main fibres (mostly between 100 and 200 μ in stoutness) and numerous slenderer, for the most part paucispicular, connecting fibres. Spicules of the main fibres rather loosely (and often somewhat plumosely) arranged. Both main and connecting fibres provided with moderately numerous, more or less nearly perpendicularly-directed, echinating spicules similar in kind to the coring spicules. Spongin present only in moderate quantity. Megascleres: styli and (relatively few) oxea,

ranging from less than 300 to upwards of 500 μ (occasionally to upwards of 600 μ) in length, and (in different specimens) varying from 16 to 22 μ in maximum stoutness. Microscleres: (i.) numerous sigmata of two sizes, respectively 11 and 21 μ in maximum length; (ii.) trichodragmata typically of two sizes, together with scattered trichites of similar length (viz., up to about 60 μ) to those composing the larger dragmata; and (iii.) numerous microstrongyla, the largest measuring 20 by 8 μ .

Loc.—Off Crookhaven River, N.S.W. ("Thetis").

Introductory.—In addition to the single example originally described, there are now available three other complete specimens of the species, and a fragment of a fourth. Of these, only the last-mentioned is preserved in alcohol, the remainder (with the exception of the type-specimen, which has been dried—probably after having been some time in alcohol—without complete removal of the sarcode) being washed-out and otherwise more or less damaged beach-specimens.

External features.—In all four specimens, the general habit is the same. The sponge consists of an often more or less intricate cluster of erect lamellæ, which are joined each to another along one lateral edge,—the other edge either remaining free or (less frequently) becoming connected by anastomosis with some portion of another lamella,—and which tend most frequently to become narrowed and more or less pointed above, or sometimes to partially resolve distally into several pointed digitiform processes. The lamellæ vary from 2 to 12 mm. in thickness; and the largest specimen measures 130 mm. in height. Usually, a main or primary lamella is to be distinguished, and from this secondary lamellæ proceed, which in turn give rise in a similar way to others of higher order. The lamellæ are not always directed perpendicularly to those from which they arise, but often more or less obliquely; and occasionally some of the larger ones may be vertically curved or folded. The sponge is sessile, and is sometimes attached only by a limited portion of the base of the primary lamella; but more usually the area of attachment is much more extensive, and is formed partly by the bases of other lamellæ as well. The surface is rendered more or

less uneven by irregular, longitudinally disposed ridges and furrows, and by numerous acuminate conuli. The former inequalities are much more marked in dried and washed-out specimens (Pl. xxx., fig. 2) than in the perfect sponge (Pl. xxx., fig. 1), since in the case of the latter the depressions are largely filled up with fleshy tissue and covered over by dermal membrane. In the washed-out condition of the sponge, numerous lesser inequalities also are in evidence, causing the surface to present a somewhat cellular or roughly pitted appearance, and giving rise here and there—more especially in the case of thinner lamellæ—to actual perforations: it is the depressions producing this appearance that are somewhat misleadingly referred to in the original description as “pores.” The conuli are conspicuous in the well-preserved sponge, but may be entirely missing in the case of beach-specimens owing to their fragility and the ease with which they become broken off when dry; they are narrow at the base and thread-like at the apex, are traversed axially by a single skeletal fibre, and vary in length from 2 to 5 mm. Oscula were not observed.

The consistency of the sponge in alcohol is firm, fairly tough, compressible, and resilient; and the colour is yellowish-brown. Dry specimens vary considerably in their consistency and textural appearance according to the extent to which the sarcode has been removed. When thoroughly washed-out, the sponge is tough and elastic, and its texture (as compared with that, say, of an ordinary washing sponge) is loosely and coarsely fibrous: the fibres that terminate at the surface run towards it in an obliquely ascending direction, and being free from one another (*i.e.*, unconnected by transverse fibres) for some distance from their extremities, give to the surface a slightly shaggy appearance (Pl. xxx., fig. 3). On the other hand, if dried without (or with only partial) removal of the sarcode, the sponge (as in the case of the type-specimen) is inelastic and rather brittle, and of a texture that might be described roughly as pumiceous (Pl. xxx., fig. 2). In this latter condition of the sponge, the interstices of the skeleton are frequently tympanised by delicate parchment-like membranes (erroneously referred to in the original descrip-

tion as being portions of the dermal membrane). The colour of dry specimens varies from light to brownish-grey.

The dermal membrane is very distinct and fairly tough, and overlies numerous, usually not very extensive, subdermal spaces; it is not (to the naked eye) visibly porous. The dermal pores, over limited areas of the surface, are similar in their arrangement to those of *A. victoriana* (cf. Pl. xxxviii., figs.1-4), except that the circular groups they form (which, in rare instances, attain a diameter of 130 to 150 μ) are relatively less closely apposed; but generally they occur only several together in much smaller groups—or, in rare cases, even singly—and the groups are separated by distances sometimes exceeding their own diameter.

Skeleton.—Whilst in regard to spiculation no definite distinction can be drawn between the present species and *A. victoriana*, the arrangement of the skeleton in the two differs very considerably. This will be evident from a comparison of the figures of the skeleton (prepared by treatment with caustic potash) in the two cases, as seen in section,—especially Pl. xxix., fig.4, and Pl. xxxi., fig.1,—the former of which is from a lamella (varying in thickness from less than 1 mm. at one edge to 8 mm. at the other) of the present species, and the latter from a thick vertical slice (from 6 to 10 mm. in thickness) of a massive specimen of *A. victoriana*. The chief points of difference are two. Firstly, there is an entire absence, in the present species, of any observable differentiation in the structure of the skeleton relative to a number of separate axes, and the pattern is accordingly everywhere (including even the incipient processes into which the lamellæ sometimes tend to resolve) much the same; and secondly—in necessary correlation with this—the main fibres are never transversely directed, but always run in a more or less ascending direction, with gradual trend surfacewards, branching (not very frequently) as they go. As in *A. victoriana*, the connecting fibres are numerous, and interunite with one another to form (along with the main fibres) a rather small-meshed reticulation; but the reticulation is here very irregular, and there is no marked tendency on the part of the connecting fibres to be confined (as

in *A. victoriana*) to vertical planes; in some parts, however,—more especially in the processes—a slight tendency towards such an arrangement is occasionally exhibited. A further notable point of difference is the frequency of occurrence, in the present species, of megascleres disposed more or less perpendicularly to the fibres,—with their bases implanted therein,—in the manner of echinating spicules. The main fibres are composed chiefly or (not seldom) almost entirely of spicules, arranged usually in a loose, often in a more or less dishevelled or somewhat plumose fashion, and are usually between 100 and 200 μ in stoutness; in the oldest portions of the sponge, however, they occasionally attain a diameter of from 300 to 400 μ . The amount of spongin cementing their spicules is rather variable, but is seldom sufficient to form a well-defined sheath; as seen in cross-section, the outline of the fibres is very irregular. The connecting fibres are uniserial to multiserial in spiculation, and are relatively more sponginous than the main fibres. But very few megascleres are scattered between the fibres. Sigmata (of two sizes) and microstrongyla occur in great abundance throughout all parts of the interior, together with moderately numerous trichodragmata and singly scattered trichites; the last-mentioned, however, are not very evident owing to their extreme tenuity. In the dermal membrane, sigmata are again very abundant, and single trichites almost equally so, but trichodragmata and microstrongyla are extremely rare, and megascleres are altogether absent.

Spicules.—(i.) The megascleres are styli and relatively few oxea—the proportionate number of the latter variable, ranging from less than 1 in 100 (in the type-specimen), occasionally to as many as 1 in 10. Though somewhat scarce as echinating spicules, the oxea occur in all the same situations in the skeleton as the styli, and are undoubtedly only variants of them; nevertheless, transitional forms between the two are extremely rare. The styli are slightly curved, with the curvature most pronounced in, and usually confined to their basal moiety; are evenly rounded at the base, and of uniform or nearly uniform diameter thence to beyond the middle of their length; and taper gradually to a sharp point. The oxea—apart from their being diactinal—

differ from the styli only in being curved symmetrically and more strongly, and also somewhat angulately. In different specimens, the megascleres vary from 520 to 670 μ in maximum length and from 16 to 22 μ in maximum stoutness; and the shortest spicules in any specimen are between 200 and 300 μ in length. The longest spicules are seldom much more than one-half (very rarely, if ever, as much as two-thirds) the maximum stoutness, the greatest diameter being attained by those of intermediate and lesser lengths.



Text-fig. 10.

Allantophora plicata. a, megascleres; b, c, larger and smaller sigmata; d, e, microstrongyla from each of two different specimens.

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(ii.) The sigmata are, almost without exception, more or less contort, but seldom to such an extent as to appear S-shaped when viewed from the side. They are of two sizes, the larger 15 to 21 μ , the smaller 7 to 11 μ , in length, and measure respectively 1.5 and about 0.75 μ in maximum stoutness. The latter are by far the less numerous, but are nevertheless by no means scarce.

(iii.) The trichites are typically of two sizes; the longer ones immeasurably thin, 50 to 65 μ in length in some specimens, only 35 to 50 μ in others, and occurring both in dragmata and scattered singly; the shorter ones relatively stouter and slightly fusiform in shape,

15 to (rarely) 30μ in length, and apparently occurring only in dragmata. In two (dry) specimens, however, the shorter trichites were not observed. The dragmata frequently take the form of dense roundish masses of trichites, sometimes exceeding 300μ in breadth, which refract the light in such a way as to appear blackish and opaque.

(iv.) The microstrongyla are seldom less than 10μ in length and 2μ in diameter, but are usually much stouter, and have a maximum size of 20 by 8μ . They are nearly always slightly curved and more or less distinctly centrotylote. Abnormal forms occur, in which the annular swelling is irregular in shape, excentric in position, or several times repeated, but they are not very numerous and seldom depart from the normal shape to any considerable extent.

ALLANTOPHORA VICTORIANA, n.sp.

(Pl. xxx., figs. 4, 5; Pl. xxxi., figs. 1-4; Pl. xxxii., figs. 1-5; Pl. xxxviii.,
figs. 1-4; Pl. xl., figs. 5, 6.)

Diagnosis.—Sponge erect, either entirely massive or subdividing superiorly into separate tapering digitations. Surface slightly irregular, and provided with numerous, fairly uniformly distributed, more or less acuminate conuli. Dermal membrane very distinct; without contained megascleres; usually showing to the naked eye a minutely reticulate pattern due to the mode of arrangement of the dermal pores. Skeleton (in the body of the sponge) consisting of a congeries of similar components, each constructed on the same plan as the entire skeleton of a single digitation. In each component, the main fibres (excepting, usually, one or a few longitudinally-directed primary fibres occupying its axis) are disposed more or less perpendicularly to the axial direction of the component, *i.e.*, in a radial or pinnate fashion; and these are joined together by connecting fibres which are almost exclusively confined to vertical planes. The main fibres are relatively very stout (up to over 300μ in diameter), and are composed chiefly of spicules arranged more or less compactly; the connecting fibres are slender, mostly paucispicular, and composed chiefly of spongin. A few echinat-

ingly-disposed spicules occur on the main fibres, but are rare or absent on the connecting fibres. The spiculation is almost identically the same as that of *A. plicata*, the chief point of difference being that the microstrongyla are much more various in form and size, and frequently pass into spherulæ.

Loc.—Port Phillip.

Introductory.—The species is represented in the Australian Museum by two half-specimens from Port Phillip, and a complete specimen (of somewhat different habit) the locality of which is uncertain; in addition, a third half-specimen is included among the original specimens described, by Dendy, as *Sigmari-nella ciocalyptoides*,—viz., the one referred to by him as R.N.338. The last-mentioned, however, does not constitute a fourth example of the species, but is plainly only the other half of one of the Australian Museum specimens. All the specimens are well preserved in alcohol.

External features.—The two Port Phillip examples are massive sponges, of erect, somewhat quadrangulately prismatic shape, slightly narrowed below to form a broad base of attachment, and with a very rugged, monticulate upper surface (Pl. xxx., figs.4, 5): the slightly larger is 115 mm. in height, and would measure, if complete, about 60 or 70 mm. in breadth and in thickness. The third specimen (Pl. xxxi., fig.3), which is very much smaller,—measuring only 55 mm. in height,—is similarly massive in its lowermost portion, but divides above into many separate (or more or less incompletely separate) tapering digitations of various size, the largest measuring 25 mm. in length and 5 or 6 mm. in diameter at the base. The difference in habit in the two cases, however, is probably to be regarded only as one of degree, since the rugged character of the distal surface of the more massive specimens is such as might be due to incipient digitation.

The whole surface, including that of the processes, is covered with conuli formed in the same manner as in *A. plicata*; they are sometimes low and sharp, sometimes acuminate or even filiform, up to 2 or 3 mm. in length, and situated at an average distance apart varying from one to several millimetres. The

surface is rendered uneven by low, irregular undulations and indistinct, longitudinal furrows. On the upper surface only of the more massive specimens, between the monticular elevations, there are many oscula-like openings, the appearance of which (although they are plainly seen to be the orifices of main exhalant canals) suggests that they have been caused by laceration of the dermal membrane; and it is possible, therefore, that in the perfect sponge the dermal membrane is continuous across the debouchures of the exhalant canals, thus producing a condition of lipostomy. This may account for the fact that, in the smaller, digitate specimen, oscula were not observable.

The main exhalant canals run longitudinally upwards through the sponge, increasing in diameter as they ascend; they attain a maximum diameter, in the largest specimen, of about 3 mm., but in the smallest specimen, only of about 1 mm. Many of the canals, especially in the upper part of their course, run for a considerable distance immediately below the surface, their outer wall consisting of scarcely more than the dermal membrane. Immediately underlying the dermal membrane, also, there are, elsewhere, numerous and fairly extensive incurrent spaces.

The consistency of the sponge in alcohol is firm, fairly tough, compressible, and resilient; and the colour varies from pale cream to light yellowish-brown. The colour in life, as recorded in the case of a single specimen by Dendy, is "cinnamon, [with] the projections deep chrome." The skeletonised sponge is very loose-textured, and not of uniform density (Pl. xxxi, fig.1): the coarseness of the fibres is about the same as in *A. plicata*, but, in the present species, the skeleton is of considerably smaller bulk relatively to the bulk of the entire sponge.

The dermal membrane—owing partly to the many spaces immediately underlying it, and partly to its being of considerable thickness—is very distinct, and, except on the upper surface of the sponge (*i.e.*, in the region of the oscula-like openings) presents a minutely reticulate appearance due to the mode of arrangement of the dermal pores (Pl. xxxviii., figs.1-4). The reticulate pattern is conspicuous, even to the naked eye, in the two massive specimens, but requires a lens for its detection in

the case of the digitate example. Where the reticulation is apparent, the dermal pores are arranged in closely situated, oval or rounded groups, or "pore-areas" (Pl. xl., figs. 5, 6) measuring up to 0.5 mm. in diameter, the pores themselves varying in diameter from less than 20 to upwards of 80 μ ; within the pore-areas, the dermal membrane is reduced, owing to the presence of the pores, to a fine, lace like network. Where the dermal membrane is apparently non-reticulate, this is due to the fact that the pore-areas are much smaller and much more widely separated.

Skeleton.—The structure of the skeleton is such as would result if the sponge had consisted, in the first place, of a number of independent, simple or branched, digitiform upgrowths, each with its own separate skeleton, and if subsequently these individual upgrowths, by lateral expansion and coalescence, had grown together into a single mass,* and their skeletons become more or less interunited: or, in other words, the skeleton is resolvable into similarly constituted, simpler components, the arrangement of which conforms to that of a system of ascending, branched axes. In order to convey an idea of the general conformation of the skeleton, therefore, it will be sufficient to describe the structure and mode of arrangement of the skeleton in a single such component (as shown to best advantage in a digitate process of the semi-massive specimen), and to explain the manner in which interunion is effected between the skeletal fibres of different components.

In each simple digitation, the skeleton consists (Pl. xxxi., fig. 4; Pl. xxxii., fig. 1): (i.) of stout multispicular main fibres radiating outwards, almost invariably without branching, from the axis of the process in a direction perpendicular or nearly perpendicular thereto, and at a considerable distance (usually not less than 1 mm.) apart from one another; and (ii.) of very much slenderer connecting fibres, most abundant towards the axial region of the

* The occurrence of pebbles and small patches of coarse sand here and there in the interior of all these specimens, more especially towards their base, lends colour to the view that the massive body of the sponge actually has been formed by the coalescence of originally separate digitations.

digitation, which reticulate among themselves to form a narrow-meshed network between the main fibres (*cf.* Pl. xxxii., figs. 3, 4, 5). The first-mentioned, or radially directed fibres appear usually to arise by the branching of one or a few axially situated fibres running lengthwise: but, in some instances, no such primary main fibres are observable, the radially-directed fibres each arising independently. In addition to the paucity or absence of longitudinal main fibres, the skeleton also presents two other characteristic and distinctive features: the radial fibres are arranged for the most part in a more or less orthostichous manner, and, almost without exception, the connecting fibres between them occur only between those belonging to the same orthostichies. Hence it follows that the connecting fibres are confined almost exclusively to vertical (or, as one might almost say, to meridional) planes; and thus, in a transverse section of a digitation (Pl. xxxii., fig. 2), the main fibres appear to be without connections. The pattern of the reticulation formed by the connecting fibres is also characteristic, the meshes usually being elongated and narrow, with their long axis in the direction perpendicular to the main fibres. The main fibres vary in stoutness from 120 to 350 μ ; the spicules composing them are fairly closely and regularly packed, seldom slightly plumose in their arrangement, and are cemented by a relatively small amount of spongin, seldom sufficient in quantity to form a distinct sheath. The connecting fibres are peculiar in being thin and ribbon-shaped, and are mostly paucispicular and composed chiefly of spongin. Echinating spicules occur similarly as in *A. plicata*; but they are here very rare upon the connecting fibres, and are scarce even upon the main fibres. Interstitially scattered megascleres are relatively very few. The microscleres have the same distribution, and are equally as abundant as in *A. plicata*.

In the massive body of the sponge, as already stated, the skeleton consists of interuniting components each constructed on the same plan as the above-described skeleton of a single digitation. The interconnection between the components is effected simply by the prolongation of the radial (main) fibres of one component, and their ultimate union with connecting fibres of

another; as a rule, the fibres only of one of any two connected components are thus prolonged. A feature not observed in the skeleton of a separate digitation is provided by the fact that the



Text-fig. 11.*

to 5 or 6 μ , and in length up to 17 or 18 μ .

fibres proceeding surfacewards from some of the more peripheral components (more especially from such as are situated not very close to the surface) run in a more or less upward direction (instead of perpendicularly outwards), and may thus attain a considerable length, and may also several times branch (Pl. xxxi., fig. 2).

Spicules.—The spiculation is almost identically similar to that of *A. plicata*, not only as regards the forms, but also the sizes, both of the megascleres and microscleres,—the only noteworthy point of difference in the case of the present species being the much greater irregularity in the forms of the microstrongyla and the frequency of occurrence among them of spherulæ. In all three specimens, the megascleres are of about the same dimensions, ranging in length from about 230 or 240 μ (rarely, however, less than about 300 μ) up to 680 μ , and having a maximum stoutness of 16 or 17 μ ; the sigmata, which appear not to be separable into two groups as regards size, vary in length from 8 to 20 μ , and up to 1.5 μ in stoutness; the longer trichites attain a maximum length of 70 μ , while the shorter ones are rarely longer than 30 μ ; and the microstrongyla vary in diameter from less than 1 up

ALLANTOPHORA CIOCALYPTOIDES Dendy, (et var.).

1896. *Sigmaxinella ciocalyptoides* Dendy(7), p. 243.

Diagnosis.—Sponge in the typical form of the species incrust-

* *Allantophora victoriana*. a, megascleres; b, c, sigmata; d, microstrongyla.

ing to lowly-massive, rising above into short, slender, digitiform processes; in the varietal form (so far as known) consisting of a compressed, plate-like, sessile basal portion soon completely dividing above into a single series of long, slender, tapering digitations. Surface acutely conulose, the conuli usually not very distinct except on the processes, where they are slender and acuminate. Surface minutely reticulate, though not always visibly so to the naked eye. Skeleton in the typical form of the species approaching in structure to that of *A. victoriana*; in the variety similar to that of *A. plicata*. Spiculation differing from that of the foregoing two species only in the absence of microstrongyla.

Loc.—Port Phillip (typical form). Off Botany Bay (variety).

It is very probable that the two forms which I associate under this species, - one of which I distinguish as a variety, *reducta*,— have separately originated from, and should be regarded as no more than varieties of, *A. plicata* and *A. victoriana* respectively. In the absence of more conclusive evidence than is furnished by the specimens available, however, it has seemed to me advisable to regard them as constituting a species distinct.

ALLANTOPHORA CIICALYPTOIDES (typical form).

(Pl. xxx., figs. 6, 7.)

Of this, there are four examples,—the three originally recorded by Dendy,* and an additional one in the collection of the Australian Museum. Two of these (the last-mentioned and one of the originals) are almost identically similar (Pl. xxx., fig. 7), each having the form of a comparatively thin crust which spreads extensively over the surface of a flattened water-worn stone, and from which arise, short, tapering, digitiform processes—in part occurring singly at wide and irregular intervals, and in part disposed closely in clusters (usually with some amount of coalescence). The digitations are from 5 to 15 mm. in length and seldom more than 2 or 3 mm. in stoutness except near their base, and are provided with moderately numerous, filosely acuminate

* In the original description, four specimens are referred to; but, as already mentioned, one of them (R.N. 338) is an example of *A. victoriana*.

conuli, 1 to 2 mm. in length, which give to them a somewhat spinose aspect. The encrusting base of the sponge attains a maximum thickness of about 10 mm. centrally, and thins out peripherally almost to a film; its upper surface is slightly irregular and uneven, and provided with usually inconspicuous conuli. The thin and semitransparent dermal membrane is underlain, between the conuli, by extensive subdermal spaces, and is not of reticulate appearance. The other specimens (one of which is shown in Pl. xxx., fig.6) are much less extended horizontally, and are relatively more elevated than the preceding two, and might be described as intermediate in form between them and the specimen of *A. victoriana* illustrated in Pl. xxxi., fig.3. Otherwise, they exhibit no noteworthy point of difference, excepting that the dermal membrane is, for the most part, minutely reticulate. The colour in life has been described as "cinnamon, with the projections deep chrome." The consistency, especially of the encrusting specimens, is rather soft and lacking in toughness.

The skeleton in the digitate processes is similarly constructed as in the processes of *A. victoriana*. In the encrusting base of the sponge, it consists, in the thinnest portions thereof, simply of single, vertically-running, stout main fibres connected in a somewhat irregular fashion by inter-reticulating slender transverse fibres; but, in the thicker portions of the base, the main fibres, as they ascend, become irregularly branched and also interunite with one another by anastomosis. On approaching the surface, the main fibres (which vary from 150 to 300 μ in stoutness) usually become slightly plumose. The spiculation differs in no way, except in the complete absence of microstronyla (and of spherulæ), from that of the preceding species.

ALLANTOPHORA CIOCALYPTOIDES(?), var. *REDUCTA*.

(Pl. xxx., fig.8.)

The single specimen (Pl. xxx., fig.8) consists of a sessile erect plate,—5 to 10 mm. in thickness, 110 mm. in length, and 35 to 45 mm. in height,—prolonged above, in a pectinate fashion, into a series of very gradually tapered, almost subuliform, digitate

processes varying in length from 35 to 70 mm. The specimen is in a much macerated condition, the dermal membrane and most of the superficial fleshy substance having disappeared, leaving exposed the surface of the skeleton. The texture is coarsely fibrous and fairly dense, and the consistency is flexible and moderately tough. The exposed surface, both of the basal plate and of the processes, is irregularly and closely furrowed in the vertical direction. From the surface, at distances of from 1 to 2 mm. apart, there project single bristle-like fibres, which are most conspicuous on the processes, where they frequently attain a length of 1.5 to 2 mm.; these fibres no doubt represent the remnants of conuli.

The skeleton is of the same structure as in *A. plicata*. In the processes (in which it is but very slightly condensed axially) it consists of numerous more or less longitudinally-running, stout, multispicular main fibres, frequently branching and interuniting with one another, and connected by numerous, inter-reticulating, slender transverse fibres. The bristle-like fibres, which project from the surface, arise as branches from longitudinal fibres situated towards the axis, and run surfacewards in a direction obliquely upward and outward; at first they are comparatively slender and paucispicular, but increase in stoutness and become more densely spicular as they proceed, finally attaining a diameter of between 150 and 200 μ . Without removal of the sarcode, the pattern of the skeleton is rather difficult to determine owing to very faint outlines of the almost colourless spongin, and to the numerous, mostly longitudinally-directed megascleres lying scattered between the fibres.

TYLODESMA Thiele.

Diagnosis.—Axinellidæ(?) typically of massive (or rarely incrusting) habit, the outward form irregular or somewhat compressed, occasionally more or less leaf-shaped. Skeleton consisting of a more or less irregular network of spicules, or of fibres that are most frequently not very well-marked and reach no great length, or finally, of well-developed spicular fibres. Spongin present only in relatively small amount, or altogether wanting.

Megascleres of a single order: tylostyli, subtylostyli, or tylostrongyla, occasionally in part reduced to styli. Microscleres: sigmata and (or) toxa, the latter sometimes in dragmata.

Type-species.—*T. inornata* Bowerbank.

In proposing the name *Tylodesma*, in lieu of *Desmacella*, for the genus wrongly designated *Biemna* (misspelt *Biemma*) by Topsent(46), Thiele(41) omitted to indicate which species was to be considered the type: since, however, two species only (other than those described by him as new) were enumerated by Topsent as belonging to *Biemna*,—viz., *B. inornata* Bowerbank, and *B. corrugata* Bowerbank,—it is one of those, no doubt, which should be preferred, and I select the former, both because it is that which was named first in order by Topsent and is the better known. The name *Tylodesma* is adopted here in preference to *Desmacella*, not so much from conviction of the correctness of Thiele's contention—accepted by Wilson(61) and some other authors, but not by Dendy(8)—that the latter name is properly a synonym of *Hamacantha*, as owing to the fact that the original species of *Desmacella* described by Schmidt—viz., *D. rayabunda* and *D. pumilio*—are imperfectly known, and may possibly prove not to belong to the present genus.

For reasons already stated above in my remarks on *Biemna*, a slightly amended definition of *Tylodesma* is here proposed, necessitating the removal therefrom, to the former genus, of Hentschel's *Tylodesma microstrongyla* and *T. microsa*, and the addition thereto of *Biemna humilis* Thiele, *B. truncata* Hentschel, and *B. vulgaris* Topsent.

Leaving out of account Topsent's *Biemna dautzenbergi* and *B. chevreuxi*, the former of which is stated by Lundbeck(30) to be identical with *T. rosea* Fristedt, and the latter by Topsent(53) himself to be identical with *T. annexa* Schmidt, the species which I regard (provisionally) as belonging to *Tylodesma* are as follows:—

- | | |
|--|-------------------------------------|
| <i>T. inornata</i> Bowerbank(1); (46); (53). | Shetland Is.; Azores. |
| <i>T. corrugata</i> Bowerbank(1); (46). | British Is.; Azores. |
| <i>T. annexa</i> Schmidt(36); (30). | North Atlantic; widely distributed. |

<i>T.</i> (?) <i>pumilio</i> Schmidt(35).	Florida.
<i>T.</i> (?) <i>vagabunda</i> Schmidt(35).	Florida.
<i>T. infundibuliformis</i> Vosmaer(56);(30)	Arctic Ocean.
<i>T. rosea</i> Fristedt(9); (30); (53).	E. Greenland; Azores.
<i>T. vulgaris</i> Topsent(38).	Banyuls.
<i>T. grimaldii</i> Topsent(44); (46); (53).	Azores.
<i>T. humilis</i> Thiele(41).	Ternate.
<i>T. jania</i> Verrill(55).	Bermudas.
<i>T. alba</i> Wilson(61).	E. of Galapagos Is.
<i>T. vestibularis</i> Wilson(61).	E. of Galapagos Is.
<i>T. truncata</i> Hentschel(15).	Arafura Sea.
<i>T. informis</i> Stephens.*	W. Coast of Ireland.

Under the name *Desmacella arevifibrosa*, Hentschel(14) has described, from Western Australia, a species which evidently cannot be referred with propriety either to *Tylodesma* or to *Bienna*: for although the megascleres are styli and subtylostyli, and the microscleres toxa (of two sizes, the longer measuring 303 to 340 μ in length and much resembling raphides), the main skeleton consists of stout fibres formed chiefly of sand grains, without visible spongin-cement. The constitution of the skeleton and the raphide-like character of the longer toxa suggested to me that the species might belong to Dendy's *Stylotrichophora*(6), established for a single species—*S. rubra*—from Port Phillip, and defined thus: "The main skeleton is a network of horny fibre cored with foreign bodies. In addition to this, there are smooth monactinal megascleres (styli) and hair-like microscleres (raphides)." Examination of the type-specimens of *S. rubra*, which were kindly forwarded to me by the Curator of the Melbourne National Museum, has shown that such really is the case: for in this species also, small toxa are present, and the long raphide-like megascleres are frequently curved more or less in the manner of toxa. The chief points of difference between the two species are their somewhat different external habit, and the fact that in *S. rubra* the megascleres are styli only, the fibres are provided with a well-defined spongin-sheath, and the

* Stephens, J.—"Preliminary Notice of some Irish Sponges." Ann. Mag. Nat. Hist. (8), xvii., 1916, p.234.

foreign skeletal elements are broken spicules. *Stylotrichophora* was placed by Dendy in the family Haploseleridæ (Heterorhaphidæ), in vicinity to *Phoriospongia* Marshall, and *Chondropsis* Carter, but for reasons which I intend to publish in a subsequent paper, it appears to me rather that these genera are degraded Desmacidonidæ, requiring at present to be included in the subfamily Mycalinæ.

SIGMAXINELLA Dendy (emend.).

Definition.—Axinellidæ of ramose habit, with cylindrical or compressed branches, and without conuli or other kind of surface-processes. Skeleton symmetrically arranged, consisting axially of a more or less condensed or core-like region formed by a reticulation of spongin-ensheathed spicule-fibres; extra-axial skeleton consisting of paucispicular main fibres radiating outwards to the surface, sometimes (when of considerable length) connected by frequent, typically aspiculous, transverse fibres, but more usually with relatively few, or altogether without, transverse connections. Megascleres typically of a single order: styli, sometimes in part transformed into oxea or strongyla. Microscleres: sigmata and trichites (or microxea), the latter either in dragmata or scattered singly.

Type, *S. australiana* Dendy.

As amended, the genus will include only three of the species which have formerly been assigned to it. Of the remaining four, *S. ciocalyptoides* Dendy, and *S. incrustans* Kirkpatrick, are transferred to *Biemma*; *S. flabellata* (Carter), redescribed below, is made the type of a new genus, *Sigmazia*, while *S. mammillata* Whitelegge(60), with its rhabdostylote megascleres (which are found to show traces of spination, and are accompanied by sigmata only), possesses a type of spiculation very similar to that of Carter's *Microciona intexta*,—a species referred with hesitation by Topsent(53) to his genus *Rhabderenia*,—and requires for its reception a new genus, to be included in the Myxillinæ, for which I propose the name *Rhabdosigma*. On the other hand, two species are now added to the genus,—one new, the other long since described by Carter under the name *Phakellia ramosa*.

Sigmaxinella accordingly comprises at present five species, as follows:—

- S. australiana* Dendy. *S. arborea* Kirkpatrick(20),
S. dendroides Whitelegge. *S. viminalis*, sp.n.
S. ramosa Carter(4).

Whether *S. arborea* strictly belongs to the genus as above defined is not quite certain, inasmuch as its megascleres are stated by Kirkpatrick to be of three kinds, (i.) basally attenuated styli, $800-1150 \times 25-37\mu$; (ii.) strongyla, $700-800 \times 25-30\mu$; and (iii.) "rhapside-like" oxea (very rare), $700-870 \times 12.5\mu$. The probability is, however, that the strongyla are merely variants of the styli and connected with them by intermediate forms; while very possibly the oxea are of foreign origin.

SIGMAXINELLA AUSTRALIANA Dendy.

(Pl. xxxiii., figs.1-3; Pl. xxxiv., fig.1.)

1896. *Sigmaxinella australiana* Dendy(7), p.240.

Diagnosis.—Ramosé, erect, stipitate; with cylindrical or slightly compressed, moderately slender, dichotomously dividing branches, usually of medium length and more or less arborescently outspread, but occasionally remaining much abbreviated and partially coherent together proximally. In outward appearance much resembling a Chalinine sponge. Surface even; non-hispid. Oscula in the form of shallow stelliform depressions, scattered or serial along the branches. Dermal membrane thin and delicate, aspiculous. Skeleton fairly regularly reticulate, more or less condensed axially; formed of spicule-cored, non-plumose main fibres, and wholly sponginous connecting fibres. Megascleres: subcylindrical styli and oxea and forms intermediate between, often irregularly pointed, and rather variable in size in the same specimen; with a maximal size, in different specimens, of from 360 to 450μ by 7 to 17μ . Microscleres: slender sigmata of two sizes, respectively 16 to 20μ and 45 to 50μ in maximal length; and trichites, almost exclusively in dragmata, 20 to 45μ in length.

Lac.—Port Phillip; Maroubra Bay, near Port Jackson.

Introductory.—Of this species, there have been examined, for

the purpose of the present description, six specimens, four of which, well preserved in alcohol, are from the original locality, while the other two are washed-out beach-specimens obtained in the vicinity of Port Jackson; examination was also made of a mounted section of one of the type-specimens. As the possibility of a mistake regarding the identity of the species was out of the question, and, moreover, as the available specimens presented a greater range of variation than that recorded in the case of the original specimens, the latter were not sent for to be consulted. The two specimens from the northern locality differ slightly from the Port Phillip ones (more especially in certain details of spiculation), but not sufficiently, I think, to warrant their being regarded as constituting a distinct variety. In order briefly to distinguish the specimens, the former are referred to in the description as the P.J. specimens, the latter as the P.P. or typical specimens.

External features.—The typical habit of the species, so far at least as regards the shape and mode of disposition of the branches, is that displayed by the specimen illustrated in Pl. xxxiii., fig. 1—the largest and most profusely branched of those before me, measuring 180 mm. in total height—which may be very satisfactorily described, in the precise terms of the original description, as “consisting of a bushy bunch of rather slender, short, subcylindrical or somewhat compressed branches, sometimes anastomosing, and supported on a short stalk.” But in two respects this specimen is perhaps exceptional: namely, in the great multitude and closely crowded arrangement of the branches (the number of which exceeds two hundred), and, secondly, in possessing oscula which in comparison with those of other specimens are conspicuously noticeable. In the four P.P. specimens available, the branches vary from 5 to 8 mm. in stoutness, and, except when somewhat compressed, are usually nearer to the latter figure than the former; but in the P.J. specimens, in the case of which also the stalk is comparatively long and narrow, they are slenderer, 3 to 5 mm. in diameter, and much more uniformly cylindrical (Pl. xxxiii., fig. 3). Branching takes place chiefly, if not entirely, by dichotomy, and successive dichotomies,

as a rule, are in the same plane, the consequence being a well-marked tendency, most clearly expressed in sparsely-branched specimens, towards a flabellate disposition of the branches; but with their multiplication in number and consequent displacement due to mutual interference, the branches gradually come to assume a more or less regularly arborescent arrangement. The maximum length attained by the branches rarely exceeds 80 mm., but is usually greater than 40 mm.; occasionally, however, as in the single case of one of the P.P. specimens (Pl. xxxiii., fig. 2), they remain quite short (even the longest not exceeding 25 mm.) and more or less coherent with one another proximally, thus forming, or tending to form, a cluster or "head" of (somewhat palmately) lobed or digitate lamellæ.

The oscula are characteristic, having the form of shallow stelliform depressions, 1 to 2 mm. in diameter, at the centre of each of which is a group of several (usually 3 or 4) minute exhalant orifices; their stellate shape is frequently enhanced by short, shallow grooves radiating from them. Most frequently, they are arranged along the branches more or less distinctly in two rows, but sometimes only one such row is apparent, and sometimes they are in part disposed in a scattered fashion; their arrangement appears generally to be the more irregular in proportion as the branches are the more compressed. In most cases, the oscula are not conspicuous, and they are less evident in the desarcodised than in the perfect condition of the sponge; indeed, in the case of the two washed-out P.J. specimens, they were altogether unobservable.

In general appearance and in texture, the sponge is nearly similar to an ordinary Chalinine sponge. The consistency is fairly tough and elastic; moderately soft, but not fleshy; compressible and resilient. The colour in life is recorded in the original description as brownish-red or orange-rufous; in alcohol, it varies from pale greyish-yellow to light brown.

The dermal membrane is extremely thin and delicate, and without spicules; it appears to be very easily destroyed, since, even in the specimens which otherwise are excellently preserved, only portions of it remain. The dermal pores are arranged in

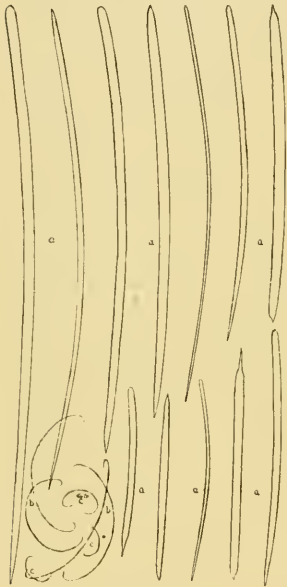
small oval or circular groups, averaging about 150μ in diameter but somewhat variable in size, scattered over the entire surface, and containing usually less than 10 pores each. Where the dermal membrane has disappeared, the surface is closely perforated with minute pinhole-like apertures, which are the openings of the inhalant canals: the presence of these is discernible also where the dermal membrane is intact, but, as a rule, only faintly and indistinctly.

Skeleton.—The skeleton which remains, after complete maceration of a specimen by means of caustic potash, preserves exactly the external form of the perfect sponge; it is composed of pale-coloured, highly sponginous fibres, and is fine-textured and of sufficient density to render it difficult for one to perceive from external inspection whether a condensed axial region is present or not. In section, under the microscope, the pattern is seen to be fairly regularly reticulate, the reticulation being formed by longitudinal and obliquely outward-trending main fibres pauciserially cored with spicules, and by numerous short connecting fibres containing no spicules (Pl. xxxiv., fig. 1). The reticulation is condensed axially, though not in any very marked degree except in the older, more basal parts of the branches, the condensation being the result merely of a progressive increase of stoutness of the fibres,—most rapid in connection with the axially situated ones, and scarcely at all affecting those situated near the periphery,—with increasing age. Within the axial region of the oldest part of the branches, the fibres may attain a stoutness of over 100μ ; but throughout the greater part of the skeleton, they are comparatively slender, even the main fibres seldom exceeding 40μ , while the connecting fibres are of all degrees of lesser stoutness down to below 5μ . Irregularity in the pattern of the skeleton is due to the fact that the connecting fibres rarely pass singly and directly between the main fibres (in such manner as to produce a rectangular or scalariform reticulation), but to a greater or less extent,—depending on the distance apart of the main fibres,—interunite among themselves, thus giving rise to an irregularly-meshed, somewhat plexiform reticulation. The average width of the meshes is less than 100μ ,

while the average distance apart of the main fibres is not less than 200μ . As the main fibres trend surfacewards, — with gradually increasing deflection from the longitudinal direction as they proceed, — they increase in number, mainly by branching, but partly also (at least in proximity to the surface) through the formation of additional ones which take origin from connecting fibres; and they arrive at the surface almost at right angles. The spicules of the main fibres are seldom more than 4- or 5-serial in their arrangement, very rarely as many as 9- or 10-serial; as a rule they lie fairly closely together, forming a moderately compact core. The most superficially situated fibres of the skeleton, including the outermost of the connecting fibres, give support to relatively numerous outwardly-directed spicules, for the most part collected, or tending to be collected, into loose divergent tufts surrounding the extremities of the main fibres.

In balsam-mounted sections of the perfect sponge (*i.e.*, with the soft tissues intact), the above-described features of the skeleton are to a very considerable extent obscured or disguised. This is due partly to the very pale colouration of the spongin, — in consequence of which the outlines of the fibres are usually almost or quite indiscernible, — and partly to the fact that the bulk of the megascleres are located externally to the fibres. These extra-fibral megascleres for the most part are not scattered irregularly through the mesogloea, but are situated chiefly in proximity to the main fibres, lying in approximate parallelism therewith. As a consequence, it is often difficult, or even impossible, to distinguish between spicules lying immediately adjacent to the fibres and others enclosed within them; and the skeleton may thus appear as if composed solely of spicules, for the most part directed parallelly to the directions of growth of the sponge, and more or less collected loosely into ill-defined strands. Irregularly scattered megascleres also are present, as well as relatively few transversely-directed ones, the latter of which always occur singly. Sigmata and trichodragmata are present in moderate number, but the former are not readily perceived owing to their slenderness; rare singly-scattered trichites also occur.

Spicules.—The megascleres are slightly curved, subcylindrical to subconical styli, fewer oxea, and scarce strongyla, the three forms differing in general only with respect to the character of their extremities, and connected with one another by numerous intermediates. They are often irregularly ended and more or less blunt-pointed, and many of the oxea are markedly anisoactinate. Their size is very variable both as regards length and stoutness. In the P.P. specimens, they range in length from 120 or 130 to 360 μ in some cases, up to over 400 μ (rarely to 450 μ) in others, and vary in diameter, irrespective of length, from 2 to 7 (rarely) to 10 μ .



Text-fig. 12. *

In the P.J. specimens, they are generally much stouter, attaining a maximum diameter of from 15 to 17 μ , and range in length from about 150 to 420 μ . The styli are, on the average, stouter than the oxea, and the stoutest spicules are mostly those of intermediate and lesser lengths. In the case of the P.P. specimens, the shortest spicules,—those of lesser length than, say, 200 μ ,—are chiefly oxea, generally with abruptly, often mucronately pointed ends; but, in the P.J. specimens, the shortest spicules are nearly always styli.

(ii.) The sigmata are extremely slender,—invariably less than 1 μ in diameter,—and of two kinds, the smaller (and less numerous) varying in length from 9 to 16 μ , the larger from 25 to 45 μ , measured from bend to bend. Both kinds are mostly more or less contort, — the smaller, however, usually only slightly so, the larger often to such an extent as to appear S-shaped; both kinds

* *Sigmaxinella australiana*. a, megascleres; b, c, larger and smaller sigmata.

occur in dragmata, as well as scattered singly, but the shorter dragmata are rare.

(iii.) The trichites, both forming the dragmata and scattered singly, are exceedingly slender microxea, varying in length from 20 to 45μ .

SIGMAXINELLA DENDROIDES Whitelegge.

(Pl. xxxiv., fig. 2.)

1907. *Sigmaxinella dendroides* Whitelegge (60), p. 513, Pl. xlvii., fig. 42.

Diagnosis.—Ramosae, erect, stipitate; with cylindrical, tapered, dichotomously dividing, slender branches of moderate length. Surface even. Oscula presumably either very small or very shallow, at any rate not apparent in the skeletonised specimen. Dermal features unknown. Skeleton consisting (i.) of a condensed axial reticulation, the fibres forming which are moderately rich in spongin, and (ii.) of fibres radiating therefrom which are poor in spongin, are united only sparingly by (entirely sponginous) transverse fibres and by single spicules, and run (with occasional branching) in nearly parallel courses to the surface, becoming multispicular and somewhat plumose on nearing it, and terminating each in a subpenicillate tuft. The spicules of the radial fibres are of greater average length than those of the axial reticulation. Megascleres: subcylindrical styli, usually tapering gradually to a sharp or slightly rounded point at the apex, and usually slightly curved, sometimes bent; frequently tending to become abruptly blunt-pointed at the base; occasionally passing into strongyla, very rarely into oxea; 300 to 640μ long by 10 to 26μ in diameter. Microscleres: slender sigmata of two sizes, respectively 20 to 40μ in maximal length; and scarce trichites (microxea), 25 to 35μ long, scattered singly.

Loc. South of Port Hacking, N.S.W. ("Thetis").

External features.—The only known specimen—a figure of which has been furnished by Whitelegge—is a stipitate arborescent sponge, 180 mm. in total height, with moderately elongated, cylindrical, distally tapered branches, 4 to 6 mm. in diameter, rising erectly from an equally slender stem, and occasionally

anastomosing. The mode of branching is dichotomous, and successive dichotomies are usually in the same plane, but owing to irregularities, partly resulting through mutual interference, the branches come to be disposed in various planes: it is very probable, however, that specimens occur in which the branching is confined entirely to the one plane. The division of the stem to form the first two branches takes place 25 mm. above the base, each of those again dichotomising at about the same distance above their origin, and each of the resultant four branches also at about the same distance above theirs: the subsequent divisions for the most part occur at increasingly longer intervals, some of the terminal branches having an uninterrupted length of 70 mm.

The specimen is imperfect, consisting only of the dried skeleton,—in which condition it appears to have been also when first described. Nothing can be said, therefore, in regard to the dermal features; but evidently the outer surface was even, without conuli or elevations of any kind. Oscula are not indicated. The skeletonised sponge being held between the eye and the light, the skeleton is plainly perceived to consist, in each branch, (i.) of a sharply circumscribed cylindrical core, of diameter generally less than one-fourth and (except in the lowermost parts of the sponge, up to about as far as the third dichotomy) not greater than one-half the diameter of the branch, and (ii.) of an outer region formed of slender radiating fibres, which are inclined to the longitudinal direction of the branch at an angle varying from 60° to nearly 90°, and present collectively an appearance somewhat resembling that of fur. The colour is a faintly creamy-tinted pale grey or dirty white, its paleness being due to the extremely small amount of spongin entering into the composition of the radial fibres. In the original description, the consistency is described as “tough, resilient, and compressible,” but this is not strictly correct: the axial region is fairly tough and slightly compressible (and the branches consequently are flexible), but the extra-axial layer is soft, and on compression remains partially crushed.

Details of skeletal structure (Pl. xxxiv., fig.2).—Except towards

the extreme apices of the branches, the demarcation between the axial region of the skeleton and the extra-axial, as seen in longitudinal section, is very pronounced (more especially if the spongin has been stained) notwithstanding there is no discontinuity between the main fibres of the two regions (*i.e.*, between the longitudinal fibres of the former and the "radial" fibres of the latter), such as might be inferred from the terms "primary" and "secondary" used in the original description to distinguish them. The contrast is partly due to the much greater density of the axial skeleton, and also partly (i.) to the rapidity with which the fibres change in direction from longitudinal to almost perpendicularly transverse, and (ii.) to the sudden and very considerable diminution in the amount of their constituent spongin,— as they pass from the one region to the other; but there are other differences also.

In the axial region, the main or longitudinal fibres, which have a maximal stoutness of 80 or 90 μ , usually contain multi-serial spicules, for the most part not very compactly or regularly arranged; are rather closely juxtaposed, and frequently coalesce with each other for short distances; and are connected at close intervals by short, aspiculous, transverse fibres. Participating in the formation of the axial skeleton also are many spicules whose relation to the fibres is more or less indefinite, as well as many transversely and obliquely directed ones occurring singly. In the older portions of the skeleton, the meshes of the reticulation become much reduced in size, often to the point of obliteration, through the continued growth in stoutness of the fibres. The more peripherally situated of the main fibres run, not longitudinally, but with a slight, and gradually increasing, trend outwards; ultimately they pass into the extra-axial region, and, curving surfacewards, immediately subdivide each several times in rapid succession to form the radial fibres.

The radial fibres, throughout the greater part of their length, are only two or three spicules broad; the spongin cementing their spicules is usually so small in quantity as scarcely to be discernible unless stained; and the connecting fibres between them occur only at comparatively wide and irregular intervals.

They run with slight divergence (gradually becoming more nearly parallel to each other as they proceed), and with occasional branching, generally at a distance of from 200 to over



Text-fig. 13.

Sigma xinella dendroides.
a, megascleres; b, c, larger and smaller sigmata.

300 μ apart, to meet the surface almost at right angles. As the surface is approached, their spicules increase in number and become disposed for the most part in a somewhat plumose manner, the fibre undergoing a gradual change in character culminating in the formation, at its extremity, of a corymbiform, slightly divergent tuft consisting frequently of as many as 10 or 12 spicules. Elsewhere in the radial fibres the spicules lie mostly with their long axis in, or only very slightly inclined to, the direction of the fibre; but obliquely directed spicules, disposed more or less in an echinating fashion, are by no means uncommon. Some of the latter become united at their apices, by means of spongin, with adjoining fibres, and thus assist in the task performed by the connecting fibres; occasionally such spicules are ensheathed with spongin. The connecting fibres proper, of which mention has been made above, are formed entirely of spongin, like those of the axial region; they are very slender, varying in stoutness from less than 5 μ to at most 20 or

25 μ , and occur at distances apart usually exceeding, say, 300 μ ; where occurring closely together, they generally interunite among themselves.

The megascleres forming the radial fibres are notably longer, on the average, than those of the axial skeleton; while the longest spicules of all are found in the surface-tufts. Sigmata are present in great number, and occur for the most part arranged uniseriably along lines which probably coincide with the courses of the main canals; they are of two sizes, the larger being much the more numerous. Short, slender microxea (unmentioned in the original description) are also present, but appear to be rare; apparently also, they occur only singly scattered, never in dragmata.

Spicules.—(i.) The megascleres are almost exclusively styli, usually of slightly lesser diameter at the base than at some distance therefrom, and tapering towards the apex; frequently more or less blunt-pointed apically, and occasionally passing into strongyla, those of the latter form being almost invariably of less than the average length; often abruptly somewhat blunt-pointed at the basal end, but very rarely becoming oxea; ranging in length from about 300 to 640 μ , and in stoutness from rarely less than 10 to about 26 μ . The shorter spicules are generally straight or nearly so, the longer are nearly always slightly curved, or sometimes bent, the flexure as a rule being mainly in the basal moiety of the spicule.

(ii.) The two kinds of sigmata are scarcely different except with respect to size. The smaller vary in length from 12 to (rarely) 20 μ , the larger from 25 to 40 μ , measured from bend to bend; the maximal stoutness is in each case about 2 μ . They are, without exception, more or less contort,—often (especially in the case of the larger ones) to such an extent as to appear S-shaped.

(iii.) The microxea (trichites) are fusiform, 25 to 35 μ in length, and at most 1.5 μ in diameter.

SIGMAXINELLA VIMINALIS, sp.nov.

(Pl. xxxiii., fig.4; Pl. xxxv., figs.1, 2; Pl. xxxvi., fig.1.)

Diagnosis.—Ramosae, erect, stipitate; with elongated, slender, cylindrical, tapered branches, disposed irregularly. Surface hispid. Oscula, if present, small and inconspicuous. Dermal

membrane thin, without contained megascleres. Skeleton with a central axis, in which the megascleres for the most part are so disposed as to produce a lattice-like pattern, and in which (except in the older portions of the sponge) spongin is only scantily developed. Extra-axial skeleton consisting of numerous, short, pauciserial lines of (relatively very long) spicules, radiating from the central axis to the surface,—the spicules composing which are more or less divergently directed, and are not united by visible spongin. Megascleres: slightly curved styli, 320 to 1525 μ in length by 18 μ in maximal stoutness. Microscleres: sigmata of two sizes, respectively 18 μ and 50 μ in maximal length, the larger ones in part occurring in dragmata; and fusiform trichites, 22 to 48 μ in length, occurring both in dragmata and scattered singly.

Loc.—Great Australian Bight (exact locality unknown).

External characters.—The single specimen (Pl. xxxiii., fig. 4)—280 mm. in total height—consists of about half-a-dozen more elongated or main branches, 130 to nearly 200 mm. in length,—one of which is a direct continuation upwards of the stalk and gives off the others at different levels,—and of a score or so shorter branches, ranging from 5 to over 100 mm. in length, which arise from the former at distant intervals, and nearly always proceed off from them at very wide angles, often almost or quite perpendicularly. The mode of branching, therefore, is not dichotomous (as it usually is in the case of ramose sponges) but irregular. The branches are at most 5.5 mm. in diameter proximally, and diminish in stoutness to slightly less than 2.5 mm. at their extremities. The stalk has a length of 55 mm. measured from its base to the origin of the first branch, and terminates below in a tuft of branched rootlets. The species is very similar, in general habit, to *Raspailia tenuis* Ridley and Dendy (33).

The specimen, although in alcohol, is not in a very good state of preservation, the superficial layer being much damaged and the dermal membrane almost completely destroyed through maceration. Whether there are oscula or not, is accordingly not evident; but, if present, they must be rather small and inconspicuous. The surface is everywhere hispid with far project-

ing spicules. The branches are flexible and tough, with an outer layer of softer consistence; this layer has disappeared from the stalk, which is dense and tough throughout, and has a smooth and even surface. The colour in spirits is greyish-yellow.

Skeleton.—The formation of the skeleton differs from that of *S. dendroides*, described above, mainly in two respects; and these differences are to some extent consequent upon the much greater length (up to 1.5 mm.) of the megascleres in the present species, and upon the relative narrowness of the external layer intervening between the central axis and the surface. In the central axis, there are not to be distinguished, as in *S. dendroides*, definite longitudinal fibres joined by transverse ones in more or less ladder-like fashion, but the megascleres are disposed rather loosely in ill-defined tracts which cross one another at acute angles, thus giving rise to a somewhat lattice-like arrangement. And, secondly, the extra-axial skeleton (Pl. xxxv., fig. 2) is entirely without transverse fibres, and consists simply of numerous, short, pauciserial lines of spicules running outwards to the surface in a direction nearly perpendicular thereto,—these spicules being arranged more or less penicillately and united by, at most, an infinitesimal amount of spongin, and the terminal ones projecting far beyond the surface.

The axial skeleton changes considerably in character with age, owing to gradual increase in the amount of spongin developed in connection therewith, and presents a very different appearance in the older and more basal parts from that which it exhibits in the uppermost portions of the branches. In the latter region, for a considerable distance (several centimetres at least) from the extremities of the branches, the amount of spongin present is so slight that its existence is apparent only in sections from which the fleshy tissue has been removed by maceration (Pl. xxxv., fig. 1). In this portion of the skeleton also, the spongin appears diffused, and is without definite outlines. Proceeding towards the base of the sponge, the spongin gradually becomes more and more concentrated upon the sides of the lattice-like meshwork formed by the megascleres, which is thus converted into a reticulation of spiculo-spongin fibre. The elongated, narrow meshes of

this reticulation ultimately (in the stalk of the sponge) become reduced in size almost to the point of obliteration.

In addition to a gradual increase of density, the central axis also undergoes with age a gradual increase in diameter. This is effected by the continued formation, and addition to it externally, of fresh tracts of megascleres, which later similarly become ensheathed in spongin. In this way, the axial skeleton eventually comes to include within it the lines of spicules which previously constituted the extra-axial skeleton (Pl. xxxvi., fig. 1). The extra-axial layer, however, maintains about the same width—viz., about 1 to 1.5 mm.—throughout the whole length of the branches.

Sigmata of two sizes are scattered throughout all parts, the smaller in extreme abundance, more especially in the extra-axial layer; the larger ones, which are only moderately abundant, occur also in dragmata. Trichodragmata and singly scattered trichites are also moderately abundant, except in the axial region, where they are rare.

Megascleres.—These are slightly curved, occasionally slightly flexuous styli, almost without exception evenly rounded at the base, and of uniform diameter therefrom to beyond the middle of their length, whence they taper gradually to a sharp point; in very rare cases only, the basal extremity also is more or less pointed, and the spicule may become an anisoxea. They range from 320 to 1525 μ in length and up to 18 μ in stoutness. Spicules much below 700 μ in length are relatively scarce.

Microscleres.—(i.) The larger sigmata are always more or less contort, though rarely to such a degree as to appear S-shaped when seen from the side; the smaller are usually C-shaped or but very slightly



Text-fig. 14.*

* *Sigmaxinella riminalis*. Megascleres and sigmata.

contort. The former vary in length from 27 to 50 μ , the latter from 12 to 18 μ , measured from bend to bend; and their maximal stoutness is respectively 1.5 μ and 1 μ .

(ii.) The trichites or microxea, whether in dragmata or scattered singly, are all of the same kind. They are slightly fusiform, from 22 to 48 μ in length, and from 0.5 to 0.75 μ in stoutness.

SIGMAXIA, gen.nov.

Definition.—Axinellidæ typically of erect habit, stipitate, without conuli or other kind of surface-processes. Skeleton a reticulation of spiculo-spongin fibre; the main fibres more or less plumose, the connecting fibres typically few. Megascleres of two distinct kinds,—styli forming the fibres, and flexuous strongyla occurring interstitially. Microscleres: sigmata and trichites (or microxea), the latter in dragmata and scattered singly.

Type, *S. flabellata* Carter; the only species.

SIGMAXIA FLABELLATA Carter.

(Pl. xxxiii., fig.5; Pl. xxxvi., figs.2, 3.)

1885. *Axinella flabellata* Carter(3), p.361.

1896. *Sigmaxinella flabellata* Dendy(2), p.241.

Diagnosis.—Sponge composed of one or several proliferous, thick lamellæ, or of a single more or less flabelliform lamella, springing from a short stalk. Surface coarsely granular. Oscula minute, marginal (or scattered?). Dermal membrane very thin; no dermal skeleton. Skeleton chiefly formed of loosely constituted, semi-plumose, stout main fibres, comparatively poor in spongin, running longitudinally side by side in moderately close apposition, and gradually curving towards the surface; connecting fibres few, arranged irregularly, mostly paucispicular, sometimes without contained spicules. Megascleres: styli, curved or slightly bent, and gradually sharp-pointed, occasionally passing into oxea, from 300 to 350 μ in maximal length and up to 18 μ in stoutness; and slender, flexuous strongyla and (fewer) tornota, 200 to (rarely) 580 μ in length, and at most 7 μ in diameter. Microscleres: slender sigmata 15 to 20 μ long; and trichites of

two sizes, respectively about 30 to 60 μ in maximal length, the former occurring only in dragnata, the latter in part also scattered singly.

Loc.—Port Phillip.

The species is known now from six specimens, one of which forms the subject of the original description, while four in addition have been taken account of in the summary of specific characters furnished by Dendy. The present description, so far as it relates to the structure of the skeleton, is based almost entirely upon the sixth, the identity of which with the preceding has been established by comparison of it with a mounted preparation of one of Dendy's specimens.

External characters.—The sponge may be simply flabelliform, consisting of a single, erect, stout lamella narrowed below and prolonged into a stalk, as, for example, in the case of the single immediately accessible specimen (Pl. xxxiii., fig. 5),— in which, however, the lamina is not of uniform thickness, but is rendered irregular by a number of rounded hummocks and several low, compressed ridges, the latter evidently of the nature of incipient secondary lamellæ; this specimen, 65 mm. in total height, has an orbicular lamina about 50 mm both in height and breadth and from 8 to over 20 mm. in thickness, and a cylindrical stalk, 7 mm. in diameter, expanded proximally into a broad disc of attachment. Of somewhat similar, but of less regular form,— and of larger size, measuring 88 mm. high by 112 by 37 mm. horizontally,—was also the original example, described by Carter thus: "compressed, expanded, thickish, lobate; margin irregular; stem short, angular, and thick." But more usually, it seems, the form assumed is one of less simplicity owing to the development of additional lamellæ, perhaps both primary and secondary: for the specimens upon which Dendy's account is based are described as composed of "proliferous lamellæ about a quarter of an inch thick, springing from a short thick stalk."

Oscula, unobserved by Carter, are stated to be present by Dendy, who describes them as minute, marginal or scattered; in the present specimen they are certainly absent from the lateral surfaces, and are not distinguishable on the margin,— but the

latter circumstance may be owing to the slightly damaged condition of the surface there. The dermal membrane is thin and delicate, and easily destroyed. The undamaged surface has a finely to coarsely granular appearance, due to minute pimple-like elevations of the dermal membrane produced by the impingement upon it of the outer ends of the main skeletal fibres; where the membrane has disappeared, the projecting ends of the fibres render the surface slightly shaggy. The texture is tough, fibrous, resilient. The colour in spirit is pale brownish or yellowish-grey.

The dermal pores are distributed singly, though often in rather close apposition; they are variable in size, 20 to 50 μ in diameter.

Three of the four specimens recorded by Dendy are noted by him as being beset with parasitic Anthozoa. The present specimen is likewise infested, no doubt with the same organism: it is a small, solitary anthozoan, only 1 to 2 mm. in height and diameter, occurring almost completely imbedded in the sponge.

Skeleton.—The structure of the skeleton, as revealed in sections of the completely desarcodised sponge, in which nothing remains but the spongin-cemented elements (or skeletal framework), is very definite and uniform in character, and at first sight, more especially under the lowest powers of the microscope, appears as if more correctly to be described as dendritic than as reticulate (Pl. xxxvi., figs. 2, 3). It consists almost entirely of ascending, frequently branching, stout main fibres, running moderately closely side by side in subparallelism (at an average distance apart, say, of from 300 to 400 μ), gradually curving outwards, as they ascend, towards the surface. Connecting fibres, however, are by no means rare, but for the most part they are comparatively inconspicuous. The main fibres, which are seldom less than 100 μ , and occasionally surpass 200 μ in stoutness, are formed chiefly of spicules, for the most part rather loosely and confusedly arranged, a variable proportion (generally a small minority) of which are disposed with their points directed more or less obliquely outwards. As the surface of the sponge is approached, however, the spicules composing the fibres become

gradually more and more divergingly disposed, as well as more loosely compacted, and the fibres finally assume, in consequence, a typically plumose aspect. The spongin cementing the spicules, —though necessarily fairly considerable in amount owing to their loose arrangement,—is, except in the stalk and oldest portions of the skeleton, usually of scarcely more than the minimal quantity required to hold them together, and seldom or never forms a distinct sheath; where the spicules lie more widely apart, it often becomes reduced to a mere film between them, and here and there even leaves small open spaces or fenestræ. Running upwards from the stalk, and continuing for some distance into the body of the sponge, gradually dissolving as they proceed, are a number of relatively stout strands of spicules, or funes, evidently formed each by the fusion of several originally separate fibres (Pl. xxxvi., fig. 2). Connection between the main fibres, apart from occasional anastomosis or direct union between them by inosculation, is partly by means of relatively few, obliquely-running multispicular fibres, similar in character to the main fibres except in being usually of lesser stoutness, and partly by means of connecting fibres proper. The latter are mostly very slender, and usually contain few spicules or are composed of spongin alone; they occur at irregular intervals, sometimes singly, sometimes several together, and in the latter case usually interunite also among themselves.

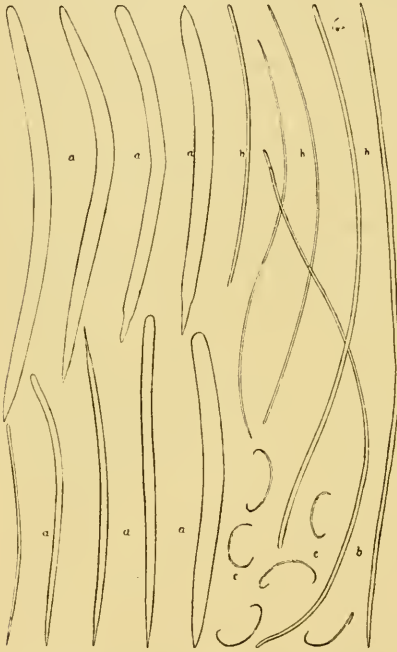
In sections of the sponge with the soft tissues intact, the appearance of the skeleton is somewhat different. The presence of spongin is scarcely apparent; the main fibres have a much looser and more plumose aspect; and the connecting fibres are seldom definitely recognisable as such, owing to the difficulty of distinguishing between the megascleres actually constituting them and others that are merely scattered between the fibres. The more diffuse and plumose appearance of the main fibres is probably due to the fact that some proportion of the more exteriorly situated (and likewise more obliquely directed) spicules entering into their formation are not attached by spongin, and consequently are absent from the skeleton that remains after maceration. In the more peripheral parts of the skeleton, the

megascleres scattered between the fibres are relatively few, and consist of styli only, similar to those composing the fibres. But at some distance from the surface,—usually a somewhat considerable distance,—megascleres of a second kind make their appearance,—flexuous strongyla and tornota,—which increase in number towards the deeper portions of the sponge and eventually become very abundant; indeed, it is almost as much to the increased multitude of the latter, as to augmentation in the quantity of the spongin, that the greater density of the skeleton in the stalk and other older portions of the sponge is due. A considerable proportion of the latter spicules are developed in close contiguity to the fibres, and ultimately, owing to the subsequent formation of additional spongin, become completely united to them. The presence of these flexuous megascleres, owing to their extreme rarity in, or total absence from, those portions of the sponge usually selected for examination, hitherto has escaped notice.

Through all parts of the sponge there are scattered small sigmata singly in moderate abundance, trichodragmata of three kinds, and single trichites of similar size to those composing the larger trichodragmata. The trichodragmata of two kinds are in the form of neat sheaves of extremely slender trichites, and differ from each other only in length; the shorter of these are almost as numerous as the sigmata, while the longer are relatively scarce. The dragmata of the third kind are composed of trichites equal in length to those of the just-mentioned longer dragmata, but stouter and more fusiform, and occur for the most part in dense masses of irregular shape and size, which refract the light in such a way as to appear blackish and opaque, and are, therefore, very noticeable although comparatively scarce; some of the largest of these aggregations exceed 200μ in breadth. The singly scattered trichites, or microxea, are moderately scarce in the interior, but more plentiful near the surface.

Megascleres.—(i.) The styli are invariably more or less curved, are usually evenly rounded at the base and of uniform or nearly uniform diameter therefrom to beyond the middle of their length, and almost invariably taper throughout the remainder

of their length gradually (except frequently for slight irregularities near the apex) to a sharp point; a gradual slight narrowing of the spicule towards the basal end, however, is not uncommon. The curvature as a rule is restricted to the basal moiety of the spicule, and is usually well-pronounced, but varies much



Text-fig. 15.—*Sigmaxia flabellata*.
a, megascleres of the fibres; *b*, interstitial megascleres; *c*, sigmata.

both in form and degree: frequently it is more or less angulate, the spicule appearing slightly bent; and occasional spicules are bi-angulate. In odd cases of extreme curvature, the form of the spicule makes some approach to that of a rhabdostyle. Variability exists also in the shape of the spicule at its basal extremity, which frequently shows a tendency to become abruptly more or less sharp-pointed, either hastately or mucronately so; but sometimes the attenuation is more gradual, and the form assumed is that of an oxea. The proportion of oxeote forms is greatest amongst the slenderer, presumably immature spicules, which only

occur scattered between the fibres, and are relatively few in number. The maximal size of the spicules in the case of Dendy's specimens is given as $290 \times 16.6\mu$; in the present specimen, the size attained is $350 \times 15\mu$, but individuals much exceeding 320μ in length are scarce; those composing the fibres are seldom less in stoutness than 10μ . Developmental forms of all sizes down to less than $140 \times 1\mu$ are to be met with. (In the

original description, the size of the spicules is given as 70 by 2-6000ths of an inch—*i.e.*, $296 \times 8.4\mu$, but this, I think, must be due either to an error of measurement or to a misprint).

(ii.) The variously curved, usually more or less flexuous megascleres are mostly strongyla, but individuals with sharp-pointed ends are also numerous. They range from about 200 to 580μ in length and from 1.5 to 7μ in diameter. The acutely-ended spicules, as a rule, are more or less abruptly-pointed, *i.e.*, are tornota; but more or less oxea-like forms are not rare. Some of the shortest among the latter spicules are hardly to be distinguished from the oxea that derive from the stylote megascleres.

Microscleres.—(i.) The sigmata are invariably more or less contort, though seldom to such a degree as to appear S-shaped when seen from the side; they are 15 to 20μ in length measured from bend to bend, and about 1μ in stoutness.

(ii.) The trichites are of two sizes as regards length, the shorter measuring from 15 to 28μ , the longer from 37 to about 60μ . As already mentioned, the former occur only in dragmata, the latter both in dragmata and scattered singly.

CERATOPSIS Thiele.

Definition.—Axinellidæ of erect, lamellar or ramose habit; typically with an axially condensed skeleton deficient in spongin. Megascleres either of two distinct kinds—styli (sometimes in part secondarily diactinal) and elongated flexuous strongyla,—or the latter spicules are absent. Microscleres: smooth microxea only, typically occurring most abundantly in the dermal layer.

Type, *C. expansa* Thiele.

The genus was instituted by Thiele(38) for four species from Japan, differing from all previously known Axinellidæ by the presence of microscleres of a single kind in the form of smooth microxea, and further characterised according to the generic diagnosis—(i.) by the presence of smooth stylote megascleres “die ein festes Axenskelett bilden, von dem nach Peripherie radiäre Style ausgehen”, (ii.) by the very small amount of spongin present, and (iii.) by the almost complete restriction of the microscleres to the ectosome, where they constitute a dermal

skeleton. The only additional information provided regarding the skeleton is to the effect that the "feste Axe" is similar in character to that of the genus *Acanthella*; whether the radially-directed styli are collected into fibres or not, or in what respects, if any, the several species differ in skeletal structure, is not stated. Three of the species,—viz., *C. expansa*, *C. erecta*, and *C. ramosa*,—agree in their described characters very closely, and are undoubtedly congeneric; but the fourth, *C. clavata*, is distinguished not only by its non-lamellar (cauliform) habit and conulose surface, but also by the fact that the megascleres are of two distinct kinds,—styli composing the main skeleton, and relatively few long flexuous strongyla (presumably occurring interstitially). Since it is not unlikely that *C. clavata* will be found to differ from the remaining three species in other important respects also, its inclusion in the present genus must be looked upon as provisional.

More recently Kirkpatrick(20) has described from Cape Colony, under the name *Phakellia microcephora*, a fifth species with microxea, which it seems necessary also to include provisionally in the genus *Ceratopsis*. This species agrees with *C. clavata* in the possession of elongated flexuous strongyla, but the accompanying megascleres are relatively few, and chiefly oxoete, and the external habit of the sponge is lamellar as in the case of the typical species of the genus. Concerning the structural characters of the skeleton in this species, no information is available.

By Thiele and Kirkpatrick, the oxoete microscleres were regarded as indicative of affinity with the genus *Higginsia*. The evidence afforded by the spiculation of *C. clavata* and *C. microcephora*, however, much more strongly justifies the view that *Ceratopsis* is related to *Sigmaxia*, and that it constitutes a connecting-link between the latter and such genera as *Axinella*, *Phakellia*, and *Acanthella*.

It is necessary to refer here to the species designated *Axinella frontula* by Whitelegge(60), the spiculation of which has been described as consisting of smooth styli of two sizes and of scarce small oxea 110 by 3.5μ in size, occurring "chiefly in or near the dermal portion of the sponge",—and which consequently

might be thought to be related to *Ceratopsis*. I have re-examined this species, and find that the oxea are merely variants of the smaller styli (differing from them neither in size nor in situation), and that the latter are differentiated into two kinds, one of which is distinguished by having the distal moiety vestigially spined, and by being very slightly stouter and of more conical shape than the other. The species belongs, in fact, to the Myxillinae, and requires a new genus for its reception, for which I propose the name *Echinaxia*. The sponge is thinly lamellar, flabelliform; and the skeleton consists (i.) of a condensed axial region formed mainly of an irregular reticulation of the smaller smooth styli (which vary from 90 to 150 μ in length and up to 5 μ in stoutness) and partly of fairly numerous, longitudinally directed, singly-occurring, long slender styli (varying in size from less than 200 by 2 μ to upwards of 700 by 12 μ), and (ii.) of short, fairly stout, echinated fibres radiating from the axial region towards the surface, composed both of smooth and spined short styli, and terminating in a compact bundle or tuft of long stout styli (apparently similar to the longer of those occurring in the axial region) the extremities of which project somewhat beyond the surface. I am inclined to think that the genus *Echinaxia* should be so defined as to include also the two species described by Thiele(38) as *Raspailia folium* and *Raspailia hirsuta*.

DRAGMAXIA, gen.nov.

Definition.—Axinellidæ of lamellar habit, typically flabellate or cup-shaped. Skeleton composed of dense spicule-axes ramifying in the midplane of the lamina, and of plumose spicule-columns radiating therefrom, between which interconnection by means of transverse fibres is rare. Megascleres: styli only; either of a single sort, or more or less completely differentiated into two sorts,—one (of shorter length) forming the fibres, the other occurring interstitially. Microscleres: trichodragmata accompanied or not by singly scattered trichites.

Type, *D. variabilis* Whitelegge.

The species for which I propose the genus was referred by its

author to the genus *Spongosorites*, under the erroneous impression that the microscleres present—which are exceptionally slender trichite-sheaves, peculiar in being often more or less fusiform in shape—were microxea. Even had the microscleres been as stated, however, it is not to *Spongosorites* that the species would have required to be assigned, but probably to *Ceratopsis*. Hitherto, all species with a plumose or with an axially-condensed type of skeleton, and with trichodragmata only as microscleres, have been included in the single genus *Thrinacophora*, but I now propose to regard them as representative of several distinct genera.

DRAGMAXIA VARIABILIS Whitelegge.

(Pl. xxxviii., figs. 1, 2, 3.)

1907. *Spongosorites variabilis* Whitelegge (60), p. 513, Pl. xlv., fig. 45.

Diagnosis.—Thinly lamellar, varying from flabelliform to caliculate. The lamina alternately denser and less dense along lines running towards the margin, and thus presenting an appearance as of venation, with corresponding faint ridges and grooves on the surface. The surface otherwise even. Dermal membrane distinct, aspiculous. Oscula inconspicuous. Skeleton consisting of dense spicule-axes corresponding in position with the “veins,” and of stout plumose fibres running outwards therefrom to the surface. Spongin rather scanty. Megascleres: styli only, not quite perfectly differentiated into two kinds; those forming the fibres are shorter, stouter, and more curved, attaining a maximum size of about 900 by 33μ ; the others, which are relatively few and occur only interstitially, occasionally surpass 1300 or 1400 μ in length and are not more than 18μ in diameter. The trichodragmata vary from about 100 to 200 μ in length and up to 5μ in stoutness; singly scattered trichites, similar to those forming the dragmata, also occur.

Loc.—Off Crookhaven River, N.S.W. (“Thetis.”).

External features.—The original specimen was rudely cup-shaped or, rather, compressed funnel-shaped, with a few laterally

arising secondary lamellae disposed in vertical planes; and measured, when complete, approximately 130 mm. in height by 120 and by 80 mm. respectively in the greatest and least diameters of the cup-orifice, and from 2 mm. (at the margin) to about 5 mm. in the thickness of the lamina or cup-wall: it exists now in two pieces, one of which—figured by Whitelegge—is in a dried but otherwise undamaged condition, while the other is well-preserved in alcohol. According to the original description, the lateral lamellae occur on both the inner and the outer surfaces of the cup, but this is really not the case; they are confined entirely to the interior side.

A second specimen (also obtained by the "Thetis" Expedition, but from an unknown locality) is now known, which is simply flabelliform without secondary outgrowths. This measures 90 mm. in height by only 2 to 3 mm. in thickness, and is in a dried, completely washed-out condition.

An exceedingly characteristic feature,—very clearly evident when the sponge is examined by transmitted light,—is the structural peculiarity of the lamina, which is alternately denser and less dense along slightly diverging, ever multiplying lines, or rather strips, running in a direction from stalk to margin: along the denser strips, the lamina is usually slightly thicker than it is between them, and the surface is accordingly marked with radiating faint grooves and slight ridges. With respect to this structure, however, the two specimens exhibit a very appreciable difference, which may prove to be varietally distinctive. In the smaller specimen, the strips (of greater density) are all directed radially, increasing in number upwards by repeated branching, and are all similar in character; they diminish in individual width from somewhat less than 2 mm. in proximity to the stalk to less than 0.5 mm. at the sponge-margin, and the width of the intervening strips of lesser density is about the same. In some portions of the type-specimen, the structure is very similar to this, except that the lines of greater density are generally much broader; but elsewhere there also occur a few relatively very powerful, dense, nervure-like thickenings of the lamina, ramify-

ing through it, upwards from the stalk, in the manner of the palmate leaf, and from these the lesser lines of density, in part, branch off (at small angles of divergence) in pinnate fashion (Pl. xxxvii., fig.3).

As a result of maceration, the less dense portions of the lamina largely disappear, and the sponge becomes abundantly perforated by rounded holes arranged serially along radiating lines.

The surface is somewhat uneven, owing to inequalities in the thickness of the lamina; it is also slightly granular, but not hispid. The dermal membrane is thin and translucent, but not very delicate; situated beneath it, more especially along the grooves marking the less dense portions of the lamina, are numerous small subdermal spaces. Dermal pores occur on both surfaces, but are relatively few and for the most part are scattered singly and irregularly on the one surface (*viz.*, the inner one, when the sponge is cup-shaped), very numerous, and generally so closely arranged as to produce a net-like appearance of the dermal membrane, on the other. In most places where the pores are numerous, the dermal layer appears as if consisting of two incompletely separated membranes, the outer one of which is provided with many, smaller pores, the inner with fewer and much larger ones. On the surface which has the fewer pores, there are also many circular openings, from 0.2 to 0.5 mm. or slightly more in diameter, situated only along the surface-grooves and principally in the positions where the lamina becomes perforated when the sponge is macerated; these openings appear to be oscula.

The consistency of the sponge, when well-preserved in alcohol, is firm and tough, only slightly compressible, and resilient; and the colour is a pale yellowish-brown. Dried specimens are light in weight and rather brittle, and of a pale greyish colour.

Skeleton.—The skeleton is resolvable into (i.) a system of condensed, multifibrous axes or “funes,” which ramify dendritically in the midplane of the sponge-lamina, progressively decreasing in stoutness as they ascend,—and which form the midribs, as it were, of the denser strips of the lamina above referred to; and

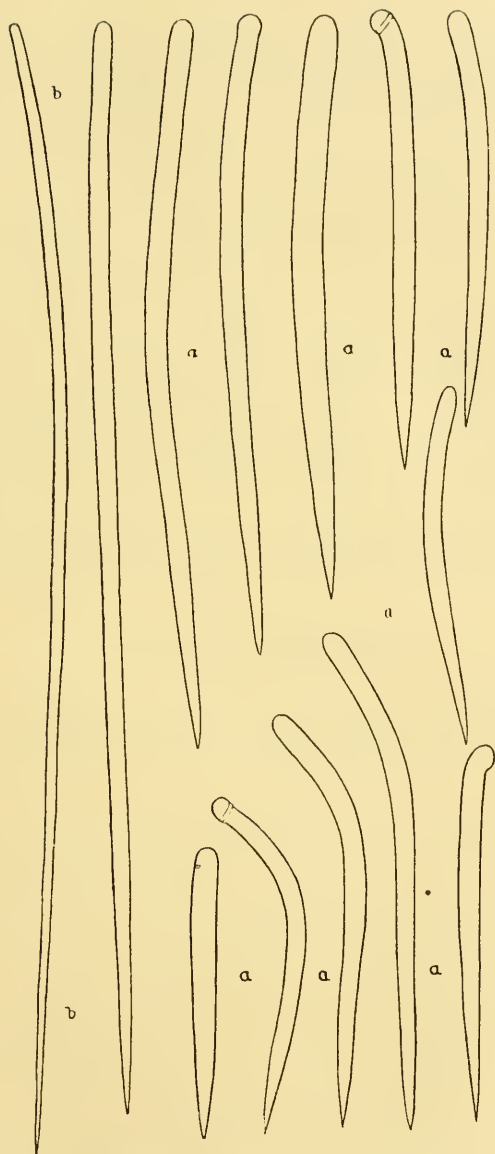
(ii.) of numerous, highly plumose, usually branched, short secondary fibres, which proceed off from the former, apparently from all sides thereof, and run upwards and gradually outwards to the surface. Towards the margin of the sponge, the funes dissolve ultimately into similar plumose fibres (Pl. xxxvii., fig.3), and the skeleton in this region accordingly is composed entirely of such (Pl. xxxvii., figs.1, 2); these fibres are composed of a compact stout core (seldom less than 200μ and frequently surpassing 400μ in diameter) of longitudinally disposed spicules, cemented together by a relatively somewhat small amount of spongin, and of rather numerous, usually very obliquely (often nearly or quite perpendicularly) directed, outwardly-projecting or "echinating" spicules of similar kind, the number of which is greatest towards the outer extremities of the fibres. The echinating spicules of immediately adjoining fibres usually intercross with one another, and very often, where two fibres lie sufficiently close together, the points of some of the spicules of each of them become embedded in the spongin of the other; occasionally, one or a few together of these connecting spicules become invested with a sheath of spongin, and a connecting fibre is thus formed, but such connections are comparatively rare. Megascleres scattered between the fibres are relatively few, and in part are much longer and slenderer than those forming the fibres. The funes are composed each of a dense, irregular plexus of stout, mostly non-plumose fibres with closely compacted spicules arranged usually in a more or less disorderly fashion, and cemented by a relatively small amount of spongin, which does not form an external sheath: the outermost-lying spicules of the fibres, indeed, are usually almost or quite free from spongin. Towards the older parts of the sponge, the meshes of the plexus tend to become obliterated, and the skeleton has the appearance of consisting of a confused mass of spicules. The formation of the plexus appears to be brought about by the continued addition of spicules to, and also in between, the plumose fibres of the original skeleton.

Trichodragmata are scattered fairly plentifully through all

parts of the sponge, including the dermal membrane, but are nowhere extremely abundant: within the funes they are rather scarce. Singly scattered trichites in moderate number also occur, but are difficult to perceive owing to their extreme tenacity. The dragmata are unusually slender, and are often notably longer than the individual trichites composing them.

Megascleres.—(i.) The styli composing the fibres are almost invariably more or less curved, and are, without exception, evenly rounded at the base and of uniform or nearly uniform diameter therefrom to beyond the middle of their length, whence they taper gradually to a sharp point. Their curvature, as a rule, is slight to moderate, and most frequently is confined to the basal moiety of the spicule, but it varies in degree very considerably, and when most pronounced is usually somewhat angulate. Quite commonly in the case of the smaller specimen, much less frequently in the larger, the basal part of the shaft, at a variable distance from the extremity, is more or less sharply curved or bent to one side; occasionally such spicules have the form of rhabdostyli. In the latter, or typical specimen, a notable proportion (numbering between 25 and 50 per cent. of the spicules) exhibit a faint annular swelling close to the basal end, at a distance therefrom varying from 15 to about 50μ ,—the distance usually being greatest, and the annulation less distinct, in the case of the longest spicules; in some of the shorter spicules, the annular swelling is replaced by a slight basal inflation, the spicule becoming a subtylostyle. In the case of the smaller specimen, this peculiarity is exceedingly rare. In the typical specimen, also, the spicules increase in stoutness towards the base of the sponge, attaining in proximity to the stalk a maximum diameter of 45μ ; whereas in the uppermost regions thereof, and throughout all parts of the other specimen, their diameter is at most 33 or 34μ . Their length is about the same in both specimens,—ranging from about 350μ (but seldom less than 400 or 450μ) to somewhat above 900μ .

(ii.) The longer and slenderer styli, occurring only between the fibres, and relatively few, are generally straight or (in comparison



Text-fig. 16.—*Dragmatocia variabilis*. a, megascleres of the fibres;
b, interstitial megascleres.

with their length) but slightly curved, often somewhat flexuously; and with extremely rare exceptions are unprovided with a sub-basal annular inflation: otherwise, in shape, they are similar to the preceding, with which they form a continuous series. In the typical specimen, they range from somewhat less than 1000 to upwards of 1500 μ (rarely to nearly 1600 μ) in length, and up to 18 μ in diameter, spicules between 900 and 1000 μ in length being comparatively rare; in the other specimen, they are of equal stoutness, but seldom surpass 1250 μ , and very rarely if ever attain to more than 1400 μ in length, while individuals between 900 and 1000 μ long are comparatively frequent.

Microscleres.—The trichites, both composing the dragnata and scattered singly, are very slender, always less than 0.5 μ in diameter, and vary in length from 75 to 110 μ ; they are very frequently curved or flexuous. The dragnata are seldom as much as 5 μ in diameter, and as a rule they are very compactly composed and somewhat fusiform in shape; they are often much longer than the trichites, occasionally attaining a length of 200 μ .

EXPLANATION OF PLATES.

Plate xxix., fig. 4.

Fig. 4.—*Allantophora plicata* Whitelegge; showing the skeleton (photographed by transmitted light) of portion of a lamella of the type-specimen, the lamella varying in thickness from 1.8 mm.: (nat. size).

Plate xxx.

Fig. 1.—*Allantophora plicata* Whitelegge; portion of a spirit-specimen; ($\times \frac{5}{8}$).

Fig. 2.—*A. plicata* Whitelegge; portion of a lamella of the partially macerated, dried type-specimen; (nat. size).

Fig. 3.—*A. plicata* Whitelegge; an entire lamella of a dry, washed-out specimen, showing the texture of the skeleton; (nat. size).

Figs. 4, 5.—*A. victoriana*, sp. nov.: specimens of massive form (cf. Pl. xxxi., fig. 3); ($\times \frac{5}{12}$).

Fig. 6.—*A. ciocalypoides* Dendy; a submassive, digitate specimen, attached to a stone; ($\times \frac{5}{12}$).

Fig. 7.—*A. ciocalypoides* Dendy; a semi-encrusting specimen, growing upon a stone; ($\frac{5}{12}$).

Fig. 8.—*A. ciocalypoides*, var. *reducta*, var. nov.; ($\times \frac{5}{12}$).

Plate xxxi.

Allantophora victoriana, sp.nov.

- Fig.1.—Skeleton (photographed by transmitted light) as it appears in a thick vertical slice of an entire massive specimen; (nat. size).
 Fig.2.—Skeleton of a moderately thick vertical slice of the type-specimen; (nat. size).
 Fig.3.—Skeleton (photographed by transmitted light) of portion of a digitate specimen, extending from the base upwards into two digitiform processes; ($\times 1\frac{1}{3}$).
 Fig.4.—Digitate specimen; (nat. size).

Plate xxxii.

Allantophora victoriana, sp.nov.

- Fig.1.—Portion of a longitudinal mesial section of the skeleton of a digitiform process, showing the axial region, the radiating main fibres, and the connecting fibres; ($\times 9$).
 Fig.2.—Portion of a transverse section of the skeleton of a digitation, showing the paucity of the connecting fibres in the transverse plane; ($\times 9$).
 Figs.3, 4, 5.—Portions of the skeleton (of the two massive specimens), showing the pattern of the reticulation formed by the connecting fibres.

Plate xxxiii., figs. 1-5.

- Figs. 1, 2.—*Sigmaicinella australiana* Dendy; ($\times 1\frac{1}{2}$).
 Fig.3.—*S. australiana* Dendy, (? var.); ($\times 1\frac{1}{2}$).
 Fig.4.—*S. riminalis*, sp.nov.; ($\times 1\frac{1}{2}$).
 Fig.5.—*Sigmaicia flabellata* Carter; ($\times 1\frac{1}{2}$). [The oscula-like pits on the surface are due to an epizoid Zooantharian.]

Plate xxxiv.

- Fig.1.—*Sigmaicinella australiana* Dendy; longitudinal mesial section of the skeleton of portion of a branch; ($\times 13$).
 Fig.2.—*S. dendroides* Whitelegge; longitudinal mesial section of the skeleton of portion of a branch; ($\times 13$).

Plate xxxv.

Sigmaicinella riminalis, sp.nov.

- Fig.1.—Longitudinal mesial section of the skeleton of the terminal portion of a branch; ($\times 14$).
 Fig.2.—Longitudinal mesial section of a branch; ($\times 14$).

Plate xxxvi.

- Fig.1.—*Sigmaicinella riminalis*, sp.nov.; longitudinal median section of the skeleton of the stalk; ($\times 14$).

- Fig.2.—*Sigmaxia flabellata* Carter: (portion of a) longitudinal section of the skeleton perpendicular to the plane of the sponge-lamina; ($\times 3$).
- Fig.3.—*Sigmaxia flabellata* Carter: portion of the section shown in the preceding figure, more highly magnified; ($\times 13$).

Plate xxxvii.

Draymaxia variabilis Whitelegge.

- Fig.1.—Skeleton as shown in a thin section parallel to and in the midplane of the sponge-lamina at its upper margin; from a typical specimen; ($\times 15$).
- Fig.2.—Skeleton as shown in a thin longitudinal section perpendicular to the sponge-lamina at its upper margin; from a typical specimen; ($\times 15$).
- Fig.3.—Skeleton (of an entire piece of the sponge-lamina) showing the arrangement of the dense multi-fibrous axes or "funes" and their ultimate resolution into single fibres; ($\times 1\frac{1}{2}$).

Plate xxxviii., figs.1-4.

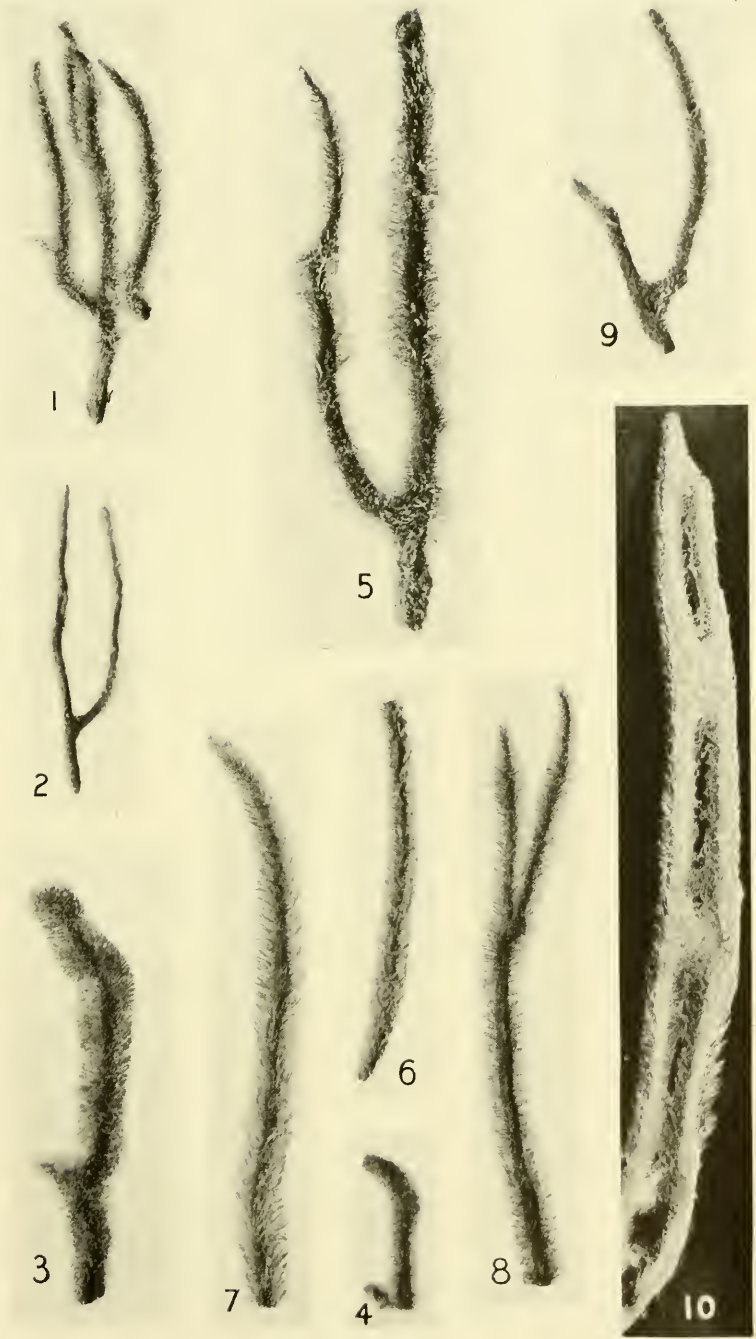
- Figs.1, 2, 3, 4.—*Allantophora victoriana*, sp.nov.; photograph of portions of the surface of different specimens, showing the mode of disposition of the dermal pores.



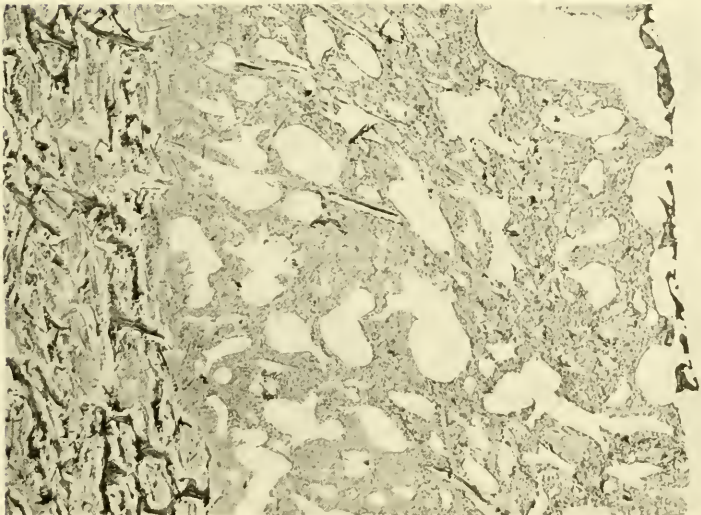
Trachycladus spp.



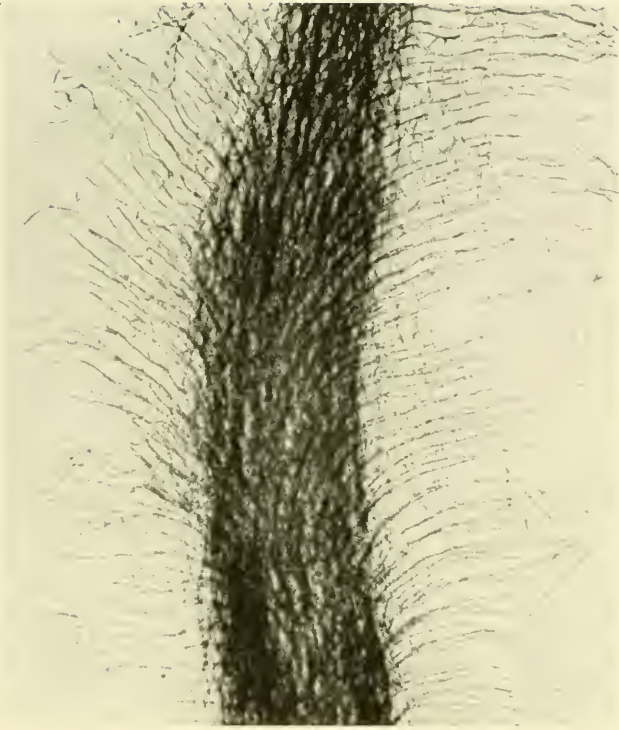
Trachycladus spp.



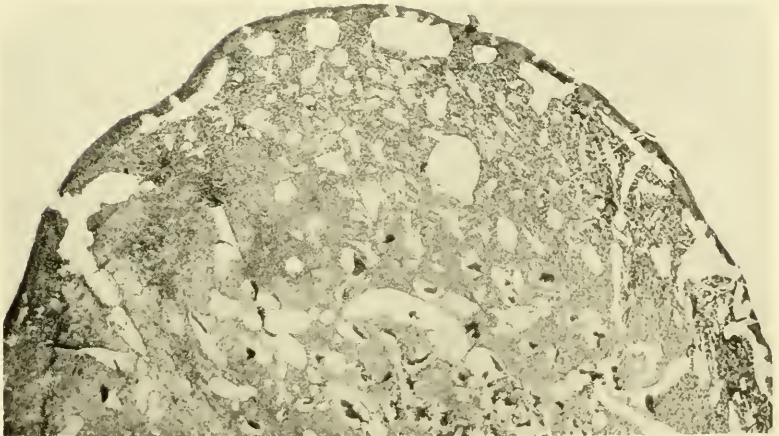
Trachyladus spp.



Trachycladus formosus, n.sp.



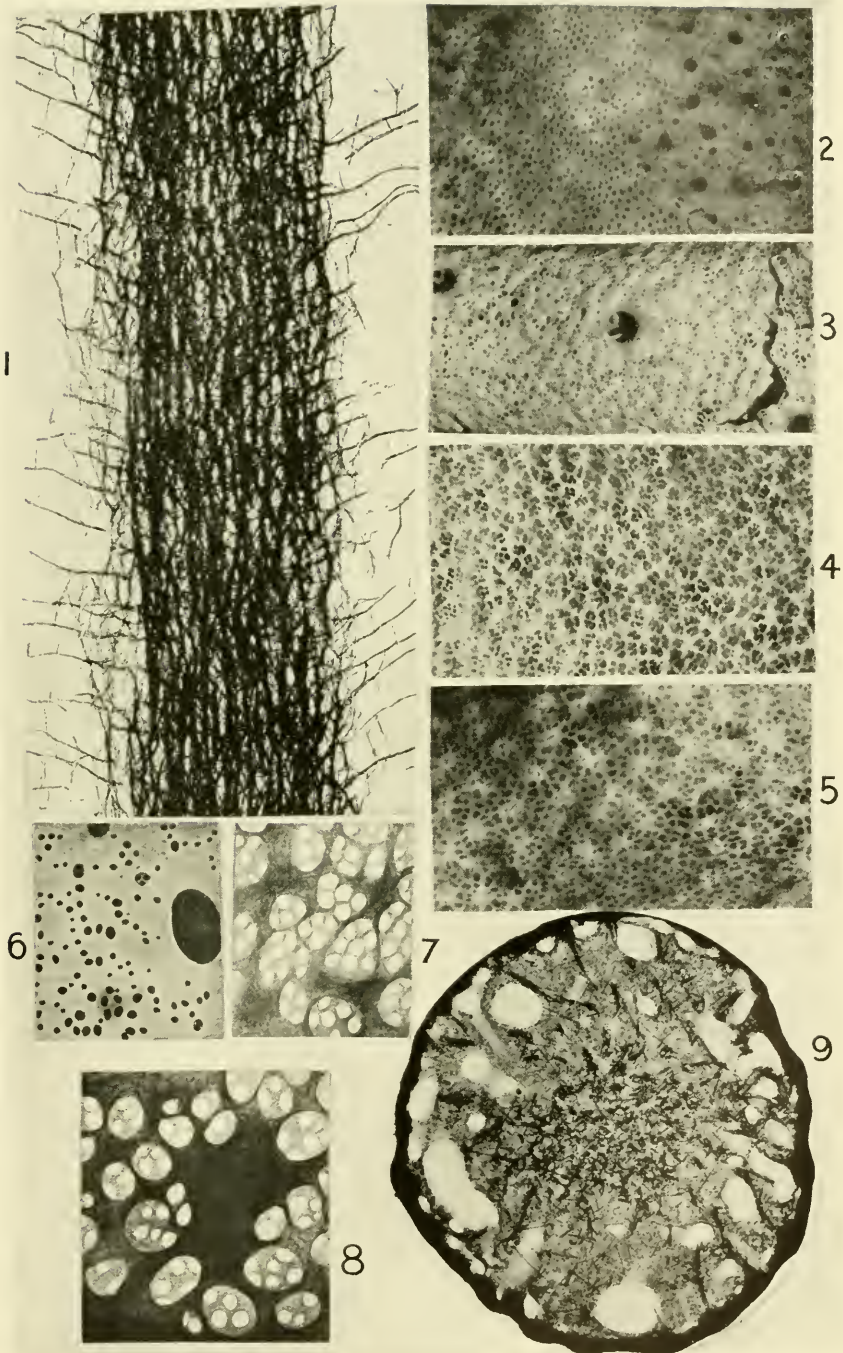
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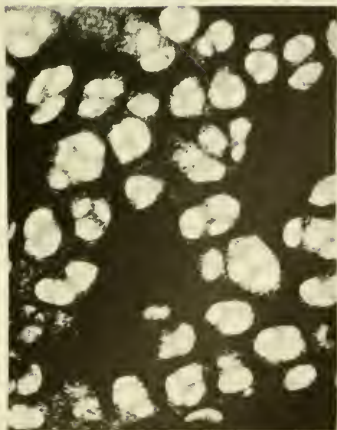
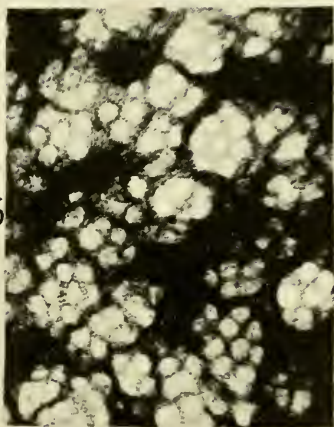
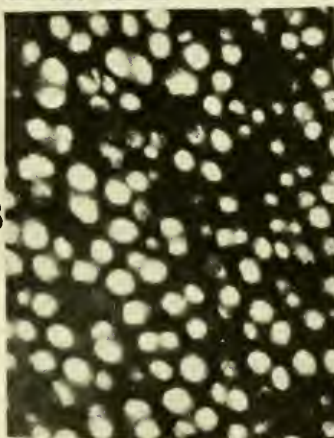
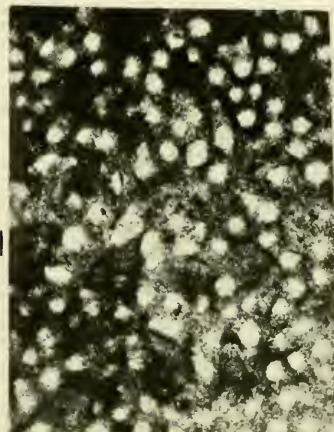
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1. *Trachycladus reteporosus*, n.sp.

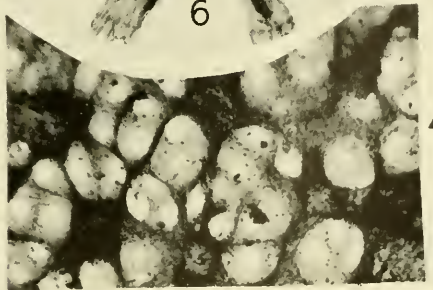
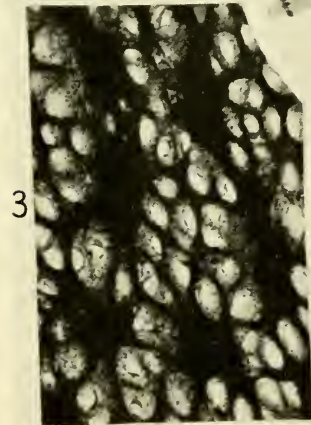
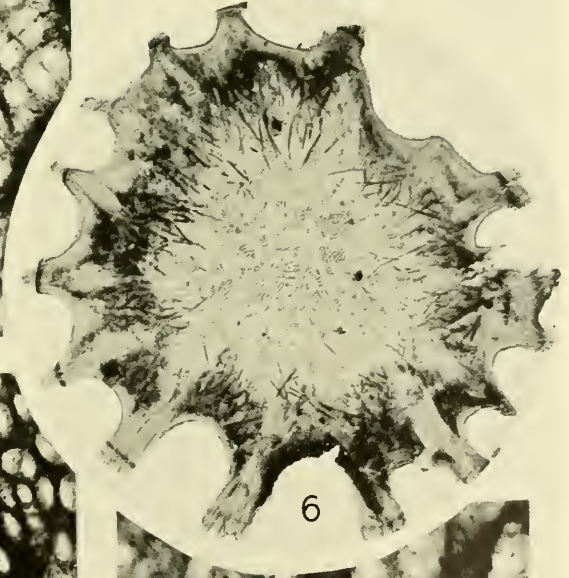
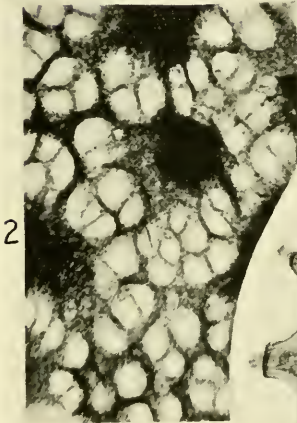
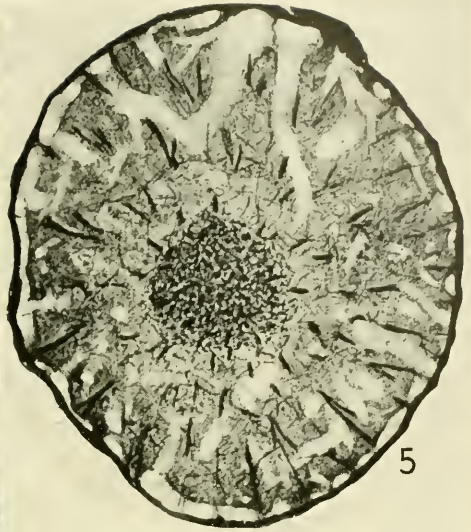
2. *T. clavatus*, n.sp.



Trachycladus spp.



Trachycladus spp. ; showing the different arrangement of the dermal pores ($\times 40$).



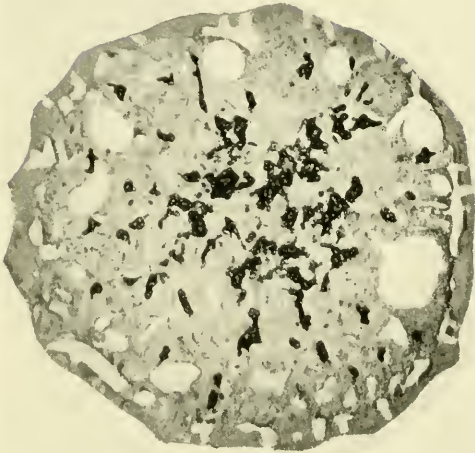
Trachycladus spp.



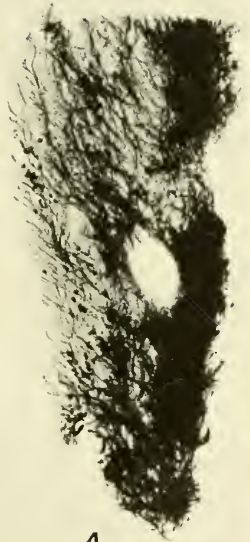
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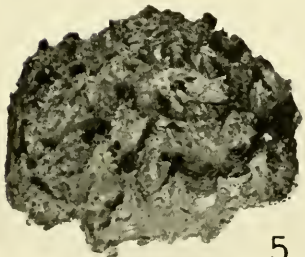
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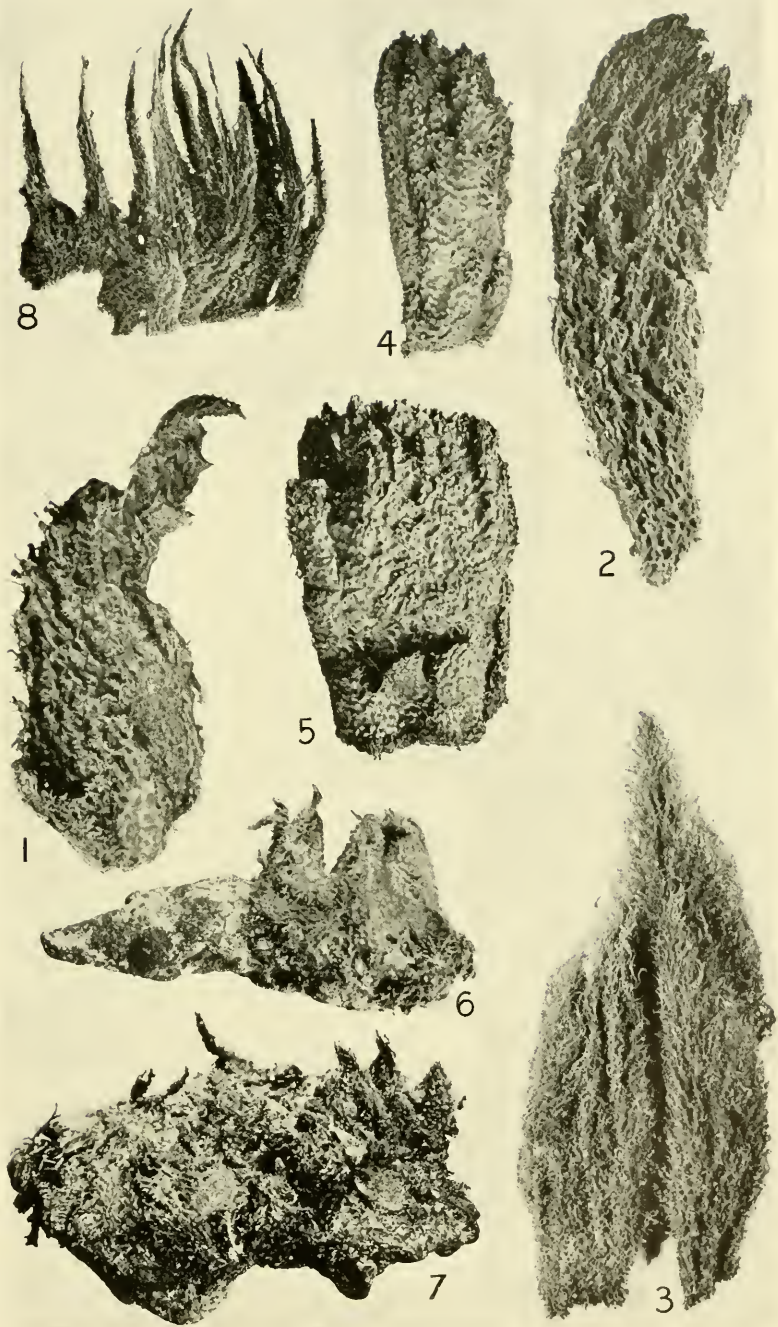


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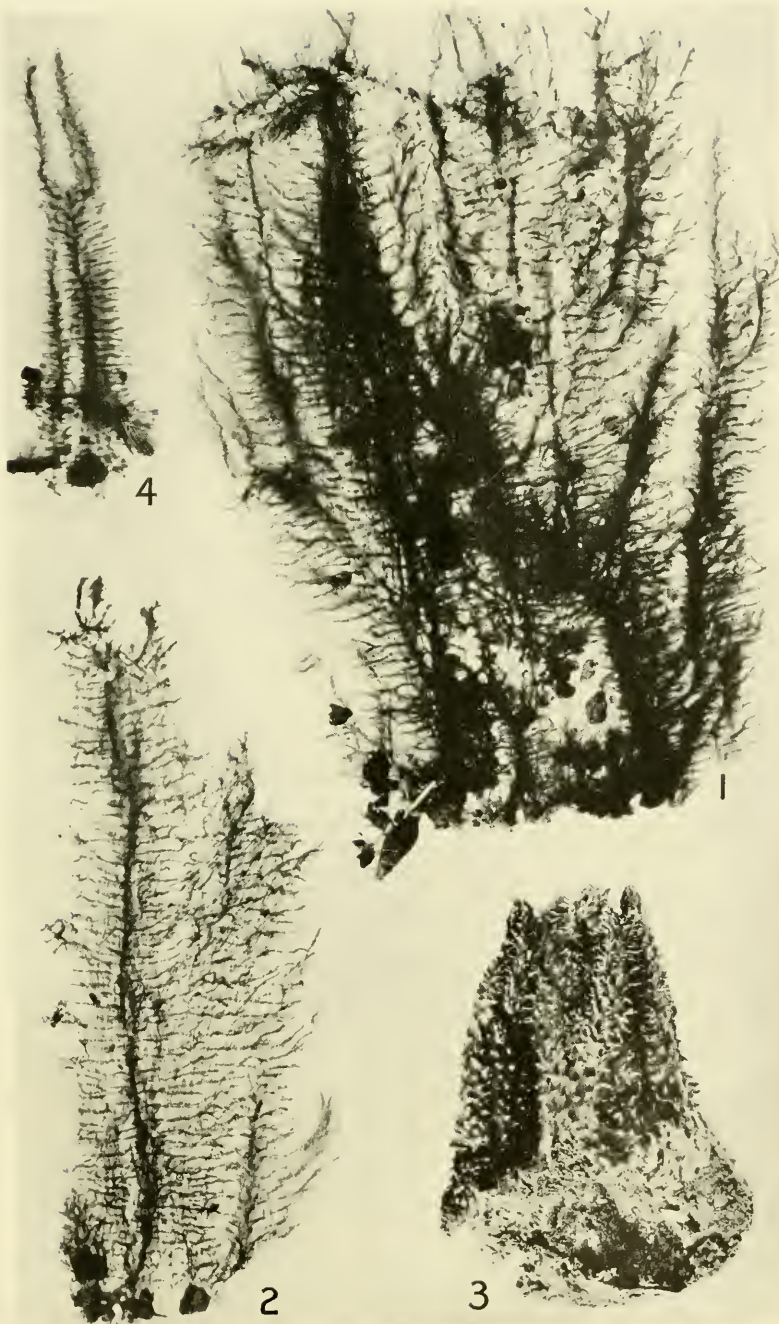


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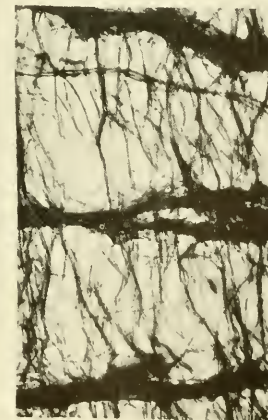
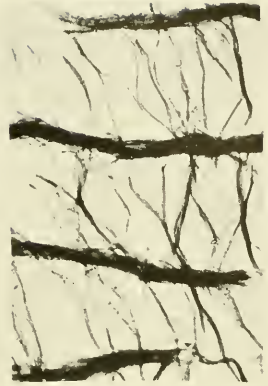
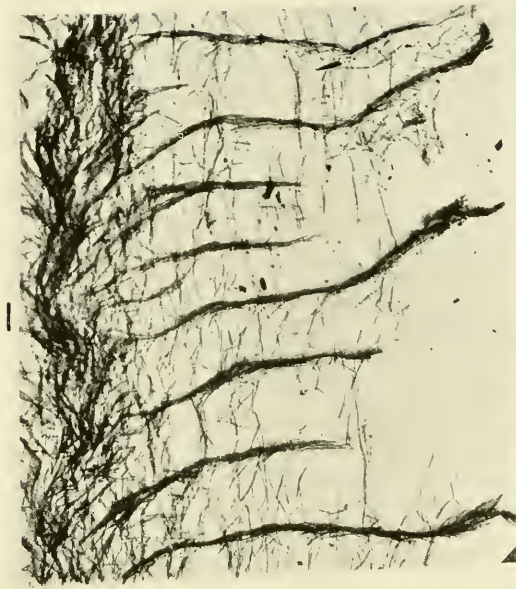
1. *Trachycladus digitatus* var. *clavatus*. 2. *T. ceteporosus*. 3. *Rhaphoxya typica*.
 4. *Allantophora plicata*. 5. *Desmoxya lunata*. 6. *Higginsia coralloides* var. *massalis*.



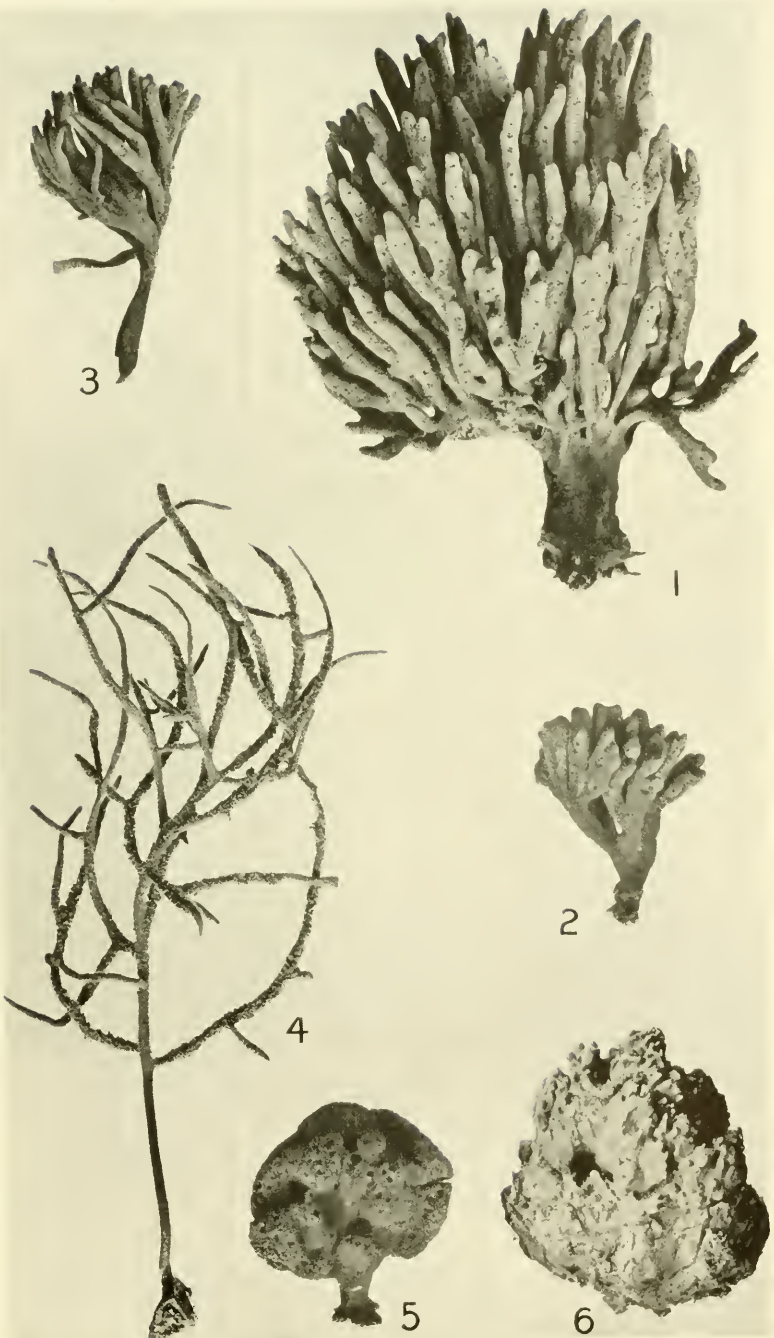
Biemna (Allantophora) spp.



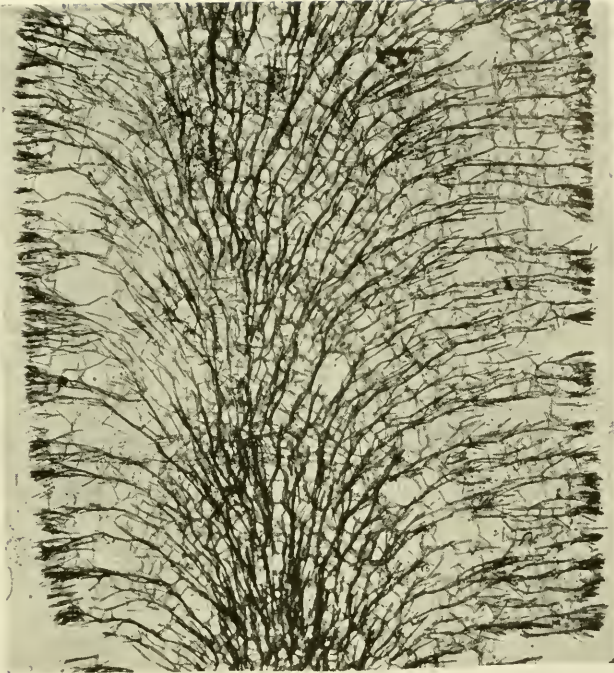
Biemna (Allantophora) victoriana, n.sp.



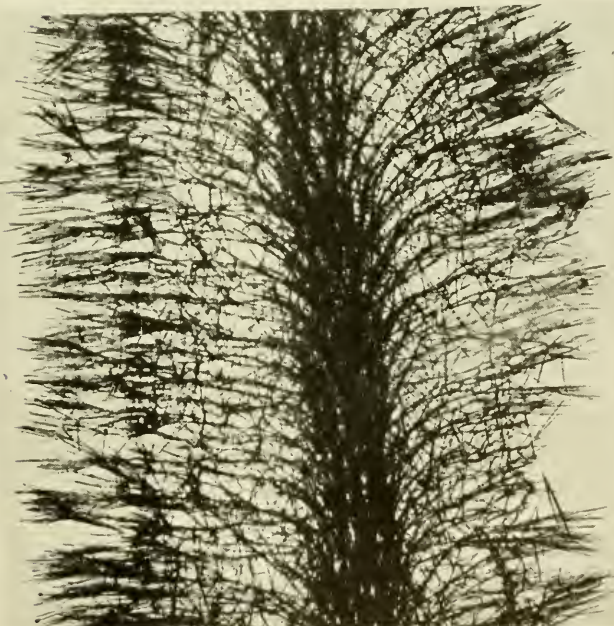
Biemna (Allantophora) victoriana, n.sp.



Sigmariella; *Sigmata*, n.g.; *Rhaphospt*, n.g.



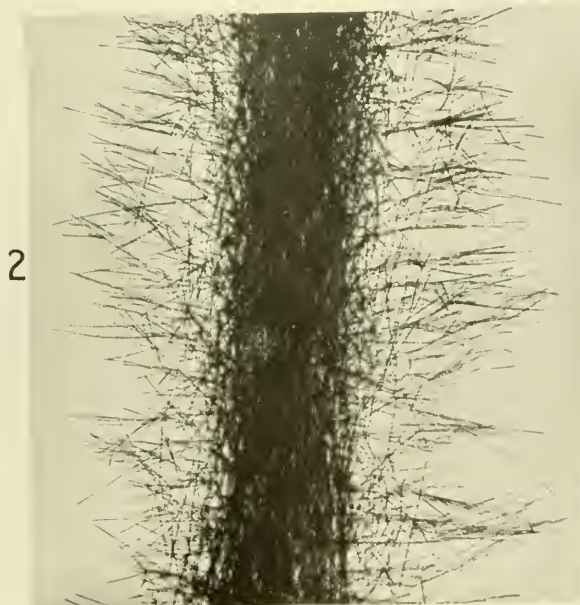
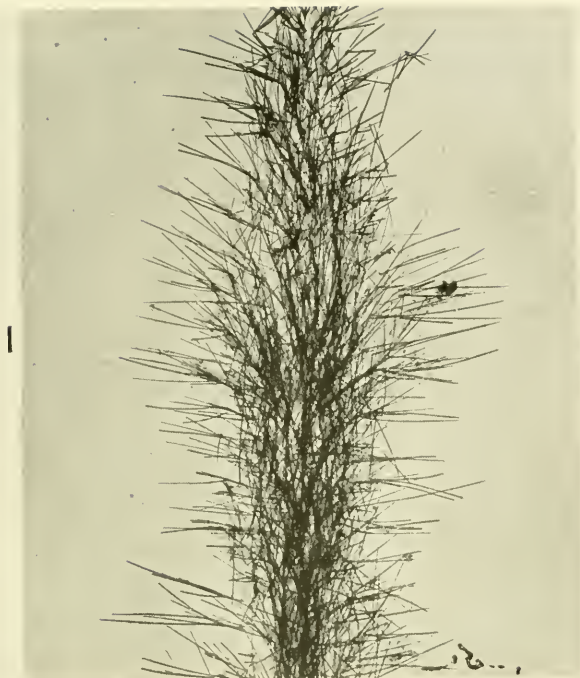
1



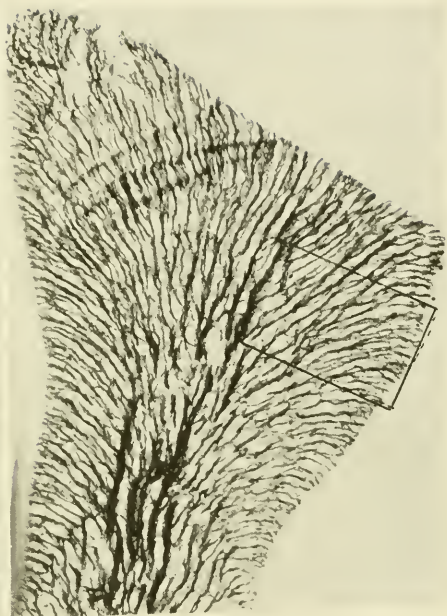
2

1. *Stigmacinella australiana* Dendy.

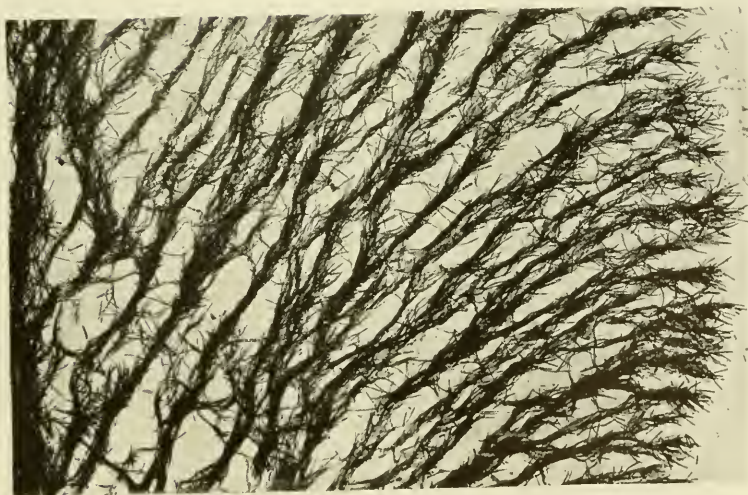
2. *S. dendroides* Whitelegge.



Sigmacinella viminalis, n.sp.



2



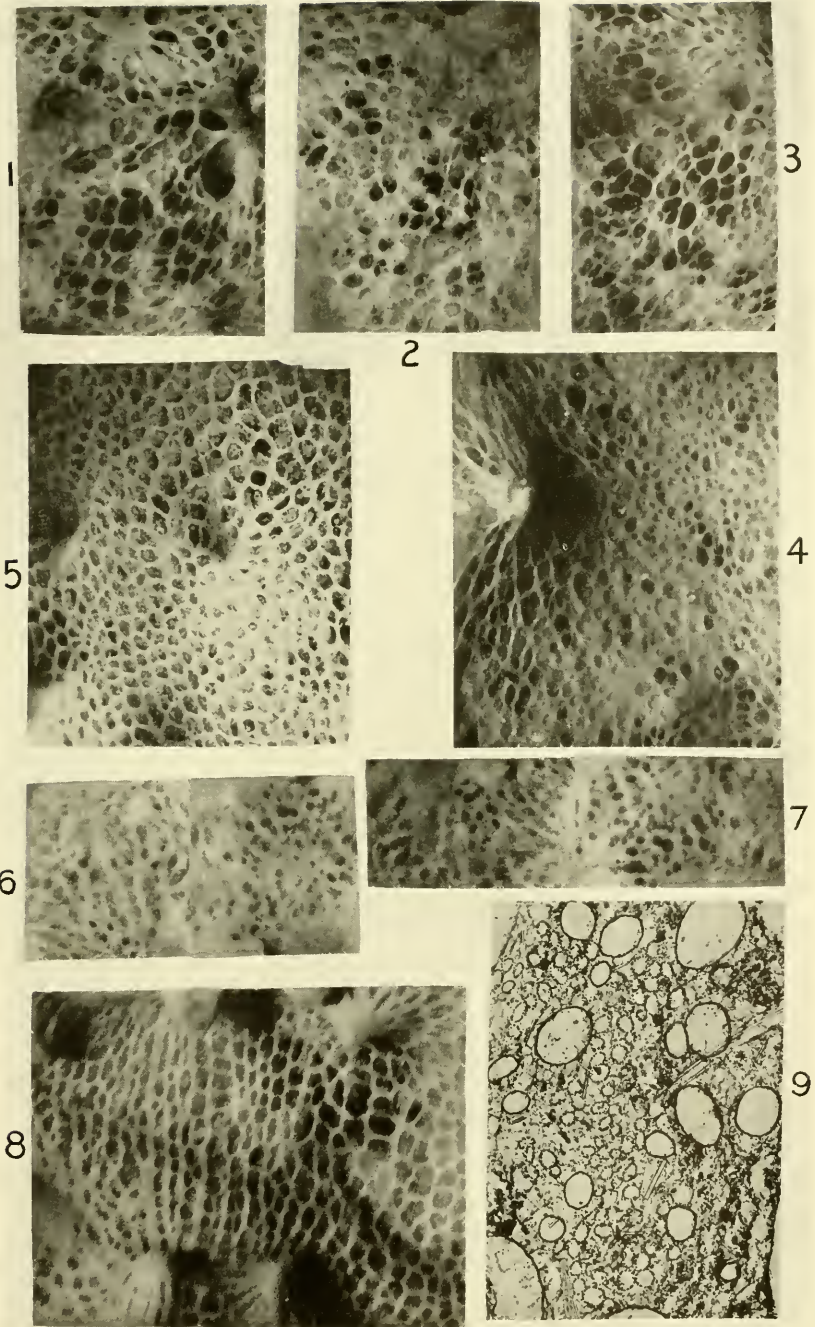
3

1. *Sigmasinella rimianalis*, n.sp.

2-3. *Sigmacia flabellata* (Carter).



Draymania variabilis (Whitelegge).



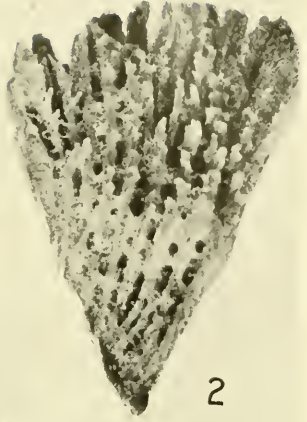
1-4. *Allantophora plicata*. 5. *Desmocyra lunata*. 6-7. *Higginsia coralloides* var. *massalis*.
8-9. *Rhaphosya typica*.



1



3



2



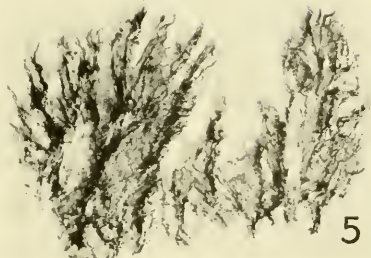
4



7



6

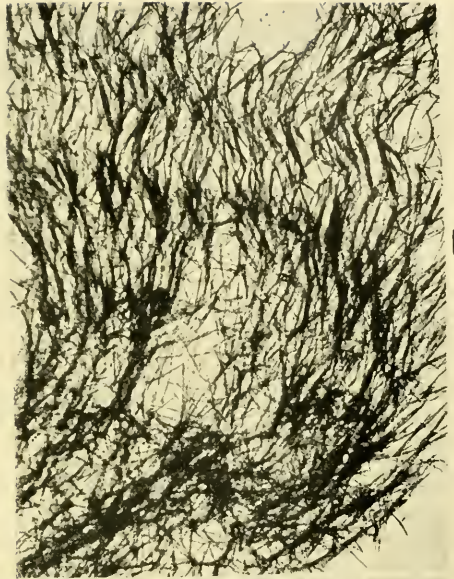
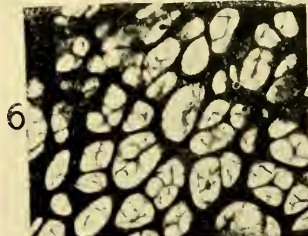
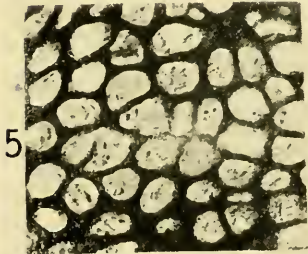
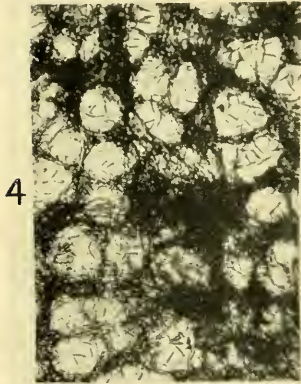


5

1-3. *Higginsia*.

4-5. *Rhaphosya*.

6-7. *Trachycladus*.

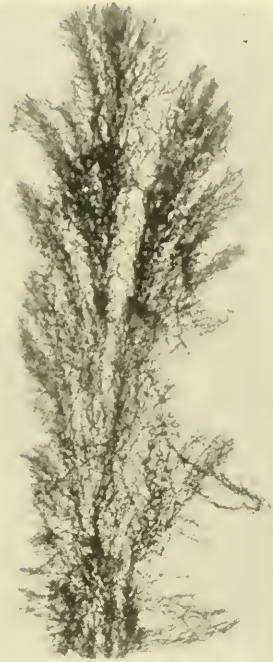


1-4. *Higginsia*.

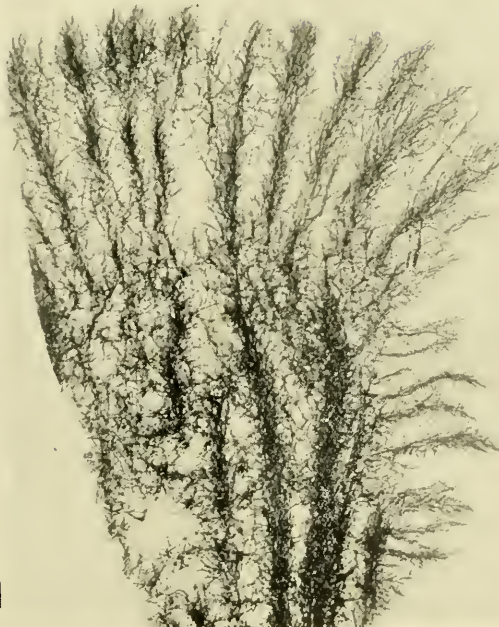
5-6. *Allantophora*.



2



3

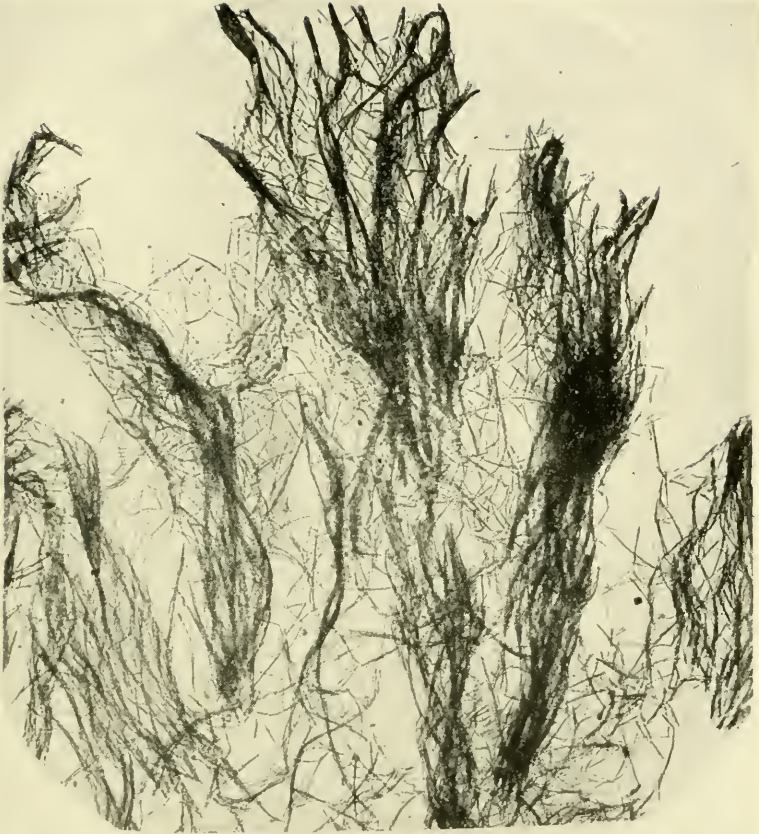


1

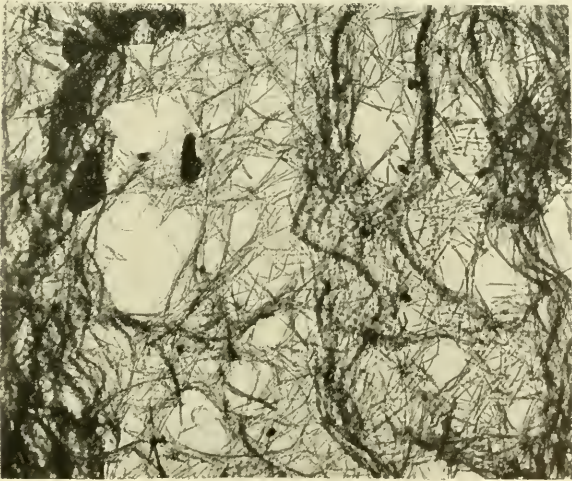
1-3. *Higginsia coralloides* var. *scabra*.



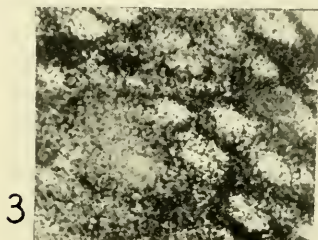
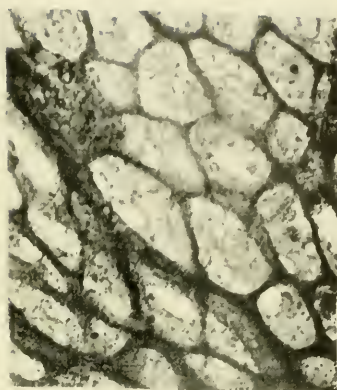
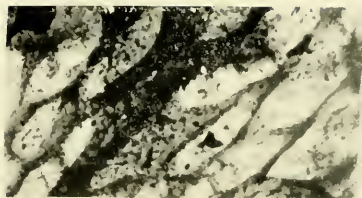
1-2. *Rhaphoxia typica*, n. sp.



2



1-2. *Rhabdomya (?) pallida* Dendy.



2

3



4

1-2. *Rhaphoxya typica*, n.sp.

3. *R. (?) pallula* Dendy.

4. *Desmorya lunata* Cart.