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REPORTS on the MARINE BIOLOGY of the SUDANESE RED SEA, from Collections made by CYRIL CROSSLAND, M.A., B.Sc., F.Z.S. (Communicated, with an Introduction, by Prof. W. A. HERDMAN, D.Sc., F.R.S., F.L.S.)—XIX. REPORT on the SPONGES collected by Mr. CYRIL CROSSLAND in 1904–5. Part II. NON-CALCAREA. By R. W. HAROLD ROW, B.Sc., F.L.S. From the Zoological Laboratory, King's College, London.

(PLATES 35–41 and 26 Text-figures.)

[Read 15th December, 1910.]

### INTRODUCTION.

THE present report deals with 77 species and varieties, belonging to 44 genera, of Non-Calcareous Sponges, and is the second (and concluding) part of the report on the Red Sea sponges collected by Mr. Crossland in the years 1904–5. The TRIAXONIDA are not represented in the collection, doubtless because the specimens were obtained entirely from coastal waters, and not from the deeper parts of the Red Sea, where Hexactinellid sponges are known to occur, Schulze having described three species from this region. The other orders of the NON-CALCAREA are all represented in the following proportion :—

MYXOSPONGIDA, 2 species.

TETRAXONIDA, 49 species, of which 24 are new, including 2 new genera.

EUCERATOSA, 26 species, of which 7 are new, including 2 new genera.

The classification adopted in this report is based upon that of Prof. Dendy (11), in which the NON-CALCAREA are divided into 4 orders of equal importance, viz., MYXOSPONGIDA, TRIAXONIDA, TETRAXONIDA, and EUCERATOSA, the last three groups, which differ from each other in the type of their skeleton, being each derived separately from the askeletous MYXOSPONGIDA.

In classifying the Tetraxonida, Prof. Dendy recognises 3 "Grades," TETRACTINELLIDA, MONAXONELLIDA, and LITHISTIDA. These groups are not considered to be necessarily monophyletic in origin, but he looks upon them as convenient divisions for classificatory purposes, owing to the very easily recognisable characters by which they are distinguished from each other. He then further divides his grades as follows :—

#### Order TETRAXONIDA.

##### A. Grade Tetractinellida.

Sub-Order 1. HOMOSCLEROPHORA.

„ 2. ASTROPHORA.

„ 3. SIGMATOPHORA.

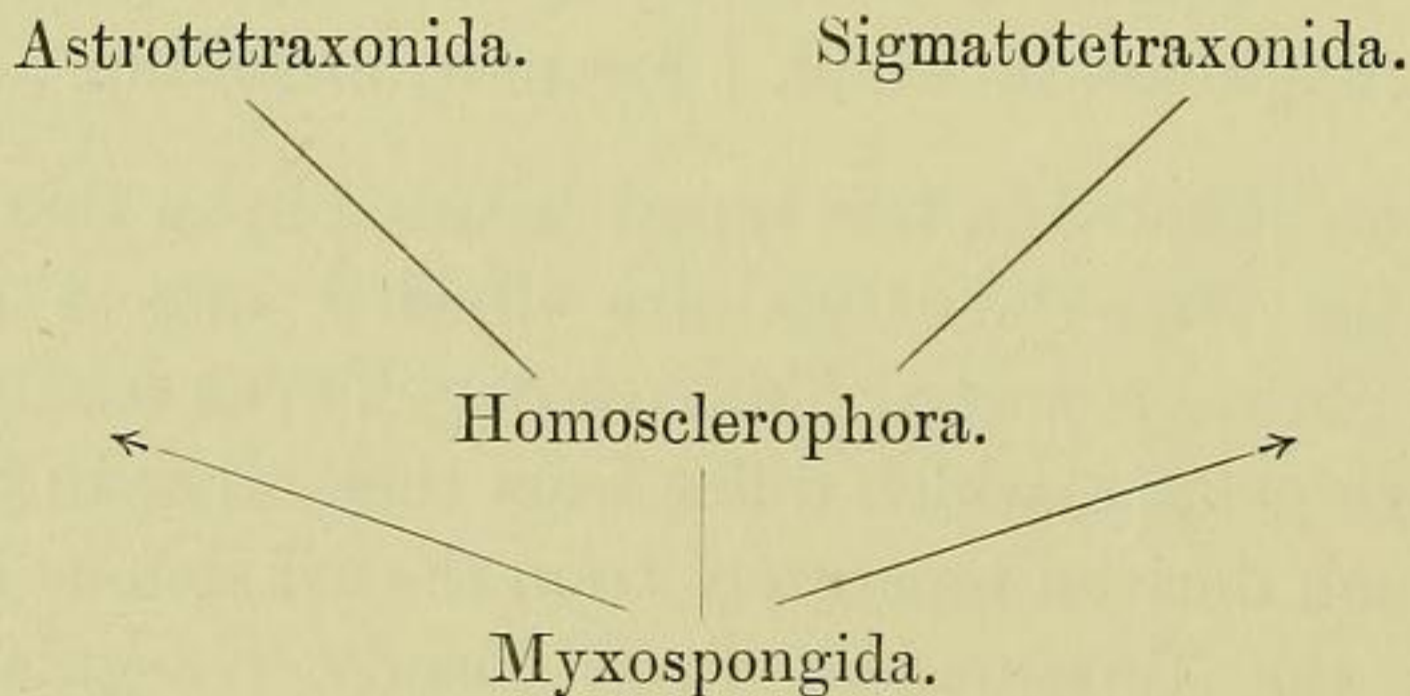
B. Grade **Monaxonellida**.Sub-Order 1. **ASTROMONAXONELLIDA**.,, 2. **SIGMATOMONAXONELLIDA**.C. Grade **Lithistida**.

With the Lithistida I do not propose to deal, as there are no species in the collection. Of the other sub-orders, the Homosclerophora do not have their spicules differentiated into mega- and microscleres, the Astrophora and Astromonaxonellida both have microscleres derivable from the aster, and the Sigmatophora and Sigmatomonaxonellida both have microscleres derived from the sigma as the original type. Also it is considered that the Astromonaxonellida are derived from the Astrophora, and the Sigmatomonaxonellida from the Sigmatophora.

In this article I propose to follow the modification of this proposed by Hentschel (15), who abandons the "Grades" TETRACTINELLIDA and MONAXONELLIDA completely, and divides the whole of the TETRAXONIDA (except the LITHISTIDA, which he does not deal with) into 3 sub-orders as follows:—

Order **TETRAXONIDA**.Sub-Order 1. **HOMOSCLEROPHORA**.,, 2. **ASTROTETRAXONIDA** (= Astrophora + Astromonaxonellida).,, 3. **SIGMATOTETRAXONIDA** (= Sigmatophora + Sigmatomonaxonellida).

The second and third of these thus form homogeneous and monophyletic groups each immediately derived from the Homosclerophora, thus:—



The complete list of species described in this report is appended.

Order **MYXOSPONGIDA**.Fam. **HALISARCIDÆ**.*Halisarca dujardini*, Johnston.*Halisarca* sp.Order **TETRAXONIDA**.Sub-Order **Homosclerophora**.Fam. **PLAKINIDÆ**.*Placortis simplex*, Schulze.

Sub-Order **Astrotetragonida.**

## Fam. STELLETTIDÆ.

*Pilochrota parva*, n. sp.

## Fam. GEODIIDÆ.

*Geodia micropunctata*, n. sp.

## Fam. EPIPOLASIDÆ.

*Coppatias albescens*, n. sp.*Diastra sterrastræa*, n. g. et sp.

## Fam. TETHYIDÆ.

*Tethya lyncurium*, Linnæus.*Tethya seychellensis* (Wright).

## Fam. SUBERITIDÆ.

*Suberites carnosus*, Johnston.*Pseudosuberites hyalina* (Ridley & Dendy).

## Fam. CLIONIDÆ.

*Cliona celata*, Grant.Sub-Order **Sigmatotetragonida.**

## Fam. TETILLIDÆ.

*Tetilla poculifera*, Dendy.*Paratetilla eccentrica*, n. sp.*Chrotella ibis*, n. sp.

## Fam. HAPLOSCLERIDÆ.

## Sub-Fam. RENIERINÆ.

*Reniera implexa*, O. Schmidt.*Reniera spinosella*, n. sp.*Reniera tabernacula*, n. sp.*Reniera* sp.*Halichondria bubastes*, n. sp.*Halichondria* sp.*Trachyopsis halichondrioides*, Dendy.

## Sub-Fam. CHALININÆ.

*Pachychalina variabilis*, Dendy.*Ceraochalina densa*, Keller.*Chalina minor*, n. sp.*Siphonochalina communis*, Carter.*Siphonochalina tubulosa*, Ridley.*Siphonochalina conica* (Keller).*Spinosella sororia* (Duchassaing & Michelotti).*Spinosella incrustans*, n. sp.

## Sub-Fam. GELLIINÆ.

*Gelliodes poculum*, Ridley & Dendy.

## Sub-Fam. HETEROXYINÆ.

*Anacanthæa nivea*, n. g. et sp.

## Fam. DESMACIDONIDÆ.

## Sub-Fam. ESPERELLINÆ.

*Esperella dendyi*, n. sp.*Esperella euplectellioides*, n. sp.*Esperella fistulifera*, n. sp.

## Sub-Fam. ESPERELLINÆ (con.).

*Esperella suezza*, n. sp.*Esperella erythræana*, n. sp.

## Sub-Fam. ECTYONINÆ.

*Myxilla isodictyalis* (Carter).*Myxilla cratera*, n. sp.*Myxilla tenuissima*, n. sp.*Ophlitaspongia* (?) *arbuscula*, n. sp.*Ophlitaspongia* (?) *horrida*, n. sp.*Ophlitaspongia* (?) *digitiformis*, n. sp.

## Sub-Fam. TEDANIINÆ.

*Tedania assabensis*, Keller.

## Fam. AXINELLIDÆ.

*Hymeniacidon calcifera*, n. sp.*Hymeniacidon zosteræ*, n. sp.*Acanthella aurantiaca*, Keller.*Phakellia donnani* (Bowerbank).*Phakellia palmata*, n. sp.*Ciocalypta tyleri* (Bowerbank).

## Order EUCERATOSA.

## Fam. APLYSILLIDÆ.

*Megalopastas erectus*, n. sp.*Darwinella aurea* (?), Müller.

## Fam. SPONGELIIDÆ.

*Spongelia ædificanda*, n. sp.*Spongelia delicatula*, n. sp.*Psammopemma commune* (Carter).*Dysidea cinerea*, Keller.*Euryspongia lactea*, n. g. et sp.

## Fam. SPONGIIDÆ.

*Heteronema erecta*, Keller.*Duriella nigra*, n. g. et sp.*Hircinia variabilis* var. *typica*, O. Schmidt.*Hircinia variabilis* var. *hirsuta*, O. Schmidt.*Hircinia fasciculata* (Esper).*Hircinia ramosa*, Keller.*Hircinia rugosa*, Lendenfeld.*Aplysina reticulata*, Lendenfeld.*Aplysina inflata*, Carter.(?) *Aplysina purpurea*, Carter.*Aplysina mollis*, n. sp.*Aplysina prætensa*, n. sp.*Cacospongia cavernosa* (Esper).*Phyllospongia radiata* (Hyatt).*Phyllospongia madagascariensis* (Hyatt).*Phyllospongia cordifolia* (Keller).*Euspongia zimocca* (O. Schmidt).*Euspongia officinalis* var. *arabica*, Keller.*Euspongia officinalis* var. *ceylonensis*, Dendy.

All reference to the geographical distribution of these species is deferred until the end of the systematic part of the paper, where a full description of the distribution of the Red Sea species will be found, with a discussion of the relationship of the Red Sea sponge fauna to that of other parts of the world.

Only the most important references are given in the synonymy lists attached to the various species.

My warmest thanks are due to Professor Dendy for the very kind way in which he has placed his knowledge of the Porifera at my disposal during the whole of the work, and also for much valued assistance and advice.

The collection is to be deposited in the British Museum (Natural History Department).

### Class NON-CALCAREA.

Porifera whose skeleton is typically not composed of calcium carbonate.

### Order MYXOSPONGIDA.

Non-Calcareia which are primitively destitute of spicules and horny fibre : with simple canal-system and usually large flagellate chambers.

### Family HALISARCIDÆ.

#### HALISARCA DUJARDINII ?

Synonymy :—

1842. *Halisarca dujardini*, Johnston (17).

There is a single specimen in the collection which has been tentatively identified as this species, though the malpreservation of the material has prevented any very certain identification. It consists of a small cushion-like mass, about 30 mm.  $\times$  15 mm., growing on a piece of coral. The surface appears lined with shallow grooves, which are the external indications of the folding of the choanosome in the sponge. In these grooves doubtless lie the inhalant and exhalant apertures, though definite oscula and pores have not been made out. Large irregular inhalant or exhalant canals always occur immediately beneath these grooves.

The folding of the choanosome is clearly distinguishable, and chambers of about 260  $\mu$   $\times$  40  $\mu$  are arranged in a single series around the folds. No details of collared cells or canaliculi leading from or to the inhalant or exhalant canals could be made out.

The ectosome is very thin, and apparently not to be distinguished from the mesoglœa of the chamber layer.

The colour in spirit is dirty grey.

*Locality.* We Shubuk (S.E. corner).

*Distribution.* Red Sea, British Coasts, Mediterranean.



(?) HALISARCA sp.

Two mussel-shells occur in the collection covered with an extremely thin film of sponge, which apparently belongs to this genus. The chambers were few in number and very long, and large numbers of embryos occurred in the sponge. No other details could be made out.

The specimens were obtained from a buoy in Suez Harbour.

#### Order TRIAXONIDA.

No Hexactinellid sponges were obtained by Mr. Crossland, but Schulze (27) describes the following three species from the deeper parts of the Red Sea :—

- Aulocystis grayi* (Bowerbank).  
*Aulocystis zitteli* (Marsh & Mayer).  
*Tretocalyx polæ*, Schulze.

#### Order TETRAXONIDA.

Non-Calcareia in which the fundamental form of the spicule is tetraxonid and tetractinellid ; the spicules may, however, be more or less reduced, and also to a greater or less extent replaced by spongin or even sand.

##### Sub-Order HOMOSCLEROPHORA.

Tetraxonida in which megascleres and microscleres are not sharply differentiated from each other, and no triænes are developed.

##### Family PLAKINIDÆ.

Homosclerophora in which no distinct cortex is developed.

PLACORTIS SIMPLEX, *Schulze*.

Synonymy :—

1880. *Placortis simplex*, F. E. Schulze (28).

1895. *Placortis simplex*, Topsent (34).

A single small somewhat irregular specimen of this sponge was obtained on Suez mud-flats, measuring 15 mm. × 8 mm. The colour is yellowish white. The skeleton is exactly like Schulze's description.

*Distribution.* Red Sea, Mediterranean.

##### Sub-Order ASTROTETRAXONIDA, *Hentschel* (15).

Tetraxonida which possess astrose microscleres, or are derived from such aster-possessing forms.

## Family STELLETIDÆ.

Astrotetragonida with long shafted triænes, without calthrops and without sterrasters.

PILOCHROTA PARVA, n. sp. (Pl. 35. fig. 3, Pl. 36. fig. 6 ; text-fig. 1.)

The only specimen of this new species in the collection is a small, irregular but complete specimen, without any indication of attachment, and measuring about 20 mm. by 15 mm.

Several prominences and protuberances occur on the sponge, and it is quite impossible to distinguish an upper or lower surface. Two comparatively large oscula occur on the specimen, one near each end of the sponge, and each is somewhat oval in shape. The larger measures 1.2 mm. in its longest diameter and the smaller measures 0.8 mm. The pores are extremely numerous and are thickly distributed over the whole surface. There are no special pore-areas, but the pores frequently lie at the bottom of slight depressions on the sponge surface.

The texture is hard and brittle, and the colour in spirit white.

The surface of the sponge is perfectly smooth, there being no projecting spicules whatever, though slight irregularities and pits occur over the surface.

The cortex is 1.0 mm. thick, and definitely marked off from the choanosome. It contains numerous large subdermal cavities, which are oval in shape, with the long axis of the oval lying vertically in the sponge. Between these cavities occur fan-like groups of spicules composed almost entirely of ortho- and anatriænes, the heads of which lie immediately below the dermal membrane. The rays of these triænes lie nearly always wholly in the cortex, very rarely projecting into the choanosome.

Immediately below the cortex lie the heads of the triænes of the main skeleton, which is radially arranged, but not gathered up into distinct fibres or bundles of spicules. Amongst the triænes lie large numbers of oxea. Both the cortex and the choanosome are filled with enormous quantities of chiasters.

*Spicules.*

## A. Megascleres.

 $(\alpha)$  Orthotriænes. (Text-fig. 1, A.)

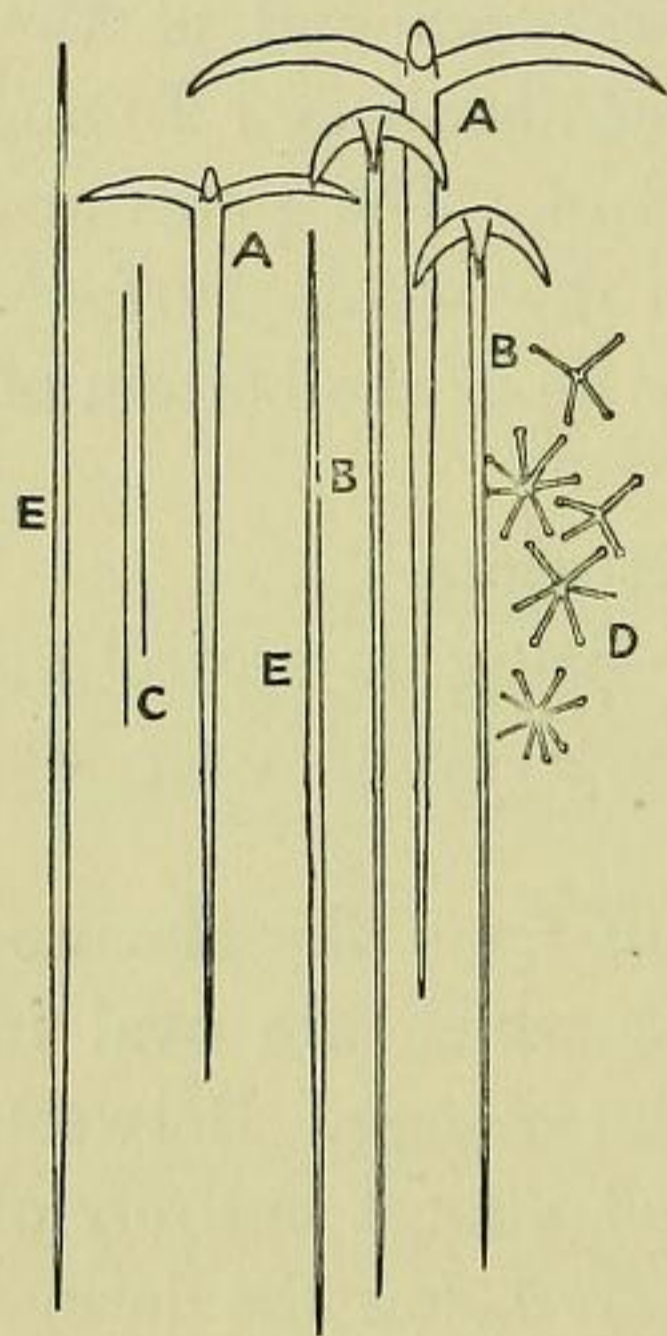
The orthotriænes of the cortex are not to be distinguished from those of the choanosome. The rhabdome is conical, delicately pointed, and is thickest at the head, and quite straight. Its length is from 1.0 mm. to 1.15 mm. and the average thickness is 0.023 mm. The cladi are fairly long, curved from the base onwards, and frequently recurved back again to the horizontal. They reach a length of 0.2 mm. in the largest specimens.

( $\beta$ ) Anatriænes. (Text-fig. 1, B.)

The anatriænes are slender-shafted and but little longer than the orthotriænes. The rhabdome is straight, conical, and very finely pointed; it measures from 1.0 to 1.28 mm. in length, and 0.009 to 0.015 mm. in diameter. The cladi are abruptly recurved, so as to lie parallel with the shaft in their distal portions. They are rather short, not exceeding 0.1 mm. in length, and they are of an equal thickness with the rhabdome at their junction with it.

The sagitta of the head is 0.06 mm. and the chord is 0.055 mm.

( $\gamma$ ) Oxea. (Text-fig. 1, C.)



(i.) The oxea of the main skeleton are very sparse in the cortex, but occur in great numbers in the choanosome. They are straight, thickest in the centre, and gradually tapered to the ends, which are very finely pointed. The oxea vary very much in length, and specimens may be found measuring anything between 1.0 mm. and 2.6 mm. in length. The thickness is, however, fairly constant and averages 0.02 mm.

(ii.) In addition to the large oxea, much smaller specimens, irregularly scattered through the sponge-body, can be found. These are apparently not young forms of the large oxea, but an entirely different spicule, similar to the somal oxea of *Pilocho rota variabilis*, Wilson. They are extremely slender, and almost raphide-like. They measure 0.25 to 0.37 mm. in length, and have a maximum thickness of about 8  $\mu$ .

Fig. 1.—*Pilocho rota parva*.

A, B, C, and E  $\times 60$ ;  
D  $\times 1100$ .

B. Microscleres.

The only microsclere which occurs is a small chiaster, with a very slight centrum and 6–10 rays. The diameter of an average specimen is 0.007 mm.

The present species occupies an intermediate position between several previously described species. These are *P. haeckeli*, Sollas, *P. pachydermata*, Sollas, *P. lendenfeldi*, Sollas, and *P. variabilis*, Wilson. All these species differ from one another in shape, and also to some extent in their spicular measurements. Nor does *P. parva* agree with any of them with sufficient accuracy to be identified therewith, though any one of the spicules of *P. parva* can be almost exactly duplicated in one or other of the above species.

For purposes of comparison I therefore give a table (p. 295) of these five species, with details of the spicular measurements &c.

*Locality.* Suez.

*Distribution.* Red Sea.

	<i>P. parva.</i>	<i>P. haeckeli.</i>	<i>P. pachydermata.</i>	<i>P. tendenfeldi.</i>	<i>P. variabilis.</i>
Locality .....	Red Sea.	Philippines.	Reefs off Tahiti.	E. Moncour I., Bass Str.	Porto Rico.
Shape .....	irregular, massive.	subglobular.	massive, irregularly lobed.	spheroidal, stalked, no apparent osculum.	spheroidal, flattened.
Colour .....	white.	grey.	surface purplish, interior yellowish white.	dark umber-brown.	white to grey-brown.
A. Orthotriæne.					
rhabdome .....	1.0-1.15 × 0.023 mm.	2.18 × 0.55 mm.	1.114 × 0.022 mm.	2.856 × 0.05526 mm.	1.35-1.7 × 0.012-0.024 mm.
cladi, length ...	0.2 mm.	0.238-0.318 mm.	0.12 mm.	.....	0.1-0.25 mm.
B. Anatriæne.					
rhabdome .....	.....	.....	.....	.....	0.5 × 0.004 mm.
cladi, length ...	.....	.....	.....	.....	0.02-0.024 mm.
rhabdome .....	1.0-1.28 × 0.009-0.015 mm.	3.03 × 0.035 mm.	1.35 × 0.0158 mm.	1.75 × 0.0237 mm.	1.53-2.21 × 0.02-0.024 mm.
cladi, length ...	0.1 mm.	0.16 mm.	0.067 mm.	0.1 mm.	0.044-0.084 mm.
sagitta .....	0.06 mm.	0.16 mm.	0.055 mm.	0.095 mm.	0.02-0.08 mm.
chord .....	0.055 mm.	0.16 mm.	0.099 mm.	0.127 mm.	.....
Oxea.					
Chiaster .....	1.0-2.6 × 0.02 mm.	2.07 × 0.040 mm.	1.193 × 0.0178 mm.	2.5 × 0.0434 mm.	1.02-1.6 × 0.012-0.016 mm.
Cortex .....	0.25-0.37 × 0.008 mm.	.....	.....	.....	0.168-0.2 × 0.006-0.008 mm.
	6-10 rays—0.007 mm. in diam.	3-7 rays—0.016 mm. in diam.	5-8 rays—0.006-0.011 mm. in diam.	numerous rays—0.007-0.018 mm. in diam.	about 8 rays—0.012-0.016 mm. in diam.
	1.0 mm. thick, with large subdermal cavities and bundles of triænes between them.	0.8-0.95 mm. thick.	1.0 mm. thick.	0.9 mm. thick, with tangential canals.	0.7 mm. thick.

## Family GEODIIDÆ.

Astrotetragonida in which the characteristic microsclere is a sterraster forming a dense cortical layer.

GEODIA MICROPUNCTATA, n. sp. (Pl. 35. fig. 5, Pl. 40. fig. 24; Text-fig. 2.)

This new species is represented in the collection by several incomplete specimens, all but two of which consist merely of pieces of the sterraster crust, without any of the interior of the sponge. The two specimens in which the choanosome is present as well as the cortex are both apparently fragments broken off from larger individuals. They are irregular and massive in shape, and each presents a relatively large surface of exposed choanosome where they have been torn away, either from their support or from the rest of the specimen. The largest specimen measures about 100 mm. long by 90 mm. wide, and the smaller about 60 mm. by 55 mm.; each of the specimens being about 30 mm. to 35 mm. thick. There is no foreign matter whatever attached to the larger specimen; but the smaller is growing over and partially enclosing a group of mussels (one of which is shown in Pl. 35. fig. 5), and two of the fragments of sterraster crust are also attached to mussels.

The surface of the sponge is gleaming white and is perfectly smooth, no spicules whatever projecting from it. It is pierced by a number of small circular oscula, irregularly scattered over the surface of the sponge and varying in size from 0.2 mm. to 0.8 mm. in diameter. On the larger specimen the oscula are somewhat few and do not grow to any large size, and this is the case with the greater portion of the surface of the small specimen. There occurs on the smaller specimen, however, a portion of the surface of the under side of the sponge, and here the oscula are many in number and of comparatively large size (see Pl. 35). This probably furnishes the explanation of the entire absence of large oscula from the large specimen, as no portion of the under surface is present in that specimen. In many cases there is present a clearly defined oscular sphincter membrane, which is frequently more or less closed. In all

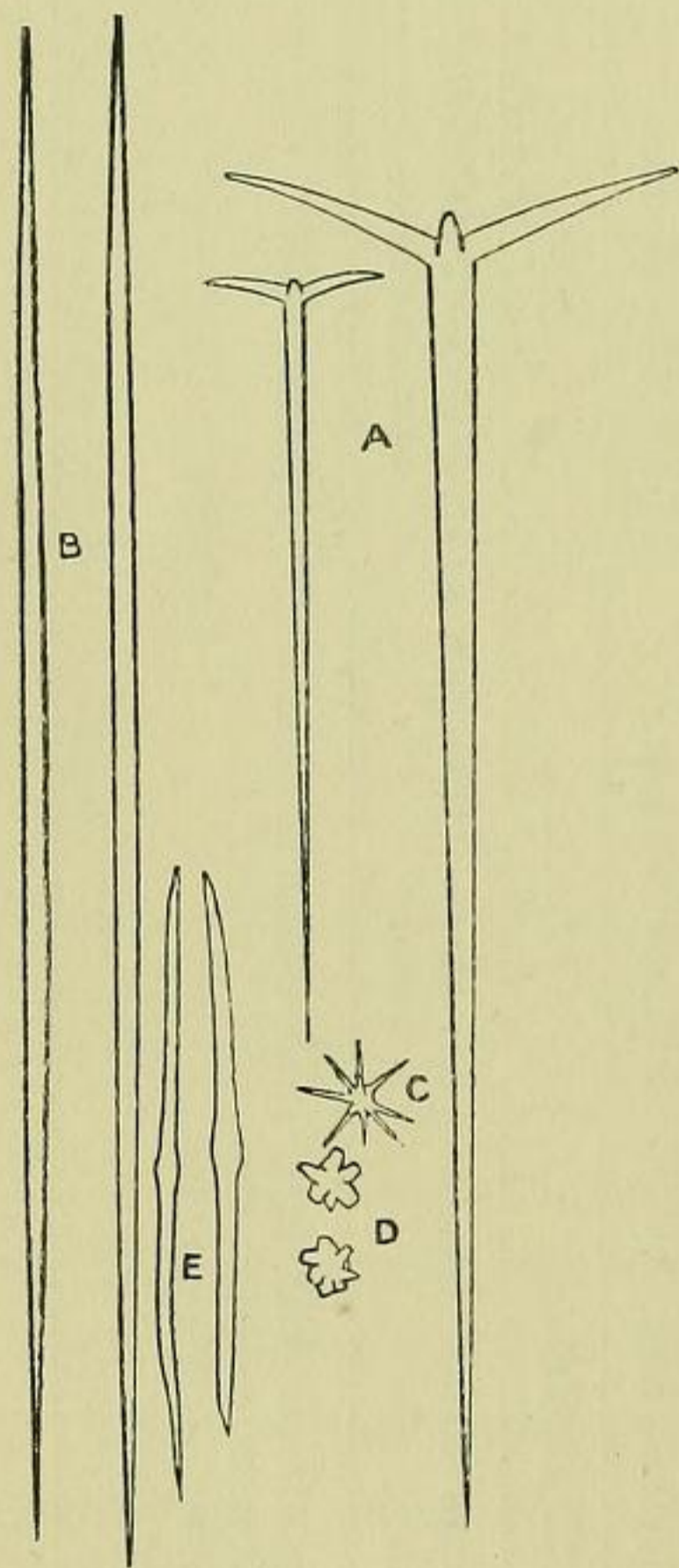


Fig. 2.—*Geodia micropunctata*.  
A and B  $\times 60$ ; C, D, and E  $\times 1000$ .

probability those oscula which do not show this membrane possess it, but in those cases it is rendered invisible by being widely open.

There also occur, scattered over the sponge surface, and apparently no more frequent on the under side of the sponge than on the upper, a number of much smaller apertures, over the great majority of which there stretches a membrane. These are in all probability pore-areas; but microscopical examination of the covering membrane has not revealed any pores, so that these apertures may possibly be closed oscula. The diameter of these small apertures is about 0.1 mm.

The colour in spirit is gleaming white on the outside, and white with a tinge of yellowish grey in the interior.

The ectosome is clearly differentiated into a cortex, which is about 1.0 mm. to 1.2 mm. thick and which is distinctly fibrous in the region below the sterraster crust. Owing to the density with which the sterrasters are packed in the outer portions of the cortex, the character of the cortex cannot be made out in that region. The cellular elements, if there are any occurring in the cortex, were not distinguishable, and the cortex was quite hyaline.

*Skeleton arrangement.* (Pl. 40. fig. 24.)

The cortical skeleton consists of a dermal layer of minute chiasters, very thickly scattered over the whole sponge surface, and especially thickly lining the sides of the vents. Below them lie the sterrasters, which are packed into a solid mass 0.6 mm. to 0.8 mm. thick, extending over the whole sponge surface, and only interrupted at the oscula (and at the presumed pore-areas). The main skeleton is radial, but only partially composed of spicular fibres, large numbers of spicules lying separately in the choanosome. The spicular bundles which do occur are, however, frequently very large, sometimes as much as 0.5 mm. in diameter. They are very deeply packed together, and in the deeper parts of the sponge consist almost entirely of oxea, the heads of the triænes lying either in the deeper parts of the cortex or immediately below it.

*Spicules.* (Text-fig. 2.)

A. Megascleres.

( $\alpha$ ) Triænes. (Text-fig. 2, A.)

There only occurs one form of triæne in this species, an almost typical orthotriæne. The rhabdome is straight, thickest at the junction with the cladi, and gradually tapering to the point. The cladi are somewhat long, as stout as the rhabdome, and very slightly recurved. Like the rhabdome, they also taper from base to point. The heads of the triænes never lie within the layer of sterrasters, but always either in the deeper parts of the cortex or in the more superficial parts of the choanosome. The rhabdome measures

0.77 mm. to 0.9 mm. in length in the largest specimens, and is 0.035 mm. in diameter at the thickest point. The cladi are 0.236 mm. long in full-grown specimens and 0.03 mm. in diameter at the base.

There are present also a few small plagiotriænes, which are apparently young specimens of the regular orthotriænes.

( $\beta$ ) Oxea. (Text-fig. 2, B.)

(i.) The large oxea of the main skeleton are quite straight, and thickest in the middle of their length. They form the main part of the radial skeleton, and the whole of it a little way below the cortex, but they never actually project into the cortex itself. The largest specimens considerably exceed in length the rhabdomes of the orthotriænes, sometimes reaching a length of 1.75 mm., though they do not exceed the triænes in diameter, being usually about 0.031 mm. thick. Oxea may be found in all stages of growth, from quite small specimens up to the largest.

(ii.) Quite distinct from the above oxea, much smaller ones can be found scattered irregularly, and rather sparsely, through the cortex and choanosome. They can be immediately distinguished from small specimens of the oxea of the main skeleton by the fact that they do not lie radially, but are irregularly scattered, quite without orientation. They are much more slender than the larger oxea, and measure 0.2 mm. to 0.24 mm. in length by 0.011 mm. in diameter in the largest specimens.

B. Microscleres.

( $\alpha$ ) Sterrasters.

The sterrasters are almost spherical and, when fully grown, form an almost perfectly solid mass, on the surface of which it is only just possible to distinguish the actines. There is a distinct but not conspicuous hilum. No immature sterrasters could be distinguished in the cortical sterraster-crust; but in the choanosome, where the sterrasters also occur in considerable numbers, the proportion of developing specimens was extremely high.

From this it would seem that the sterrasters are formed in the choanosome and transferred to the cortex; if so, it would indicate a continually increasing thickness of the sterraster-crust, or a continual wearing away of the external regions of the crust, in all probability the latter.

The diameter of the fully formed sterraster is 0.06 mm. to 0.07 mm.

( $\beta$ ) Spherasters. (Text-fig. 2, D.)

The dermal spherasters are extremely small and irregular, about  $5\ \mu$  in diameter, of which the centrum occupies one-half, or  $2.5\ \mu$ , the individual rays being 1.0 to  $1.5\ \mu$  long, as a rule. The spherasters only occur as a dermal layer, and not in the deeper parts of the cortex or choanosome.

( $\gamma$ ) Oxyasters. (Text-fig. 2, C.)

There are typical oxyasters sparsely scattered through the choanosome

and not occurring in the dermal cortex-wall. They measure about 7 to 8  $\mu$  in diameter and possess 6 or 8 rays on the average.

From the above description of the spicules of this species it will be seen to fall into Sollas's subgenus *Dirhabdosa* of the genus *Geodia*.

*Locality.* Three specimens were obtained from a buoy in Suez Harbour, and a fourth specimen was obtained at Khor Dongonab.

*Distribution.* Red Sea.

#### Family EPIPOLASIDÆ.

Astrotetragonida with oxeote megascleres, and usually euasters for microscleres.

*COPPATIAS ALBESCENS*, n. sp. (Pl. 36. fig. 9; Text-fig. 3.)

The present species has been founded upon a specimen of small size. It consists of a flattened lamella of somewhat triangular shape, and appears to have grown in an erect position, attached to a branching coral. The point of attachment is very small, and the sponge gradually increases in width to the summit. It measures 18 mm. high, 12 mm. wide at the top, and has a thickness of about 5–7 mm.

Two oscula occur near the top of the sponge, each possessing a clearly marked oscular membrane, which is partially closed over the osculum in each case. The oscula, when wide open, would measure 2–3 mm. in diameter.

All over the surface of the sponge there occur very large numbers of small pore-areas (see photo, Pl. 36. fig. 9). These pore-areas are nearly always situated at the bottom of very slight depressions, and rarely contain more than two or three pores. Many of the pore-areas in the photograph, in fact, will be seen to contain but a single pore, though a few cases may be seen where six or eight are visible in a single pore-area. The average pore-areas measure from 0.1 mm. to 0.15 mm. in diameter, and the pores themselves are usually not more than 0.05 mm. in diameter.

The sponge is of hard texture, and cannot be bent without breaking.

The colour in spirit is white.

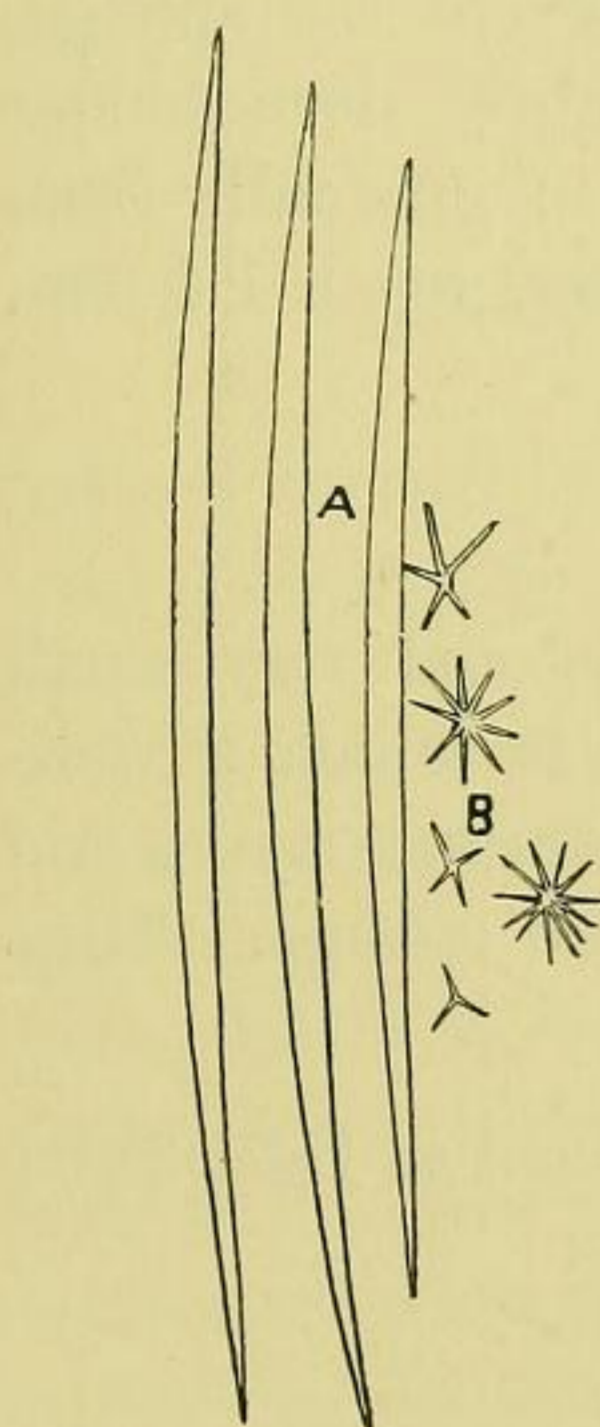


Fig. 3.—*Coppatias albescens*.  
A  $\times$  60; B  $\times$  500.

The ectosome does not appear differentiated into a cortex, but there is present a special ectosomal skeleton in the form of a dense layer of minute oxyasters immediately below the surface of the sponge, and a very dense layer of oxea lying below the asters, which are typically tangential, but lie frequently quite irregularly between the tangential and vertical positions.



The skeleton consists chiefly of bundles of spicules, arranged more or less radially; but large numbers of spicules occur scattered through the sponge, and not bound up into bundles. The spicular bundles are fairly large, averaging 0.3 mm. in diameter, and in the deeper parts of the sponge are closely bound together. Dermal, however, they become somewhat plumose in character, and sometimes lose the appearance of fibres. The megascleres consist wholly of diactinal oxea of one kind; and the oxea of the spicular fibres cannot be distinguished either from those scattered about in the choanosome, or from those of the dermal tangential skeleton. Only one sort of aster is present, a minute euoxyaster.

*Spicules.* (Text-fig. 3.)

A. Megascleres. (Text-fig. 3, A.)

(i.) The somal oxea are typically somewhat curved, sometimes having a more or less definite angle in the middle, more frequently gradually throughout their length. They are thickest in the middle and gradually taper towards the ends. All sizes can be found, from minute raphide-like forms to the full-grown specimens, which measure 0.9 mm. to 1.1 mm. in length by 0.025 mm. to 0.04 mm. in diameter at the thickest part. The measurements of length are given from point to point, and not around the curve.

(ii.) There also occur oxea irregularly scattered throughout the sponge, and mixed with the above, which are rather longer and slightly more slender than the somal oxea. They are also quite straight, and taper gradually from the central point towards each end. When full-grown, they reach 1.4 mm. in length and 0.03 mm. in diameter.

B. Microscleres. (Text-fig. 3, B.)

The only microsclere is a euoxyaster, with pointed rays and very small centrum in most cases; but a very few asters were seen in which a well-defined centrum was discernible. These asters form a dermal layer, and also occur scattered in very large numbers throughout the sponge. They measure from 6  $\mu$  to 10  $\mu$  in diameter.

*Locality.* The single specimen in the collection was obtained at Tella Tella Kebira.

*Distribution.* Red Sea.

Genus DIASTRA, n. gen.

Epipolasidæ with spherasters of two kinds, one a minute dermal spheraster and the other large and simulating a sterraster.

The main skeleton consists almost entirely of a cortical layer of tangentially placed oxea.

## DIASTRA STERRASTRÆA, n. sp. (Pl. 35. fig. 4 ; Text-fig. 4.)

This sponge is represented in the collection by a single specimen. It consists of an erect, somewhat rounded mass growing on a thin sheet of calcareous matter, possibly coral. The specimen shows a tendency to become lobose, but is not actually divided into lobes. It is, however, not a complete specimen ; so that the typical external form of the species may differ from that of the specimen here described. The fragment obtained is about 35 mm. in height by 25 mm. in diameter. The surface of the sponge is slightly grooved, and these grooves run nearly vertically down the sponge, but they do not seem to be connected either with oscula or pore-areas, or to be otherwise important.

A considerable number of oscula occur scattered over the surface of the sponge. They are of greatly varying size, but all are quite small, the largest

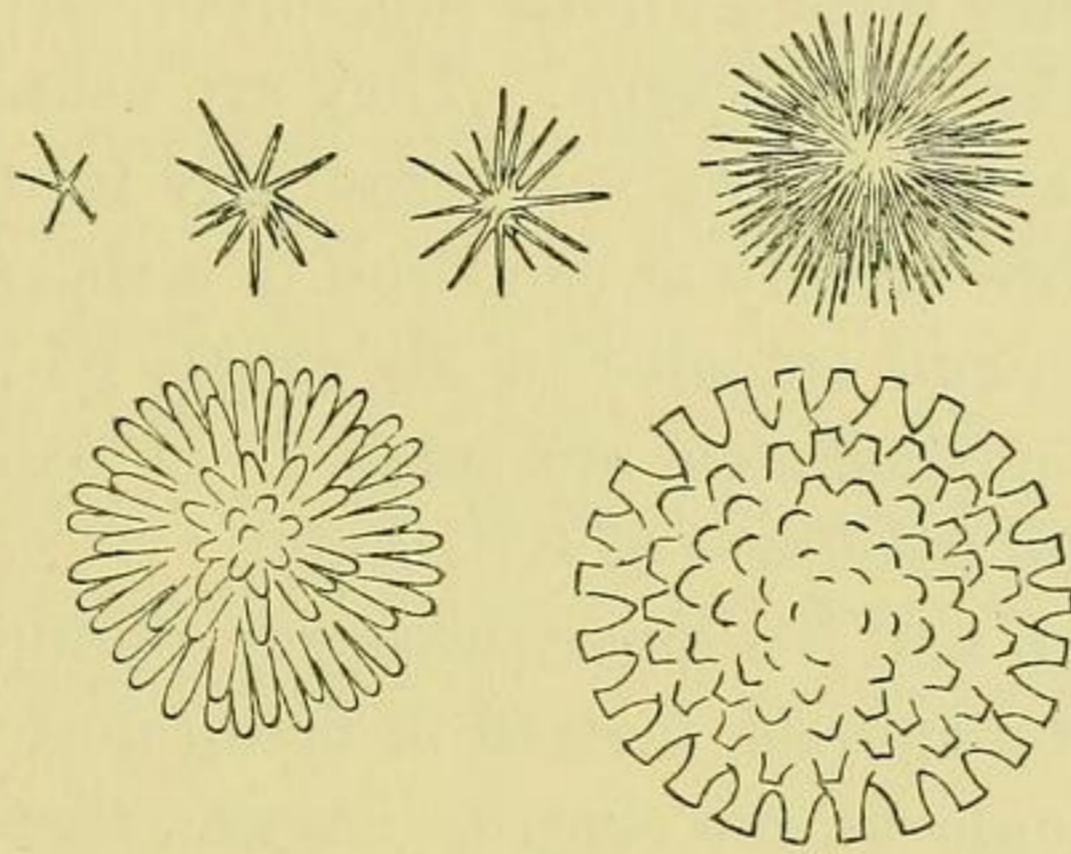


Fig. 4.—*Diastra sterrastræa*. Development of spherasters,  $\times 700$ .

seen not exceeding 1.0 mm. in diameter. They are of very irregular shape, and hardly possess the usual characteristics of oscula. There is no oscular skeleton at all, nor can any oscular membrane be distinguished. They open directly, however, into the canal-system of the sponge.

The pores are scattered all over the sponge surface, and are not collected into pore-areas. They appear on the surface of the sponge as minute light spots, clearly showing up against the darker colour of the sponge. This is apparently a pore-membrane ; and almost always in the centre of the light spot was a dark hole, undoubtedly the pore itself. In some of the pore-membranes no pore could be distinguished, presumably owing to its complete closure by the contraction of the membrane.

The colour in spirit is dark brown throughout the sponge.

The texture of the sponge is firm, but neither hard nor tough, nor is the sponge easily compressible. If bent out of its proper shape it immediately recovers it on being released.

The ectosome is differentiated into a cortex, which possesses a special skeleton in the form of a special layer of oxea in its deeper parts. The oxea

lie tangentially, but otherwise without orientation, and the layer is very dense. This spicular layer is about 0.2 mm. thick, and lies 0.5 mm. from the surface of the sponge.

Dermally also there is a dense surface-layer of small spherasters, among which considerable numbers of the large sterraster-like spherasters occur.

Below the cortex the skeleton is very scanty, consisting solely of somewhat sparsely scattered oxea, which lie in the sponge-body entirely without orientation and without relation to each other. Both small and large spherasters also occur throughout the sponge.

### *Spicules.*

#### A. Megascleres.

The only megascleres occurring in the sponge are oxea, and only one kind of these is present. They form both the tangential cortical skeleton and the scattered spicules of the choanosome. They are usually quite straight and are thickest in the centre, tapering very gradually towards the ends for most of their length, and more rapidly at each end to a sharp point. The spicules vary very much in size, and spicules in all stages of growth can be found; the average full-grown specimen measures from 0.85 mm. to 1.0 mm. in length, with a maximum thickness of 0.016 mm.

Certain malformations and irregularities occur among these spicules. It is occasionally found that a spicule, instead of being quite straight, is distinctly bent, with a distinct angle at the centre. Again, there may be found, more rarely, specimens with one end abruptly rounded off, thus making the spicule apparently a style. These are, however, quite rare, and the presence of other malformations points to the conclusion that the rounded ends are accidental. The other malformations occur in the shape of extra actines, usually added near the end of the spicule, but sometimes one-fourth of the length of the spicule from its end. These supernumerary actines are usually very short, sometimes being merely a knob on the shaft of the spicule. The longest I have seen measured 0.05 mm. in length. They are all inclined to the ray at an angle of  $35^{\circ}$ – $40^{\circ}$ .

#### B. Microscleres. (Text-fig. 4.)

##### ( $\alpha$ ) Spherasters.

(i.) A large spheraster which, when fully grown, simulates a sterraster, occurs throughout the sponge-tissues, but most frequently in the superficial regions of the cortex. The smallest seen examples are typical oxyasters with 4 or 5 rays, and measuring  $6.5 \mu$  in diameter. Between these minute spicules and the fully-formed spheraster a complete series of intermediate forms occur, clearly showing the mode of growth of the spicule. The rays of the young aster grow in length and rapidly become very numerous,

the centrum being only represented by the fused ends of the rays. The largest specimen in which the actines retained their original sharply pointed condition was 0.17 mm. in diameter. The further growth takes place by elongation and thickening of the rays, but they do not seem to increase very much in number. In the fully-grown spicule the rays have developed slightly expanded heads, very similar to those of a true sterraster. The spicule never becomes absolutely solid, however, and the ends of the rays can always be distinguished, projecting from 3 to 5  $\mu$  from the central mass. The fully-grown spicule measures 0.36 mm. in diameter. There is no hilum such as is found in a typical sterraster.

In an account of the sponges of South-Western Australia, Hentschel (15) has described a species of *Stelletta* (*S. aurora*) which possesses somewhat similar spherasters to those of the species under consideration, especially in the variety *arenosa*: the rays are again numerous and are swollen and finger-like, but instead of the enlarged terminations which occur in *Diastra sterrastræa* the ends are provided with minute spines. Also the coalescence of the rays has not gone quite so far in *S. aurora* as in *Diastra sterrastræa*, but otherwise the spicules are very similar.

It is also noteworthy that in *Stelletta aurora* var. *arenosa* the heads of some of the triænes are evidently becoming obsolescent, so that there is considerable evidence furnished by these two species—*Stelletta aurora* and *Diastra sterrastræa*—of a direct descent of the family Epipolasidæ from the Stellettidæ.

(ii.) A small spheraster occurs scattered throughout the sponge, both cortex and choanosome, and forming a very dense dermal layer immediately beneath the surface. They consist of a comparatively large centrum, from which arise short knob-like rays. The size of the spherasters varies considerably, the largest being about 0.009 mm. in diameter.

*Locality.* The single specimen was obtained at Khor Dongonab.

*Distribution.* Red Sea.

#### Family TETHYIDÆ.

Astrotetragonida with stylote megascleres and euasters for microscleres, with strongly developed fibrous cortex and radially arranged skeleton.

#### TETHYA SEYCHELLENSIS.

Synonymy:—

1881. *Alema seychellensis*, Wright (36).

1884. *Tethya cliftoni* (Bow.), Ridley (23).

1888. *Tethya seychellensis*, Sollas (29).

1891. *Tethya seychellensis*, Keller (18).

There are three specimens in the collection. Two are rather small specimens, about 30 mm. in diameter. They each possess a single osculum,

situated, as in the specimens of *T. lyncurium*, at the summit of a very small papilla.

The sponge itself and the spicular measurements agree exactly with those described and figured by Keller (18).

A third specimen, which is dark brown in colour, has also been assigned to this species. It is very small indeed, being only 15 mm. in greatest diameter; and only a very few of the characteristic irregular, somewhat branched oxyasters were seen.

*Locality.* One specimen was obtained from the Etulah Shoals, Suez Bay; and two others from Khor Dongonab.

*Distribution.* Red Sea, Seychelles, Australia, Philippines, Brazil, Porto Rico.

#### TETHYA LYNCURIUM, *Linnaeus*.

All the specimens obtained by Mr. Crossland, referable to this species, are small subspherical cushions attached to rock or coral by a large base. The largest is 30 mm. in diameter and about 25 mm. from base to summit. They each possess, exactly in the centre of the cushion, a small papilla, at the top of which occurs an osculum; and in no specimen could a second osculum be seen. The surface of the sponge is quite smooth, and the brush-like ends of the spicule-bundles show clearly. The colour in spirit is white.

The spiculation and spicule measurements agree exactly with those given by Dendy (11) for *T. lyncurium*, var.  $\alpha$ , of the Ceylon Sponges. They also agree very closely with those of *T. seychellensis*, save that the irregular and sometimes branched oxyasters of the latter are lacking in these specimens.

*Locality.* Five specimens occur in the collection—one from Suez, the others from Tella Tella Kebira.

*Distribution.* Red Sea, Ceylon, North Atlantic, Porto Rico, Mediterranean.

#### Family SUBERITIDÆ.

Astrotetragonida in which the megascleres are styli or tylostyli, and in which the microscleres have completely disappeared.

#### SUBERITES CARNOSUS, *Johnston*.

Synonymy:—

1842. *Suberites carnosus*, Johnston (17).

1900. *Suberites carnosus*, Topsent (34). With complete synonymy.

1891. *Suberites carnosus*, Keller (18).

*Locality.* Two specimens of this cosmopolitan species were obtained in Suakin Harbour. The larger measures 75 mm.  $\times$  55 mm.

*Distribution.* Red Sea, Atlantic Ocean, Mediterranean, Indian Ocean, Australia.

## LAXOSUBERITES sp.

A single very much dilapidated specimen, apparently belonging to this genus, was obtained.

*Locality.* Suez.

PSEUDOSUBERITES HYALINUS (*Ridley & Dendy*).

Synonymy :—

1887. *Hymeniacidon hyalina*, Ridley & Dendy (24).

1900. *Pseudosuberites hyalinus*, Topsent (34). With complete synonymy.

A single very ragged specimen occurs in the collection which has been assigned to this species. The external form is not clearly apparent, owing to breaking of the specimen, but in general character it agrees very closely with *Pseudosuberites hyalinus* (*Hymeniacidon hyalina* of the 'Challenger' Report) except in the spiculation, the spicular measurements being much larger than those of *P. hyalinus* and more nearly corresponding with those of *P. sulphurea*, Tops. (34). The specimen has, however, been assigned to the former species on the grounds of general similarity.

*Locality.* The specimen was obtained on Suez mud-flats.

*Distribution.* Red Sea, Mediterranean, Patagonia.

## Family CLIONIDÆ.

Astrotetragonida of boring habit, forming excavations in the shells of Mollusca and other calcareous bodies.

CLIONA CELATA, *Grant*.

Synonymy :—

1826. *Cliona celata*, Grant (14 a).

1900. *Cliona celata*, Topsent (34). With complete synonymy.

1909. *Cliona celata*, Hentschel (15).

The Clionids in the collection consist of four Lamellibranch shells, all more or less bored by the sponge. None of them show any growth of the sponge outside the shell.

It has therefore been decided to place them all in the species *C. celata*, with the spiculation of which they agree very well.

The shells are all *Margaritifera vulgaris*, save one, which is very much damaged by the *Cliona*, and unidentifiable.

*Locality.* Two specimens were obtained from Suez mud-flats and two from Khor Dongonab. Of these latter Mr. Crossland says in his notes :—

“The Clione forms a sheet on both surfaces of the shell, a state of things I do not remember seeing before. In this connection note that in many old pearl-shells the Clione destroys the outer part of the shell completely, but is

unable to penetrate the inner part and dies off. Many shells show that they were attacked badly some time previously and have recovered."

*Distribution.* Red Sea, Great Britain, Norway, Denmark, France, Mediterranean, Atlantic coasts of America, south coasts of Australia, New Guinea.

#### Sub-Order SIGMATOTETRAXONIDA, *Hentschel*\* (15).

Tetraxonida in which the typical microsclere is a sigma or some form derived from it. True astrose microscleres are never found.

#### Family TETILLIDÆ.

Sigmatotetraxonida in which there are well-developed protriænes and a usually strongly radiate skeleton.

#### TETILLA POCULIFERA, *Dendy*.

Synonymy:—

1905. *Tetilla poculifera*, *Dendy* (11).

Six subspherical specimens of this sponge were obtained. They are all somewhat small, the largest being 26 mm. in diameter. They agree closely in all points with Professor Dendy's specimens from Ceylon, but the small oxea which occur throughout the choanosome are even more numerous than in his specimens, so that a section looks quite dark when examined owing to their enormous numbers.

All the specimens were obtained from Tella Tella Kebira.

*Distribution.* Red Sea, Ceylon.

PARATETILLA ECCENTRICA, n. sp. (Pl. 35. fig. 1, Pl. 36. fig. 8; Text-figs. 5, 6, 7.)

This species is represented by a single small specimen, of nearly spherical shape, but with the basal part missing. The surface of the sponge is very minutely hispid, the projecting spicules being few and small.

The specimen measures 21 mm. in diameter.

The oscula are irregularly scattered over the surface of the sponge, about a dozen in number, and measuring 1–2 mm. in diameter. An oscular membrane is usually visible, and the sides of the osculum are frequently sparsely coated with sand-grains. The pores were indistinguishable.

\* *Hentschel* (15) gives no definite diagnosis to this sub-order, save to say that it comprises the *Sigmatophora* and *Sigmatomonaxonellida* of *Dendy*'s classification (11). The above diagnosis, therefore, has been formulated to correspond with his diagnosis of the sub-order *Astrotetraxonida*.

The colour in spirit is grey-black on the surface. When cut or broken the cortex appears grey and the choanosome a dark brownish grey.

The ectosome (Pl. 36. fig. 8) is differentiated into a distinct cortex, which varies in different parts of the specimen from 1.2 mm. to 1.4 mm. thick. In it occur the triænes, which are characteristic of the genus, and which in this species have undergone considerable malformation; they lie quite irregularly, mixed up with the other spicules of the cortex.

The main skeleton is arranged radially and consists of large bundles spicules. In the deeper parts of the sponge these bundles are very dense, the spicules composing them being very closely bound together; but near the outer surface they become spread out into a fairly loose brush, so that there is no unprotected part of the sponge surface, owing to the overlapping of the brushes. These brushes are chiefly composed of oxea, but anatriænes and protriænes also occur in them. The protriænes are of considerable rarity, especially below the surface of the sponge. There is a special cortical skeleton consisting of a loose network of tangentially arranged oxea. These oxea are similar to those of the main skeleton, but do not reach quite so large a size.

In addition to the spicular bundles, the choanosome contains numbers of small oxea arranged very irregularly. The microscleres consist of sigmata, which occur in very large numbers throughout the choanosome, and rarely in the cortex.

### *Spicules.*

#### A. Megascleres.

##### ( $\alpha$ ) Protriænes.

The protriænes of this species are few in number and inconspicuous. They are nearly always found with the heads projecting from the sponge surface. They consist of a long slender shaft, which frequently does not lie quite regularly in the spicular bundle, and a head composed of three small cladi, which are sometimes unequal or somewhat irregular. The shaft varies from 2.0 mm. to 2.5 mm. in length, and is of the same diameter for the greater part of its length. For the last half-millimetre of its length it tapers very gradually to a fine point, the most distal portions of the rhabdome being almost hair-like. The maximum diameter of the rhabdome is 0.005 mm. The cladi are short and usually bluntly pointed; they vary considerably in length, from 0.008 mm. to 0.02 mm., and their diameter at the base is equal to that of the rhabdome. The expanse of the head varies with the length of the rays, being usually approximately equal to their length.

##### ( $\beta$ ) Anatriænes.

The anatriænes are fairly numerous; a few of them have their heads projecting from the surface of the sponge, but by far the larger number do not project. The heads of these non-projecting spicules almost invariably lie in



the cortex, it being very rare to find a head in the choanosome. The rhabdomes are similar to those of the protriænes, but even longer, and they frequently possess a swelling just below the head. The length of the rhabdome varies from 2.5 mm. to 3.6 mm.; it is very slender, rarely exceeding 0.004 mm. in diameter, and frequently does not measure more than 0.0025 mm. The swelling below the head, when present, usually occurs about 0.013 mm. down the shaft, and is about 0.006 mm. to 0.01 mm. in diameter. The cladi composing the head are rather short and slender; they are straight in their distal portions, which make an angle of about  $60^\circ$  with the rhabdome. They are usually obtusely pointed. Their average length is about 0.02 mm. to 0.026 mm. and their diameter 0.003 mm. at the base; the sagitta of the head is 0.02 mm. to 0.025 mm., and the chord 0.042 mm. in full-grown specimens.

Like the protriænes, the anatriænes do not always lie regularly in the spicular bundle, their extreme length in proportion to their thickness rendering them specially flexible. They are frequently found outside any spicule-fibre for a portion of their length.

( $\gamma$ ) Cortical triænes. (Text-figs. 5 & 6.)

The cortical triænes, which are characteristic of the species, are extremely irregular, and present extraordinary modifications and abortions. One or more of the rays may be greatly stunted, or even entirely absent, or they may be greatly prolonged, abruptly bent at sharp angles, covered with knobs and excrescences, or even branched.

They do not occur in large numbers, and are entirely confined to the cortex. They are arranged quite irregularly, both as to frequency and orientation.

Two main types of malformation can be distinguished. In the first (text-fig. 5) all four actines can be distinguished, though one or two of them are frequently dwarfed, being sometimes only represented by knobs. The angles at which the rays meet vary very much, and the rays are sometimes all in one plane, but it is usually possible to recognise the spicule as a true triæne.

The other type (text-fig. 6) usually only possesses two of the four actines, though sometimes one or both of the others are present. One ray is long, more or less regular and straight, and usually pointed. The other ray (or rays) are dwarfed, and nearly always covered with knobs or protuberances, and form a kind of head to the spicule. The whole spicule may, in fact, be compared to a "freak" walking-stick. The head nearly always forms a right angle with the long ray. The whole spicule bears a striking resemblance to walking-sticks.

It must be noted, however, that no hard-and-fast line can be drawn between the two types as described above, though they are separated for

purposes of description. Many of the spicules would go almost equally well into either, such as those in which the "walking-stick head" is formed of more than one ray.

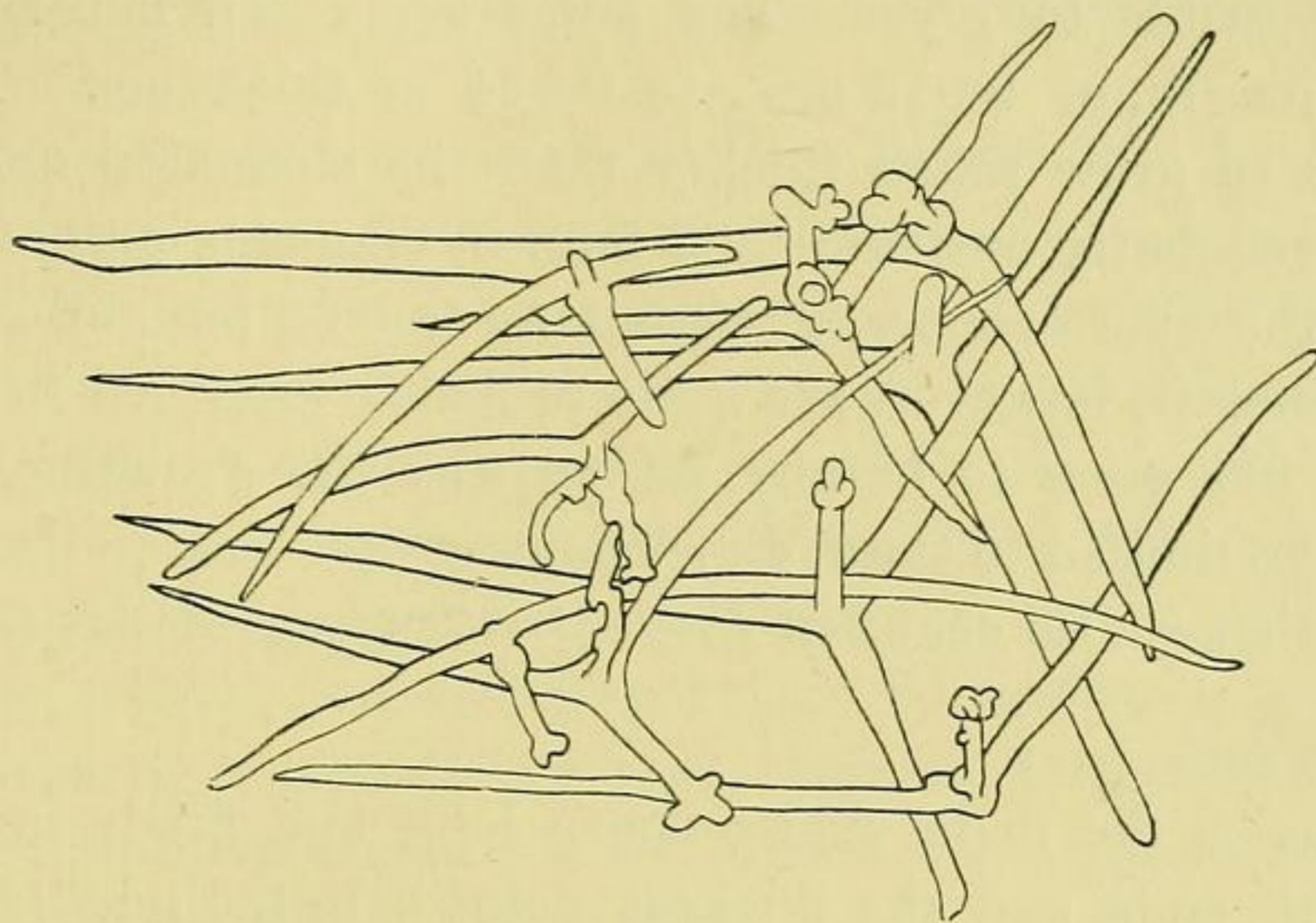


Fig. 5.—*Paratetilla eccentrica*. Cortical triaenes,  $\times 250$ .

Others, again, do not come under either of these groups. Sometimes spicules can be found with a "head" at each end of the long ray ; sometimes

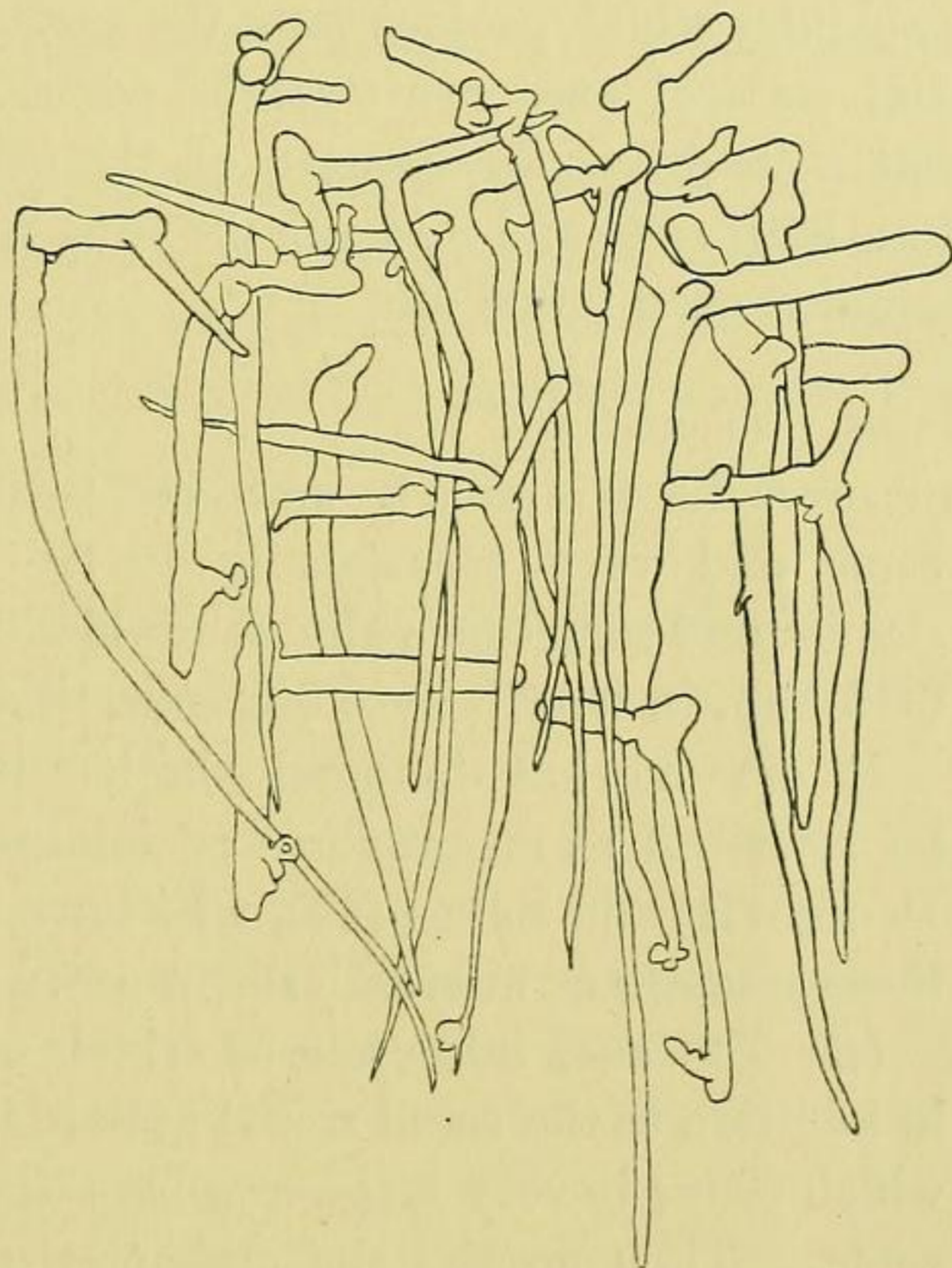


Fig. 6.—*Paratetilla eccentrica*. Cortical "walking-stick" triaenes,  $\times 250$ .

all four actines are dwarfed and bulbous ; sometimes the spicule is reduced to two short rays, more or less malformed ; or it may even be represented by a single ray. It is worthy of note, however, that those rays which are

elongated are almost never covered with excrescences, nor otherwise grotesquely malformed.

The measurements of these spicules vary extremely, so that average lengths are quite impossible to give. The longest rays do not seem to exceed 0.26 mm. in length, or 0.012 mm. to 0.014 in thickness. Dwarfed rays, however, seem to grow much thicker than the elongated ones as a general rule. They frequently measure 0.02 mm. in diameter across the ray itself, or, including the excrescences, anything up to 0.03 mm. or even 0.035 mm. These measurements, however, are quite probably exceeded in other spicules, as there does not seem to be any reason why the growth of these excrescences should be limited to these dimensions.

Abnormal triænes also occur in *Pachastrella abyssi*, Sollas (29).

( $\delta$ ) Oxea.

(i.) The oxea of the main skeleton are long and fairly stout. They are pointed at both ends, and the thickest point is in the middle of the spicule length, from which there is a gradual tapering towards either end. They measure from 2 mm. to 3 mm. in length, and from 0.01 to 0.015 mm. in diameter at the thickest part. These spicules form the greater part of the spicular bundles and always lie very strictly radially. They form a large proportion of those spicules which project from the surface of the sponge.

(ii.) The tangential cortical oxea are straight, rather slender oxea, which do not reach so great a length as do the oxea of the main skeleton. They are sharply pointed at both ends and measure 0.8 mm. to 1.4 mm. in length. Their thickness does not exceed 0.008 mm.

B. Microscleres. (Text-fig. 7.)

( $\alpha$ ) The somal microoxea lie irregularly scattered throughout the choanosome and very occasionally in the cortex. They are slender and sometimes almost raphide-like. They measure 0.15 mm. in length by 0.002 mm. in diameter.



It is somewhat doubtful whether these spicules should be described as megascleres or microscleres, but I follow Dendy (11) and Sollas (29), who have previously described these spicules as microscleres in other species.

( $\beta$ ) The only microscleres which occur in this species in addition to the small somal oxea are very small sigmata, which occur in very large numbers throughout the choanosome. They possess the characteristic S- or C-shape of all the sigmata found among the Tetillidæ, and measure about 0.01 mm. to 0.02 mm. across. Their diameter does not exceed 0.001 mm.

Fig. 7.—*Paratetilla eccentrica*. Microscleres,  $\times 350$ .

The present species forms the third known species in this somewhat

remarkable genus, the two previous species being *P. merguensis*, Carter (7), and *P. cineriformis*, Dendy (11). All three species come from the Indian Ocean or adjacent waters: *P. cineriformis* was obtained in Ceylon and *P. merguensis* at various localities from Mergui Archipelago to Torres Strait.

These three species form a complete series illustrating the development of the cortical triænes. In *P. merguensis* the spicule can be clearly seen to be developed from an ordinary plagiotriæne, since the rhabdome can always be distinguished from the cladi in them. Further, young forms can be found in which the plagiotriæne form is not obscured. A considerable advance is seen in *P. cineriformis*, where the true triæne form is entirely lost and the spicule is somewhat irregular. The triænes are, in fact, very similar to those of *P. eccentrica* which possess all four rays. A further advance is seen in *P. eccentrica*, where, as described above, some of the triænes have become modified into "walking-sticks." Otherwise these two species are very similar, both in shape, colour, and skeleton.

The genus is especially interesting as indicating a possible origin for the Lithistida. The appearance of two main types of triænes in *P. eccentrica* also suggests that the Tetracrepid Lithistida and the Monocrepid Lithistida may have arisen from the same group, by selective specialism, from some such form as this, where spicules bearing a resemblance to desmas of both kinds occur.

The evidence which can be brought forward in favour of a Tetillid ancestry for the Lithistida is, however, far too vague to enable one to do more than point out the possibilities suggested by the various species.

*Locality.* The single specimen was obtained at Tella Tella Kebira.

*Distribution.* Red Sea.

CHROTELLA IBIS, n. sp. (Pl. 35. fig. 2, Pl. 36. fig. 7; Text-fig. 8.)

This species is represented in the collection by several specimens, all very similar in appearance. Each consists of a subspherical mass, in the largest specimen 23 mm. in diameter. The basal portion of the sponge is wanting in all the specimens, probably being left on the support when the sponge was collected. The broken surface forms a large, more or less flat area, the diameter of which is very nearly as great as that of the sponge at its thickest point, so that if this area really represents the approximate area of attachment, the sponge will have the shape of a somewhat globose cushion.

The surface is densely but minutely hispid, but the greater part of the projecting spicules are broken off close to the surface of the sponge. Immediately covering the surface is a single compact layer of sand-grains, entangled among the projecting spicules.

There are several small oscula visible on each of the specimens, measuring

about 0.75 mm. in diameter and scattered over the sponge surface quite irregularly. The pores were not distinguishable.

The colour in spirit is yellowish to dull yellow-brown.

The ectosome is quite clearly marked off from the choanosome; it is perfectly hyaline in appearance and no cell-elements could be found in it. The average thickness of the ectosome is 0.5 mm. There is no special cortical skeleton whatsoever, unless the layer of sand-grains referred to above is considered to fall under this head.

The skeleton is radial, and most of the spicules are arranged in rather loose bundles, though many spicules occur lying free in the choanosome between the spicule bundles.

In the deeper parts of the sponge the spicule bundles are fairly compact, but the spicules are quite separate in the outer regions of the sponge. When the actual surface of the sponge is reached, the spicule bundle is expanded into a brush-like head, and the spicules of adjacent bundles become intermingled. Thus the whole surface of the sponge is covered by an even coat of spicule heads. These spicular bundles measure from 0.12 mm. to 0.14 mm. in diameter when the spicules composing them are close together, as they are near the centre of the sponge. The whole of the spicules in the main skeleton in the deeper parts of the sponge are oxea, the anatriænes and protriænes being confined to the superficial parts; in fact, it is quite rare to find a triæne head more than 2 mm. from the sponge surface.

Scattered about through the choanosome occur large numbers of small oxea, closely resembling those of *Tetilla poculifera*, Dendy, referred to above.

There are now, in fact, six species of Tetillidæ in which these microxea occur now known to science, namely: *Tetilla australiensis*, in which they are minutely spined, and *Tetilla poculifera*, *Chrotella ibis*, and all the three species of *Paratetilla* at present described, *P. merguiensis* (Carter), *P. cineriformis*, and *P. eccentrica*, in all of which they are smooth. It is also noteworthy that in two species—*Tetilla poculifera* and the species at present being described, *Chrotella ibis*—they occur in enormous numbers, so that the colour of the specimen is noticeably affected. In the present species they do not occur so thickly as in *Tetilla poculifera*, but nevertheless they form a conspicuous part of the whole skeleton. They are entirely confined to the choanosome, the cortex being absolutely free from them.

### *Spicules.*

#### A. Megascleres.

##### ( $\alpha$ ) Triænes. (Text-fig. 8.)

Triænes are present in considerable numbers in the sponge. They form a very considerable proportion of the spicules projecting from the sponge surface, and although these projecting spicules are very frequently broken

off, so that the triæne head is not present, yet they can always be distinguished from the oxea by the much more slender rhabdome. Both anatriænes and protriænes occur in this species, and both kinds occur with their heads both projecting from and buried in the sponge. Of those projecting from the sponge it is impossible to determine the proportions in which the two kinds of spicules occur, owing to the breaking off of the triæne-heads referred to above ; but of those which still retain their cladi, the anatriænes are much the more plentiful, both outside and inside the sponge.

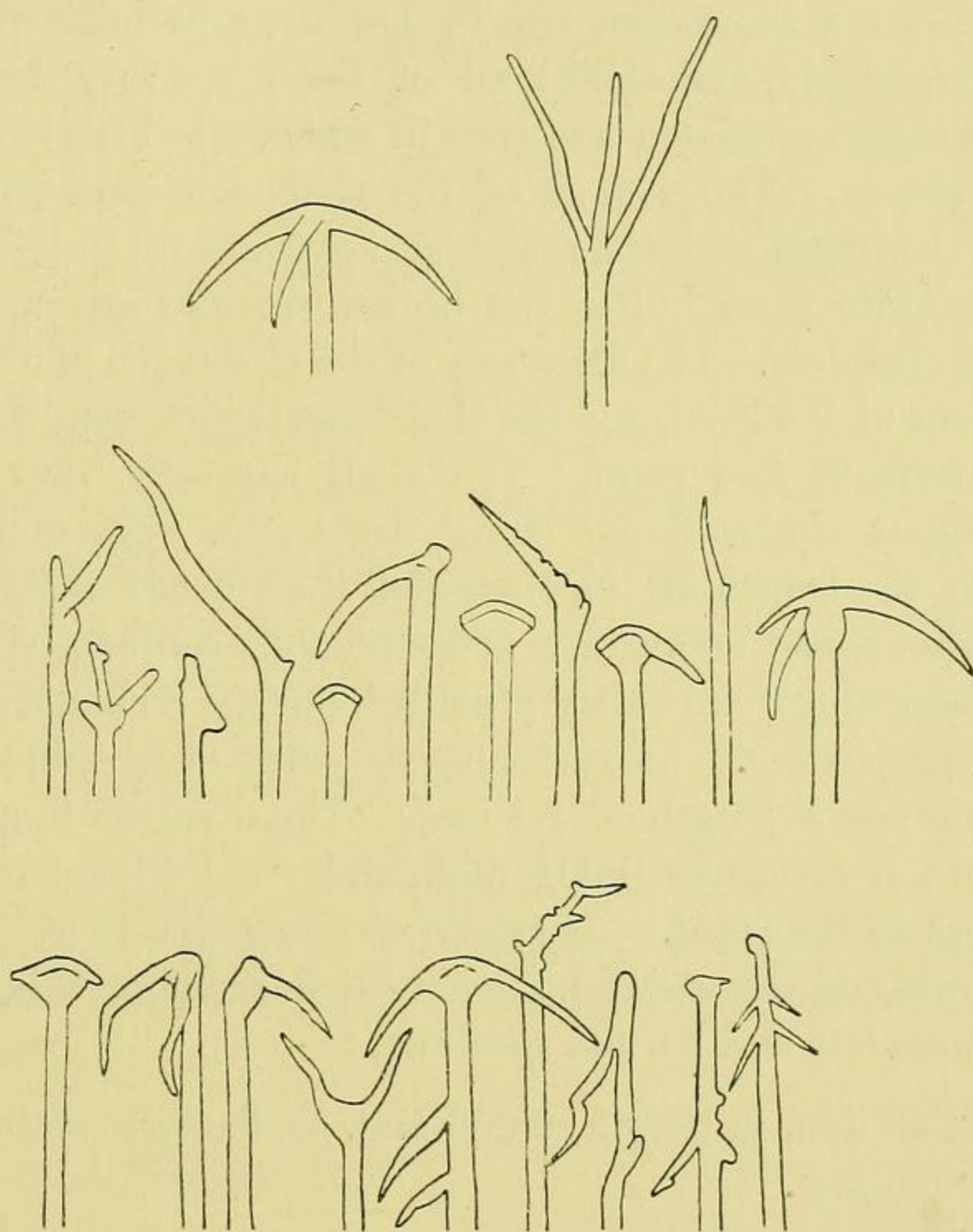


Fig. 8.—*Chrotella ibis*. Triænes,  $\times 30$ .

The two spicules on the top line are the normal type of spicule ; those in the second row are abnormal forms, the heads of which protruded from the sponge surface ; the third row contains similar abnormal forms which were entirely embedded in the sponge tissue.

The most characteristic feature of these spicules is the constant malformation of the heads, in both kinds, so that the cladi are frequently reduced in number, and those that are present of unequal length, or the whole head may be reduced to a knob. In addition extra cladi may occur on the rhabdome, as many as five such being seen in one case ; spicules bearing these extra cladi have not, however, been seen outside the sponge. Both these cladi and

the cladi of the regular head are frequently malformed, with knobs and small excrescences growing on them. In exceptional cases the cladus may be bent at a sharp angle part way along its length. Examples of these malformations are shown in text-fig. 8, the two spicules at the top of the figure being normal perfect examples, those in the second row malformed spicules projecting from the sponge surface, and those in the lowest row similar spicules whose heads were buried in the sponge-body. The rhabdomes of both anatriænes and protriænes are very slender and flexible, and frequently do not lie parallel with the oxea, but sinuously in the sponge.

The *protriænes* are somewhat few in number, especially with their heads inside the sponge-body, and almost all of them are very much malformed. In fact, only a single specimen was seen in which all three rays were present and well developed. The length of the rhabdome varies very much, and specimens may be found with the rhabdome anything up to 1.5 mm. in length. It is, of course, quite possible that the broken spicules measured much more than this when complete. The thickness of the rhabdome is 0.005 mm. in the largest specimens at the head, and the rhabdome tapers from this point gradually to an extremely fine point. The cladi naturally vary very much in length, the longest cladus found being 0.084 mm. The chord of the head also varies with the length of the cladi and the amount of malformation the head has undergone, and no average measurements can be given.

The *anatriænes*, which are fairly plentiful, possess a rhabdome very similar to that of the protriænes. It varies considerably in length, some specimens being found to attain a length of 2.1 mm. The diameter is greatest close to the head, where it measures 0.004 mm., and from this point the rhabdome gradually tapers to the point. It is almost impossible to give measurements for the head, owing to the malformations which occur, but the following are taken from a complete and normal specimen :—

Cladi 0.043 mm. in length, 0.006 mm. in diameter at the base.

Sagitta 0.035 mm.

Chord 0.06 mm.

One of the most frequent malformations, that in which the head is reduced to a knob, seems to be confined entirely to anatriænes. This knob usually measures from 0.013 to 0.018 in diameter.

### (β) Oxea.

(i.) The oxea of the main skeleton are long, pointed at both ends, and much stouter than the triænes. They are thickest in the middle of their length, and taper gradually and uniformly to each end. Those oxea which have one end projecting from the surface of the sponge are practically all broken, so that their length cannot be ascertained, but there does not seem any reason for

supposing them different to the spicules of the interior of the sponge. These have a maximum length of 1.6 mm. and a diameter of 0.025 mm. at their thickest point.

(ii.) The small choanosomal oxea are short and very slender. They lie irregularly throughout the choanosome and are quite unoriented. They do not seem to occur more thickly in one part of the sponge than another. They measure 0.15 mm. in length, by 0.021 mm. in diameter.

#### B. Microscleres.

The only microscleres found in this species are small delicate sigmata of typical shape. They occur profusely scattered throughout the choanosome, and in somewhat less numbers in the ectosome. They measure 0.01 mm. to 0.015 mm. across the curve.

*Locality.* All the specimens were obtained at Tella Tella Kebira.

*Distribution.* Red Sea.

### Family HAPLOSCLERIDÆ.

Sigmatotetragonida in which microscleres, when present, are usually in the form of sigmata or derivations thereof, but never chelæ. The skeleton is reticulate and the fibre is typically non-plumose. The megascleres are all monaxonid and usually diactinal.

#### Sub-Family RENIERINÆ.

Haploscleridæ in which the microscleres have entirely disappeared and the skeleton consists of a reticulation of oxeote megascleres with little or no spongin.

#### RENIERA IMPLEXA, O. Schmidt.

Synonymy:—

1870. *Reniera implexa*, O. Schmidt (25).

1886. *Reniera implexa*, Ridley & Dendy (24).

1904. *Reniera implexa*, Topsent (33).

1905. *Reniera implexa*, Dendy (11).

A few broken cylindrical tubes occur in the collection, which agree very well with Schmidt's (25) description, both as to external form and appearance and in their spiculation.

*Locality.* No definite locality is given. The bottle is labelled "Sponge Trials 1."

*Distribution.* Red Sea, Ceylon, Adriatic, Azores.



*RENIERA TABERNACULA*, n. sp. (Text-fig. 9.)

This species is represented by a single, apparently complete specimen of nearly triangular shape. The sponge measures 55 mm. in its greatest length and is 22 mm. wide. It is flattened and, in fact, nearly lamellar, being only 7–8 mm. in thickness. The specimen is quite unattached to any support, but on one of the two triangular surfaces (presumably the lower) there is a deep oval hollow, extending almost through the whole thickness of the sponge, from which the original support of the sponge has presumably been detached. From the shape of the cavity this support seems to have very possibly been a crab.

The surface of the sponge is devoid of fistulæ or outgrowths, but nevertheless it is not quite smooth, owing to the projection of the ends of the spicular fibres slightly from it. The dermal membrane is almost entirely absent, but the small portion remaining is quite smooth between the projecting fibres of spicules, and pierced with very numerous pores. The rest of the sponge surface is regularly reticulate, with a number of small holes in each mesh. Whether these are oscula or inhalant canals cannot be ascertained, as the dermal membrane is absent.

The colour in spirit is yellowish white.

The texture of the sponge is tough, but very easily compressible.

The skeleton is of a typical Renierine type, and possesses a large number of very clearly marked main fibres, whose direction is radial and whose ends project from the surface of the sponge. Owing to the lamellar character of the sponge, however, the radial direction of the fibres has become modified in the central parts of the sponge so that they run from the base to the upper surface of the sponge, directly perpendicular to both surfaces. These fibres are densely spicular, the spicules in them being frequently 6–10-serial; they lie rather irregularly in the sponge, and the distance between them varies considerably, especially in the deeper parts of the specimen. At the surface

they are more regular in arrangement, and the average distance between them is 0.15 mm., or rather more than the length of the individual spicules. Many of them branch, and a very few anastomoses between main fibres were observed.

Connecting fibres, lying tangentially in the sponge, and exactly similar to the main fibres in structure and size, occur occasionally, but the greater part of the skeleton network is formed of a regular reticulation of uniserial secondary fibres, which form a rectangular mesh, each side of which is composed of a single spicule.

There is no dermal skeleton distinct from the above-described secondary fibres.



Fig. 9. — *Reniera tabernacula*. Spicules,  $\times 235$ .

The spicules are cylindrical, usually very slightly curved, and abruptly pointed at each end. They measure 0·11 mm. long in the secondary fibre, and slightly more (0·12 mm. to 0·14 mm.) in the main fibres. The average diameter is 0·0035 mm.

*Locality.* Agig Harbour.

*Distribution.* Red Sea.

RENIERA SPINOSELLA, n. sp. (Text-fig. 10.)

This new species is represented by several specimens, none of which is large. All the specimens consist of an irregularly shaped mass of conical processes, each of which bears an osculum at the top. There is, however, a very considerable variation in the amount of fusion which these processes have undergone, as in some cases they are completely separate and in some they are almost completely fused, so that the whole specimen looks like an irregular mass with some slight rounded swellings over it. The largest specimen measures 55 mm. by 40 mm., and is 27 mm. high. The average diameter of the conical processes is 15 mm.

All the specimens are growing amongst seaweed, and in some cases the seaweed has been enclosed within the sponge tissues.

The surface of the sponge is typically covered with small processes scattered irregularly over the whole of the specimen. In the specimen in which they are developed to their greatest extent they are on the average 2 mm. high, and do not stand erect, but lie decumbent on the surface of the sponge. In other specimens they are shorter and more or less upright, but they are always very lax and easily bent. In one specimen these small processes are entirely absent and the surface quite smooth. The skeleton in this specimen is, however, exactly like that of the others, and it is quite impossible to separate this specimen from the others specifically.

The surface is covered with a very delicate dermal membrane, which has no special skeleton.

The oscula are confined to the summit of the large conical processes, each of these processes possessing a single osculum, which varies in diameter in different examples from 1 mm. to 2 mm. The pores could not be distinguished.

The colour of the sponge is dirty grey.

The texture is lax and very easily compressible, but not fragile, however, and not easily torn.

*Skeleton arrangement.*

The skeleton consists of a reticulation of spicules, with a few spicular fibres here and there. These primary fibres usually contain from three to five rows of spicules, and in rare cases six or eight. The primary fibres themselves are very few in number, and are wholly absent from some parts

of the sponge. They run quite regularly radially in the sponge, and frequently pass out into the small processes above described. The rest of the skeleton is wholly unispicular, and the sides of the mesh usually consist each of a single spicule. The reticulation thus formed is quite regular in most parts of the specimen, but at the points of fusion of the large processes of which the sponge is composed they become more or less irregular.

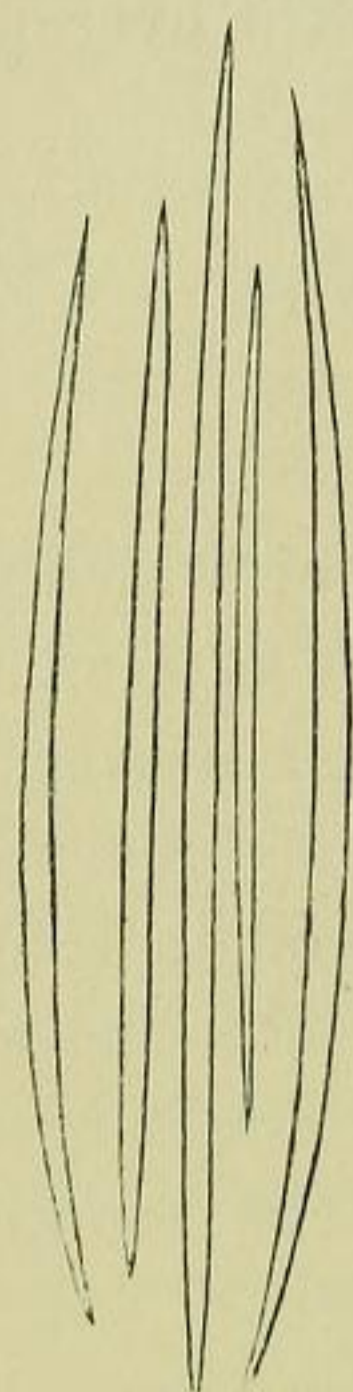


Fig. 10.—*Reniera spinosella*. Spicules,  $\times 500$ .

#### *Spicules.*

The only spicules which occur in this species are oxea; they are sometimes slightly curved, but usually quite straight and cylindrical. They are usually tapering throughout their length, but occasionally spicules may be found of the same diameter for the greater part of their length, and are abruptly pointed at each end. They measure 0.13 mm. in length and 0.005 mm. in diameter.

*Locality.* The whole of the specimens were obtained in Suez Docks, "from beneath a floating stage, which had been in the docks for several years."

*Distribution.* Red Sea.

#### RENIERA sp.

A small, somewhat triangular fragment, apparently broken off from a lamellar sponge. The fragment is 5 mm. thick, and measures 25 mm. long by 15 mm. wide at the widest part. The broken surface extends around two sides of the triangle, the third (and shortest) side being the external edge of the sponge.

The skeleton arrangement is very regular, consisting of a rectangular meshwork, each of the sides of each mesh being composed typically of a single spicule, so that the diameter of the mesh is the same as the length of the spicules.

A few spicular fibres can be distinguished here and there in the sponge, but they do not seem to lie in any particular direction, and they very rarely indeed contain more than two rows of spicules, and never more than three.

The dermal membrane is supported by a reticulation of spicules, but neither the size of the mesh nor that of the spicules differs at all from those of the main skeleton.

The spicules are oxea, and as a rule quite straight, though a few were seen

that were slightly curved. They are of the same diameter throughout the greater part of their length, and taper abruptly to a sharp point at each end. They measure 0.13 mm. in length and 0.005 mm. in thickness.

*Locality.* Agig Harbour.

*Distribution.* Red Sea.

HALICHONDRIA BUBASTES, n. sp. (Text-fig. 11.)

A single large specimen of this new species occurs in the collection. It is massive and irregular in shape, and possesses several very irregular shallow fistulæ arising from it. It measures 75 mm. × 55 mm., and is 40 mm. high, including the fistulæ. On the summits of most of these fistulæ are the oscula, which are large and possess a distinct oscular lip. They vary in size from 2 mm. to 5 mm. in diameter. The pores could not be distinguished.

This external form is noteworthy as being identical with that of *Trachyopsis halichondrioides*, Dendy (11), specimens of which also occur in the Red Sea. Its spiculation is, however, quite different to that of *Trachyopsis*.

The surface of the sponge is not reticulate, but quite even and regular; it is, however, very minutely hispid through the slight projection of spicules from it.

The sponge is soft and very easily compressible, but when whole is firm and elastic, though in spirit the interior of the sponge is friable and easily breaks.

The colour is similar to that of sand.

The skeleton arrangement is very irregular, and consists of a very ill-defined network of spicular fibre and scattered spicules. The number of spicules which lie scattered singly, or in twos and threes, about the sponge is very large, and they render the skeleton arrangement very similar to that of *Reniera* at first sight; but since this arrangement varies in different parts of the sponge, both as to the regularity of the network and the size of the mesh, and since the size of the spicules is also very variable indeed, I have come to the conclusion that the apparent regularity of the skeleton arrangement in some parts of the sponge is only accidental, and I have therefore placed the species in *Halichondria* rather than in *Reniera*.

The spicular fibres, where they occur, vary very greatly in the number of spicules they contain, and also in the closeness with which their spicules are bound together. They cannot, however, be divided into primary and secondary fibres, nor do they have any definite direction in the sponge. The spicules composing them vary in number from 1- to 20-serial, and fibres of all intermediate sizes may be found.

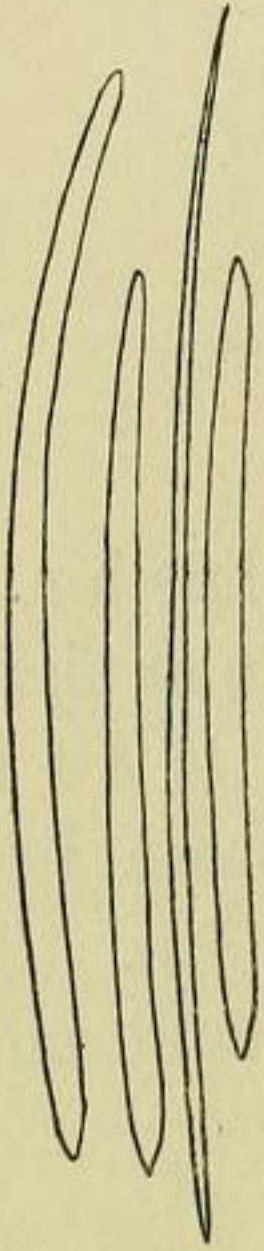
*Spicules.* (Text-fig. 11.)

Fig. 11.—*Halichondria bubastes*.  
Spicules,  $\times 500$ .

The only spicules occurring in the sponge are oxea, and, though they vary very greatly both in length and diameter, there cannot be drawn any line of demarcation between the various forms. In this respect (though not in actual size) the spicules of *H. bubastes* are very like those of *H. panicea*, but the external surface of the two species is very different. As a general rule, the oxea are quite straight, but some of them are slightly curved, and when this is the case the curvature is always regular and extends throughout the length of the spicule. The spicules vary from 0.06 mm. to 0.13 mm. or even more, and in diameter from 0.001 mm. to 0.005 mm.

The above species is a somewhat unsatisfactory one. The characters on which it is founded are, as in the case of so many *Halichondrias*, of a very indefinite nature, and no characteristic shape, or size, or skeleton can be assigned to it. It does not seem to go into any of the previously named species very easily, however, and I have thought it better to add to the number of species in this already very confusing genus rather than assign it to any species not thoroughly agreeing with it.

## HALICHONDRIA sp.

Three masses of calcareous worm-tubes were obtained, which are surrounded by an irregular sponge belonging to this genus. The sponge also fills up all the spaces between the tubes. All three specimens were obtained together, and are probably fragments torn away from some large sponge. Neither of the three specimens shows any part of the external surface of the sponge, so specific identification is impossible.

The skeleton consists of an irregular reticulation of spicular fibre and scattered spicules. In the fibres the spicules vary considerably in number and lie somewhat irregularly. The fibres possess from 3 to 8 rows of spicules.

The spicules are oxea, which are frequently slightly curved, and which vary tremendously in length, any size up to 0.13 being found. They are thickest about the middle of their length, and have a maximum diameter of 0.005 mm.

*Locality.* Not stated.

*Distribution.* Red Sea.

TRACHYOPSIS HALICHONDRIOIDES, *Dendy*.

Synonymy :—

1904. *Trachyopsis halichondrioides*, Dendy (11).

This species, previously only recorded from Ceylon, is represented in the collection by several large specimens, some of which are considerably larger than the type specimen. The general character of the specimens is, however, exactly that assigned to this species in Dendy's original description, the sponge being large, massive, and irregular, with irregular, more or less conical projections here and there on its surface, each of which possesses an osculum at its summit.

The largest specimen forms an irregular mass 100 mm. long by 55 mm. broad. Its thickness varies in different parts from 10 mm. to 25 mm.

The skeleton arrangement is even denser than in Dendy's specimen, and the dermal spicular brushes, which are characteristic of the genus, are very well marked. The spicules vary enormously in length, and specimens of all sizes are mixed up together, the smaller specimens being apparently young spicules in process of formation. The length of full-grown specimens is about 0.6 mm.

*Locality.* No locality for these specimens was given, the bottle containing them being labelled merely "Sponge Trials 1."

*Distribution.* Red Sea, Ceylon.

## Sub-Family CHALININÆ.

Haploscleridæ without microscleres and with diactinal megascleres. Skeleton a network of more or less strongly developed horny fibre covered by megascleres.

PACHYCHALINA VARIABILIS, *Dendy*.

Synonymy :—

1890. *Pachychalina variabilis*, Dendy (8).

This species is represented in the collection by a single large specimen composed of a number of irregular lobes and branches, which grow erect and arise from a rather small base. The whole sponge presents an exactly similar appearance to that shown in Dendy's (11) figure of this species. There does not seem to be any real difference between the cylindrical branches and the large lobes which occur here and there in the specimen; the lobes may arise by the enlargement of branches, and branches may grow out of these lobes. In one place the sponge has formed a fairly large irregular covering around

a horny lamellibranch shell (? *Avicula*), and from this mass other branches arise.

The whole specimen stands 160 mm. high from base to summit; the branches vary from 10 mm. to 20 mm. in diameter, and the lobes are about 20 mm. in thickness at their thickest point.

The oscula are fairly numerous and are scattered irregularly over the whole surface of the sponge. They are not of great size, averaging 3 mm. in diameter. The pores are very numerous, of comparatively large size, and are scattered thickly over the whole of the dermal membrane.

The colour in spirit is dark brown.

The texture of the sponge is firm and resistant, but easily compressible.

The skeleton consists of an irregular network of spicular fibre, the spicules of which are cemented together by spongin. As a rule, a series of radial primary fibres can be distinguished, but in some parts of the sponge no distinction can be drawn between the primary and secondary fibres. The secondary fibres uniting the primary fibres form a very irregular reticulation, and possess no definite arrangement whatever. The mesh is very variable in size, but on the average is between 0.5 mm. and 0.6 mm. in diameter. The meshes are quite irregular in shape.

The primary fibres possess sometimes as many as 10 rows of spicules, and usually 7 or 8 rows. In the secondary fibres the spicules rarely lie more than 2-3-serial, though fibres intermediate between primary and secondary may be found in some parts with 5-8 rows of spicules. The spongin coating the spicules is somewhat scanty and only just shows outside the fibres. The dermal membrane is supported by an extremely fine fibre-network, in which the spicules rarely lie more than 2-serial, and the meshes of which are very fine.

Outside these fibres a very few oxea can be found lying in the sponge substance without any orientation. They are exactly similar to those of the fibres.

The spicules are almost wholly diactinal, but a very few styles may be found occasionally intermingled with the oxea. They are certainly only accidental malformations of the typical spicules, and not true styles.

The oxea are fairly large, reaching 0.16 mm. in length by 0.004 mm. in diameter. These measurements are slightly larger than those given by Dendy for this species in the type specimens from the West Indies, but otherwise the two specimens are extremely similar. Dendy's measurements are: length 0.126 mm., diameter 0.003 mm.

*Locality.* No definite locality is given for this sponge, but merely "Sponge Trials 1."

*Distribution.* Red Sea, West Indies.

## CHALINA MINOR, n. sp. (Text-fig. 12.)

This new species has been created for the reception of two small specimens.

The first specimen is of irregularly ovoid shape and shelters a small crab. The complete specimen measures 28 mm. long by 19 mm. wide, and is 19 mm. high at the highest point.

The second specimen does not shelter a crab, but there is on one side a shallow oval depression, from which it seems likely that a crab has been detached. The specimen is an upright mass, somewhat larger than the previous one, and measures 30 mm. by 35 mm., and is 32 mm. high. All over the surface of the sponge, except the depression supposed to have been occupied by a crab, there occur irregular and rather large fragments of calcareous matter and rock (average size 5 mm.  $\times$  5 mm.), some of which are merely attached to the surface, while others are actually partially embedded in the sponge.

The true surface of the sponge is wanting in both specimens, the dermal membrane having been entirely destroyed all over the specimen. As a result, the surface appears finely reticulate, as the skeletal fibres are apparent. This reticulation varies in the size of the mesh from 0.1 mm. to 1.0 mm.

The oscula and pores were neither visible, doubtless owing to the destruction of the dermal membrane.

The colour in spirit is a rather dirty yellowish white.

The texture of the sponge is soft and easily compressible, but nevertheless tough and not easily broken.

*Skeleton arrangement.*

The skeleton consists of a fairly regular reticulation of spicule-covered spongin-fibre, in which primary and secondary fibres are clearly differentiated.

The primary fibres run radially, as a rule about 1.0 mm. apart, though in some parts of the sponge they lie more irregularly, sometimes close together, and in other places much more rarely. They always contain several rows of spicules, usually 5 or 6. These spicules are arranged in a somewhat plumose manner in the fibres, so that their outer points extend frequently almost to the surface of the fibre. The fibres measure 0.06 mm. in diameter.

In the secondary fibres the spicules always lie uniserially, and there are frequently short gaps between the ends of the spicules in the fibre. The fibres do not possess any definite orientation, but form a fairly regular network which varies in size of mesh from 0.2 mm. to 1.0 mm. The fibres measure, on the average, 0.004 mm., some being as small as 0.03 mm., while a few may be found as large as 0.06 mm.



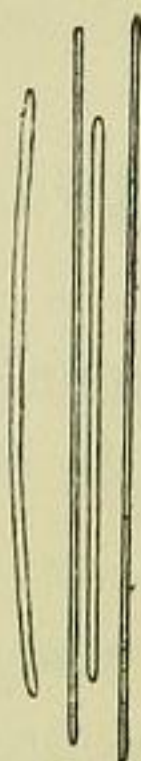


Fig. 12. — *Chalina minor*. Spicules,  $\times 400$ .

*Spicules.* (Text-fig. 12.)

The spicules of this species consist solely of oxea, which are nearly always curved, cylindrical oxea, tapering from the middle to either end. The ends are sharply pointed. The average length of the spicules is 0.09 mm.

*Spongin.*

The spongin coating the spicules is very pale in colour, and not very abundant in the main fibres. In actual size the secondary fibres sometimes quite equal the primary fibres, though they contain many less spicules.

*Locality.* From Suakin Harbour, in 5 fathoms of water.

*Distribution.* Red Sea,

*CERAOCHALINA DENSA*, Keller.

Synonymy:—

1889. *Ceraochalina densa*, Keller (18).

Two specimens occur in the collection belonging to this species; they are large spreading sponges, not rising very high from their support, and they bear a number of large, low tubes, partially fused together where their sides come in contact, which form the major portion of the specimens. These tubes are about 25 mm. high from base to summit, and 60 mm. in diameter in the largest specimens. The whole sponge forms a low cushion.

The skeleton, both in structure and measurements, and the spicules occurring in it, agree very closely with Keller's descriptions.

*Locality.* Suakin Harbour.

*Distribution.* Red Sea.

*SIPHONOCALINA CONICA* (Keller).

Synonymy:—

1889. *Phylosiphonia conica*, Keller (18).

Several specimens of this species occur in the collection. The largest forms an irregular spreading mass covering a large base, with several tubular processes arising from it. Another specimen is growing over a group of mussels, and others have mussels embedded in them. In all a very great similarity of form is apparent, and the tubular processes which arise from them are very similar. From the largest specimen 12 of these tubes arise, which are 15 mm. high and 8 mm. in diameter at the base. At the summit the diameter of the tube is only 6 mm., and here the sponge-wall merely consists of the oscular lip, the osculum being as wide as the tube itself in this

region. Throughout the length of the process the wall of the tube is very thin and rarely exceeds 3 mm. in thickness.

The colour in spirit is dirty white.

The skeleton arrangement and the spicular measurements agree with Keller's description.

*Locality.* All the specimens were obtained from buoys in Suez Bay.

*Distribution.* Red Sea.

#### SIPHONOCALINA COMMUNIS, *Carter.*

Synonymy:—

1880. *Siphonochalina communis*, Carter (7 a).

1905. *Siphonochalina communis*, Dendy (11).

This species is represented in the collection by three specimens representing two varieties.

*Var. α.*—The first variety is represented by two fairly large specimens, the largest possessing five tubular processes 20–25 mm. in diameter. They agree very closely with Dendy's figure in the report on the Ceylon Sponges (11). The tubular processes are quite smooth on the surface, but they exhibit a very slightly raised and rather inconspicuous reticulation on the surface, as do Dendy's specimens. At the summit of each of the tubes is an osculum whose diameter is on the average 4 mm.

The colour of the specimens is yellowish white.

The skeleton consists of an irregular reticulation of spicule-covered spongin-fibres, in which main fibres can be distinguished from secondary fibres, for the main fibres, which run somewhat irregularly, are covered by several rows of spicules, while the secondary fibres have the spines arranged uniserially.

The spicules are oxea, straight, smooth, and cylindrical. They are of the same diameter for the greater part of their length, and abruptly but sharply pointed at each end. They measure 0.1 mm. in length and 0.002 in diameter.

*Var. β.*—The second variety is represented by a single specimen, consisting of two tubes only. These tubes are somewhat low, not being more than 12 mm. in height, but are of distinctly larger size than those of var. α, the largest measuring 33 mm. in diameter. The second tube is a small one, arising as an offshoot from the first, and measures 15 mm. in diameter. They each possess a widely open osculum at the summit, the diameter of the oscula being 8 mm. in the case of the larger tube and 4 mm. in the case of the smaller tube.

The surface of this specimen is even smoother than that of the two previous, there being no reticulation visible in this case.

The colour in spirit is dark brown.

The skeleton is very similar to that of var. α, but the main fibres run more regularly and do not contain quite so many spicules.

*Locality.* Two specimens were obtained from the mud-flats at Suez, and the third from Suez Docks.

*Distribution.* Red Sea, Kurrachee, Ceylon, Port Jackson.

SIPHONOCALINA TUBULOSA, *Ridley*.

Synonymy:—

1884. *Siphonochalina tubulosa*, Ridley (23).

1887. *Phylosiphonia pumila*, Lendenfeld (19).

1889. *Phylosiphonia pumila*, Keller (18).

This species is represented by a considerable number of specimens, all of which are small. The largest possesses five tubes arising from a flat spreading base. The whole specimen measures 70 mm. by 60 mm.; the tubes are 25 mm. high and 12 mm. to 15 mm. in diameter. At the top of each tube is a large osculum 6 mm. to 7 mm. across.

The colour in spirit is yellowish white.

All the specimens are very similar in external appearance, and their tubular processes are almost identical, but the skeleton of two of the specimens differs considerably from that of the others in the size of the spicules, which measure as follows:—

	Specimens A to G.	Specimens H & K.
<i>Length</i> .....	0·08 mm.—0·12 mm.	0·06 mm.—0·08 mm.
<i>Diameter</i> ...	0·008 mm.	0·008 mm.

*Locality.* One specimen was obtained from a buoy in Suez Bay, all the others (8) coming from Mersah Makdah.

*Distribution.* Red Sea.

SPINOSELLA SORORIA (*Duchassaing & Michelotti*).

Synonymy:—

1864. *Tuba sororia*, Duchassaing et Michelotti (13).

1870. *Siphonochalina papyracea*, O. Schmidt (25).

1890. *Siphonochalina sororia*, Dendy (8).

A single incomplete specimen, consisting of one tubular process, apparently broken off from the centre of a large specimen, has been placed in this species. The lower surface of the specimen has evidently been attached to some object, but of this support there is no part on the sponge. The sponge is 55 mm. in height, and 30 mm. wide at the top, which is the widest portion, and the aperture or "pseudosculum" which occurs at the top of the tube is 10 mm. in diameter.

The surface of the sponge is raised into prominent conuli, which average 5 mm. in height. At these points the main fibres of the skeleton come to the surface.

These main fibres are arranged fairly regularly, and lie radially in the

sponge. The spicules which occur in them are very numerous, frequently lying 10- to 20-serially, and frequently being arranged in a slightly plumose fashion. Between these main fibres secondary fibres occur, forming a connecting meshwork; in these fibres the spicules are usually uniserial, but may be 2- or 3-serial. Rarely they are altogether absent from the fibre.

The spicules are small, straight oxea, abruptly pointed at each end; they measure on an average 0.08 mm. in length and 0.002 mm. in diameter.

The colour in spirit is grey-brown.

*Locality.* Suakin Harbour.

*Distribution.* Red Sea, West Indies.

#### SPINOSELLA INCRUSTANS, n. sp. (Text-fig. 13.)

This new species has been created for the reception of a single specimen of rather small size, consisting of four very low and wide tubes. Two of these tubes face laterally and are almost wholly fused into one, only the oscula at their summits being separate. The specimen measures in all 75 mm. long, 40 mm. broad, and the tubes vary in height from the base from 15 mm. to 25 mm. This highest point occurs on the tubes facing laterally. Each tube possesses an osculum at the summit, and these vary in diameter from 3 mm. to 6 mm.

The surface of the sponge is covered with small low conuli, whose average height is 2 mm. and which are usually 4 mm. to 5 mm. apart. In some parts, however, the conuli are much smaller and fewer, and in some parts hardly visible at all. They indicate the ends of the main skeletal fibre.

The colour of the specimen varies in different parts from light brown to dark red-brown, and purplish at the summits of the tubes.

The texture of the sponge is very firm, almost hard, and incompressible.

#### *Skeleton arrangement.*

The skeleton is a regular reticulation of spicule-covered spongin-fibre, with a fairly rectangular mesh which averages 0.4 mm. to 0.6 mm. wide in most parts of the sponge. There can be distinguished primary and secondary fibres. In the primary fibres the spicules lie 3- to 4-serial, and the fibres run radially. The secondary fibres contain only one row of spicules, and occasionally are entirely without spicules. They run both radially and tangentially in the sponge. These secondary fibres can be divided into large and small fibres. The large are nearly as thick as the primary, measuring 0.1 mm. in diameter, while the small are much thinner than the primary fibres, and only measure from 0.015 mm. to 0.02 mm. in diameter.

The dermal membrane contains a very delicate reticulation of spongin-fibre, in which spicules are rather scanty, only one or two here and there. In size they are similar to the small secondary fibres.

At the conuli which cover the surface the reticulation of the fibres becomes somewhat closer, and as a rule three or four of the primary fibres come close together, and all take part in forming the support of the conulus. Between these main fibres there occurs a dense reticulation of the small secondary fibres, and the dermal reticulation is also somewhat closer.



Fig. 13.—*Spinosella in crustans*. Spicules,  $\times 400$ .

*Spicules.* (Text-fig. 13.)

The only spicules which occur in the sponge are oxea. They are slender, rather small spicules, which are of the same thickness for most of their length, but somewhat gradually pointed at the ends. They are almost always quite straight, but a few can be seen slightly curved. They average 0.095 mm. to 0.1 mm. in length, and are very variable in thickness. Nearly all the spicules are about 0.001 mm. in diameter, but a few may be found as much as 0.0025 mm. thick.

*Locality.* The specimen was attached to a dead pearl-shell obtained at Khor Dongonab.

*Distribution.* Red Sea.

Sub-Family GELLIINÆ.

Haploscleridæ with diactinal megascleres, and sigmata or toxa or microxea for microscleres.

GELLIODES POCULUM, *Ridley & Dendy*. Var.

Synonymy:—

1887. *Gelliodes poculum*, *Ridley & Dendy* (24).

Two specimens of this species occur in the collection—one fairly large and apparently complete, the other a mere fragment. The larger is small compared with the 'Challenger' species, and differs slightly from the type there illustrated. It consists of an irregularly ramifying tubular basal mass, from which arise a number of upright hollow tubes. In the basal part there occur several horny Lamellibranch shells (probably *Avicula* sp.).

The largest tube is 20 mm. in diameter, and the various tubes which form the specimen vary from this size down to 3 mm. in diameter. The canal inside the basal portion is usually about 3 mm. in diameter, but may reach as much as 5 mm. The upright tubes have comparatively much larger canals inside them, and at the summit the wall of the tube is thinned out to a mere oscular rim. The oscula at the top of the tubes attain a maximum diameter

of 10 mm. They only occur on these upright processes, being entirely absent from the basal portion of the sponge.

The complete specimen measures 120 mm. in length, 60 mm. in breadth, and is 35 mm. high from the base to the top of the highest tube.

The colour in spirit is yellowish white.

The sponge is very fragile, being very easily broken at any point.

The skeleton, both in arrangement and in the spicules comprising it, is typical of the species. The sigmata, as in the type, are rather scarce, fairly large, and of the usual shape.

*Locality.* Along the 5-fathom line in the north-west part of Suez Bay.

*Distribution.* Red Sea ; Port Jackson, Australia.

#### Sub-Family HETEROXYINÆ.

Haploscleridæ with a dense cortex composed of radially arranged megascleres. Megascleres oxea, some of which may or may not be spined. Microscleres present or absent.

This diagnosis has been slightly altered from Dendy's original one (11) to admit of a new genus, *Anacanthæa*, being placed in it. The position of the group is rather unsatisfactory, especially as the general character of the oxea approaches much more nearly to the Axinellidæ than to the Haploscleridæ, as it also does in the presence of trichodragmata in some species.

I have, however, left it in its original position, as I do not feel that a single specimen justifies its removal.

#### ANACANTHÆA, n. gen.

Heteroxyinæ in which the oxea are not differentiated into two forms, and without spines on them. There are no microscleres.

The present genus has been created for the reception of a single specimen, showing very great external resemblance to the genus *Acanthoxifer*, Dendy (11), but whose spiculation differs from this genus in the entire absence of spines from all the oxea. The placing of this new genus in this sub-family has also been decided on on account of this resemblance ; but the sub-family Heteroxyinæ, as at present constituted, does not seem to have any very definite characteristics, save that the megascleres are all oxea.

#### ANACANTHÆA NIVEA, n. sp. (Pl. 38. fig. 17 ; Text-fig. 14.)

This new species, the only representative of the new genus *Anacanthæa*, is represented by a single rather small specimen. It is in the form of an

upright, rather thick lamella, growing from a small circular base. The attachment of the sponge is absent, and a portion of the sponge has been lost with it. The whole specimen is 40 mm. high, 30 mm. wide, and 8 mm. to 10 mm. thick.

The external surface, where visible, is almost exactly like that of *Acanthoxifer*, Dendy (11); the whole surface of the sponge is lined by pore-grooves, which divide up the surface into a number of polygonal or rounded areas, which measure from 3 mm. to 6 mm. in diameter. The pore-grooves are usually about 1.5 mm. wide. Each of the polygonal areas marked out by the pore-grooves is somewhat higher in the centre than at the edge, so that it has the form of a very low rounded eminence, with a perfectly smooth surface.

The pore-areas possess a special skeleton, but it is very slightly different from that of the general dermal skeleton. On the outside it is marked by the fact that the brushes of spicules project somewhat further from the surface than they do elsewhere. The pore-groove thus presents the appearance of a densely, but minutely, hispid ridge, raised very slightly above the immediate surrounding surface.

The colour of the sponge is a very slightly yellowish white, a colour probably due to the fact that it was placed in the same bottle as some deep yellow specimens, and the spirit in which the sponges were preserved is coloured a very deep yellow. Since there is no spongin in the specimen, and the surface is densely covered with spicules, the probability is that in life the sponge was a brilliant white.

The texture of the sponge is firm, almost hard, and the sponge can only be cut with difficulty.

#### *Skeleton arrangement.*

The main skeleton consists of a very dense mass of oxea, felted together without any orientation save at the surface. The whole sponge contains immense numbers of oxea throughout, almost filling the entire specimen. At the surface there are a very large number of small brushes of similar oxea, packed closely together, and forming a cortical skeleton.

Over the polygonal areas these brushes of spicules do neither attain a large size nor project much from the surface; but in the pore-grooves they are very large, sometimes containing 30 or 40 spicules, and they project considerably from the surface. In the size and shape of the spicules, however, they do not differ either from the other dermal spicular brushes or from the main skeleton.

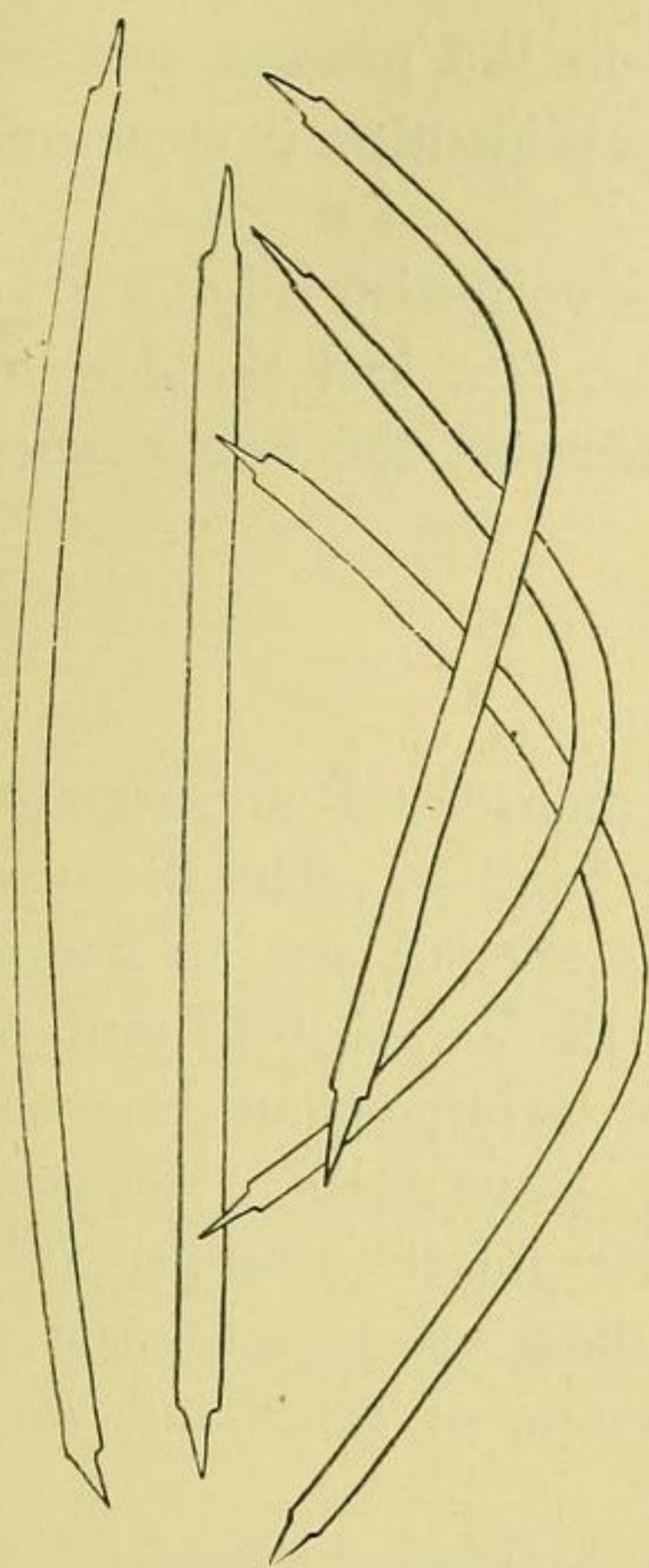


Fig. 14.—*Anacantha nivea*.  
Spicules,  $\times 250$ .

#### *Spicules.* (Text-fig. 14.)

The only spicules are oxea, of varying shape and size, but not marked out into different types, as all intermediate conditions between the extremes can be found.

They are very rarely quite straight, and sometimes very strongly curved, and not always regularly; they vary considerably in length, and slightly in thickness in the full-grown specimens, but all stages of growth can be found in the sponge, and therefore all lengths and thicknesses. As a rule, those spicules which are very strongly bent are rather shorter than those which are straight. They are thickest in the middle and taper very slightly in each direction for a great part of their length; the ends are of the typical irregular Axinellid shape and are sharply pointed.

The length varies in apparently full-grown spicules from 0.35 mm. to 0.43 mm., and the thickness from 0.006 mm. to 0.01 mm.

#### Family DESMACIDONIDÆ.

Sigmatotetragonida in which some of the microscleres are chelæ (except where such have been lost by degeneration).

#### Sub-Family ESPERELLINÆ.

Desmacidonidæ without echinating spicules, and without fistular outgrowths of the sponge-body.

#### ESPERELLA DENDYI, n. sp. (Text-fig. 15.)

This remarkable species is represented by two specimens, one of which is very small. Neither is quite complete, each showing a large torn surface. The largest consists of a roughly triangular mass, which apparently grew in an upright position; it measures 90 mm. high. The outer surface, where visible, is exactly like that of *Esperella murrayi*, of the 'Challenger' report (Ridley & Dendy (24)), being marked out into irregularly shaped areas by the peculiar meandering pore-grooves which are characteristic of these two



species. These pore-grooves are very well marked in the present species, quite as well as in *Esperella murrayi*, and their skeleton is identical in structure with that of the 'Challenger' species.

The colour of the specimens in spirit is white with a yellowish tinge.

The interior of the sponge is cavernous and rather lax, and the dermal skeleton is not so dense as in *Esperella murrayi*, otherwise the two species are almost exactly similar in skeleton arrangement.

#### *Skeleton.*

The main skeleton consists in huge bundles of monactinal megascleres which spread out on the surface to meet the adjacent bundles. The distance between the bundles immediately below the surface is about 1 mm. to 2 mm. on the average; the bundles of spicules average 0.12 mm. to 0.13 mm. in diameter. In the interior of the sponge the spicular arrangement becomes much more confused, and the bundles are difficult to distinguish. Between these spicule-bundles occur large subdermal cavities irregularly arranged, into which open the channels from the pore-areas; from these subdermal cavities there leads down into the interior of the sponge a system of large and very numerous canals.

The whole tissues of the sponge are filled with enormous quantities of raphides and trichodragmata, with conspicuous rosettes of remarkable anisochelæ near the surface. Small anisochelæ of quite another type also occur in the sponge, scattered throughout the tissues, and especially abundant on the dermal membrane.

#### *Spicules.*

##### A. Megascleres.

The only megascleres are styli which form the spicular bundles referred to above. They average 0.5 mm. long and 0.01 mm. in diameter.

##### B. Microscleres.

###### (a) Chelæ. (Text-fig. 15.)

Scattered fairly plentifully about immediately below the surface are very large rosettes of palmate anisochelæ of very striking form. These chelæ form the great distinction between this species and *Esperella murrayi*. The rosettes are about 0.12 mm. in diameter and contain numerous chelæ. The chelæ are characterised by the extremely stout and strongly curved shaft and by the comparatively large size of the smaller end. The chelæ measure 0.055 mm. to 0.06 mm. in length and 0.032 mm. wide at the widest point. Both median and lateral palms are present at each end, and the palms are of large size. The lateral palms of the larger end extend some way down the shaft in most cases. The shaft is oval in section and measures 0.01 mm. by 0.006 mm. in major and minor diameters.

The smaller anisochelæ are not arranged in rosettes and are much more typical in shape. They measure 0·026 mm. in length. The palms of the larger end are well developed, especially the median one, but they are very small indeed at the small end.

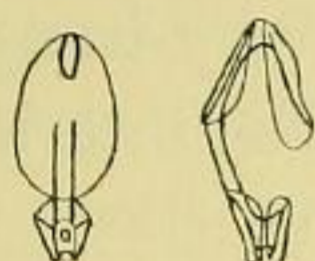
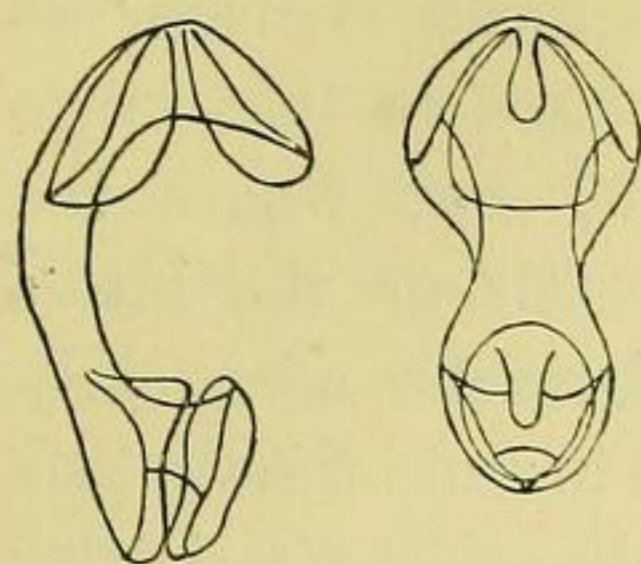


Fig. 15.—*Esperella dendyi*.  
Anisochelæ,  $\times 450$ .

(b) Trichodragmata.

The trichodragmata occur in enormous numbers throughout the sponge; they measure 0·065 mm. to 0·08 mm. in length. They are composed of numerous very slender raphides.

(c) Raphides.

Extremely slender raphides also occur in large quantities through the sponge. They are exactly like the individual raphides of the trichodragmata.

*Locality.* No definite locality is given, but the bottle bears a label "Sponge Trials 1."

*Distribution.* Red Sea.

*ESPERELLA EUPLECTELLIROIDES*, n. sp. (Pl. 37. fig. 12; Text-fig. 16.)

A single specimen of this remarkable sponge occurs in the collection. As the name indicates, the external form of the sponge is very similar to that of the Hexactinellid genus *Euplectella*.

The sponge is attached to its support by a small base measuring about 35 mm.  $\times$  22 mm. in extent, but the actual area of attachment consists of an irregular surface, which appears to have been situated vertically and which does not entirely cover the base of the sponge. From this base the sponge grows erect, the lower part being curved abruptly to bring the sponge into this position.

The body of the sponge consists of a hollow cylindrical tube, 200 mm. in height and about 100 mm. in diameter at the widest part, which occurs about halfway up. The cylinder is widely open at the top, the aperture being slightly oval and 75 mm. across.

The wall of the cylinder consists of a coarse and very irregular reticulation of skeletal fibre, covered with sarcode. This fibre consists of a core of spicules coated with spongin. The diameter of the fibres varies very much, some of them being very delicate, while the largest fibres, which occur towards the base of the sponge, reach 1·0 mm. in diameter, or possibly even more. The fibre reticulation is very irregular, and large and small fibres are mixed up together in such a way that it is quite impossible to call some primary and others secondary fibres. In fact, there does not seem to be any distinction between the fibres, save that of size. In the same way the meshwork made by

these fibres is very irregular, and the diameter of the holes varies from practically nothing to 5 mm. in diameter. Where this mesh is wide the sarcode coating the fibres frequently does not fill the spaces, so that large holes and cavities occur throughout the sponge-wall; but where the reticulation of the fibre is compact, the sarcode completely fills up the interspaces. Thus the sponge-wall consists of a number of tracts, of greatly varying size and irregular arrangement, where the sarcode around the various skeletal fibres has completely fused together, united to each other by similar tracts or by fibre-covered bars of sarcode, and between these tracts there occur large interspaces, transforming the wall of the sponge into a very irregular honeycomb. By the various spaces in the wall, the cavity of the interior of the sponge-cylinder is placed in communication with the exterior.

The inner surface of the sponge-cylinder is comparatively smooth, though the sarcode tracts are covered with low ridges and small prominences, owing to the irregularity of the skeletal fibre. This fibre does not proliferate towards the interior of the sponge-cylinder, however, so that these irregularities of surface are confined to one plane, that of the surface itself.

On the other hand, the outer surface of the sponge-wall is covered with a forest of protruding fibres, which branch out and anastomose with one another profusely. These fibres in their distal portions are almost bare of sarcode, and appear as small tree-like processes outside the general tissues of the sponge.

The oscula are not easy to distinguish from the interspaces between sarcode tracts, but true oscula appear to be fairly common, irregularly scattered over the whole surface of the sponge. They are quite small, rarely exceeding 1.0 mm. in diameter. They occur on the inside as well as the outside of the cylinder wall. Where pores could be distinguished, they were extremely numerous, scattered thickly and regularly over the dermal membrane of the sponge. They are quite small and appeared somewhat irregular in outline. They are not located in special pore-areas, and no special skeleton is present in connection with them.

As stated above, the spicule-covered fibre which forms the main skeleton may reach a diameter of over 1.0 mm., and all sizes less than this maximum can be distinguished. The fibres are entirely filled up with spicules of various kinds, of which the most frequent by far are tylostyles, with considerable numbers of foreign bodies, chelæ, and sigmata, and broken spicules mixed with them. The tylostyles and the broken megascleres, whether foreign or not, lie longitudinally and very regularly in the fibre, but the chelæ and sigmata, and the non-spicular foreign bodies, which are usually quite small, lie entirely without orientation in the fibre. The spongin which coats the spicule is dull yellowish brown in colour, and even in the largest fibres does not greatly exceed the spicular bundle in diameter. In fact, spicules seem to

be added during the whole life of the fibre, though no spicules seemed to occur just outside the spongin, as one would expect if this were the case.

The branching of the skeletal fibre is very irregular and many anastomoses occur between the fibres in the deeper parts of the sponge-wall. On the outside of the sponge the fibres which extend furthest are often entirely free from any covering of sarcode, and the spicules do not project from the spongin.

Outside these fibres megascleres are somewhat rare, but a few spicule-fibres entirely free from spongin occur. The spicules composing these fibres are always wholly tylostyles, exactly similar to those of the main fibres, and, as far as could be ascertained, in no way distinguishable from them, and they very rarely lie more than 5- or 6-serial in the fibres. Owing to the peculiar structure of the sponge-wall, no definite direction can be assigned to these fibres, but they nearly always have one end projecting from the sponge-wall.

Isolated tylostyles may also be occasionally found in the sponge, but these are very rare, and are not related to any definite part of the sponge.

The microscleres are extremely numerous, and consist of small anisochelæ and comparatively large sigmata. They are arranged quite irregularly in the sponge, and no anisochele rosettes occur.

### *Spicules.*

#### A. Megascleres.

The tylostyles referred to above are the only megascleres occurring in this species. They are somewhat small, straight, conical, and the shaft tapers gradually from the head to the apex. The head is typically Esperelline in shape, being oval, with the long axis of the head a continuation of the axis of the whole spicule. The length of the spicule varies from 0.157 mm. to 0.21 mm., but by far the greater number of spicules approximate very closely to the latter measurement.

The diameter of the shaft at its thickest point (close to the head) is 0.003 mm. in full-grown specimens, and very slightly under this in immature spicules. The head averages 0.007 mm. in length by 0.0045 mm. in greatest diameter. There is no difference in measurements between the tylostyles of the skeletal fibres and those scattered about in the sarcode.

#### B. Microscleres. (Text fig. 16.)

##### (i.) Chelæ. (Text-fig. 16, A.)

The chelæ occur scattered throughout the whole of the sponge, and entirely without orientation or definite arrangement, either in reference to the sponge itself or to one another. They are extremely numerous in all parts of the sponge.

The chelæ are palmate anisochelæ of rather small size, with the "palms" extremely delicate and difficult to distinguish. They measure 0.026 mm. long.

In addition to these large forms there occur also larger numbers of smaller anisochelæ, which are also scattered about without orientation or arrangement. They are apparently the young forms of the above anisochelæ, as all intermediate stages can be found.

(ii.) Sigmata. (Text-fig. 16, B.)

The sigmata are comparatively large and of typical **C** or **S**-shape. They are not nearly so numerous as the anisochelæ, but, like them, they are not

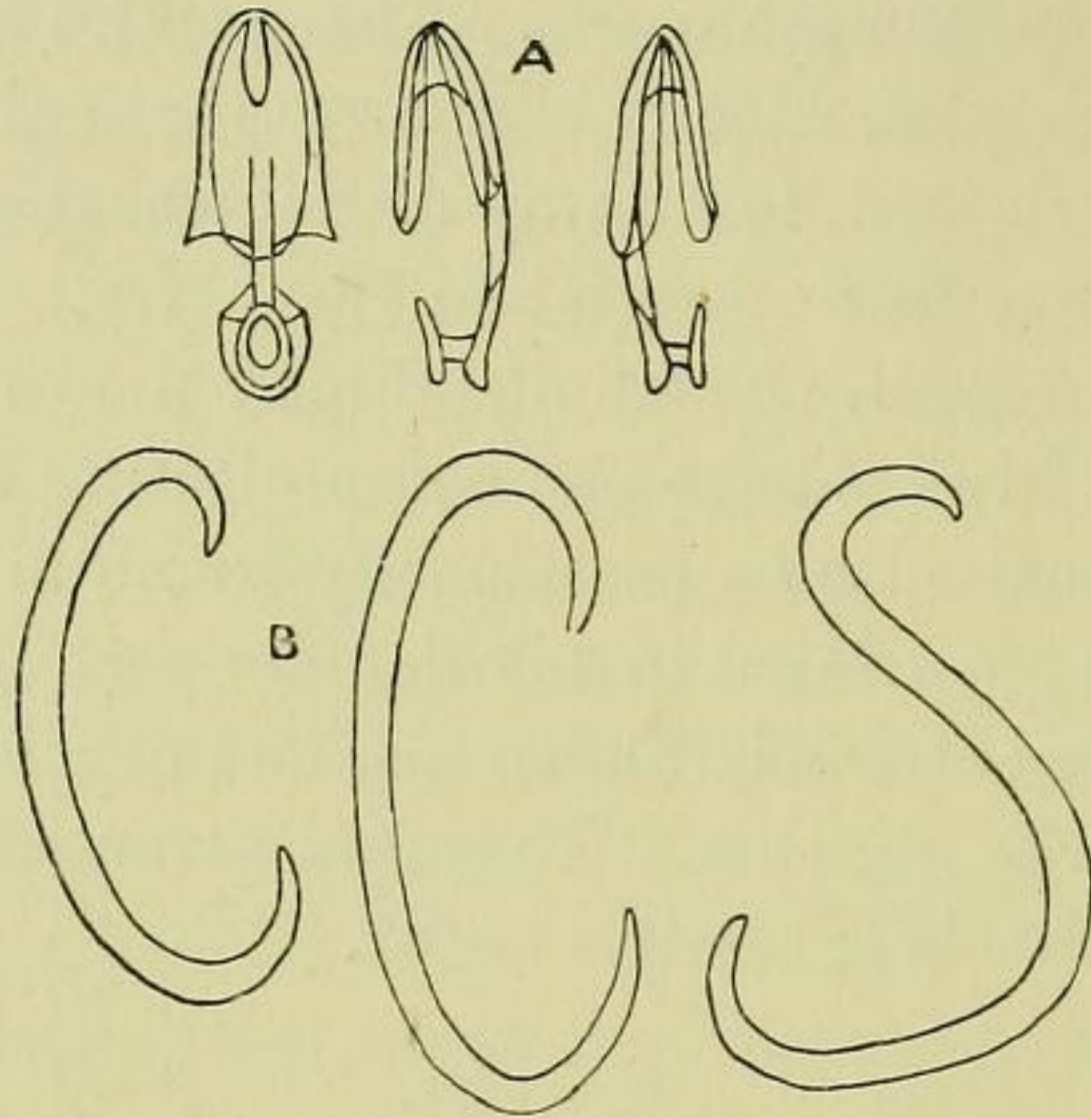


Fig. 16.—*Esperella euplectellioides*. Microscleres,  $\times 675$ .

orientated at all in the sponge. They measure on the average 0.05 mm. to 0.06 mm. across the curve, and about 0.1 mm. along the spicule itself. They are comparatively slender, being not more than 0.0012 mm. in diameter. No small or immature sigmata were seen.

*Locality.* No locality is given.

*Distribution.* Red Sea.

*ESPERELLA FISTULIFERA*, n. sp. (Text-fig. 17.)

The characteristic feature of the present species is the external form. It consists of an undivided basal portion, of considerable size and very irregular shape, from the surface of which arise large numbers of small tubular processes, each with an osculum at the summit. These processes frequently occur in groups arising from a common stalk, so that the whole group may possibly arise by the branching of a single process. They occur over the whole of the upper surface of the sponge, and also in considerable numbers on its sides. They invariably stand erect, those arising on the sides of the mass being sharply curved at their base so as to assume the vertical position immediately.

These processes vary very considerably in length, but never appear to exceed 10 mm. when single, but a group of processes as a whole may reach a

length of 25 mm. or even 30 mm. The largest complete specimen in the collection measures 120 mm. in length, 45 mm. in breadth, and 55 mm. high to the summit of the processes.

The surface of the sponge is smooth and even, and no reticulation can be seen on it. Under the microscope it is very minutely hispid, owing to the projection of spicules from it.

The oscula are confined to the summits of the processes above described and are very small. When widely open (at any rate in my specimens) they do not exceed 0·8 mm. in diameter, and in most cases they do not measure more than 0·3 mm. to 0·5 mm. A few of them are completely closed and invisible, the process being lipostomous. The pores are exceedingly minute and are scattered all over the sponge-surface.

The colour is a dull yellowish grey, due doubtless to a large extent to the great quantities of mud the sponge has engulfed.

The texture is very lax and soft, and the whole sponge is very fragile and easily broken.

#### *Skeleton arrangement.*

The skeleton consists almost entirely of rather sparsely and quite irregularly scattered tylostyles, but here and there occur slender spicular fibres, composed of spicules exactly similar to those scattered throughout the sponge. These fibres run irregularly in the sponge-body, even in the processes, but, as a rule, they tend toward the surface and finally project from it. In the processes they also run more or less longitudinally. The number of rows of spicules composing them varies from 3 in small fibres to 6 to 8 in the largest.

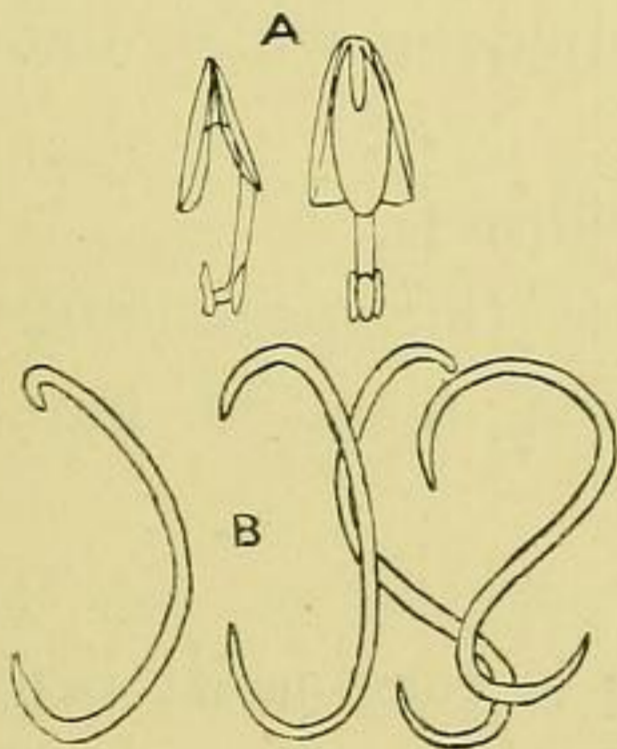


Fig. 17.

*Esperella fistulifera.*

Microscleres :

A  $\times 650$ ; B  $\times 380$ .

#### *Spicules.*

##### A. Megascleres.

The only megascleres which occur in this sponge are sub-tylostyli. They are very slender and always quite straight. The head is small and oval, and has its longest axis a continuation of the axis of the shaft of the spicule. The average length of the spicule is 0·25 mm. The thickest part of the shaft is close to the head; from these the spicule tapers very gradually to a very fine point. The diameter of the spicule is about 0·002 mm. at the thickest point, and that of the head 0·0025.

##### B. Microscleres. (Text-fig. 17.)

###### (i.) Chelæ. (Text-fig. 17, A.)

The chelæ are very small palmate anisochelæ, which occur sparsely scattered about throughout the sponge. They do not form rosettes, nor are they more

plentiful in any one part of the sponge than in another. They measure 0·023 mm. in length, and 0·008 mm. in breadth in the largest examples.

There are also present much smaller chelæ, which are apparently the young forms of the above. All intermediate sizes can be seen.

(ii.) Sigmata. (Text-fig. 17, B.)

Like the chelæ, the sigmata are not numerous in any part of the sponge, but they are somewhat more frequent than the former. They are not very regular in shape, showing very considerable variation in the amount of the curvature, and also in the abruptness of the curve. They measure 0·035 mm. to 0·04 mm. across the curve and from 0·001 mm. to 0·003 mm. in diameter.

*Locality.* Suez.

*Distribution.* Red Sea.

ESPERELLA SUEZZA, n. sp. (Text-fig. 18.)

This new species is represented by several specimens, all more or less damaged, owing to their very lax nature. Each specimen consists of a mass of tissue showing only a small portion of the true external surface. Several are attached to horny Lamellibranch shells (probably *Avicula*). In those specimens where the external surface can be seen, it appears to be fairly regular and to be covered with small, very low, rounded prominences, which are on the average 5 mm. in diameter.

The surface is apparently quite smooth and almost glabrous.

The oscula and pores could not be made out in most of the specimens, but in one case a few small oscula were seen, measuring about 1 mm. in diameter.

The colour in spirit is a dirty dark grey.

The texture of the sponge is very lax, and the sponge is very easily broken into fragments. Nearly always, however, the sponge tears apart vertically.

No further details of external appearance can be given owing to the fragmentary nature of the specimens.

*Skeleton arrangement.*

The main skeleton consists of spicular fibres, which lie very irregularly in the sponge. They do not form a reticulation of fibres, but lie in sinuous and irregular lines throughout the sponge. They also do not seem to be very long, but frequently stop short abruptly. The fibres branch frequently, sometimes forming a tree-like group of fibres, but the fibres never anastomose with each other and some of them are very short. A few fibres project from the surface.

The number of spicules which go to form any fibre varies enormously, especially according to whether the fibre is near the surface or far from it. In the former case the fibres may contain only 2 or 3 rows of spicules, and

rarely possess more than 5 or 6, while in the deeper parts of the sponge there may be 20 or 25 rows of spicules in each fibre.

In addition to the spicular fibres, there also occur considerable numbers of scattered spicules throughout the sponge. They are exactly similar to those found in the fibres.

There is no special cortical skeleton.

### *Spicules.*

#### A. Megascleres.

The only megascleres present are tylostyli, which possess well-marked heads. The spicule is fairly stout, cylindrical, and the shaft is thickest close to the head, from which point it gradually tapers down to a very fine point. The spicules are always quite straight. They measure from 0.32 mm. to

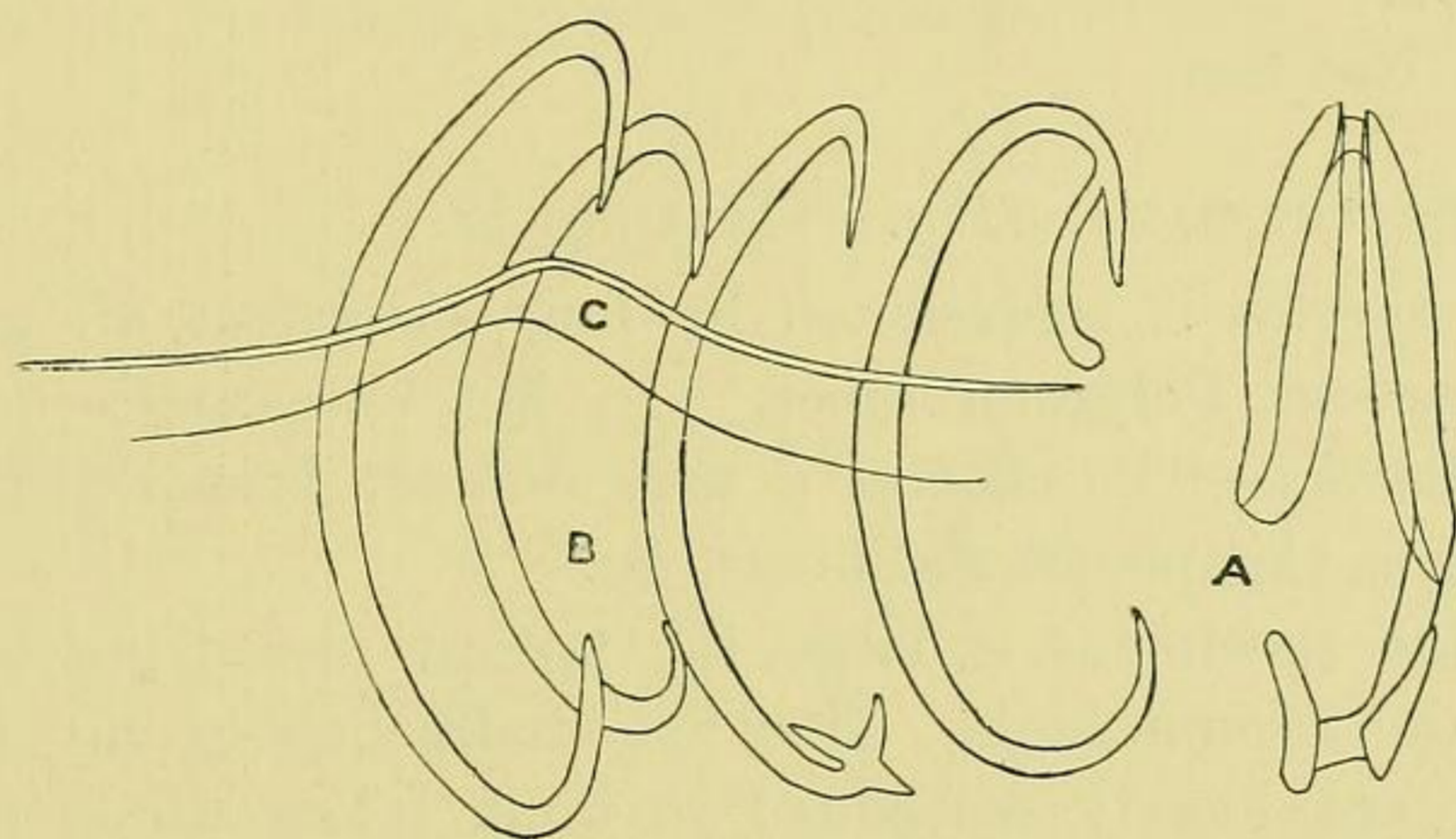


Fig. 18.—*Esperella suezza*. Microscleres: A  $\times 1000$ ; B & C  $\times 675$ .

0.33 mm. in length and 0.004 mm. in diameter at the thickest point in the shaft. The head, which is oval, measures 0.005 mm. in diameter.

#### B. Microscleres. (Text-fig. 18.)

##### (i.) Chelæ. (Text-fig. 18, A.)

The palmate anisochelæ are very abundant, occurring in large numbers throughout the sponge. They do not form rosettes. They are not very large, and the length of the largest specimens does not exceed 0.04 mm. Small forms are very numerous indeed.

##### (ii.) Sigmata. (Text-fig. 18, B.)

The sigmata are large, and are present in the sponge in enormous numbers, so that in some places they almost form a solid mass. For the most part they are C-shaped, but occasionally specimens may be seen contort. The average length of the sigmata, measuring across the curve, and not along it, is 0.07 mm., and the diameter of the spicule 0.004 mm.

Sigmata are occasionally found in which one of the ends is malformed, either swollen, or knobby, or possessing one or more excrescences or rays upon it. Typical examples are shown in the text-figure.



## (iii.) Toxa. (Text-fig. 18, C.)

The toxa are very large, but not numerous. The amount of curvature varies considerably, and also the abruptness of the curve. For almost its whole length the toxon is very slender, so slender that the diameter cannot be accurately measured, but at the centre of the bow it swells out into comparative stoutness. The ends of the spicule taper off to so delicate a point that it is almost impossible, when examining the spicules *in situ*, to ascertain the exact point at which they end; and in boiled-out preparations they are invariably broken. For this reason the lengths given here are only to be considered approximate. The length varies very considerably, from 0·31 mm. to 0·21 mm. The diameter at the centre is 0·001 mm., while the greater part of the spicule does not exceed 0·00025 mm. in diameter.

*Locality.* Suez.

*Distribution.* Red Sea.

## ESPERELLA ERYTHRÆANA, n. sp. (Text-fig. 19.)

The present species is represented by four specimens all growing over masses of calcareous Polyzoan tubes. In Mr. Crossland's notes they are described as follows:—"Patches of a very delicate branched Polyzoan, and with this Sponges, Compound Ascidians, &c."

Neither of the specimens is large, the largest measuring 65 mm. long, 52 mm. wide, and 25 mm. high. They are unattached to any foreign body, but apparently are loosely embedded in mud. The whole mass is quite amorphous, and no definite external form can be assigned to it.

The surface is smooth, but irregular, for branches of the Polyzoan project here and there all over the sponge, and in other places branches just beneath the dermal membrane cause projections and ridges to appear on the sponge-surface. Where the polyzoan is absent the surface is perfectly smooth and even.

The oscula are very small, not exceeding 0·5 mm. in diameter. They are very inconspicuous, and can only be distinguished on the surface by means of a lens. They are very numerous and are scattered fairly evenly over the whole sponge surface.

The pores are large, measuring from 0·15 mm. to 0·2 mm. in diameter. They occur in large numbers everywhere on the outside of the sponge, usually scattered singly, but occasionally in small groups. These groups, however, never form true pore-areas.

The colour is dark grey-brown in spirit.

The texture of the sponge is lax, and where it is not held together by the polyzoan it is very easily torn. The whole mass, however, is firm and fairly resistant, since the polyzoan tubes serve as a supporting framework.

*Skeleton arrangement.*

The main skeleton consists of a large number of spicular fibres, which run irregularly in the sponge. In the central parts of the sponge the fibres are very stout and frequently contain 30 or even more rows of spicules. As they get nearer the surface they frequently branch, and each time the branches into which they divide are smaller than the parent fibre, so that at the surface the average number of rows of spicules in a fibre does not exceed three to five. The general tendency of the fibres is to run more or less toward the surface, but the individual fibres show very great irregularities of position. The various fibres never anastomose with one another, and rarely cross, and their frequent branching when near the surface results in a tree-like appearance, when seen in a section. The spicules are sometimes arranged in a slightly plumose fashion in the fibres, especially in the large ones.

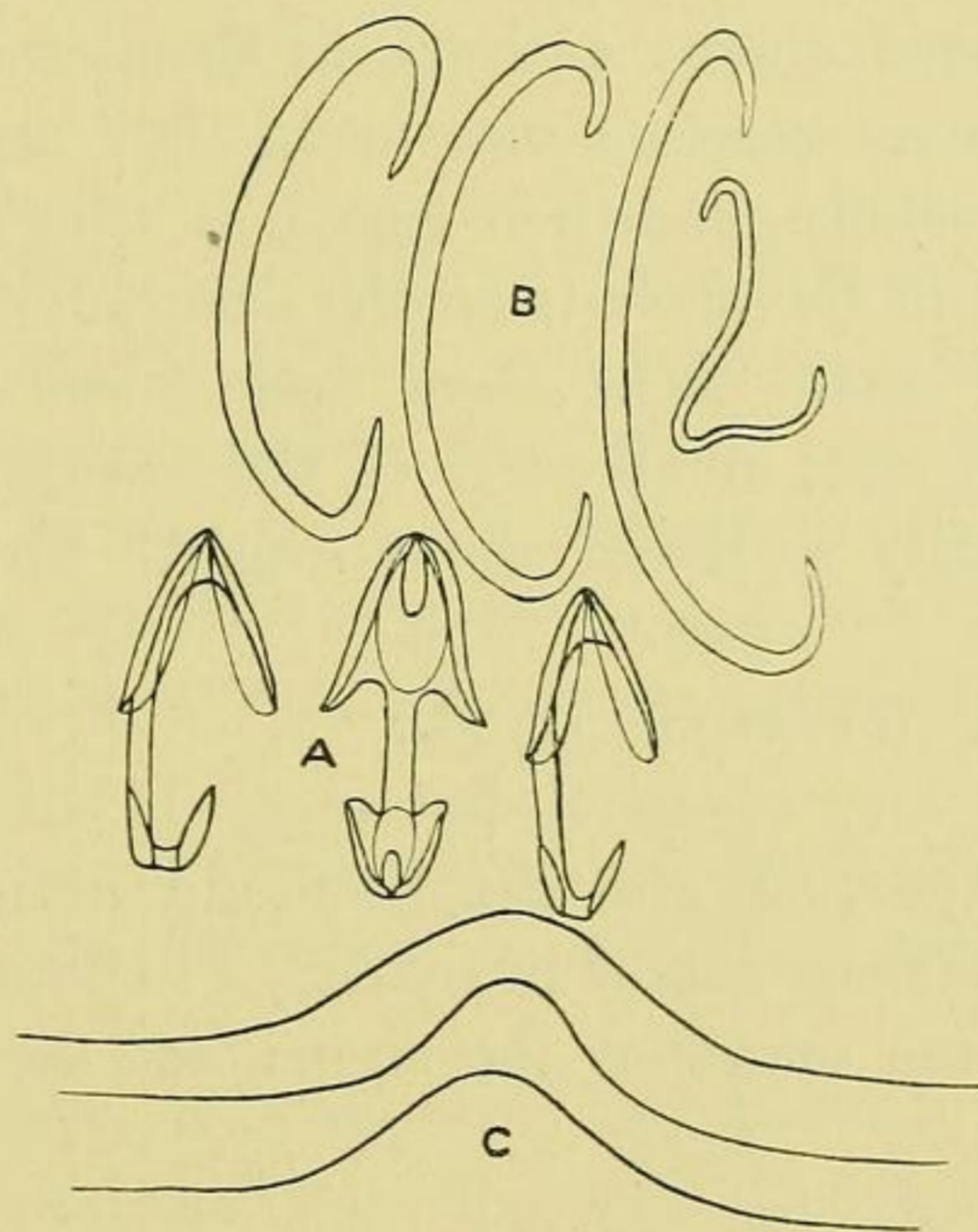


Fig. 19.—*Esperella erythræana*. Microscleres,  $\times 500$ .

At the surface of the sponge the fibres expand into loose brushes, about 0.15 mm. wide on the average, and containing possibly 20 to 25 spicules.

The dermal membrane is protected by a delicate, though irregular reticulation of spicular fibre. These fibres run without any orientation (save that they are necessarily longitudinal) over the surface of the sponge, and usually contain two or three rows of spicules, very rarely four or five. They do not branch or anastomose with one another.

The dermal membrane also contains a few anisocbele rosettes.

*Spicules.*

## A. Megascleres.

The only megascleres occurring in this sponge are subtylostyli, and there is no difference either in shape or measurement between the spicules of the dermal reticulation of spicule fibre and those of the main skeleton.

They consist of a long slender shaft, with a very slightly developed head at one end, and have a very fine point at the other. The thickest part of the shaft is about halfway along the spicule, and from this point the shaft gradually tapers towards either end. The head is very small and oval in shape, with its longer axis a continuation of the axis of the spicule-shaft.

The length of the spicule varies from 0.32 mm. to 0.33 mm., and the average diameter of the shaft at its thickest point is 0.004 mm. The diameter of the head varies from 0.004 mm. to 0.0045 mm.

## B. Microscleres. (Text-fig. 19.)

## (i.) Chelæ. (Text-fig. 19, A.)

The chelæ are confined almost entirely to the dermal membrane, where they occur in conspicuous rosettes, measuring 0.07 mm. in diameter. The chelæ are palmate anisochelæ, and their length is usually from 0.024 mm. to 0.036 mm. The width of the chela is on the average 0.0115 mm.

A large number of small chelæ were seen, some being isochelæ, and varying very much in size, in all parts of the sponge. They do not form rosettes, and were usually scattered about singly. Their average length is 0.015 mm.

## (ii.) Sigmata. (Text-fig. 19, B.)

The sigmata are not very plentiful, but occur in all parts of the sponge. They are usually C-shaped, but also can be found contort. They vary considerably in size and to some extent in shape. They measure from 0.05 mm. to 0.075 mm. across the curve of the sigma, and their diameter does not exceed 0.002 mm.

## (iii.) Toxa. (Text-fig. 19, C.)

The toxa are very few in number, and only occur in the deeper parts of the sponge. They are strongly bowed, and very slender throughout their length, so much so that at the extremities it is very difficult to determine the ends of the spicule with accuracy. Their average length is 0.09 mm., and their diameter less than 0.0005 mm.

## (iv.) Raphides.

Numerous very slender hair-like oxea occur throughout the sponge. It is not possible to say for certain whether they are young oxeote forms of the regular styli or true raphides. They vary in length from 0.02 mm. to 0.15 mm. Their diameter rarely exceeds 0.001 mm.

*Locality.* Khor Shinab.

*Distribution.* Red Sea.

## Sub-Family ECTYONINÆ.

Desmacidonidæ in which some of the megascleres take the form of spined styli, originally developed as echinating spicules of the skeleton fibre or projecting at right angles from the substratum.

MYXILLA ISODICTYALIS (*Carter*).

Synonymy:—

1882. *Halichondria isodictyalis*, Carter (4).

There is a small fragment of this species in the collection, which, though extremely small and fragmentary, is easily recognizable as this species by its skeleton arrangement and spicules, which agree with Carter's original description in every particular.

*Locality.* Suez mud-flats.

*Distribution.* Red Sea, Acapulco.

## MYXILLA CRATERA, n. sp. (Pl. 37. fig. 13; Text-fig. 20.)

This new and remarkable species is represented in the collection by a considerable number of specimens, all of which are very similar in external appearance. They each consist of a cushion-like mass of rather irregular shape and varying size, attached to some foreign body by a large base. The largest specimen measures 50 mm. by 32 mm., and is 25 mm. high from base to summit.

The surface is covered thickly with small crater-like projections, which are pore-areas, and which measure about 2 mm. to 3 mm. in diameter on the average.

Each pore-area is raised on a more or less circular wall from the regular surface of the sponge, and this wall is usually about 0.7 mm. high. Inside the cone thus formed, but rather below the top of the wall, a membrane is stretched, in which are pierced a very large number of pores of small size. (There are sometimes hundreds of minute pores in a single pore-area.) Below the membrane is a large cavity, above the surface of the sponge, and occupying almost the whole of the inside of the crater-like process. At the level of the general surface of the sponge there is another membrane, this time apparently sphinctrate, which can close (presumably) the entrance to the inhalant canals, which run directly down from these "pore-cones" into the interior of the sponge.

These pore-areas, as can be seen in the photograph (Pl. 37. fig. 13), are packed together thickly over the whole surface of the sponge. They extend right down the sides of the cushion to the base.

The oscula are small, and are provided with special cones like the pore-

areas. In this case, however, the sieve-membrane stretched over the pore-area is replaced by a sphincter-membrane. The oscula usually measure about 1.5 mm. to 2.0 mm. in diameter.

The colour is yellowish white in spirit.

The texture is firm, resistant, and hardly at all compressible.

#### *Skeleton arrangement.*

The main skeleton consists of a very dense and quite irregular mass of spined styli, lying in the sponge entirely without orientation. Here and there a few spicular fibres can be seen, but these fibres are very few and are

not oriented, so that it seems probable they are but accidental, owing to the spicules lying parallel instead of irregularly at that particular spot.

At the surface of the sponge tylote spicules are met with. In the actual dermal surface, between the "pore-cones," both tylota and acanthostyli occur, promiscuously mixed with each other, and tylota are also found below the surface, but always near it.

The pore-cones are supported by a special skeleton, composed entirely of tylostyles, and the oscular cones have an exactly similar skeleton. The wall of the cone is supported by numerous dense bundles of tylota, arranged vertically in the cone-wall. These bundles are about 0.15 mm. in diameter, and the spicules in them are very densely packed. They are separated from each other by a width approximately equal to the diameter of the bundle. In the sieve-membrane there frequently occur single tylota and large numbers of chelæ, but there is no special skeleton.

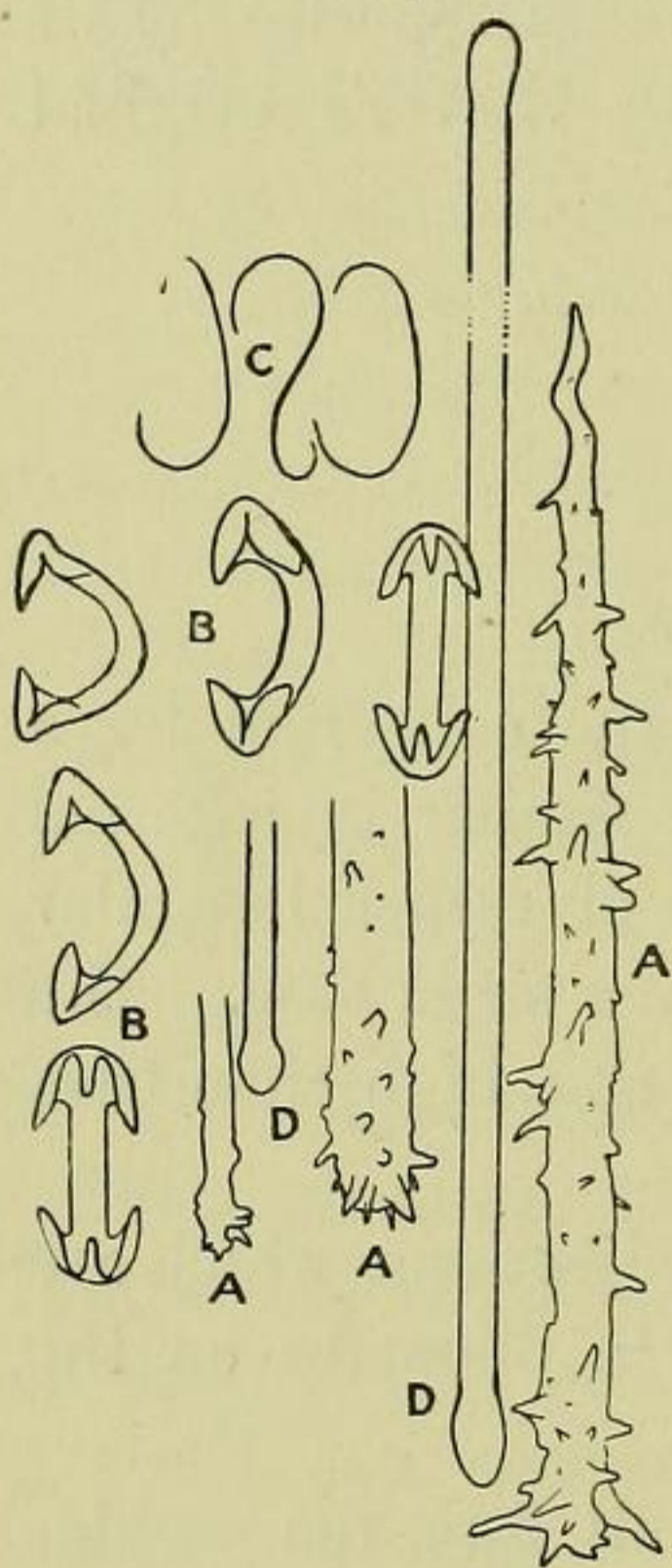


Fig. 20.—*Myxilla cratera*.  
Spicules,  $\times 650$ .

#### *Spicules.* (Text-fig. 20.)

##### A. Megascleres.

##### (i.) Tylota. (Text-fig. 20, D.)

Rather long, slender tylota, with a slight but curiously shaped head. In no part is the head of much greater diameter than the shaft of the spicule, but it is quite definitely, if slightly, larger than it; but instead of being rounded off on the distal side, the head is occasionally almost sharply pointed. The tylota are confined to the dermal membrane and adjacent parts. Length 0.23 mm. on the average; diameter 0.003 mm. Diameter of head 0.004 mm.

## (ii.) Styles. (Text-fig. 20, A.)

All the styles have spines on them, both at the surface and in the interior of the sponge, but both in amount of spinulation and in the length of the spines considerable variation occurs, the spicules nearest the surface being the most spiny, both in number and length of spine. Great variation also occurs in the length of the spicule, those in the interior of the sponge being much larger than those near the surface. Thus the largest spicules have the fewest spines and *vice versâ*. The length of the styles varies from 0.1 mm. to 0.24 mm. The diameter of the head, excluding spines, is on the average 0.01 mm.

## B. Microsclerès.

## (i.) Chelæ. (Text-fig. 20, B.)

The chelæ are tridentate isochelæ, and they occur chiefly on the sieve-membranes of the pore-areas and near the dermal surface of the sponge. They also occur in large numbers among the tylota forming the skeleton of the pore-areas, and in the sphincter-membranes over the inhalant canals. They are all similar, and measure 0.02 mm. in length. The diameter of the shaft is 0.0036 mm.

## (ii.) Sigmata. (Text-fig. 20, C.)

A few sigmata occur scattered about in the sponge. They are very slender, C-shaped or contort, and usually measure about 0.02 mm. in length.

*Locality.* No locality is given, the bottles containing the specimens being merely labelled "Sponge Trials 1."

*Distribution.* Red Sea.

## MYXILLA TENUISSIMA, n. sp. (Text-fig. 21.)

There are three specimens of this species in the collection. Each of them consists of very thin lamellæ covering over a mass of calcareous and siliceous débris, but whether the sponge gathers these fragments together during its growth, it is impossible to say. In most parts the lamella covering the débris is extremely thin, often not exceeding 0.05 mm. in thickness, but occasionally, in crevices or between two pieces of débris not close together, the sponge may have a thickness of 0.3 mm. or even 0.5 mm. The largest specimen forms an irregular mass 30 mm. × 25 mm. and is 25 mm. high.

The surface is quite smooth and even, but under the microscope it can be seen to be very minutely hispid, owing to the projection from the surface of the points of the acanthostyli.

The oscula and pores could not be made out.

The colour of the specimens in spirit is a dense black, the pigment being contained in immense numbers of spherical or stellate cells, which occur throughout the sponge. Frequently these pigment-cells are arranged in bands along the surface of the sponge, but the meaning of this could not be ascertained.

*Skeleton arrangement.*

The main skeleton, which is also the dermal skeleton, owing to the peculiar character of the sponge, consists of an irregular reticulation of spicular fibres, which run tangentially just under the surface of the sponge. The spicules composing them are tylota, and there are usually several (six or eight) rows of spicules in the fibres. These fibres run quite irregularly, but do not seem to branch or anastomose.

In addition to these spicular fibres, there occur very large numbers of spined styli, which are arranged vertically to the surface. They occur scattered singly over the sponge surface and are fairly evenly and regularly distributed over the whole sponge. As a rule, they project for about half their length from the sponge surface.

*Spicules.* (Text-fig. 21.)

## A. Megascleres.

## (i.) Tylota.

The tylota are straight, slender spicules, with very slight heads. As was noticed in *Myxilla cratera*, the distal ends of the head are pointed instead of being rounded, and in the present species it is even more noticeable than in the former. They are, as a rule, about 0.16 mm. long, and the shaft, which is of almost the same thickness for the whole of its length, measures 0.002 mm. in diameter. The head does not exceed 0.003 mm. in diameter in most of the specimens, but a few were seen with large swollen heads, very similar to those of *Suberites*. These spicules are probably foreign.

## (ii.) Styles.

The styli are all thickly covered with fairly long spines, and throughout their whole length; also the spines are largest towards the head. They vary very considerably in length, probably owing to the variation in thickness of the sponge-film, and all measurements of length may be found between 0.05 mm. and 0.115 mm. The diameter of the head of the spicule, excluding the spines, measures 0.004 mm.

## B. Microscleres.

The only microscleres present in this species are tridentate isochelæ, which occur sparsely scattered throughout the sponge. The shaft of the chela is curved, almost bow-shaped, and the head is well developed. The chela measures 0.02 mm. to 0.024 mm. in length.

*Locality.* All three specimens were obtained in Suakin Harbour, in 5 fathoms of water.

*Distribution.* Red Sea.



Fig. 21.—*Myxilla tenuissima*.  
Spicules,  $\times 650$ .

OPHLITASPONGIA (?) ARBUSCULA, n. sp. (Pl. 39. fig. 22; Pl. 40. fig. 25; Text-fig. 22.)

This species has been created for the reception of two large tree-like specimens which were obtained together from a locality not stated. Each specimen consists of a considerable number of long irregular branches, which themselves branch irregularly, arising (and presumably growing more or less erect) from a small base. In the larger specimen the exact size and character of the pediment cannot be ascertained, as a portion of it is broken away, but the portion remaining measures 28 mm. by 15 mm. From this base four branches arise immediately, and there is no undivided basal portion of the sponge save the flat thin and encrusting pediment itself. The smaller specimen is even more incomplete than the larger, and in this case the pediment is entirely wanting.

The branches which form the sponge are irregular in shape, but usually more or less cylindrical. Numerous prominences and swellings occur on them, however, and here and there short processes arise from them which are apparently the commencements of new branches. The actual size of the branches also varies. The largest reach an extreme length, in the larger of the two specimens, of about 500 mm., but their fairly frequent branching, and the junctions which occasionally occur between contiguous branches, and also the manner in which the branches lie tangled up together, tend to diminish very considerably the height of the actual specimen. The branches vary in diameter from 5 mm. to 10 mm.

The outer surface of the sponge is harsh and often gritty, owing to the frequent occurrence of an incrustation of foreign bodies upon it. These are mostly sand-grains and minute coral fragments, but an encrusting polyzoan also grows over the sponge. The actual surface of the sponge is quite smooth, being covered by a very delicate dermal membrane, but it is covered with slight prominences and low ridges, owing to the pushing up of the dermal membrane by skeletal fibres lying just below. However, there are no actual projections of either fibre from the surface, but the spicules project very slightly and render it minutely hispid.

Both the specimens are apparently lipostomous, no oscula being distinguishable on either. The pores are very numerous and small, and are scattered all over the sponge surface, there being no special pore-areas.

The colour of the sponge is described by Mr. Crossland as "brick-red" during life, in spirit it is dark brown-black on the outside and orange-brown within; the spirit in which the sponge has been preserved is coloured bright orange-red.



*Skeleton arrangement.* (Pl. 40. fig. 25.)

The main skeleton consists of a dense reticulation of spicule-cored fibre, and of spicules scattered irregularly about throughout the sponge. The fibres are strongly coated with spongin and the reticulation is very close. There cannot be made a distinction into primary or secondary fibre, no separation of the fibres into groups being possible either in direction or size, for the reticulation, although the fibres are unoriented, is fairly regular, and they are all of equal size. The fibres average 0.08 mm. in diameter, but where a junction between two or more fibres occurs there is a slight swelling into a knob, which usually measures 0.12 mm. in diameter. The spongin coating the fibres is made up of a series of layers, and the divisions between the various layers can very easily be seen.

The dermal skeleton consists of dense brushes of spicules, typically arranged fanwise at right angles to the surface of the sponge, but also frequently almost tangential in direction. As a result, the dermal skeleton forms a dense felting over the surface of the sponge.

*Spicules.* (Text-fig. 22.)

## A. Megascleres. (Text-fig. 22, A.)

The whole of the megascleres are subtylostyles, and the spicules of the fibres are not distinguishable either in size or shape from those of the dermal skeleton or those scattered throughout the sponge. In almost all the fibres they form a slender core, being usually arranged 2- to 3-serially; but in some fibres they are uniserial, or in rare cases even entirely absent. They are frequently arranged in a slightly plumose manner within the spongin-fibre, but they never project outside it. Thus, although true echinating spicules are entirely absent in this species, they seem to retain some slight indication of Ectyonine affinity.

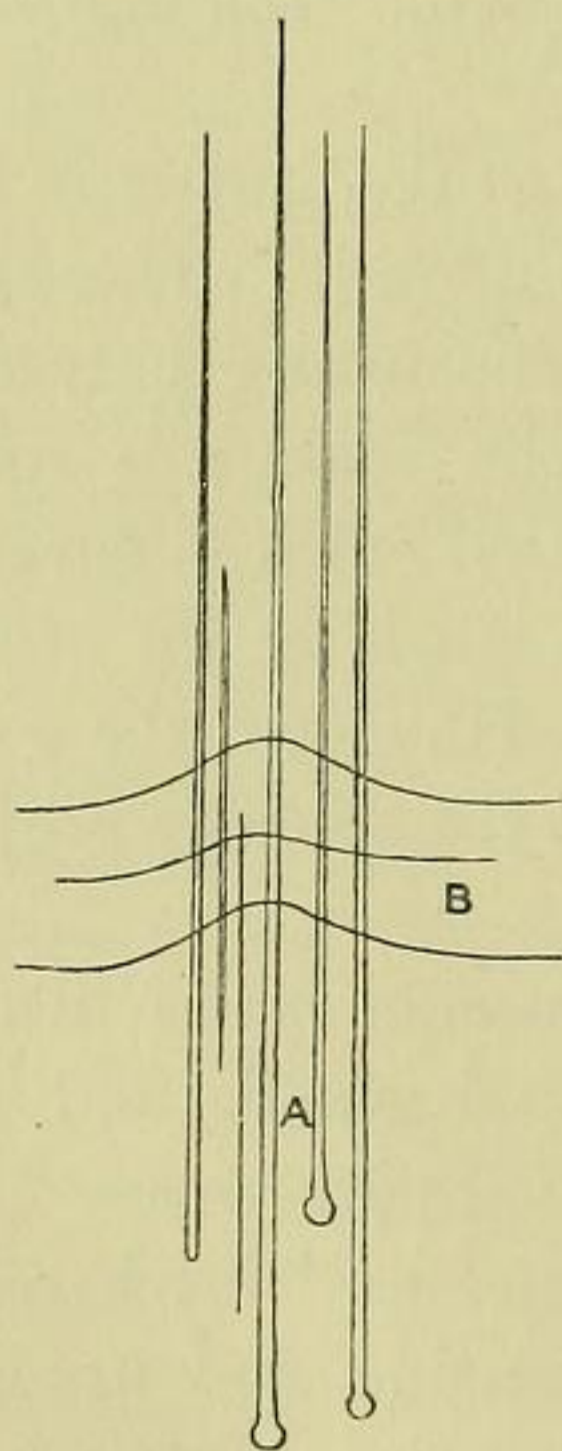


Fig. 22.

*Ophlitaspongia arbuscula.*Spicules,  $\times 250$ .

The spicules are slender, frequently curved, and, not always uniformly throughout their course, they seem to follow the curve of the fibre. They almost always possess slight heads, which are oval, with the long axis of the head a continuation of the axis of the spicule. The size varies considerably, and spicules in the fibres seem to attain slightly larger dimensions than those outside them, but this difference is very slight and may not be so in all parts of the sponge. The length of the average spicule is 0.3 mm., but specimens measuring as much as 0.33 have been seen. Their diameter

does not exceed 0·002 mm. at the thickest part of the shaft, which is of equal diameter for almost the whole of its length ; the head measures on the average 0·0025 mm. in diameter. A few spicules occur with oxeote or stylote ends.

B. Microscleres. (Text-fig. 22, B.)

The microscleres present in this species are toxa and are of extreme rarity, a single toxon being only found at long intervals during a careful search. That they acutally belong to the sponge is, however, shown by the facts that they are all exactly similar and that no other foreign bodies occur in the sponge.

They are straight for most of their length, being sharply bowed in the centre, and they taper very gradually from the centre to each end. The actual ends are so delicate that it is a matter of considerable difficulty to ascertain the exact end to the spicule. They measure in length 0·06 mm., and are 0·0015 mm. wide in the centre.

*Locality.* No definite locality is given for these specimens.

*Distribution.* Red Sea.

OPHLITASPONGIA (?) HORRIDA, n. sp. (Pl. 40. fig. 26 ; Text-fig. 23.)

The present species is very similar in its general character to the previous one, but differs from it in external form, in the character of the skeletal reticulation of spongin-fibre, and also in the shape of the toxa.

The single specimen which represents this new species consists of a low, irregularly branching mass, creeping on coral and calcareous shells, from which arise at frequent intervals stout and short processes which frequently branch. The length of these processes between points of branching rarely exceeds 15 mm. The processes themselves and the branches into which they divide are stout and rather irregular in shape ; they are usually about 10 mm. in diameter, but are flattened and somewhat strap-shaped, in which case their greater diameter may be 15 mm. or 18 mm. and the shorter 5 mm.

The surface of the sponge is smooth, but not glabrous, as it is echinated by the projecting ends of the spicules of the dermal skeleton.

The oscula are numerous and very minute, not exceeding 0·2 mm. in diameter ; they are scattered irregularly over the whole surface of the sponge.

The pores are scattered, very numerous, and small.

The colour of the sponge is yellowish grey in spirit.

The texture is firm, almost hard ; it is somewhat compressible and very resilient. The sponge can be cut fairly easily, but torn with great difficulty.

*Skeleton arrangement.* (Pl. 40. fig. 26.)

In general, the skeleton arrangement is very similar to that of *Ophlita spongia arbuscula*, above described. There is the same dark-orange spongin-fibre feebly cored with monactinal megascleres, and the same large numbers of spicules scattered about throughout the sponge. There is also present a dermal skeleton, even more dense than in the former species. It consists of brushes of spicules, whose ends project from the surface, and which are densely matted together. There are, in addition, large numbers of spicules lying in a tangential position, and others which occupy positions intermediate between the radial and tangential, so that the whole makes a very dense felt-like covering to the exterior of the sponge. Frequently, also, large sand-grains occur either enmeshed in the dermal skeleton or else lying immediately below it.

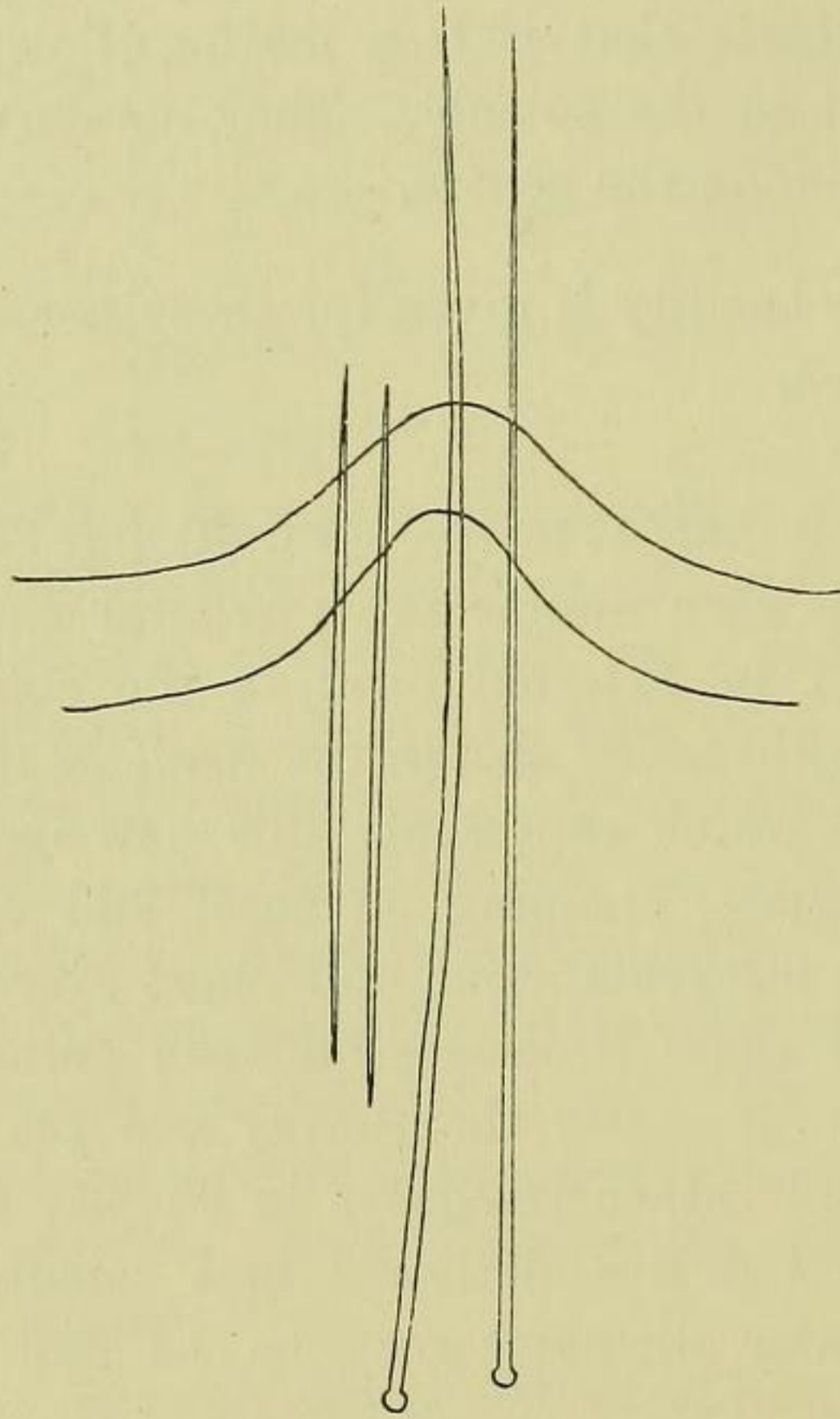


Fig. 23.—*Ophlitaspongia horrida*. Spicules,  $\times 315$ .

The reticulation of the spicule-cored spongin-fibre of the main skeleton is much less regular than in *O. arbuscula*, and the mesh is elongated and varies so much in size that it is almost impossible to give an average. As limits 0.2 mm. and 1.5 mm. may be suggested.

The fibres cannot be differentiated into primary and secondary, either by their spiculation or their size. They vary very little in size or in the number of spicules they contain, the diameter of the fibre being usually 0.09 mm., and the spicules in the fibre being 4- to 7-serial. The spicules are arranged in a very slightly plumose manner.

Scattered spicules occur in enormous numbers throughout the sponge, and lie without the slightest orientation, either with regard to the sponge itself or the spongin-fibres.

*Spicules.* (Text-fig. 23.)

A. Megascleres. (Text-fig. 23, A.)

The only megascleres are substylostyli. They are rather long, slender spicules, with a small and inconspicuous head. They are nearly always quite straight, but sometimes slightly and regularly curved. The average length is 0.3 mm. in the full-grown specimens, but many may be met with much shorter than this. The greatest diameter of the shaft is near its middle point, from which spot it tapers gradually towards the head at one end and to a sharp point at the other. The diameter of the spicule varies from 0.002 mm. to 0.0025 mm. at its widest point; the diameter of the head is usually 0.0025 mm. A few specimens can be found sharply pointed at each end, but these are probably immature specimens.

B. Microscleres. (Text-fig. 23, B.)

The only microscleres met with in this species are toxa. They are extremely rare, and only a very few have been seen. They are very delicate throughout their length, but strongly bowed at the centre. The length is 0.2 mm. on the average, and the diameter less than 0.0005 mm.

*Locality.* "Dredged in 9 fathoms from a bottom of coarse sand with shells and coral, immediately off the south-east corner of We Shubuk."

*Distribution.* Red Sea.

OPHLITASPONGIA (?) DIGITIFORMIS, n. sp. (Pl. 37. figs. 14, 15.)

There occur in the collection two specimens of this rather striking species. One of these specimens is complete, but the other consists merely of a single long cylindrical process, apparently broken off from a large specimen. Both the specimens were obtained at the same time.

The large specimen stands erect on a small oval base, which measures 35 mm. by 25 mm. The basal portion of the sponge is undivided, and is in the form of a somewhat oval cylinder, about 80 mm. high and 65 mm. in breadth at its widest point. From front to back the diameter of the cylinder never exceeds 30 mm.

From the top of this basal portion arise three large digitiform processes, of perfectly uniform diameter throughout their length, which stand upright side by side. In section these processes are circular, and two of them measure 28 mm. each in diameter; the third, which is smaller, only measures 15 mm. in diameter. The two large processes measure 230 mm. in length from base to summit. These processes do not branch, in the ordinary sense of the term, but from a swelling on the side of one of the large processes

there arises a fourth short process, which lies parallel to the others throughout its length.

The surface of the sponge is slightly irregular, being covered with low ridges or slight swellings. These prominences occur both on the basal undivided portion of the sponge and also on the digitiform processes. They are arranged quite irregularly, and entirely without relation to each other.

The actual surface of the sponge is quite smooth and covered with a very delicate dermal membrane, which is not supported by a spicular skeleton. This dermal membrane has been rubbed off in many places, and here the surface appears finely reticulate with apertures between the meshes.

The oscula are very numerous and occur all over the surface of the specimen, their arrangement being quite irregular. On the large processes as many as 20-25 oscula occur, and about the same number on the undivided basal portion of the sponge. They are fairly large, and measure 5 mm. or 6 mm. in diameter. An oscular sphincter membrane can be seen in some cases. The pores are small, very numerous, and scattered over the whole surface of the sponge.

The texture of the sponge is like that of *Euspongia*; it is firm, very tough indeed, and difficult to cut, but easily compressible and also resilient. The sponge is also very soft to the touch.

The colour is dark brown throughout the sponge in spirit.

*Skeleton arrangement.* (Pl. 37. fig. 15.)

The skeleton consists of a very fine-meshed network of spicule-cored spongin-fibre, the meshes of which are of but little greater diameter than the length of a spicule.

Radial primary fibres can be distinguished, in which the spicules usually lie 3- to 4-serial, and these primary fibres occur regularly throughout the sponge about 0.12 to 0.2 mm. apart. They run straight from the centre to the circumference of the sponge, and occasionally divide into two. Occasionally smaller primary fibres arise from these, in which the spicules are only 2- or 3-serial, but as these separate from the parent fibre they become larger, and then take on the characters of the primary fibres themselves.

Between these primary fibres there is an elaborate reticulation of secondary fibre, usually with the spicules lying uniserially, which forms an extremely regularly rectangular meshwork, the diameter of the meshes of which varies from 0.12 mm. to 0.16 mm. These fibres are but little less in diameter than the primary fibres, as the spongin is considerably more developed in comparison.

A few spicules are scattered here and there outside the fibres.

There is no special cortical skeleton.

*Spicules.*

The spicules consist entirely of megascleres and are extremely slender. They are nearly always styli, but considerable numbers of oxea also occur, and the smallness of the diameter of the spicule frequently makes it very difficult to distinguish between them. They vary in length from 0.11 mm. to 0.13 mm., and average 0.0025 mm. in diameter.

*Spongin.*

Spongin is present in large quantity, the fibres being usually fully 0.04 mm. in diameter.

*Locality.* The two specimens were obtained at Shab-ul-Shubuk.

*Distribution.* Red Sea.

## Sub-Family TEDANIINÆ.

Desmacidonidæ in which the megascleres are tylota and which do not possess echinating spicules.

TEDANIA ASSABENSIS, *Keller.*

Synonymy:—

1891. *Tedania assabensis*, Keller (18).

1892. *Tedania* sp., Topsent (32).

This species is represented by three large and complete specimens and a considerable number of fragments. The complete specimens are large, sub-spherical, cushion-like masses, whose diameter is about 120 mm., and whose height, from base to summit, is 80 mm. The under surface is smooth but slightly corrugated, but the upper surface is covered with the small foliaceous processes which are characteristic of the species. The fragments are, as a rule, about 25 to 30 mm. each way, and do not possess either the shape or the characteristic processes of the larger examples. That they belong to the same species as the complete specimens is, however, made evident by their spiculation.

The colour of the sponge in life has been noted by Mr. Crossland in the case of the complete specimens as "vermilion." The specimens described by Topsent (32), but not specifically named by him, are similarly coloured, in this case the term employed to describe the shade being "orangées," and, I think, without any doubt, belong to this species, as Topsent himself suggests. The colour of the specimens in the Crossland collection in spirit is white.

The spicules are tylota, with their swollen ends minutely spined.

*Localities.* Suez mud-flats (complete specimens), Suakin (fragments).

*Distribution.* Red Sea; Bay of Jibouti.

## Family AXINELLIDÆ.

Sigmatotetragonida in which the microscleres have usually been entirely lost by degeneration ; the megascleres are usually, in part or entirely, stylote ; the skeleton arrangement is usually, but not always, plumose ; and there are no spined echinating styli.

*HYMENIACIDON CALCIFERA*, n. sp. (Pl. 38. fig. 19 ; Text-fig. 24.)

There are two specimens of this new species in the collection, each of them growing over a mass of calcareous Lamellibranch shells and coral. The sponge forms a rather thin sheet over the coral and shells and is easily stripped off. The largest specimen measures 50 mm. by 50 mm. The film of sponge varies from 1 to 6 or 8 mm. thick.

The surface (Pl. 38. fig. 19) is irregular, and covered with slight prominences and depressions, and also exhibits in parts a coarse and very irregular reticulate appearance, due to the skeleton arrangement. An examination of the photograph will, however, convey a better impression of the appearance of the surface than a written description possibly can.

The oscula are fairly numerous, usually rather small, and scattered irregularly over the surface. Here and there large oscula occur measuring 3 mm. to 5 mm. in diameter, but the average size of the oscula does not exceed 1 mm.

The pores are very numerous and are not confined to special pore-areas. In some parts of the sponge no pores could be seen, but in others they were very plentiful, especially in those parts of the specimen which had a reticulate appearance. They are very small, and do not exceed 0.1 mm. in diameter.

The colour of the sponge in spirit was a clear chalk-white.

The texture is rather lax, and the film of sponge when stripped from its support is limp and easily injured.

*Skeleton arrangement.*

The main skeleton consists of an irregular reticulation of spicule-fibres, which are quite small and scattered in most parts of the sponge, but which here and there in the sponge are much larger and form a definite, but irregular reticulation. In this case the spicules composing the fibre may be as many as 10- to 15-serial, but usually they do not lie more than 5-serial in the fibre. At the surface these fibres usually project very slightly.

The most curious and characteristic feature of the sponge lies in the fact that there is a distinct dermal skeleton formed of calcareous aster-like spicules. These form a dense and regular covering over almost the whole surface of the sponge, and apparently never lie more than one thick. It does not seem reasonable to suppose that these spicules are formed by the

sponge, and one can only suppose that they are foreign bodies taken up by this sponge as others take up sand-grains for the same purpose. A noticeable difference between the two cases occurs, however, in the fact that these calcareous spicules occur well below the dermal membrane, and not as a superficial layer at the surface of the sponge.

A careful examination of the whole specimen has entirely failed to find any animal at all which might have produced these spicules, but Mr. Crossland's notes (quoted below) show that compound Ascidians occur here as well.



*Spicules.* (Text-fig. 24.)

The spicules of the sponge (omitting the dermal calcareous asters) are all tylostyles, with usually a straight shaft and well-developed oval head. The shaft tapers very gradually from its thickest part, which is about the middle of the spicule, towards the head, and rather more sharply (though still gently) to the pointed end.

The spicules vary from 0.1 mm. to 0.15 mm. in length, and average about 0.0015 mm. to 0.0025 mm. in diameter.

*Calcareous asters.*

These bodies vary very much in the number of rays they possess, some only possessing 6 or 8 rays, while in others there may be 50 or even more. They are much more like some of the calcareous asters of some Ascidians than like the siliceous asters of the Astrotetaxonida. They vary in diameter from 0.016 mm. to 0.022 mm.

*Locality.* "From the under side of a buoy in Suakin Harbour. They, with Compound Ascidians and Barnacles, here enter into competition with *M. vulgaris* (Pearl Oyster) and prevent its attaining a profitable age."

*Distribution.* Red Sea.

*HYMENIACIDON ZOSTERÆ*, n. sp. (Text-fig. 25.)

This new species is represented by several specimens, all growing on the stems of *Zostera* plants, and usually at the nodes.

The largest specimen is a small, rather irregular, but somewhat rounded mass, which is growing in a fork of the stem, and evidently gradually spreading up and down the stems of its support. The greatest diameter of the mass is about 25 mm.

The surface is smooth, but here and there spicular fibres project, which are easily visible to the naked eye, and which may project a considerable distance.

The oscula are numerous but small, and do not measure more than



1.0 mm. in diameter, as a rule. They occur scattered in considerable numbers over the whole surface.

The pores are very small, irregularly scattered over the surface, but not grouped into special pore-areas.

The colour of the sponge in spirit is a dark grey-brown.

The texture is very lax and the whole sponge very easily damaged.

*Skeleton arrangement.*

The skeleton consists of spicular fibres very irregularly arranged, and lying quite unoriented in the sponge. As a rule, these fibres contain only five or six rows of spicules, but here and there they form dense spicule-bands, which may contain as many as 50 or even more rows of spicules. There is no special dermal skeleton.

*Spicules.* (Text-fig. 25.)

The only spicules occurring in the sponge are tylostyles, with well-developed heads. They average 0.02 mm. in length and 0.0025 mm. in diameter. The head measures 0.004 mm. in diameter.

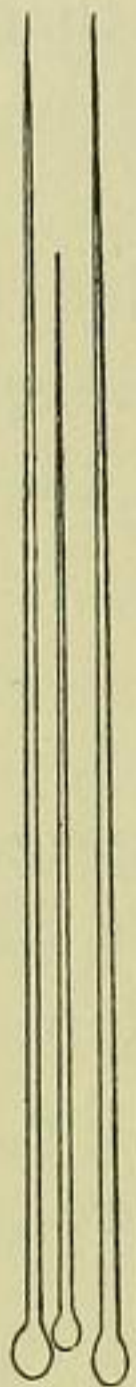


Fig. 25.

*Hymeniacidon*  
*zosteræ.*

Spicules,  $\times 350$ .

*Locality.* Mersa Wadi Lehami, Egyptian coast.

*Distribution.* Red Sea.

*ACANTHELLA AURANTIACA, Keller.*

Synonymy:—

1891. *Acanthella aurantiaca*, Keller (18).

1904. *Acanthella aurantiaca*, Dendy (11).

A single specimen of this species is preserved in the collection. It consists of three or four irregular lamellæ, growing adjacent to each other and attached by their contiguous surfaces to each other at frequent intervals. It is thus somewhat difficult to distinguish the various lamellæ from each other.

The sponge is 80 mm. high and 50 mm. wide. The lamellæ vary in thickness from 3 mm. to 5 mm.

The skeleton arrangement and the measurements of the spicules are exactly similar to Keller's description.

*Locality.* "From shallow water of the inner parts of Suakin Harbour, particularly the cove north-west of Condenser Island."

*Distribution.* Red Sea, Ceylon.

*PHAKELLIA DONNANI* (*Bowerbank*). (Pl. 38. fig. 16.)

Synonymy :—

1873. *Isodictya donnani*, Bowerbank (2).

1887. *Axinella donnani*, Dendy (12).

1904. *Phakellia donnani*, Dendy (11).

Two very small specimens, both of them cup-shaped, occur in the collection. The largest has been photographed (Pl. 38. fig. 16), and it measures 14 mm. in height and 14 mm. in diameter at the widest part of the cup.

The general appearance of both specimens is similar to the specimens described from Ceylon by Dendy (11).

*Locality.* The labels in the bottle containing these sponges were completely macerated, but there seems to be some evidence in favour of the opinion that they were obtained at Cape Elba. Out of the 56 bottles in which the sponges of the Crossland collection were sent to me, 23 were indicated on the labels inside the bottles merely by a number, and with them were sent MSS. notes relating to these numbered bottles. The numbers in the MSS. ran from 1 to 24, but only nos. 1-18 and 20-24 were present in the bottles themselves. The remaining 33 bottles were labelled as follows: one had the labels macerated, and is now being discussed, the other 32 had MSS. notes on the labels in the bottles stating the spot where the specimens were obtained &c. There is therefore a considerable possibility that this bottle with macerated labels is the missing no. 19, which was described in the MSS. as "From a piece of coral, brought up from 10 fathoms by a fishing-line, near a reef off Cape Elba, Egyptian Sudan Frontier."

*Distribution.* Red Sea; Ceylon; Madras.

*PHAKELLIA PALMATA*, n. sp. (Pl. 39. figs. 20, 21; Text-fig. 26.)

This new species has been created for the reception of a single specimen. It consists (Pl. 39. fig. 20) of a single frond-like lamella, growing upright on a cylindrical stalk. The base of the sponge is a flat circular area, but there are no remaining indications of the actual support. From this there arises a short stalk, circular in section, and about 10 mm. high and 6 mm. in diameter. The main body of the sponge is a broad, flat lamella, 50 mm. wide, 40 mm. high, and from 3 mm. to 5 mm. thick. From the edge of this lamella a number of very short conical processes arise, some of them merely slight protuberances from the sponge, some of them 5 mm. or 6 mm. in height. At the summit of each of these are the oscula, which are thus arranged around the edge of the sponge lamella, on special oscular processes. No oscula occur in any other position in the sponge.

The surface of the sponge is coarse and uneven; small ridges and irregularities occur all over it, none of them definite enough to disturb the general

level of the surface, but sufficiently marked to prevent its appearing smooth. The photograph gives a very definite indication of this appearance.

The pores are difficult to see, but appear to be irregularly scattered all over the sponge surface, and not in pore-areas.

The colour of the specimen is dark brown.

The texture is very firm and tough, almost hard. The sponge is not at all easy to cut, and difficult to bend out of shape.

*Skeleton arrangement.* (Pl. 39. fig. 21.)

The main skeleton consists of a large number of spicules not arranged in bundles, but all definitely oriented in the sponge. The direction in which the spicules lie is an obliquely radial one, partially pointing towards the side of the sponge lamella, and partly towards its edge. As the spicules approach the surface they become more and more nearly perpendicular to it, but as a rule never actually attain to the completely vertical position.

At the surface of the sponge there occur bundles of spicules, arranged at intervals of 0.2 mm. to 0.5 mm., instead of the scattered spicules of the general skeleton. These bundles vary considerably in size, and may contain any number of spicules from 6 or 8 to 20. The ends of the fibres project slightly from the surface and render it minutely hispid.

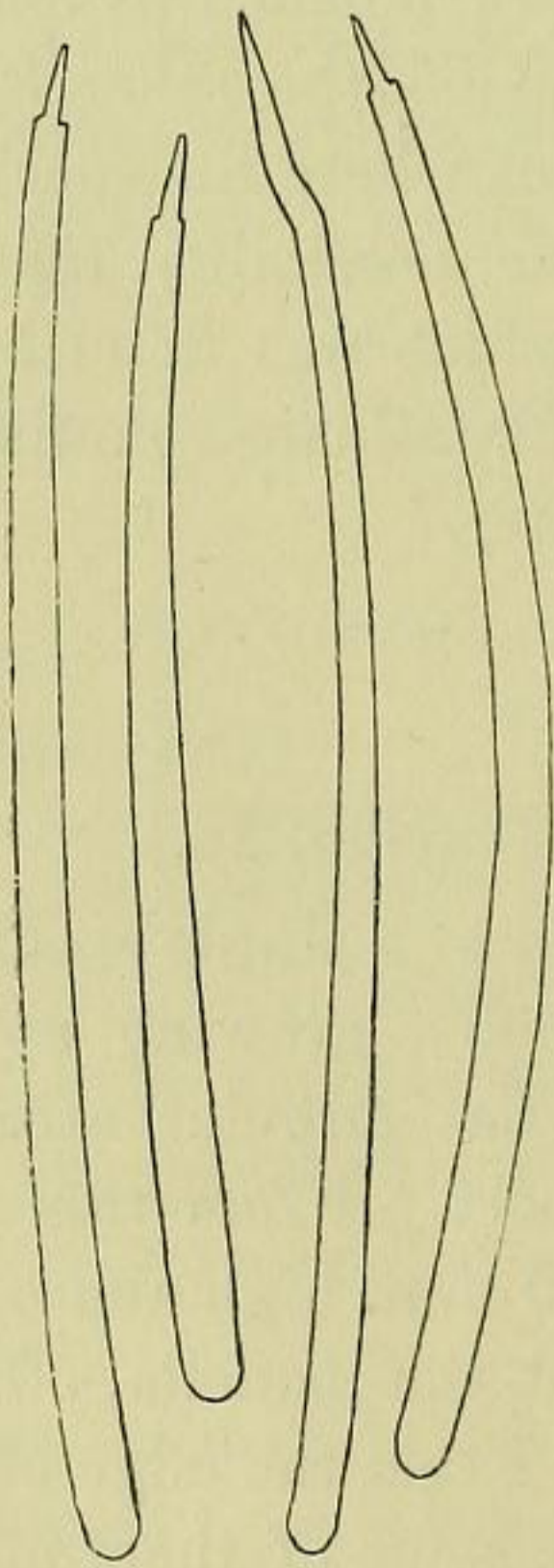


Fig. 26.—*Phakellia palmata*.  
Spicules,  $\times 250$ .

*Spicules.* (Text-fig. 26.)

The only spicules which occur in the sponge are styli. They vary very considerably in size and shape, from straight to strongly curved, and from 0.2 mm. to 0.35 mm. in length. An average length is about 0.3 mm. Their greatest diameter occurs near the rounded end, from which point they taper very gradually indeed for the major portion of their length and more rapidly in the last part. The actual end is usually irregular, and frequently possesses the typical Axinellid end. The diameter of the largest specimens does not exceed 0.008 mm., and most are not more than 0.005 mm.

*Locality.* The specimen occurred in the bottle with macerated labels, with *Phakellia donnani*.

It is therefore uncertain where the sponge was obtained, but it was possibly off Cape Elba. (For the reasons for assigning this locality to the specimen, see *Phakellia donnani*, p. 357.)

*Distribution.* Red Sea.

CIOCALYPTA TYLERI, *Bowerbank*.

## Synonymy :—

1873. *Ciocalypta tyleri*, Bowerbank (3).1904. *Ciocalypta tyleri*, Dendy (11).

There are several specimens of this species in the collection. Two of these are complete, the rest being more or less fragmentary. The complete specimens are each in the form of a subspherical cushion, from which the finger-like processes characteristic of the genus arise. The largest specimen measures 50 mm. in diameter, and the basal cushion-like mass is 35 mm. thick. The processes are very numerous, and vary in length from 25 mm. to 60 mm. Their average diameter at the base is 4 mm.

The skeleton arrangement and the spicule measurements are of the type ordinarily met with in this well-known species.

Another specimen, also assigned to this species, consists of a number of processes (about 20) united together at frequent intervals, and considerably larger than those of the typical specimens given above. They measure 105 mm. long, and average 6 mm. in diameter at their widest point. They taper gradually towards each end from the middle of their length, and show no signs of any attachment surface, either to the rest of the specimen or to a support.

The colour of all the specimens is white in spirit.

The skeleton and spicules are exactly similar in all these specimens to the type of this species.

*Locality.* Trawled at Khor Dongonab, north of the Barrier, from very barren mud in 20 fathoms.

*Distribution.* Red Sea ; Ceylon.

## Order EUCERATOSA.

Non-calcareous sponges without siliceous spicules, but with a skeleton consisting of horny fibres developed independently, *i. e.*, not in relation to any previously existing spicular skeleton. (The skeleton is sometimes replaced or supplemented to a greater or less extent by foreign bodies.)

## Family APLYSILLIDÆ.

Euceratosa with a dendritic or reticulate skeleton composed of spongin-fibres containing a more or less distinct pith, but usually without foreign inclusions ; sometimes also with isolated spicules of spongin ; with a lacunar canal-system and large sac-shaped flagellate chambers opening by wide mouths direct into wide exhalant lacunæ.

*MEGALOPASTAS ERECTUS*, n. sp.

The single specimen that was obtained of this new species is a small upright sponge, in the form of a rather wide and fairly thick mass. It is formed of a number of lobes, all more or less fused together and of irregular shape and varying size, and measures 65 mm. wide, 40 mm. high, and from 8 mm. to 20 mm. thick from side to side. The specimen is thickest at the centre, and gradually thins out to the sides.

The surface is covered with small conuli, from the summits of which the fibres of the skeleton project. They are very small and scattered irregularly over the whole surface. They do not exceed 1.0 mm. in height.

The oscula are very few and irregularly scattered over the sponge. They measure about 3 mm. to 4 mm. in diameter.

The pores were not distinguishable.

The colour of the sponge in spirit is deep violet.

The texture of the sponge is firm and gelatinous, yet easily broken.

*Skeletal arrangement.*

The skeleton is intermediate between that of a typical *Dendrilla*, in which there is a tree-like skeleton, and that of a typical *Megalopastas*, in which there is a reticulate skeleton. In the most typical members of the latter genus this skeletal reticulation is very regular, and primary and secondary fibres are clearly differentiated.

In the species now under consideration there are no distinct primary and secondary fibres and the reticulation is quite irregular; in fact, it is only after considerable hesitation that the species has been placed in *Megalopastas* rather than in *Dendrilla*. The skeleton consists of fairly large fibres, which branch very frequently and anastomose with each other here and there. No definite or average size can be given for the meshes of the reticulation thus formed, as the size varies enormously, and sometimes long stretches of skeleton-fibre occur without any anastomoses at all.

The fibres are solid, and do not possess a core of foreign bodies; they vary considerably in size, but do not seem to exceed 0.11 mm. in diameter.

*Canal-system and Chambers.*

The whole sponge is traversed by very many wide canals, so that in section it appears almost cavernous. These canals run in a direction approximating to the radial, down into the sponge, though the actual direction of the canal must necessarily vary as it branches.

The chambers are wide and elongated, and occur in large numbers throughout the sponge. They measure 0.2 mm. long at the maximum, by 0.04 mm. wide. They open by wide mouths direct into the large exhalant canals.

There is practically no cortex, but a slight thickening of the dermal membrane and a little mesoglœa just beneath it. There is very little mesoglœa throughout the sponge, almost the whole of the sponge being filled with chambers or occupied with canals. Here and there, however, one finds a small tract of mesoglœa; it is clear, not granular, and contains large numbers of small stellate cells.

*Locality.* "From beneath a floating stage in Suez Docks."

*Distribution.* Red Sea.

DARWINELLA AUREA (?), Müller.

Synonymy:--

1865. *Darwinella aurea*, Müller (21).

1889. *Darwinella aurea*, Poléjaeff (22).

1889. *Darwinella aurea*, Lendenfeld (20).

There is a single rather fragmentary specimen in the collection, which has been assigned to this species. It forms a thin sheet over a portion of a mussel-shell. The preservation was not good enough for minute study or even to permit of certain specific identification.

*Locality.* From a buoy in Suez Bay.

*Distribution.* Red Sea; Mediterranean; coast of Spain; S. America.

#### Family SPONGELIIDÆ.

Euceratosa with a (usually) reticulate skeleton of horny fibres, without distinct pith, but containing foreign bodies; or with a skeleton composed of foreign bodies united together by little if any spongin. With lacunar canal-system, and large sac-shaped flagellate chambers opening directly by wide mouths into wide exhalant lacunæ.

SPONGELIA ÆDIFICANDA, n. sp.

The material on which the new species is founded is all fragmentary, though considerable. It consists of a large number of pieces, evidently cut off from a large specimen, each fragment containing a barnacle or sometimes two or three. There is thus considerable difficulty in describing the external form, and the best course seems to be to describe three or four of the fragments which are the largest, and to build up from those descriptions as much as possible of the external appearance.

Fragment 1.—A strap-shaped, bluntly-ending terminal portion of a branch, measuring 30 mm. long, 12 mm. wide, and 1.5 mm. to 2 mm. thick. It contains two barnacles, each forming a subspherical swelling about 6 mm. in diameter, near the edge of the specimen.

Fragment 2.—A long, irregularly cylindrical process, with branches arising from it. It varies in diameter at different points from 8 mm. to 2 mm.

At the point where the specimen measures 8 mm. in diameter two barnacles occur, and at the same point five branches arise from the stem, in varying direction and of different size.

Fragment 3.—A small fragment consisting of a group of nearly cylindrical branches, which branch and anastomose with one another. At one point there are 3 barnacles close together. The various branches have a diameter of from 3 mm. to 5 mm.

Other fragments, which are for the most part smaller than the ones above described, show intermediate conditions between those of these three fragments. In some cases strap-shaped branches arise from cylindrical ones, and in one case a strap-shaped branch suddenly becomes cylindrical in shape. It is noteworthy that the barnacles usually grow at the point of junction of two or more branches, but sometimes they occupy other positions.

The barnacles themselves always occupy small cavities, measuring about 3 mm. in diameter, within the sponge. This causes a swelling to appear on the surface of the sponge, as noted above, which measures usually about 6 mm. in diameter, and which has a small aperture at one point by which the barnacle is able to protrude its tentacles to the exterior. The inside wall of the cavity containing the barnacle is quite smooth and shows no sign of either pores and oscula.

That the chambers in which the cirripede lives are formed by the upgrowth of the sponge around it, and not by hollowing out of already formed tissue, is clear from the following:—A section cut through the swelling just above one of the barnacles, which was lodged in the cleft between two branches, showed the following structure. The two branches, and their skeletons, were clearly shown in the section, and between them was a mass of tissue noticeably different in skeletal structure, both in size and arrangement of the fibres. This seems to render certain that the barnacle settles down on some already formed part of the sponge, and that a secondary growth of tissue takes place around it. Further, it does not seem possible that the relationship of sponge and barnacle should be accidental, for this formation of secondary tissue, in scores of cases, to form a well-defined and regular investment for the barnacle, always of about the same diameter and always furnished with the same small aperture, seems definitely to indicate that the connection of the two animals is symbiotic.

The surface of the sponge is quite smooth, and no projections whatever occur on it.

The oscula are small, few in number, and, as far as can be ascertained from the material available, irregularly scattered over the whole of the sponge surface. They average 1.0 mm. in diameter.

The pores are very numerous, and frequently occur in rows above the inhalant canals. No definite pore-areas are marked out, however.

The colour in spirit is a brownish white.

*Skeleton arrangement.*

The skeleton consists of a reticulation of spongin-fibre covered with foreign bodies, and there is also a thin and rather scanty dermal coating of small sand-grains. The structure of the spongin-fibres and their arrangement differ considerably in the regular branches of the sponge and in the secondarily formed tissue around the barnacles.

The fibres in branches themselves can be distinguished roughly into primary and secondary fibres, according as they possess a core of foreign bodies or not. The average diameter of the main fibres is 0.1 mm., and the core within them usually measures about 0.07 mm.

The foreign bodies which form the fibre-core seem to have undergone some peculiar change; they do not seem to possess any definite shape, but all lie fused up together into a continuous and irregular cylinder. In a very few places it is possible to see a few sand-grains clearly marked out from the surrounding confused mass, but, as a rule, it is quite impossible to ascertain what the various foreign bodies are.

The fibres are not always cored; sometimes the core stops quite suddenly, and in these cases the distinction between primary and secondary fibres breaks down, or else a primary fibre becomes a secondary.

The primary fibres branch and run fairly regularly. The reticulation formed by them and the secondary fibres is rather irregular in the centre of the sponge, but at the surface they form an extremely regular meshwork whose meshes are rectangular; the primary fibres are not quite so thick here as in the middle of the branch. The secondary fibres have no foreign bodies within them, and are very much slenderer than the primary fibres, measuring only 0.015 mm. to 0.02 mm. in diameter.

The fibres in the secondarily formed tissue are midway between the primary and secondary fibres of the true branches in point of size, measuring from 0.03 mm. to 0.05 mm. in diameter, but the most striking difference lies in the fact that in these latter fibres the foreign bodies, chiefly sand-grains, of the core are quite distinct, and not fused up together at all. The reticulation that they form is fairly regular, but not definitely oriented to the sponge surface.

*Canal-system and Chambers.*

The pores lead direct into large horizontal subdermal canals, from which large inhalant canals lead into the interior of the sponge. These canals ramify throughout the sponge, and cause the interior of the sponge to appear very cavernous. They measure from 0.3 mm. to 0.4 mm. in diameter.

The chambers are eurypylous, and measure 0.06 mm. to 0.07 mm. in diameter. They open direct into the exhalant canals, which are similar to the inhalant.



The mesoglœa is abundant, and is filled with cells, which are mostly stellate, though some appear circular. The mesoglœa is not granular, and there are no fibres or pigment-cells.

*Locality.* Not stated.

*Distribution.* Red Sea.

#### SPONGELIA DELICATULA, n. sp.

The single specimen obtained of this species consists of a group of small flat branches, which are irregularly lobed or slightly branched, and usually more or less strap-shaped. They are thinnest at the centre of the branch, and thicken out at the sides into a ridge. The height of the branches is 55 mm., their width anything from 5 mm. to 20 mm. and their thickness from 1 mm. to 5 mm.

The surface is covered with small conuli, regularly arranged over the whole sponge surface, and each with a spongin-fibre protruding from the centre. These conuli do not exceed 0.25 mm. in height, and are about 1.0 mm. to 1.5 mm. apart.

Oscula and pores were not distinguishable.

The colour of the sponge is horn-grey in spirit.

The texture of the sponge is firm, but the sponge is not rigid, but easily bent or twisted out of shape. It immediately regains its shape when released.

#### *Skeleton arrangement.*

The skeleton consists of an irregular sparse reticulation of spongin-fibre which is always filled with sand-grains, and does not present any differentiation into primary and secondary fibres. The fibres run quite irregularly in the sponge, but all end in the conuli on the surface, of which they form the support. They measure from 0.08 mm. to 0.1 mm. in diameter.

#### *Canal-system and Chambers.*

The whole sponge is highly vacuolated, owing to the great size of the inhalant and exhalant canals. Indeed, it may be said that the tissues of the sponge merely form a series of trabeculæ between the various canals. The canals may reach any diameter up to 0.5 mm., while the sarcode between them rarely exceeds 0.2 mm.

The flagellated chambers are not easy to see and are rather scarce; they measure 0.06 mm. to 0.08 mm. in diameter; they are eurypylous and open directly into large exhalant canals. The preservation was not sufficiently good for any further details of the canal-system to be made out.

There is a cortex in the form of a narrow dermal band of fibrous tissue,

in which the fibres run tangentially. The cortex measures 0·06 mm. to 0·07 mm. in thickness.

*Locality.* Suakin Harbour.

*Distribution.* Red Sea.

DYSIDEA CINEREA, *Keller.*

Synonymy:—

1889. *Dysidea cinerea*, Keller (18).

There occurs in the collection a single specimen which I identify with this species. It agrees with Keller's original description in general shape and appearance very closely, but in certain features it differs. Keller's original description of the external appearance runs as follows:—"Der Schwamm bildet massige Stücke oder Krusten von 5–10 cm. im Durchmesser, auf welchen sich zweilen einzelne kurze abgerundete Fortsatze erheben, deren Durchmesser etwa 1 cm. beträgt, und deren Höhe zwischen  $\frac{1}{2}$ –3 cm. schwankt."

The specimen now being considered forms a mass 60 mm. high and 120 mm. long by 45 mm. wide. The upper surface of the sponge is covered with short processes 10 mm. to 30 mm. high, by about 15 mm. in diameter. Several processes also occur on the sides of the specimen. So far the specimen is almost identical with Keller's, but the basal part of the sponge in my specimen is apparently formed entirely of the partly fused lower portions of the processes referred to above. There is no true undivided portion of the sponge, and the composite character of the whole is rendered evident by the fact that the spaces between the various processes are continued down into the base of the sponge, and the conuli that cover the outside surface of the sponge can also be seen at the sides of these cavities. It may be assumed therefore that the sponge consists of a mass of tubes, with their basal portions partially fused, and 10 mm. to 30 mm. free at the distal end.

The colour in spirit is pale brown.

The skeleton and the canal-system are identical with Keller's original description.

*Locality.* No locality is given, but the sponge was obtained at a depth of 9 fathoms.

*Distribution.* Red Sea.

PSAMMOPEMMA COMMUNE (*Carter*).

Synonymy:—

1885. *Hircinia communis*, Carter (6).

1889. *Psammopemma commune*, Lendenfeld (20).

The present species was represented in the collection by four specimens, all of the same habit. Each consists of a mass of upright cylindrical processes, which branch and anastomose to form an irregularly but densely

reticulate mass, from the upper surface and sides of which the free distal ends of the processes protrude. The free part of the processes is on the average about 20 mm. to 25 mm. in length, and from 10 mm. to 15 mm. in diameter. The largest specimen measures 60 mm.  $\times$  50 mm. and is 65 mm. high.

The colour in spirit is dark grey.

The texture of the sponge is very brittle, and the whole sponge is easily crushed to powder.

The surface is covered with small conuli, which are usually 1 mm. to 2 mm. high, though they may be as much as 3 mm. They are as a rule 3 mm. to 4 mm. apart. These conuli are produced by the occurrence beneath them of an accumulation of sand-grains, which frequently occur at the distal ends of the skeletal sand-fibres, but sometimes unconnected with them. These aggregations of sand-grains are connected with one another by sand-fibres, which form a series of ridges running between the conuli, and cause the whole surface of the sponge to appear reticulate. These dermal sand-fibres are frequently raised considerably above the level of the sponge surface, and connected with it by a delicate vertical membrane.

The skeleton is wholly of sand. There is no definite sand-cortex, but a dermal reticulation of sand-fibres, as stated above. Sand-grains are scattered throughout the cortex.

The sand-fibres of the main skeleton are somewhat irregular in arrangement, and cannot be divided into main and secondary. They usually measure 0.2 mm. in diameter, but sometimes, usually at a spot where a very large sand-grain has been engulfed, they measure much more, and may reach 0.5 mm. in diameter.

*Locality.* All the specimens were obtained from 5 fathoms of water in Suakin Harbour.

*Distribution.* Red Sea, Australia.

#### EURYSPONGIA, n. gen. (Pl. 39. fig. 23; Pl. 41. figs. 27, 28.)

Spongeliidæ with a reticulate skeleton, in which primary radial fibres cored with foreign bodies and secondary connecting fibres without foreign bodies can be distinguished.

This new genus has been necessitated by the presence in the collection of a sponge with Spongeliid canal-system and eurypylous chambers, but with a skeleton exactly similar to that of *Euspongia irregularis*.

#### EURYSPONGIA LACTEA, sp. n. (Pl. 39. fig. 23; Pl. 41. figs. 27, 28.)

The species is represented by two large specimens, which form somewhat irregular, subspherical cushions, growing probably on mud. They are of

almost identical size, though one of them is somewhat flatter in shape than the other. The largest measures 130 mm. in diameter and 100 mm. high.

The surface (Pl. 39. fig. 23) is covered with conuli crowded together very closely. They measure from 1 mm. to 2 mm. high in different parts of the sponge, and are usually about 2 mm. to 3 mm. apart, though in some parts of the specimens they are even closer together. They are frequently connected together by low ridges, so that the whole surface is divided up into meshes by them. From their summits the primary fibres of the skeleton project, often branching outside the surface of the sponge.

The oscula are numerous and very variable in size; they are scattered at irregular intervals over the whole surface. They measure from 3 mm. to 10 mm. in diameter.

The pores are minute, and occur in the meshes formed by the ridges running between the conuli, and thus the meshes are a kind of pore-area. In some parts of the sponge the pores could not be seen.

The colour of the sponge is milky white, due to the enormous quantities of fine grey-white mud which the sponge has swallowed.

The texture is soft, and the sponge is easily compressible, but quite tough.

*Skeleton arrangement.* (Pl. 41. fig. 27.)

The skeleton is exactly similar to that of *Euspongia irregularis*. There is a definite and fairly regular reticulation of spongin-fibres. The main fibres run radially, but not quite straight, and measure 0.08 mm. in diameter. They are filled with foreign bodies, which are chiefly sand-grains. The secondary fibres are very delicate, and form an irregular reticulation between the primary fibres; they do not contain any foreign bodies whatsoever. They vary considerably in size, all sizes between 0.014 mm. in diameter and 0.03 mm. being found. The meshwork formed is quite irregular, and no average size of the mesh can be given.

*Canal-system and Chambers.* (Pl. 41. fig. 28.)

The pores lead directly into a series of horizontal, small canals lying in the cortex, which open into large subdermal cavities. These subdermal cavities lie quite irregularly in the superficial parts of the sponge, and some of them are of enormous size, while others are quite small. From them inhalant canals run steeply down into the interior of the sponge.

The chambers are large, sac-shaped, and eurypylous; they open by wide mouths into large exhalant canals. The mouth is frequently the largest part of the chamber, which measures 0.08 mm. to 0.1 mm. in diameter.

The canals in the interior of the sponge are sometimes very large, examples being frequently seen in the sponge 5 mm. or 6 mm. in diameter.

*Histology.*

There is no true cortex as such, but a dermal layer occurs in which chambers are very scarce, and which is filled with cells, usually stellate in shape.

The whole ground-substance of the sponge is filled with particles of mud and débris, taken in by the sponge. This foreign matter is not specially frequent (or specially scanty) in any spot in the whole sponge, but evenly distributed throughout, so that a considerable opacity is given to sections.

The mesoglœa is in most parts scanty, but large tracts can be found here and there, especially in the neighbourhood of the inhalant and exhalant canals. The cells of the mesoglœa are much fewer than those of the cortex, but otherwise the two tissues are very similar. In the neighbourhood of the canals strands of fibres are occasionally met with, which are very possibly muscle-fibres. The fibres run radially in direction, and form slender bands in which the fibres are not closely packed together, but separated by gelatinous ground-substance.

*Locality.* One specimen was obtained at Suez ; no locality is given for the other.

*Distribution.* Red Sea.

This species, as described above, approaches very closely indeed to the genus *Euspongia*, the only difference being in the eurypylous chambers. It is, therefore, with considerable hesitation that I have placed it among the Spongeliidæ rather than the Spongiidæ ; but this course has been taken in order to avoid breaking up the existing classification of Euceratosa by means of their canal-system. Under the present conditions, therefore, the genus *Euryspongia* is looked upon as the most highly evolved member of the family Spongeliidæ, and possibly directly on the main stem of the evolution of the Euceratosa.

At any rate, it shows how little faith can be placed in the present distinctions between the families of Euceratosa, as intermediate forms are common, and almost the whole of the gaps have now been filled up.

Another example of the same thing is shown in the two genera *Heteronema*, Keller (18), and *Duriella*, n. g., described below, which have been placed among the Spongiidæ on the strength of their small and diplodal chambers, while their skeleton is of an extremely primitive type and very irregular.

## Family SPONGIIDÆ.

Euceratosa with a reticulate horny skeleton and with small more or less spherical flagellate chambers, commonly provided with special narrow exhalant canaliculi. The ground-substance between the chambers is compact and densely charged with fine granules.

*HETERONEMA ERECTA*, Keller.

Synonymy :—

1889. *Heteronema erecta*, Keller (18).

1906. *Heteronema erecta*, Topsent (35).

A single specimen has been identified as this species, though only after considerable hesitation. Keller (18) does not state whether the flagellated chambers of his genus *Heteronema* are eurypylous or diplodal, but only gives measurements for the chambers. However, he puts his sponge into the Spongeliidæ, in which the chambers are eurypylous, as the family is now understood. My specimen, however, possesses diplodal chambers, and on that account I have removed the genus *Heteronema* from the Spongeliidæ to the Spongiidæ.

(The specimen has been cut into three slices, but they can easily be fitted together.)

The specimen consists of a group of conical protuberances of somewhat irregular shape, growing upright from a small base. The specimen measures 125 mm. long, 60 mm. to 70 mm. wide, and 65 mm. to 75 mm. high at different points.

The surface is regularly covered with minute conuli, which average 0·3 mm. in height and are 1·0 mm. to 1·5 mm. apart. These indicate the ends of the primary fibres of the skeleton. They are connected by series of ridges radiating between the conuli.

The oscula are fairly numerous, and measure 2 mm. to 3 mm. in diameter.

The pores were not seen on most of the sponge, but in some parts they could be distinguished in the meshes between the ridges connecting the conuli.

The colour is black-brown on the outside of the sponge and a dark brown inside.

The texture is firm, hard, and incompressible.

The skeleton consists of a coarse but regular reticulation of spongin-fibre, filled with foreign bodies, chiefly sand-grains, and can be differentiated into primary and secondary fibres. The primary fibres run radially, and the secondary fibres form a rectangular meshwork with them.

The whole skeleton is exactly like that described by Keller, as is also the canal-system, save that Keller omits to state whether the chambers of his species are diplodal or eurystomous. In the specimen now under consideration they are diplodal and measure 0·03 mm. to 0·038 mm. in diameter.

*Locality.* Sherm Sheikh.

*Distribution.* Red Sea, Gulf of Aden.

DURIELLA, n. gen. (Pl. 41. fig. 29.)

Spongiidæ in which the skeleton is composed of an irregular reticulation of spongin-fibre, which forms lax trellis-like groups of fibres instead of simple fibres.

The present genus is an unsatisfactory one, but the specimens for which it has been created would not go into any of the previously named genera without considerably widening the generic diagnosis. Its nearest ally is undoubtedly *Heteronema*, but it differs from the latter genus principally in its much less regular skeleton, which has apparently undergone partial degeneration in *Duriella*. Here a very wide-meshed network is marked out by what I propose to call "fibre-lines" composed not of one fibre, but of a very irregular reticulation of small fibres. At the junctions of the various fibre-lines a considerable increase in the thickness of the fibres occurs, and also an increase in the number of fibres, which widen out into a system of diagonal connecting-fibres between the main "fibre-lines."

*DURIELLA NIGRA*, n. sp. (Pl. 41. fig. 29.)

The single specimen consists of two irregular upright somewhat cylindrical processes varying in different parts from 20 mm. to 30 mm. in diameter and 135 mm. high.

The surface is minutely conulose, very like that of *Heteronema erecta*, with conuli 0.5 mm. to 1.0 mm. high, and 1.0 mm. to 1.5 mm. apart. As in *Heteronema*, these conuli are connected with one another by a series of ridges radiating from each one, so that the surface presents a minutely reticulate appearance.

The oscula are numerous, and occur scattered about the surface of the sponge promiscuously and irregularly. They measure 3 mm. to 4 mm. in diameter.

The pores occur thickly scattered over the surface of the sponge, in the meshes between the ridges connecting the conuli.

The skeleton consists of an irregular, very wide reticulation of "fibre-lines," the mesh averaging 2 mm. to 3 mm. across. The fibres composing the "fibre-lines" are arranged very irregularly in the "line" and vary enormously in size, fibres of all diameters from 0.03 mm. to 0.3 mm. being found. As a rule, the thickest fibres are found near the junction of the radial and tangential "fibre-lines."

At the surface of the sponge there is a tangential reticulation of fibres, which is arranged rather more regularly than those in the interior of the sponge. The external evidences of this reticulation can be seen in the ridges radiating from the conuli. The conuli themselves are the meeting-points of a large number of fibres, each of which underlies a ridge. Between these fibres there run very numerous smaller fibres which do not show on the surface. The general average of size of the fibres is higher in the dermal reticulation than in the skeleton of the sponge interior, but the individual fibres of the former do not exceed those of the latter in size.

All the fibres are full of foreign bodies such as sand-grains, sponge-spicules, and Radiolaria skeletons.

*Canal-system and Chambers.*

There are no definite subdermal cavities in this species, but the pores open into narrow canals, which run tangentially in the cortex and open into large inhalant canals leading down into the interior of the sponge. These inhalant canals vary in size from 0.05 mm. to 0.4 mm. in diameter.

The chambers are small, diplodal, and they measure 0.04 mm. in diameter as a maximum. They occur in enormous numbers, forming dense masses separated by tracts of mesoglœa.

The exhalant canals could not be distinguished from the inhalant.

*Histology.*

The preservation of the specimen is very poor, so that but little could be made out of the histology.

The mesoglœa consists of tracts here and there, chiefly in the region of the large canals, either exhalant or inhalant. These tracts are frequently very fibrous, with the fibres very irregularly arranged, but mostly longitudinally, along the wall of the canal. Sometimes the fibres are crowded together in a mass, sometimes the fibres are very scanty, and they may merely consist of a few strung across a plain mesoglœa.

The cellular elements in the mesoglœa are scanty, and the cells are nearly all spherical, a few stellate cells occurring here and there.

*Pigment.*

The sponge contains enormous numbers of pigment-cells, containing a black pigment, throughout the whole of the sponge. The greatest numbers of them occur in the ectoderm, where they are densely filled with the colouring-matter; but they also occur in the deepest parts of the sponge, though here not in such large numbers and not so deeply pigmented.

*Locality.* Suakin Harbour.

*Distribution.* Red Sea.

*HIRCINIA VARIABILIS, var. TYPICA, Schmidt.*

Synonymy:—

1879. *Hircinia variabilis*, Schulze (26 a).

1862. *Hircinia typica*, Schmidt (26).

1889. *Hircinia variabilis*, var. *typica*, Lendenfeld (20).

One small specimen of this variety occurs in the collection, measuring 45 mm. by 28 mm., and 27 mm. in height.

The colour is dark grey.

The surface is conulose, the conuli being on the average 2 mm. high and irregularly scattered over the sponge surface.



The skeleton is quite free from foreign bodies, and agrees very closely with the original description.

*Locality.* Suakin Harbour.

*Distribution.* Red Sea, Mediterranean, East Coast of North America, Australia.

*HIRCINIA VARIABILIS*, var. *HIRSUTA*, *Schmidt*.

Synonymy:—

1879. *Hircinia variabilis*, Schulze (26 a).

1862. *Hircinia hirsuta*, Schmidt (26).

1889. *Hircinia variabilis*, var. *hirsuta*, Lendenfeld (20).

A single large specimen has been assigned to this variety, though the external form differs somewhat from the description given by Lendenfeld (20).

The present specimen consists of a fairly thick encrusting mass, which probably grew over some coral, as fragments of coral are still attached to it. The average thickness of the specimen is 5 mm., but at one place, near the edge of the sponge, a thickening occurs to 15 mm. This was probably the result of a depression in the substance on which the sponge grew, as the upper surface of the sponge is quite level. At the immediate edge the sponge rapidly thins out to nothing.

No oscula were to be observed on the sponge.

The surface of the sponge is covered with conuli, which are large and very conspicuous. They average 8 mm. high, and are about 10 mm. in diameter at the base. In some parts of the sponge they lie quite close together, while in other parts they are not only less frequent, but also smaller.

From the summit of each conulus one of the main fibres of the skeleton very slightly projects.

The colour of the sponge is a dark brown-grey in spirit.

The skeleton is extremely similar to the description given by Lendenfeld (20) for the variety. There are enormous numbers of "*Hircinia* fibres."

*Locality.* Shab-ul-Shubuk.

*Distribution.* Red Sea, Mediterranean, Indian Ocean, Australasia.

*HIRCINIA RAMOSA*, *Keller*.

Synonymy:—

1889. *Hircinia ramosa*, Keller (18).

There is a single specimen of this species in the collection, and it forms a rather small encrusting sheet, detached entirely from any support.

The surface is covered with small conuli 2 mm. to 3 mm. high, irregularly and rather sparsely scattered over the whole sponge surface.

The colour in spirit is yellowish white.

The skeleton agrees closely with the original description, and is quite free from foreign bodies.

*Locality.* The single specimen was obtained from the north-west of Condenser Island, Suakin Harbour.

*Distribution.* Red Sea.

#### HIRCINIA RUGOSA, *Lendenfeld.*

Synonymy :—

1889. *Hircinia rugosa*, Lendenfeld (20).

This species is represented by three fragments of quite irregular shape, but which were probably all encrusting. No definite external characters can be given, owing to their fragmentary condition.

The colour of the specimens was greyish white, due to the presence of a dense sand-layer in the cortex.

The whole skeleton consists of sand. There is an extremely dense dermal layer of sand varying, in different parts of the specimen, from 0.6 mm. to 0.9 mm. thick. Further, the whole sponge is full of sand, in irregular bands and tracts which no longer possess the appearance of fibres. The grains of sand in these tracts are very dense towards the centre of the tract, but thin out somewhat towards its edge. Sand-grains are scattered thickly also between these tracts.

No details of the canal-system could be made out.

*Locality.* All the specimens were obtained from the north-west of Condenser Island, Suakin Harbour.

*Distribution.* Red Sea, Australia.

#### HIRCINIA FASCICULATA (*Esper*).

Synonymy :—

1791. *Spongia fasciculata*, Esper (14).

1889. *Hircinia fasciculata*, Lendenfeld (20).

This species is represented by a single large fragment, which is only a portion of a specimen. It forms a large erect mass 100 mm. by 20 mm., and is 55 mm. high, but the external surface of the sponge is only visible over a very small portion of the specimen. Where it can be seen, however, it is covered with low conuli, 1 mm. to 1.5 mm. high, irregularly scattered over the surface at distances varying from 5 mm. to 15 mm.

The colour of the specimen is deep brown in spirit.

The skeleton agrees exactly with the original description. The trellis-like main fibres contain considerable quantities of foreign bodies, chiefly sand.

*Locality.* The single specimen was obtained from the north-west of Condenser Island, Suakin Harbour.

*Distribution.* Red Sea, Indian Ocean, Mediterranean.

*APLYSINA INFLATA*, Carter.

Synonymy:—

1881. *Aplysina inflata*, Carter (5).

1889. *Aplysina inflata*, Lendenfeld (20).

This curious species is represented in the collection by two fistulæ, broken off from the rest of the specimen. Each of them is partially open at one end and entirely closed at the other. Presumably the aperture at the one end is the spot where the fistula has broken away from the rest of the specimen, and this is therefore the lower end. No trace of attachment can be seen on either of the fistulæ at any part of the surface.

The height of the fistulæ is 45 mm. in one case and 100 mm. in the other; each of them varies in diameter from 15 mm. to 20 mm., but the actual sponge-wall does not exceed 1.0 mm. in diameter.

The surface of the specimen and the structure of the sponge-wall, both in skeleton arrangement and sarcode, agrees extremely closely with Carter's original description.

*Locality.* Sherm Sheikh.

*Distribution.* Red Sea, Australia.

*APLYSINA PRÆTENZA*, n. sp. (Pl. 36. fig. 11.)

This new species has been created for the reception of a single specimen of a form somewhat similar to that of *Aplysina inflata*, Carter, but which differs from the latter in many important characteristics, and notably in the skeleton.

The specimen (Pl. 36. fig. 11) consists of an irregular spreading mass, which is, however, very incomplete. No portion of the basal surface, or of the body to which it was attached, is present, and the specimen merely consists of a shell of variable thickness, partly surrounding a large central cavity; a considerable portion of the wall of the cavity is missing, however, and other gaps occur in the wall. The appearance of these latter apertures, which are nearly circular in shape, suggests that possibly digitiform processes have been broken away from the specimen. Also in several places low prominences and thickenings of the crust occur, which are apparently the commencement of further processes.

The sponge-wall is usually very thin, and in most parts of the sponge does not exceed 1–2 mm. in thickness, but where the hillocks and thickenings referred to above occur it may be as much as 5 mm. thick.

The surface of the sponge is covered with conuli, scattered irregularly over the sponge. They are frequently connected with other conuli by ridges, sometimes a series of them being united to form a clear upstanding ridge. They vary considerably in height, and also in frequency of occurrence, in different parts of the specimen. The average height is 2 mm. to 3 mm., and they are usually about 5 mm. to 8 mm. apart, though in some cases they are

very much closer together. From these conuli project the ends of the skeletal fibres, usually only very slightly, just so as to be apparent, but in some cases the fibre projects considerably, and occasionally branches outside the sponge.

The colour in spirit is dark purple-brown.

The texture of the sponge is firm, resistant, and not at all compressible.

The skeleton consists of an irregularly branching fibre, the junctions between the fibres being somewhat few and quite irregular. This forms the chief difference between this species and *Aplysina inflata*, in which the skeleton is regularly reticulate. The skeletal fibre cannot be distinguished into main and secondary fibres, as there is no definite distinction of either thickness or direction to be made. Very great variations in thickness occur in the fibres, and they may measure anything up to 0.6 in diameter. Other fibres were found which did not exceed 0.05 mm. thick, as well as all intermediate sizes. The anastomoses between the fibres, and also connecting fibres, were very infrequent, and almost entirely absent from the more superficial parts of the sponge.

The fibres are pithed, as is always the case in this genus, and the pith occupies usually about eight-tenths of the whole of the fibre. They are, however, entirely free from foreign bodies, as is the rest of the sponge.

The canal-system of the sponge could not be clearly made out. In most parts of the specimen flagellated chambers were not distinguishable, and the sponge consisted of mesogloea, containing very large numbers of stellate cells, and perforated by an immense number of minute canals about 0.01 mm. in diameter. Where flagellated chambers do occur they are very small, not measuring more than 0.017 mm. in diameter, and they are by no means plentiful anywhere.

No other details of the canal-system could be made out.

*Locality.* "Sponges from among coral collected from the shallows at Khor Dongola."

*Distribution.* Red Sea.

#### APLYSINA RETICULATA, *Lendenfeld.*

Synonymy :—

1889. *Aplysina reticulata*, Lendenfeld (20).

A single small specimen, consisting of a very irregular, and very thick, upright lamellar sponge, 60 mm. long by 30 mm. high. At its thickest point the lamella has a diameter of 12 mm., but this diminishes to almost nothing at the summit. The upper part of the sponge is cut into a number of lobes.

The colour in spirit is dark violet.

The skeleton-fibre is large, and possesses a very well-marked pith. It measures 0.1 mm. to 0.2 mm. in diameter, of which the pith constitutes  $\frac{9}{10}$ . There are very few anastomoses between the fibres of the skeleton, especially

on the outside, so that it closely resembles the genus *Dendrilla* in this respect.

*Locality.* "Sponges from beneath a floating stage in Suez Docks."

*Distribution.* Red Sea ; Indian Ocean.

APLYSINA MOLLIS, n. sp. (Pl. 38. fig. 18.)

This new and rather striking species is founded on six specimens, all obtained at one time. The special characteristics of the species are its remarkable colour, apparently due to a symbiotic alga, and the very great width of the skeleton-mesh.

The largest specimen in the collection (Pl. 38. fig. 18) is an upright mass from which arise three processes at the summit of the sponge. These processes are all fairly cylindrical. The other specimens are all much smaller and one of them encloses a living Lamellibranch, apparently of the genus *Avicula*. Mr. Crossland's notes on this species contain a reference to this commensalism between the Lamellibranch and the sponge, and he states that it is of common occurrence.

All over the sponge there are slight irregularities of level, protuberances and depressions, arranged quite irregularly.

The surface of the sponge is conulose, and the conuli are very well marked and wide apart. They vary from 1 mm. to 2 mm. in height, and are about 6 mm. or 8 mm. apart. They are arranged regularly over the surface, and mark the points at which the skeletal fibres reach the surface. They are sometimes connected by more or less well-marked ridges.

The oscula are few in number and irregularly scattered. Two of the cylindrical projections from the upper part of the sponge bear oscula on their summits. They vary in size from 3 mm. to 10 mm.

The pores are always situated in small depressions on the surface, and a depression may contain one or many pores. In the latter case pore-areas are formed, or, at any rate, special aggregations of pores. They are very small and numerous, and occur over the whole sponge surface.

The colour is described by Mr. Crossland as "a very dark green on the surface, light yellow where broken." This colour changes in spirit to a uniform deep violet! This dark green on the outside and light yellow inside is also found in *Halichondria intricata*, Topsent. In *Aplysina mollis* it seems to be due to a symbiotic alga.

#### *Skeleton arrangement.*

The skeleton consists of a few large pithed fibres only, and these fibres have very few branches and still fewer anastomoses. At the surface of the sponge they are almost always 6 mm. or 8 mm. apart. Their diameter is 0.3 mm., of which  $\frac{8}{10}$  is occupied by the pith. There are no foreign bodies.

*Canal-system.*

Directly below the surface occur numerous small canals, which run in the superficial layers of the cortex in a tangential direction. Into them open the pores, and they themselves lead into a series of small subdermal cavities, which have a depth of about 0·07 mm. From these inhalant canals run down into the sponge, averaging 0·2 mm. wide.

The chambers are small, very numerous, and massed together in patches. They measure 0·03 in diameter.

*Histology.*

There can be distinguished three regions in the cortex :—

(i.) The dermal layer, measuring 0·1 mm. to 0·14 mm. in thickness, and densely packed with small stellate cells, but no apparent fibres or pigment.

(ii.) Just below the subdermal cavities the cortex is hollowed out into a large number of small elongated cavities, which are filled with long rows of round cells. These I believe to be symbiotic algæ, and if this is the case they would account for the dark green colour of the surface.

(iii.) The remainder of the cortex above the chamber-layer is not to be distinguished from the ordinary mesogloea.

The mesogloea is not very abundant for an *Aplysina*, and is filled with very small stellate cells.

*Locality.* Agig Harbour, in 4½ fathoms.

*Distribution.* Red Sea.

APLYSINA PURPUREA, *Carter.*

Synonymy :—

1880. *Aplysina purpurea*, Carter (7 a).

1889. *Aplysina purpurea*, Dendy (12).

1889. *Psammopemma fuliginosum*, Lendenfeld (20).

? 1889. *Psammaplysilla arabica*, Keller (18).

A single very fragmentary specimen has been assigned to this species on the strength of the structure of its skeleton ; its preservation was not sufficiently good for more to be made out of it.

*Locality.* Suez.

*Distribution.* Red Sea ; Ceylon ; Australia.

CACOSPONGIA CAVERNOSA (*Esper*).

Synonymy :—

1791. *Spongia cavernosa*, Esper (14).

1889. *Stelospongia cavernosa*, Lendenfeld (with complete synonymy) (20).

This species is represented by a single specimen. It is quite typical in

appearance, and the sponge-tissues are mere thin membranes covering and uniting the fibres of the skeleton.

The colour in spirit is greyish black.

*Locality.* Attached to a dead pearl-shell, Khor Dongonab.

*Distribution.* Red Sea, Mediterranean, Indian Ocean, Pacific Ocean.

#### PHYLLOSPONGIA MADAGASCARIENSIS (*Hyatt*).

Synonymy:—

1877. *Carteriospongia madagascariensis*, Hyatt (16).

1884. *Phyllospongia madagascariensis*, Ridley (23).

There are four specimens of this species in the collection. Each consists of a delicate mass of lamellæ arising from a common base. Three of the specimens are rather irregular in shape, but the fourth possesses the typical flower shape, being circular with the lamellæ arranged concentrically instead of parallel, and the largest lamellæ are in the centre, and the smallest outside. The complete specimen measures about 75 mm. in diameter and 30 mm. high. The average diameter of the individual lamellæ is 1.0 mm. to 1.5 mm., but a few reach 2.0 mm. in thickness.

The surface of the lamellæ is quite smooth.

The colour in spirit is dull brownish white.

The dermis is covered with minute sand-grains, but not thickly.

The fibres are similar to Hyatt's description; their diameter is 0.07 mm.

*Locality.* One specimen from Khor Dongonab, three from Suakin Harbour.

*Distribution.* Red Sea, East African region.

#### PHYLLOSPONGIA CORDIFOLIA (*Keller*).

Synonymy:—

1889. *Carteriospongia cordifolia*, Keller (18).

A single large specimen growing on a piece of coral. It consists of a considerable number of lamellæ, which stand erect and form a dense, rather irregular mass. The lamellæ are mostly rather deeply and irregularly palmatifid; but these divisions apparently do not indicate incipient branching, but only a permanently lobed condition of the lamella.

The sponge is 110 mm. high from the base to the top of the tallest lamella, and about 70 mm. wide. The lamellæ are 1.5 mm. thick.

The surface is covered with very minute spines, 0.2 mm. high and 2 mm. apart.

The colour is dull yellowish white.

The skeleton consists of a reticulation of spongin-fibre containing a very large quantity of sand-grains and some other foreign matter.

*Locality.* Suakin Harbour.

*Distribution.* Red Sea.

PHYLLOSPONGIA RADIATA (*Hyatt*).

Synonymy :—

1877. *Carteriospongia radiata*, Hyatt (16).

1889. *Carteriospongia radiata*, Keller (18).

? 1889. *Phyllospongia pennatula*, Lendenfeld (20).

This species is represented by several detached fronds, all collected together from one locality. The largest lamella measures 190 mm. wide, 130 mm. high, and is 5 mm. thick, and arises from a pair of short cylindrical stalks, each of which possesses a disc-like base. These twin stalks are 6 mm. in diameter and 11 mm. high.

The typical radiate appearance of the sponge surface around the oscula is very well shown in all the specimens.

Colour in spirit white.

*Locality.* Khor Dongonab.

*Distribution.* Red Sea, Indian Ocean, Australia.

EUSPONGIA ZIMOCCA (*O. Schmidt*).

Synonymy :—

1862. *Spongia zimocca*, O. Schmidt (26).

1879. *Euspongia zimocca*, Schulze (26 a).

1889. *Euspongia zimocca*, Lendenfeld (20).

There are two specimens of this sponge in the collection—one a mere fragment; the other a complete subspherical cushion measuring 15 mm. in length, 12 mm. in width, and 10 mm. in height from base to summit.

*Localities.* Suez mud-flats; Khor Dongonab.

*Distribution.* Red Sea, Mediterranean.

EUSPONGIA OFFICINALIS, var. ARABICA (*Keller*).

Synonymy :—

1889. *Euspongia officinalis*, var. *arabica*, Keller (18).

1906. *Euspongia officinalis*, var. *arabica*, Topsent (35).

This variety of the bath-sponge is represented by three specimens, neither of which is large enough to be of value commercially. Each consists of an upright mass of somewhat irregular shape, from the summit or side of which one or more cone-like lobes arise. These lobes are approximately spherical



in section, and are tubular, each bearing an osculum at the summit; they vary in diameter from 8 mm. to 35 mm.

The surface of the sponge is minutely and regularly conulose, the conuli varying in height from 0.1 mm. to 0.5 mm.; they are on the average about 1.0 mm. apart.

The oscula are not confined to the cones referred to above, but occur sparsely scattered over the whole of the sponge-surface. There are four or five of these oscula on each specimen, and they measure about 3 mm. to 4 mm. in diameter.

The pores were very difficult to make out, but where seen they were numerous and scattered over the whole surface.

The colour of the sponge in spirit is very deep black on the outside and a dark brownish in the interior.

The texture is very soft and delicate, but also very firm.

*Skeleton arrangement.*

The main fibres run radially, and contain foreign bodies; they measure 0.08 mm. in diameter. The secondary fibres are not definitely oriented, but the reticulation is fairly regular and even. The diameter of these secondary fibres does not exceed 0.02 mm. The diameter of the mesh is about 0.1 mm.

The canal-system needs no special description, there being no points in which the present specimens differ from the descriptions previously given of this variety.

*Locality.* Suakin Harbour.

*Distribution.* Red Sea.

**EUSPONGIA OFFICINALIS, var. CEYLONENSIS.**

*Synonymy:*—

*Euspongia officinalis*, var. *ceylonensis*, Dendy (11).

This sponge is represented in the collection by a fairly large and extremely fine specimen. It consists of a subspherical cushion attached to the substratum by a broad base, and perfectly regular in shape. The surface is very finely conulose, and the conuli are very small and close together; they are mostly about 0.2 mm. high.

The oscula are large, but not numerous, and scattered regularly over the surface. They measure 3 mm. to 5 mm. in diameter.

The colour of the specimen is black in spirit.

The skeleton consists of a reticulation of spongin-fibre, in which primary and secondary fibres can be clearly differentiated. The main fibres measure, as a rule, 0.15 mm. in diameter, and are filled with extremely small sand-grains. They run strictly radially, and are very regularly distributed throughout the sponge, usually being separated at the sponge surface by about 0.8 mm.

The secondary fibres form a very close but not very regular meshwork, and measure 0.02 in diameter. No definite size of the mesh can be given, but 0.2 mm. is suggested as an approximate average.

This variety does not seem to be at all definitely distinguished from the New-World variety *rotunda* of the same species.

*Locality.* The specimen was obtained on the north-west of Condenser Island, Suakin Harbour.

*Distribution of the variety.* Red Sea ; Ceylon ; ? Florida.

#### THE SPONGE FAUNA OF THE RED SEA.

The first complete account of the then-known Sponge Fauna of the Red Sea was published in 1889 and 1891 by Conrad Keller (18), when he described 88 species of sponges. Since then this list has been increased by four other reports on collections, one being by Schulze (27), describing 3 Hexactinellids, and the other three papers being all by Topsent (31, 32, 35). By these four publications the number of known species of sponges was increased to 108, and at the time when Mr. Crossland made the collection at present being described, this total had not been increased. Of the 93 species of sponges obtained by Mr. Crossland no less than 79 are new to the Red Sea, so that there is now a total of 187 species known to occur in this region.

The very large proportion of species new to the Red Sea in Mr. Crossland's collection is very probably explicable to a very large extent in the fact that the area in which he collected was one which had been left almost untouched previously. With the exception of the Gulf of Suez, the localities which had been investigated when Keller wrote his work on the subject were almost entirely confined to the southern portion of the Sea, and the most northerly point (save those in the Gulf of Suez) that he obtained sponges at was Suakin, almost all his specimens coming from either Suakin, Massaua, Asab Bay, or Beilul Bay. The collections investigated by Topsent came, one from the Red Sea proper (32), one from the Gulf of Tajoura (31), and one from the Gulf of Jibuti (35), both these last two places being just outside the Red Sea and in the Gulf of Aden.

They lie so very close to the Red Sea, however, and the sponge fauna, as evidenced by these collections, is so very closely related to that of the Red Sea, that I propose to include the Gulf of Aden with the Red Sea in these notes as one and the same area.

At the present time almost the whole of the African coast of the Red Sea has been carefully collected over, and the large number of species that have been obtained is, I think, evidence that the collecting has been very thorough ; but we have practically no knowledge of the fauna of the Asian

side of the Sea, only one spot having been investigated, *i. e.* Jeddah, and only four species having been obtained there.

A table is appended (Table A) showing all the localities in the Red Sea where sponges have been collected; and another table (Table B) to show the distribution of the various species throughout the globe.

An examination of this second table will show that the Red Sea shows a very considerable affinity to the other parts of the Indian Ocean in its sponge fauna. The following 49 species are common to some part of the two regions:—*Clathrina primordialis*, *Clathrina canariensis* var. *compacta*, *Clathrina tenuipilosa*, *Clathrina darwinii*, *Sycon raphanus*, *Sycon coronatum*, *Leucandra primigenia*, *Leucandra microrhaphis*, *Leucandra pulvinar*, *Leucilla bathybia*, *Aulocystis zitteli*, *Tethya lynceurium*, *Tethya seychellensis*, *Tethya japonica*, *Tethya ingalli*, *Suberites carnosus*, *Terpios viridis*, *Placospongia melobesioides*, *Cliona celata*, *Cliona vastifica*, *Chondrilla nucula*, *Chondrosia reniformis*, *Grayella cyathophora*, *Tetilla poculifera*, *Cinachrya schulzei*, *Reniera implexa*, *Trachyopsis halichondrioides*, *Ceraochalina pergamentacea*, *Siphonochalina communis*, *Siphonochalina tubulosa*, *Siphonochalina intermedia*, *Gelliodes poculum*, *Clathria frondifera*, *Acanthella aurantiaca*, *Phakellia donnani*, *Ciocalypta tyleri*, *Psammopemma commune*, *Aplysina reticulata*, *Aplysina inflata*, *Aplysina purpurea*, *Cacospongia cavernosa*, *Hircinia variabilis*, *Hircinia fasciculata*, *Hircinia rugosa*, *Hircinia clathrata*, *Phyllospongia radiata*, *Phyllospongia otahitica*, *Phyllospongia madagascariensis*, *Euspongia officinalis*.

Of these, 17 are common to the Red Sea and the eastern coasts of Africa and the islands near, 25 to the Red Sea and Ceylon, and 30 to the Red Sea and Australia and the East Indies.

And even such a list of identical species does not exhaust the similarity between the two groups. Certain of the genera represented in the Red Sea by species confined to that locality, (as far as we know), are represented in other parts of the Indian Ocean by very closely allied species, such as *Paratetilla cineriformis* from Ceylon and *Paratetilla eccentrica* from the Red Sea. *Paratetilla*, moreover, and *Avinissa*, another genus represented in the Red Sea, though not in this collection, are widely distributed over the Indian Ocean, but do not occur outside it.

I therefore propose to enlarge the "Indo-Australian" region as defined by Ridley and Dendy (24), and enlarged by Dendy (11), to embrace the whole of the Indian Ocean, and the whole of the African shores from Suez to the Cape of Good Hope; and I propose to divide it into Eastern and Western divisions by a line following the 65th meridian of East longitude. To justify this division is at present rather difficult, as our knowledge of the sponge fauna of the East African region is much more scanty than our knowledge of the others, and elaborate comparisons of the two faunas are therefore impossible. It seems clear, however, from Dendy (11) that the

Ceylon fauna is extremely closely allied to the Australian, and though the list of species common to both Ceylon and the Red Sea has been increased since 1904 (when Professor Dendy's work was written) from 14 to 25, yet the gap is still clearly apparent when examining two collections from the different areas at the same time.

Of the relation of the Red Sea fauna to that of East Africa it is more difficult to speak. Very little indeed has been done since Ridley's report on the 'Alert' sponges (23), many of which came from this region. Certainly the number of species known has been increased since then, but even now the number does not approach that known from either the Red Sea or Ceylon. Keller, however, in 1891 (18) decided that the faunas of the Red Sea and East Africa were closely allied; and Mr. Crossland, when writing an introduction to the series of reports of which this forms one, came to the same conclusion, though in the latter case the material on which the conclusion was based was not spongological but general.

The above opinion of the area and subdivisions of the Indo-Australian area has been expressed in Table B, and there both the eastern and western divisions have again been subdivided, in order to show as clearly as possible the distribution of the various species over the area. For the purposes of the subdivision Ceylon has been considered separate from the Australian region, and the Red Sea has been shown separately from the East African region. It must be noticed that the Australian region, as defined in this paper, exactly corresponds with the Indo-Australian area as defined by the 'Challenger' report.

Another group of sponges which occurs in the Red Sea also deserves attention. There are three species, long only known from the Mediterranean (in which they are common), which are now found also in the Red Sea. They are *Leucandra aspera*, *Placortis simplex*, and *Euspongia zimocca*. It is difficult to say anything definite as to the occurrence of these sponges in the Red Sea, but I think there is very great probability that they have come there by migration through the Suez Canal.

That such migration can, and actually does, take place, Keller (18 a) gives ample proof, and I think the fact that all three of these species have been obtained at Suez is a strong support of the theory that they have migrated from the Mediterranean to the Red Sea.





TABLE A (con.).

	Suez Harbour.	Jebel Zeit.	Cape Elba.	Khor Abu Hamama.	Khor Shinab.	Khor Dongonab.	Suakin Harbour.	Shab-ul-Shubuk.	We Shubuk.	Sherm Sheikh.	Mersah Makdah.	Mersah Wadi Lehami.	Tella Tella Kebira.	Agig Harbour.	Massaua.	Dahlak Is.	" 15° N. lat."	Belul Bay.	Asab Bay.	Perim I.	Jeddah.	Masira I.	Aden Coasts.	Gulf of Tajoura.	Gulf of Jibuti.	Deeper parts of Red Sea.	Indefinite locality.
<b>TETRAXONIDA (con.).</b>																											
Fam. STELLETTIDÆ.																											
<i>Pilobrota parva</i> , n. sp. ....																											
<i>Stelletta siemensi</i> , Keller .....																											
Fam. GEODIIDÆ.																											
<i>Cydonium arabicum</i> , Carter .....																											
<i>Geodia micropunctata</i> , n. sp. ....																											
<i>Isops jousseaumi</i> , Topsent .....																											
Fam. EPIPOLASIDÆ.																											
<i>Coppatias albescens</i> , n. sp. ....																											
<i>Diastra sterrastræa</i> , n. gen. et sp. ....																											
Fam. TETHYIDÆ.																											
<i>Tethya lyncurium</i> , L. ....																											
<i>Tethya seychellensis</i> , Wright .....																											
<i>Tethya (Donatia) japonica</i> , Sollas .....																											
<i>Tethya (Donatia) ingalli</i> (Bowerbank) .....																											
<i>Tethya (Donatia) arabica</i> , Carter .....																											
Fam. SUBERITIDÆ.																											
<i>Suberites cornosus</i> , Johnston .....																											
<i>Suberites clavatus</i> , Keller .....																											
<i>Suberites mastoideus</i> , Keller .....																											
<i>Suberites incrustans</i> , Keller .....																											
<i>Pseudosuberites hyalina</i> (Ridley & Dendy) ..																											
<i>Acosuberites fauroti</i> , Topsent .....																											
<i>Terpios viridis</i> , Keller .....																											
<i>Terpios lendenfeldi</i> , Keller .....																											























TABLE B (con.).

	INDO-AUSTRALIAN.				SOUTHERN OCEAN.	NORTHERN PACIFIC.	SOUTHERN PACIFIC.	PATAGONIAN.	NORTHERN ATLANTIC.			
	Western Division.		Eastern Division.						American Division.	European Division.		SOUTHERN ATLANTIC.
	Red Sea region.	E. African region.	Ceylon region.	Australian region.						Atlantic coasts region.	Mediterranean region.	
<b>TETRAxonIDA (con.).</b>												
Fam. DESMACIDONIDÆ.												
Subfam. ESPERELLINÆ.												
<i>Esperella dendyi</i> , n. sp. ....	×	...	...	...	...	...	...	...	...	...	...	
<i>Esperella euplectellioides</i> , n. sp. ...	×	...	...	...	...	...	...	...	...	...	...	
<i>Esperella fistulifera</i> , n. sp. ....	×	...	...	...	...	...	...	...	...	...	...	
<i>Esperella suezza</i> , n. sp. ....	×	...	...	...	...	...	...	...	...	...	...	
<i>Esperella erythræana</i> , n. sp. ....	×	...	...	...	...	...	...	...	...	...	...	
<i>Leptosia lancifera</i> , Topsent ....	×	...	...	...	...	...	...	...	...	...	...	
Subfam. ECTYONINÆ.												
<i>Myxilla (Lissodendoryx) isodictyalis</i> (Carter).	×	...	...	...	...	...	...	×	...	...	...	
<i>Myxilla cratera</i> , n. sp. ....	×	...	...	...	...	...	...	...	...	...	...	
<i>Myxilla tenuissima</i> , n. sp. ....	×	...	...	...	...	...	...	...	...	...	...	
<i>Acaranus wolfgangi</i> , Keller ....	×	...	...	...	...	...	...	...	...	...	...	
<i>Echinodictium flabellatum</i> , Topsent	×	...	...	...	...	...	...	...	...	...	...	
<i>Echinodictium jousseaumei</i> , Topsent	×	...	...	...	...	...	...	...	...	...	...	
<i>Ophlitaspongia arbuscula</i> , n. sp. ....	×	...	...	...	...	...	...	...	...	...	...	
<i>Ophlitaspongia herrida</i> , n. sp. ...	×	...	...	...	...	...	...	...	...	...	...	
<i>Ophlitaspongia digitiformis</i> , n. sp.	×	...	...	...	...	...	...	...	...	...	...	
<i>Clathria frondifera</i> (Bbk.) ....	×	×	...	×	...	...	...	...	...	...	...	
Subfam. TEDANIINÆ.												
<i>Tedania assabensis</i> , Keller ....	×	...	...	...	...	...	...	...	...	...	...	
<i>Trachytetania arborea</i> , Keller ...	×	...	...	...	...	...	...	...	...	...	...	
Fam. AXINELLIDÆ.												
<i>Hymeniacion calcifera</i> , n. sp. ...	×	...	...	...	...	...	...	...	...	...	...	
<i>Hymeniacion zosteræ</i> , n. sp. ....	×	...	...	...	...	...	...	...	...	...	...	
<i>Acanthella aurantiaca</i> , Keller ...	×	...	×	...	...	...	...	...	...	...	...	
<i>Acanthella flabelliformis</i> , Keller .	×	...	...	...	...	...	...	...	...	...	...	
<i>Acanthella ehrenbergi</i> , Keller ....	×	...	...	...	...	...	...	...	...	...	...	
<i>Axinella pumila</i> , Keller ....	×	...	...	...	...	...	...	...	...	...	...	
<i>Axinissa gravieri</i> , Topsent ....	×	...	...	...	...	...	...	...	...	...	...	
<i>Phakellia donnani</i> (Bowerbank) .	×	...	×	...	...	...	...	...	...	...	...	
<i>Phakellia palmata</i> , n. sp. ....	×	...	...	...	...	...	...	...	...	...	...	
<i>Ciocalypta tyleri</i> , Bowerbank ...	×	...	×	...	...	...	...	...	...	...	...	
<b>Lithistida—Hoplophora.</b>												
Fam. TETRACLADIDÆ.												
<i>Discodermia styliifera</i> , Keller ....	×	...	...	...	...	...	...	...	...	...	...	
<b>EUCERATOSA.</b>												
Fam. APLYSILLIDÆ.												
<i>Aplysilla lacunosa</i> , Keller ....	×	...	...	...	...	...	...	...	...	...	...	
<i>Megalopastas erectus</i> , n. sp. ....	×	...	...	...	...	...	...	...	...	...	...	
<i>Darwinella aurea</i> , Müller ....	×	...	...	...	...	...	...	...	×	×	×	

TABLE B (con.).

	INDO-AUSTRALIAN.				SOUTHERN OCEAN.	NORTHERN PACIFIC.	SOUTHERN PACIFIC.	PATAGONIAN.	NORTHERN ATLANTIC			
	Western Division.		Eastern Division.						American division.	European Division.		SOUTHERN ATLANTIC.
	Red Sea region.	E. African region.	Ceylon region.	Australian region.						Atlantic coasts region.	Mediterranean region.	
<b>EUCERATOSA (con.).</b>												
<b>Fam. SPONGELIIDÆ.</b>												
<i>Spongelia fragilis</i> , var. <i>ramosa</i> , F. E. Schulze.	×	...	...	...	...	...	...	...	...	...	...	
<i>Spongelia herbacea</i> , Keller	×	...	...	...	...	...	...	...	...	...	...	
<i>Spongelia delicatula</i> , n. sp.	×	...	...	...	...	...	...	...	...	...	...	
<i>Spongelia ædificanda</i> , n. sp.	×	...	...	...	...	...	...	...	...	...	...	
<i>Psammopemma commune</i> (Carter).	×	...	...	×	...	...	...	...	...	...	...	
<i>Dysidea cinerea</i> , Keller	×	...	...	...	...	...	...	...	...	...	...	
<i>Dysidea nigra</i> , Keller	×	...	...	...	...	...	...	...	...	...	...	
<i>Euryspongia lactea</i> , n. g. et sp.	×	...	...	...	...	...	...	...	...	...	...	
<b>Fam. SPONGIIDÆ.</b>												
<i>Heteronema erecta</i> , Keller	×	...	...	...	...	...	...	...	...	...	...	
<i>Duriella nigra</i> , n. g. et sp.	×	...	...	...	...	...	...	...	...	...	...	
<i>Aplysina reticulata</i> , Lendenfeld	×	...	×	...	...	...	...	...	...	...	...	
<i>Aplysina inflata</i> , Carter	×	...	...	×	...	...	...	...	...	...	...	
<i>Aplysina prætensa</i> , n. sp.	×	...	...	...	...	...	...	...	...	...	...	
<i>Aplysina purpurea</i> , Carter	×	...	×	×	...	...	...	...	...	...	...	
<i>Aplysina mollis</i> , n. sp.	×	...	...	...	...	...	...	...	...	...	...	
( <i>Psammaplysilla arabica</i> , Keller)	×	...	...	...	...	...	...	...	...	...	...	
<i>Cacospongia cavernosa</i> , O. Schmidt.	×	×	×	...	...	×	...	...	...	×	...	
<i>Halme robusta</i> , Keller	×	...	...	...	...	...	...	...	...	...	...	
<i>Hircinia variabilis</i> , var. <i>typica</i> , O. Schmidt.	×	...	...	×	...	...	...	×	...	×	...	
<i>Hircinia variabilis</i> , var. <i>hirsuta</i> , O. Schmidt.	×	...	×	×	...	...	...	...	...	×	...	
<i>Hircinia fasciculata</i> , Esper	×	...	×	...	...	...	...	...	...	×	...	
<i>Hircinia ramosa</i> , Keller	×	...	...	...	...	...	...	...	...	...	...	
<i>Hircinia rugosa</i> , Lendenfeld	×	...	...	×	...	...	...	...	...	...	...	
<i>Hircinia atrovirens</i> , Keller	×	...	...	...	...	...	...	...	...	...	...	
<i>Hercinia echinata</i> , Keller	×	...	...	...	...	...	...	...	...	...	...	
<i>Hircinia clathrata</i> , Carter	×	...	×	×	...	...	...	×	...	...	...	
<i>Phyllospongia madagascariensis</i> , Hyatt.	×	×	...	...	...	...	...	...	...	...	...	
<i>Phyllospongia</i> ( <i>Carteriospongia</i> ) <i>radiata</i> , Hyatt.	×	...	×	×	...	...	...	...	...	...	...	
<i>Phyllospongia</i> ( <i>Carteriospongia</i> ) <i>cordifolia</i> , Keller.	×	...	...	...	...	...	...	...	...	...	...	
<i>Phyllospongia</i> ( <i>Carteriospongia</i> ) <i>otahitica</i> , Hyatt.	×	...	...	×	...	...	...	...	...	...	...	
<i>Phyllospongia foliascens</i> , Lendenf.	×	...	...	...	...	...	...	...	...	...	...	
<i>Phyllospongia</i> ( <i>Carteriospongia</i> ) <i>perforata</i> (Hyatt).	×	...	...	×	...	...	...	...	...	...	...	
<i>Euspongia zimocca</i> (O. Schmidt)...	×	...	...	...	...	...	...	...	...	×	...	
<i>Euspongia officinalis</i> , var. <i>arabica</i> , Keller.	×	...	...	...	...	...	...	...	...	...	...	
<i>Euspongia officinalis</i> , var. <i>ceylonensis</i> , Dendy.	×	...	×	...	...	...	...	?	...	...	...	

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## EXPLANATION OF THE PLATES.

## PLATE 35.

- Fig. 1. *Paratetilla eccentrica*. × 5.  
 2. *Chrotella ibis*. × 2.  
 3. *Pilochrota parva*. × 4.  
 4. Portion of the surface of *Diastra sterrastræa*. × 7.  
 5. Portion of the under surface of *Geodia micropunctata*, showing oscula and Lamellibranch shell. × 4.

## PLATE 36.

- Fig. 6. *Pilochrota parva*, skeleton arrangement. × 20.  
 7. *Chrotella ibis*, skeleton arrangement. × 20.  
 8. *Paratetilla eccentrica*, skeleton arrangement. × 20.  
 9. *Coppatias albescens*, portion of surface. × 7.  
 10. *Halichondria bubastes*. × 1½.  
 11. *Aplysina prætensa*, portion of specimen. × 1½.

## PLATE 37.

- Fig. 12. *Esperella euplectellioides*.  $\times \frac{1}{2}$ .  
 13. *Myxilla cratera*, portion of surface.  $\times 5$ .  
 14. *Ophlitaspongia* (?) *digitiformis*.  $\times \frac{1}{3}$ .  
 15. *Ophlitaspongia* (?) *digitiformis*, skeleton arrangement.  $\times 20$ .

## PLATE 38.

- Fig. 16. *Phakellia donnani*.  $\times 5$ .  
 17. *Anacantha nivea*.  $\times 1\frac{1}{2}$ .  
 18. *Aplysina mollis*.  $\times \frac{2}{3}$ .  
 19. Portion of surface of *Hymeniacidon calcifera*.  $\times 4$ .

## PLATE 39.

- Fig. 20. *Phakellia palmata*.  $\times 1\frac{1}{2}$ .  
 21. *Phakellia palmata*, skeleton arrangement.  $\times 20$ .  
 22. *Ophlitaspongia* (?) *arbuscula*.  $\times \frac{1}{3}$ .  
 23. Portion of surface of *Euryspongia lactea*.  $\times 4$ .

## PLATE 40.

- Fig. 24. *Geodia micropunctata*, skeleton arrangement.  $\times 60$ .  
 25. *Ophlitaspongia* (?) *arbuscula*, skeleton arrangement.  $\times 60$ .  
 26. *Ophlitaspongia* (?) *horrida*, skeleton arrangement.  $\times 60$ .

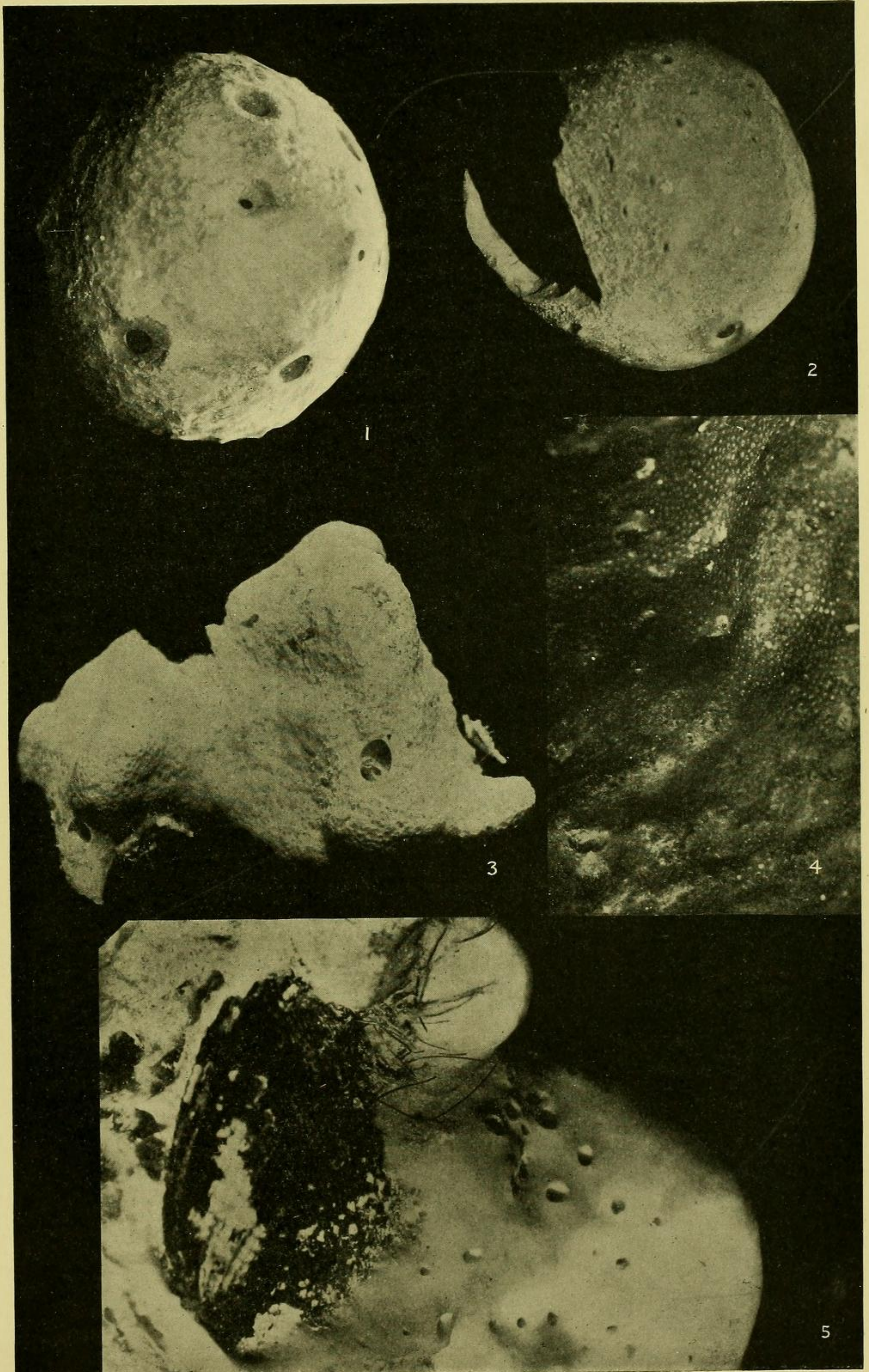
## PLATE 41.

- Fig. 27. *Euryspongia lactea*, skeleton.  $\times 40$ .  
 28. *Euryspongia lactea*, canal-system.  $\times 200$ .  
 29. *Duriella nigra*, skeleton and canal-system.  $\times 40$ .

## LETTERING ON PLATES 40 &amp; 41.

*ch.*, chone.  
*cort. sk.*, skeleton of the cortex.  
*ex. c.*, exhalant canal.  
*fl. c.*, flagellated chambers.

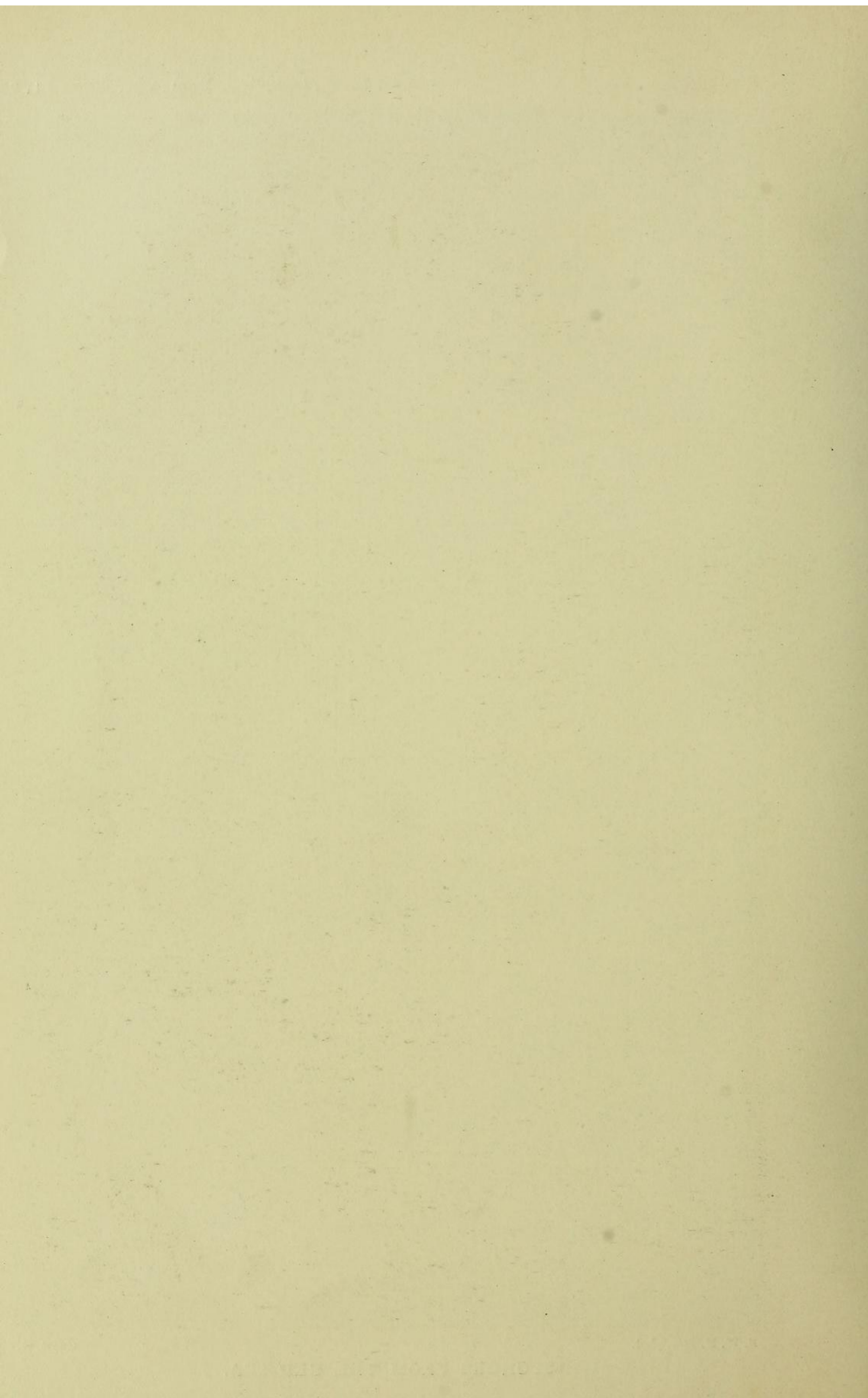
*inh. c.*, inhalant canal.  
*mes. f.*, fibres of the mesogloea.  
*pig.*, pigment-cells.  
*sk. f.*, skeletal fibres.

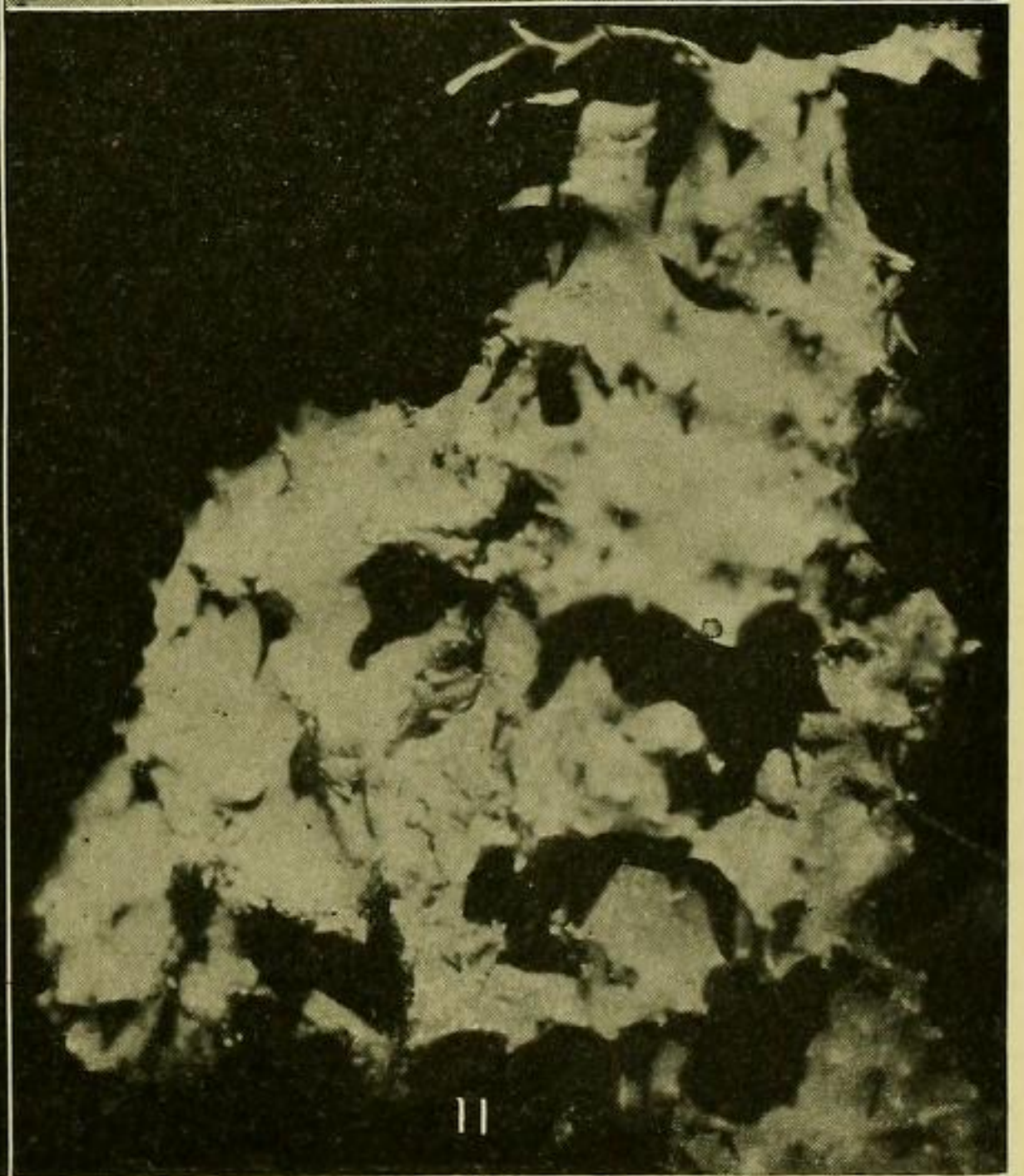
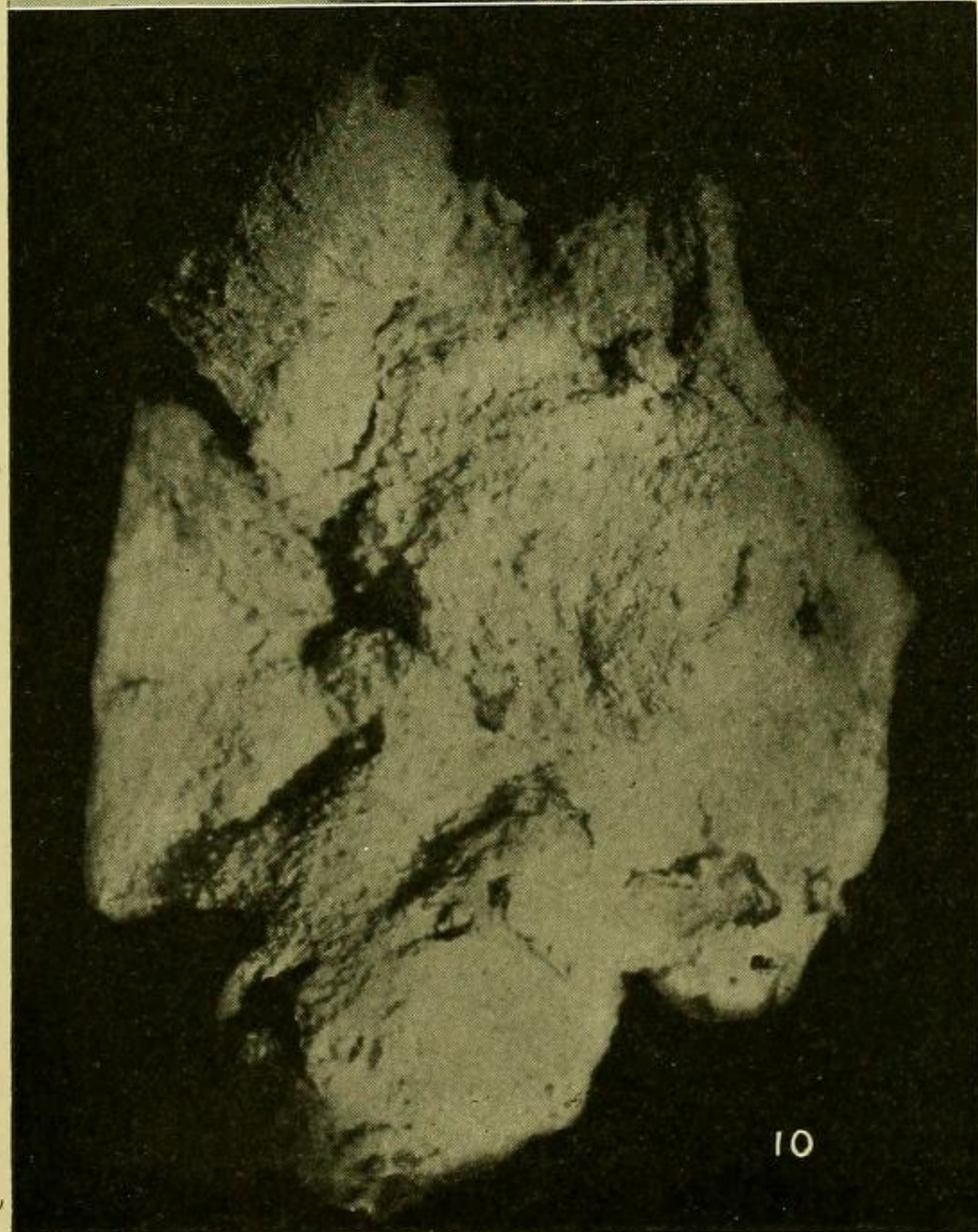
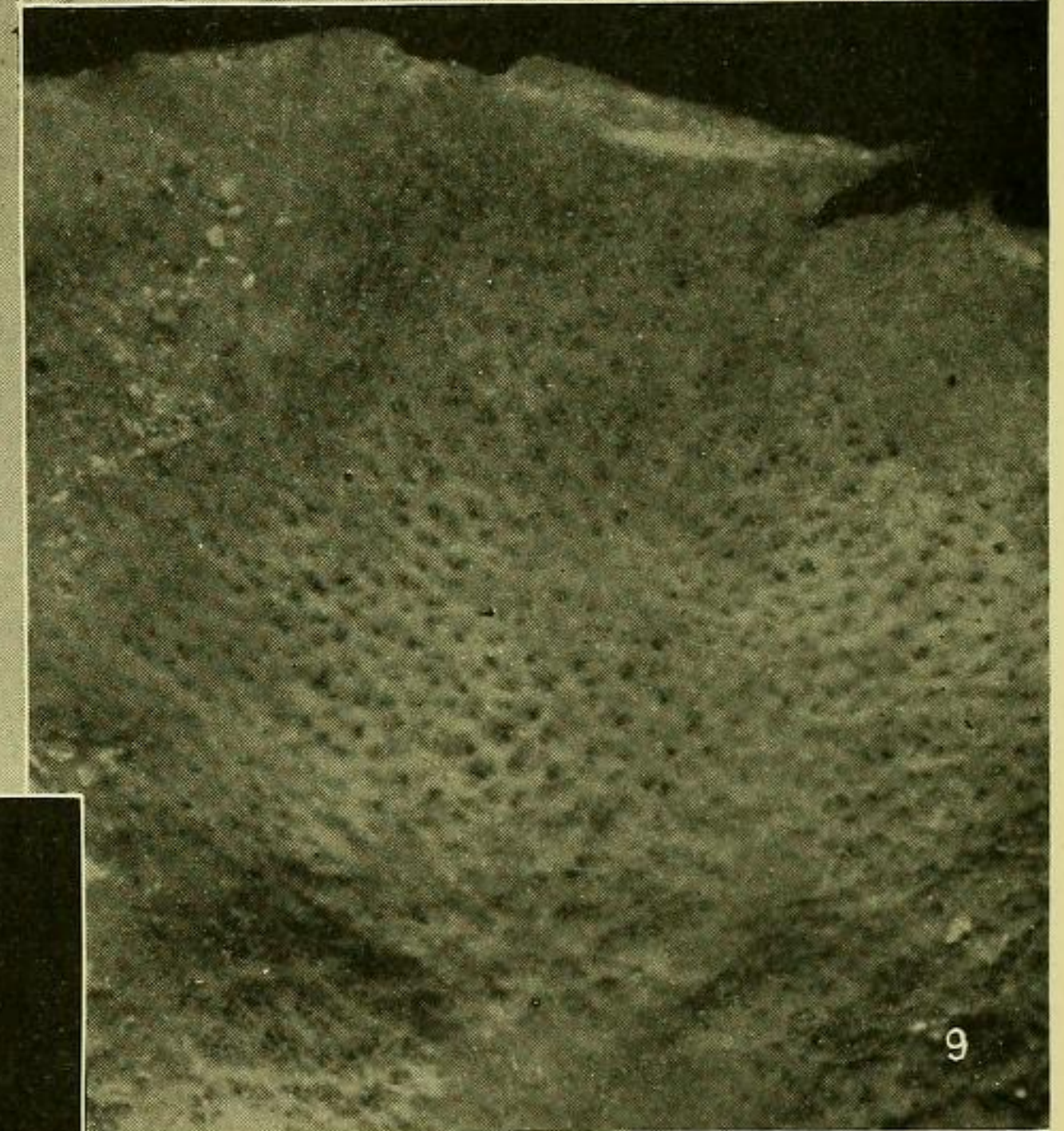
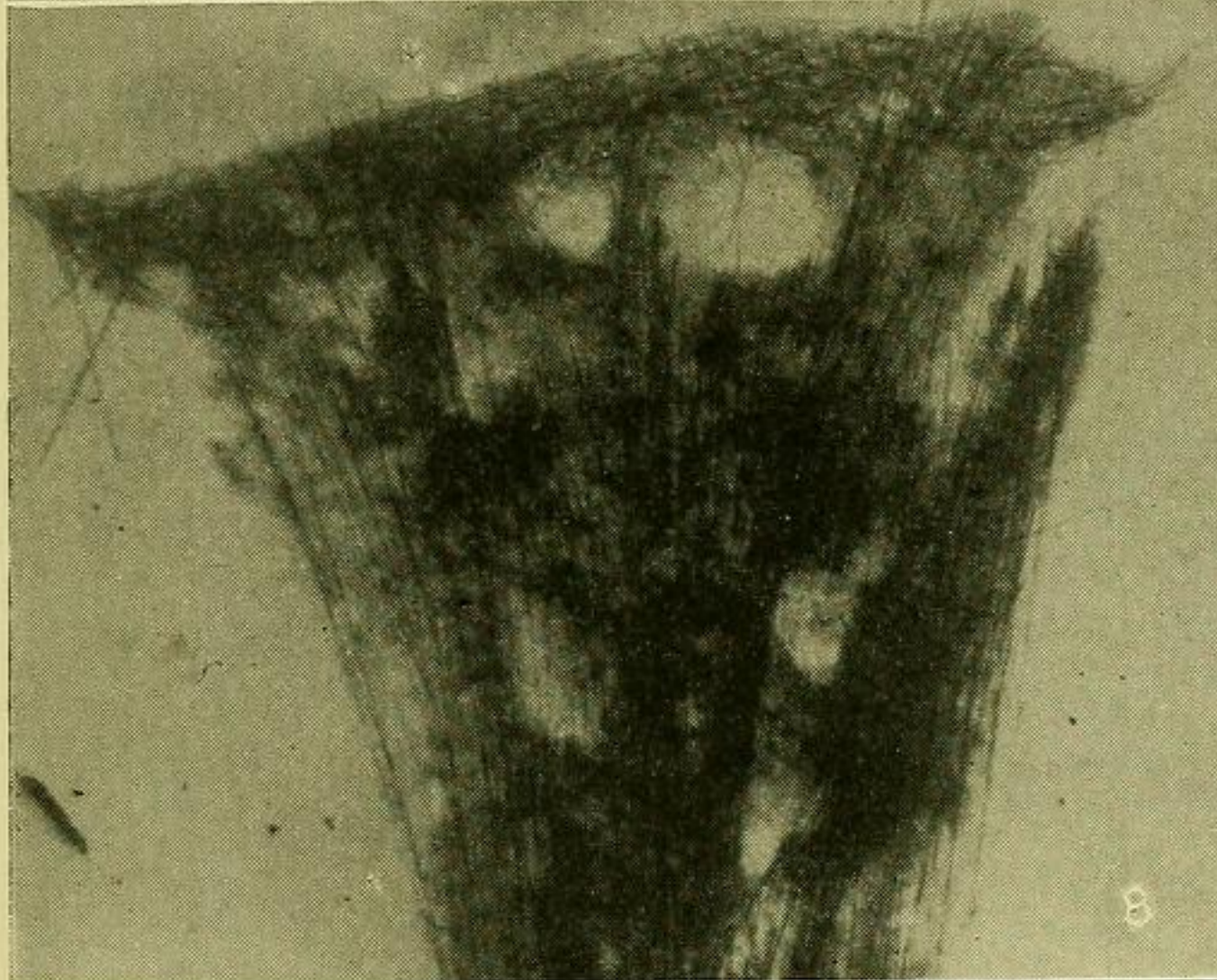
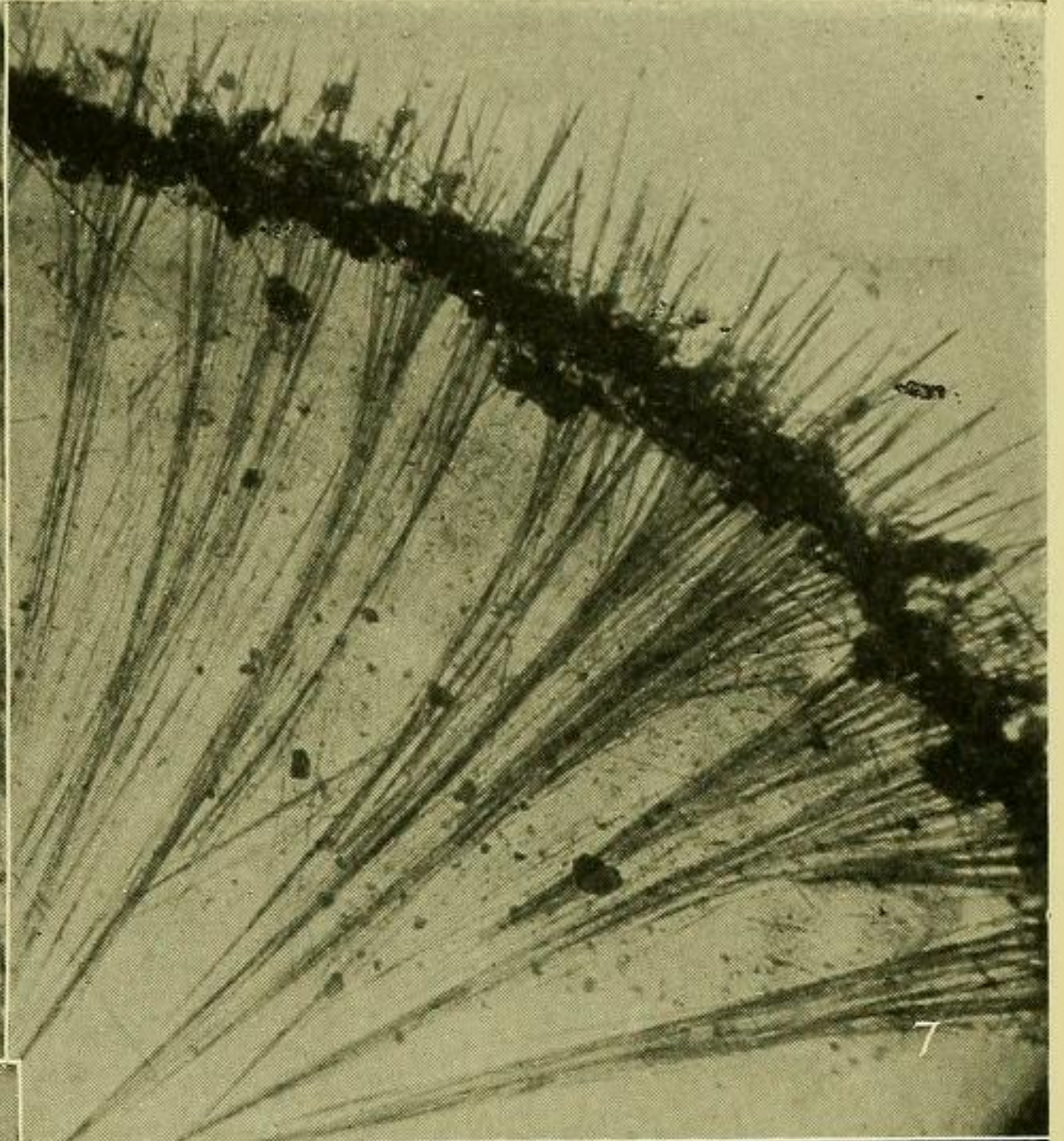
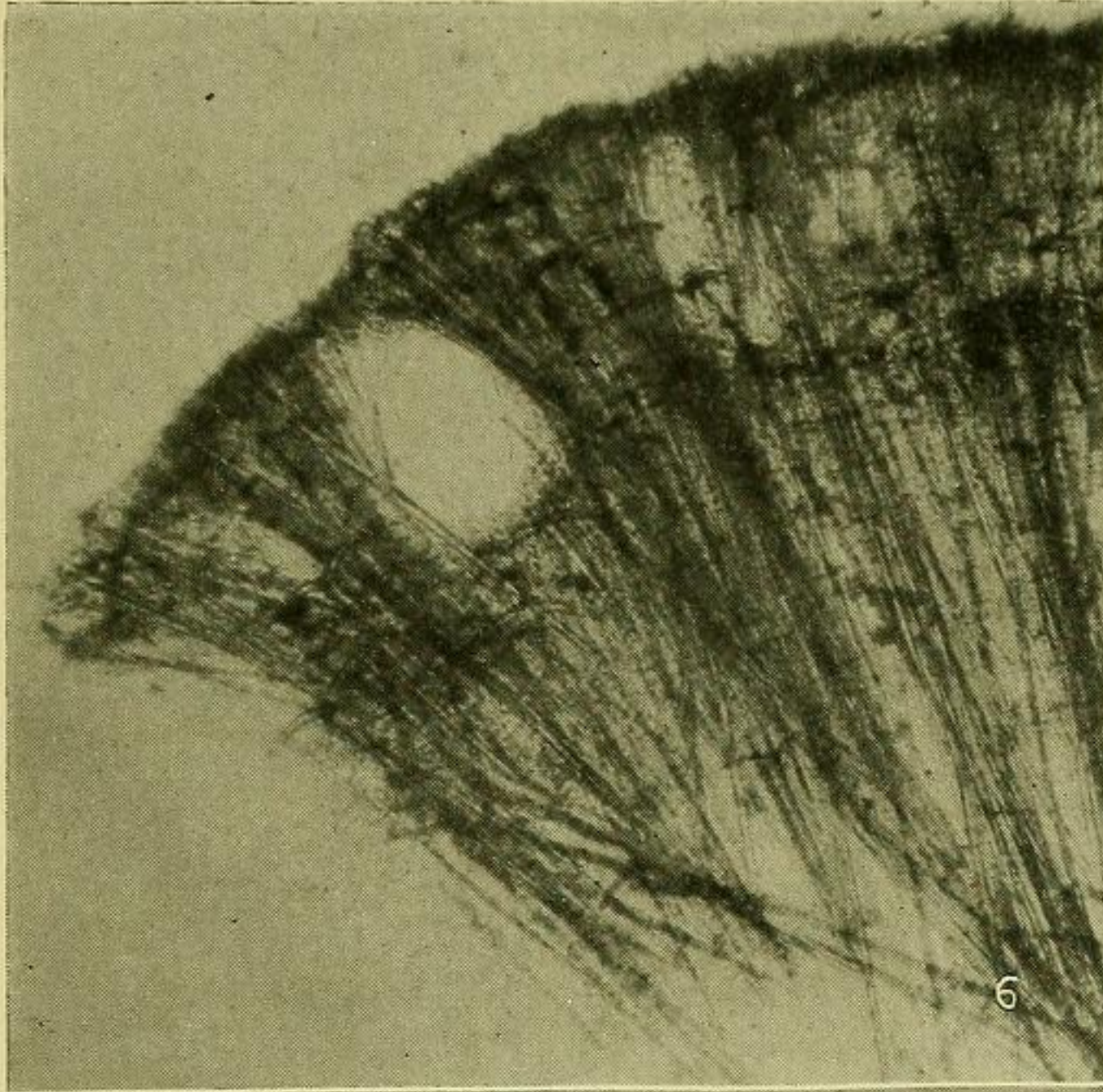


R. W. H. Row, phot.

Grout, sc.

SPONGES FROM THE RED SEA.





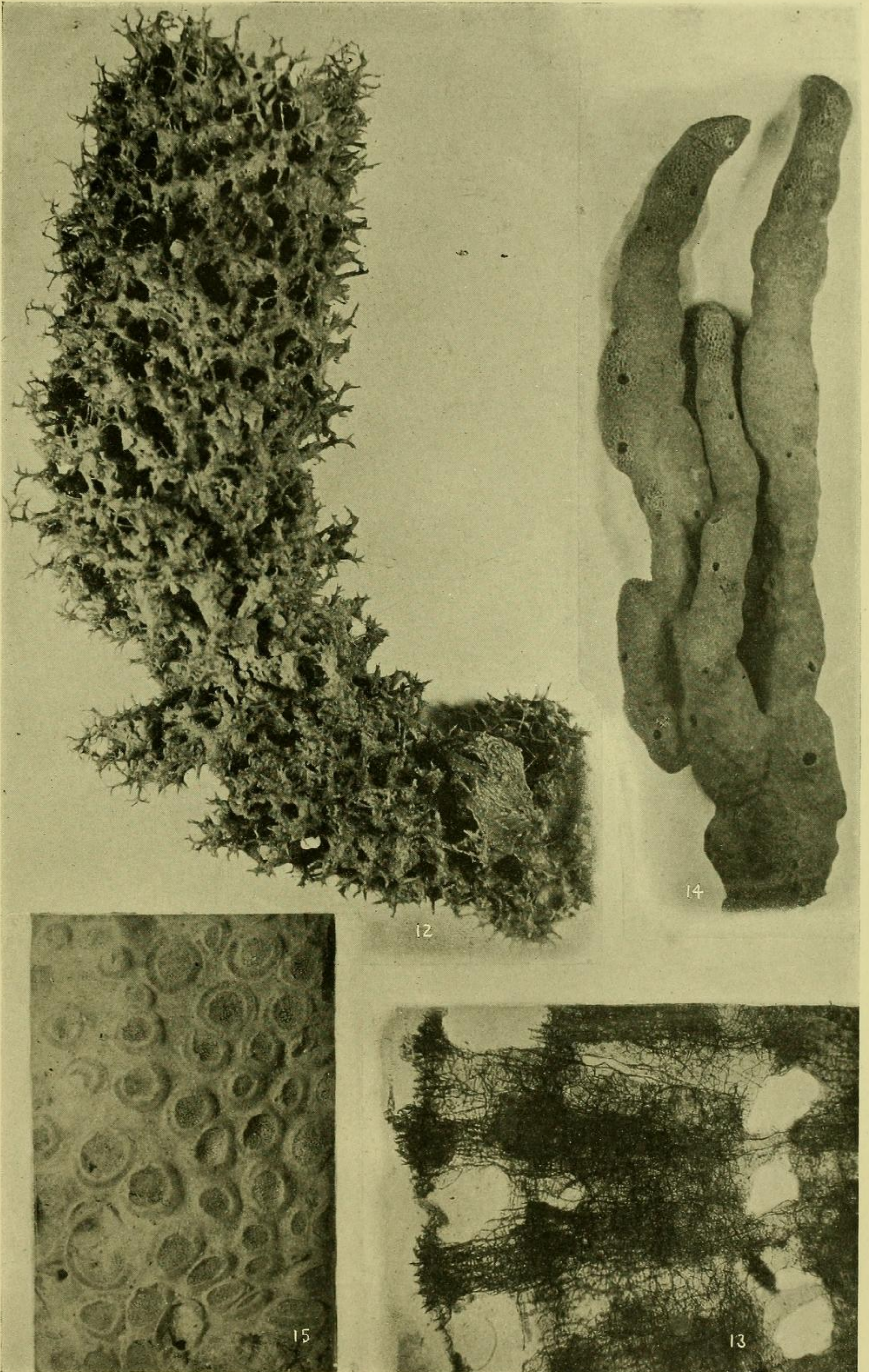
R. W. H. Row, phot.

Grout, se.

SPONGES FROM THE RED SEA.





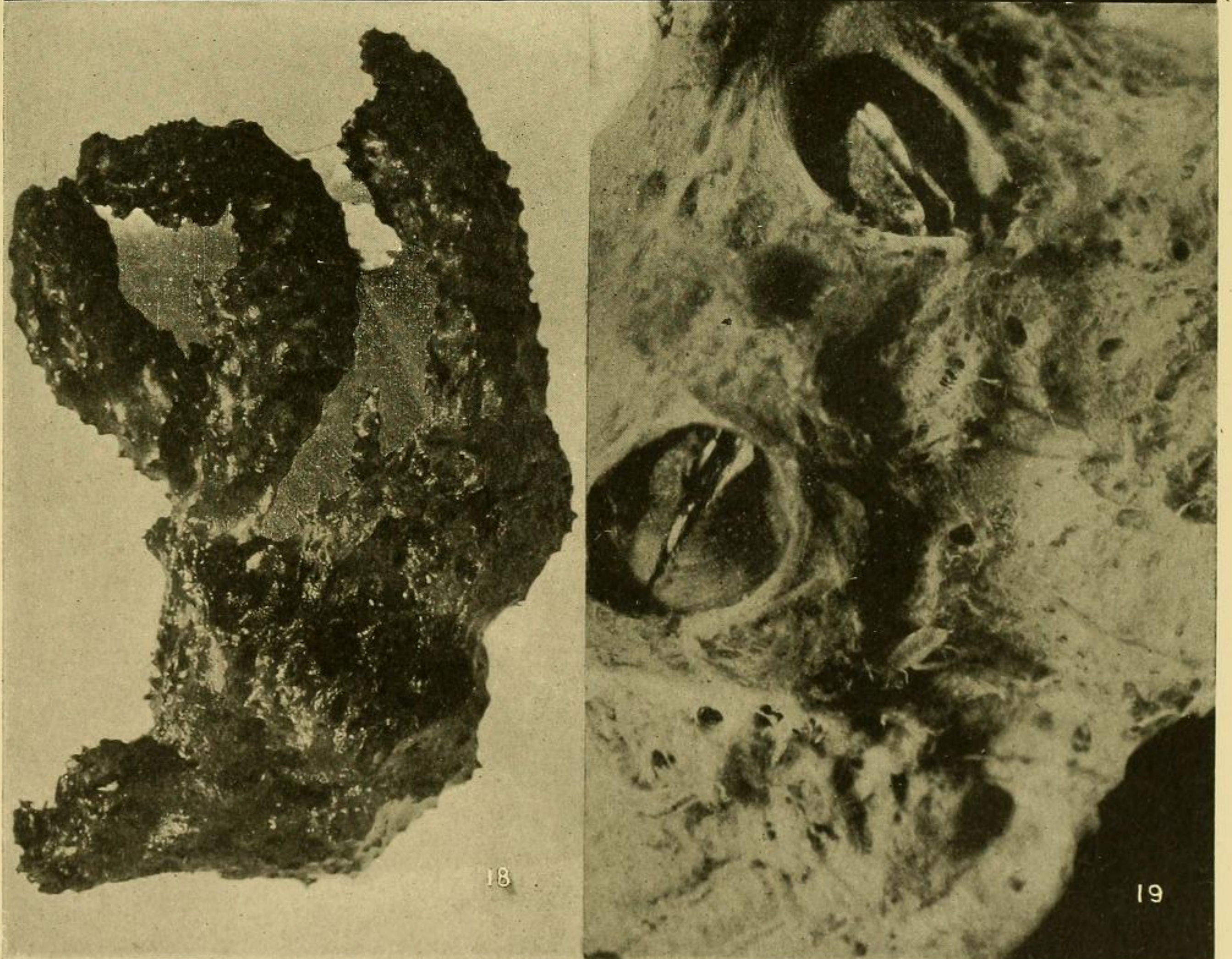
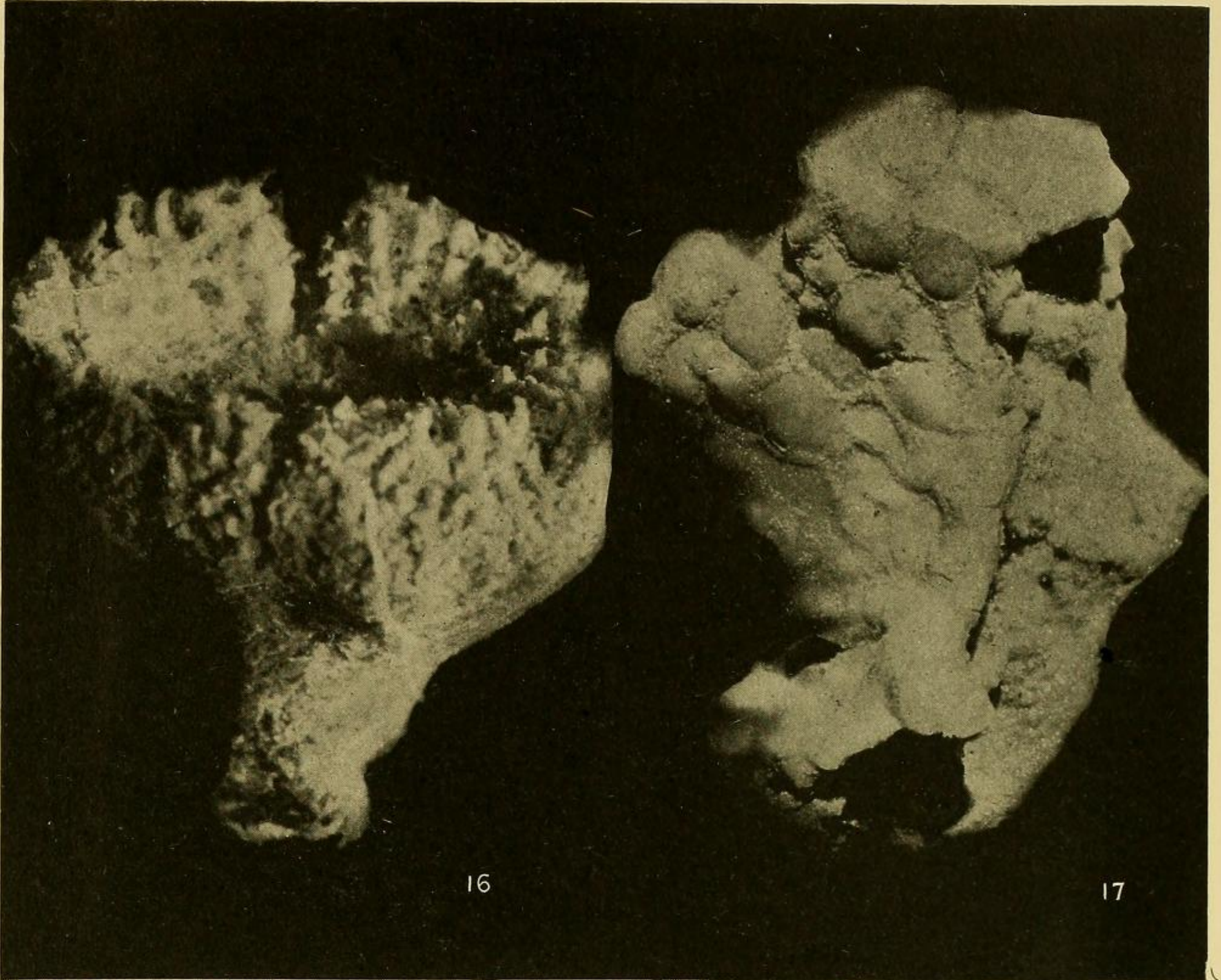


R. W. H. Row, phot.

Grout, sc.

SPONGES FROM THE RED SEA.



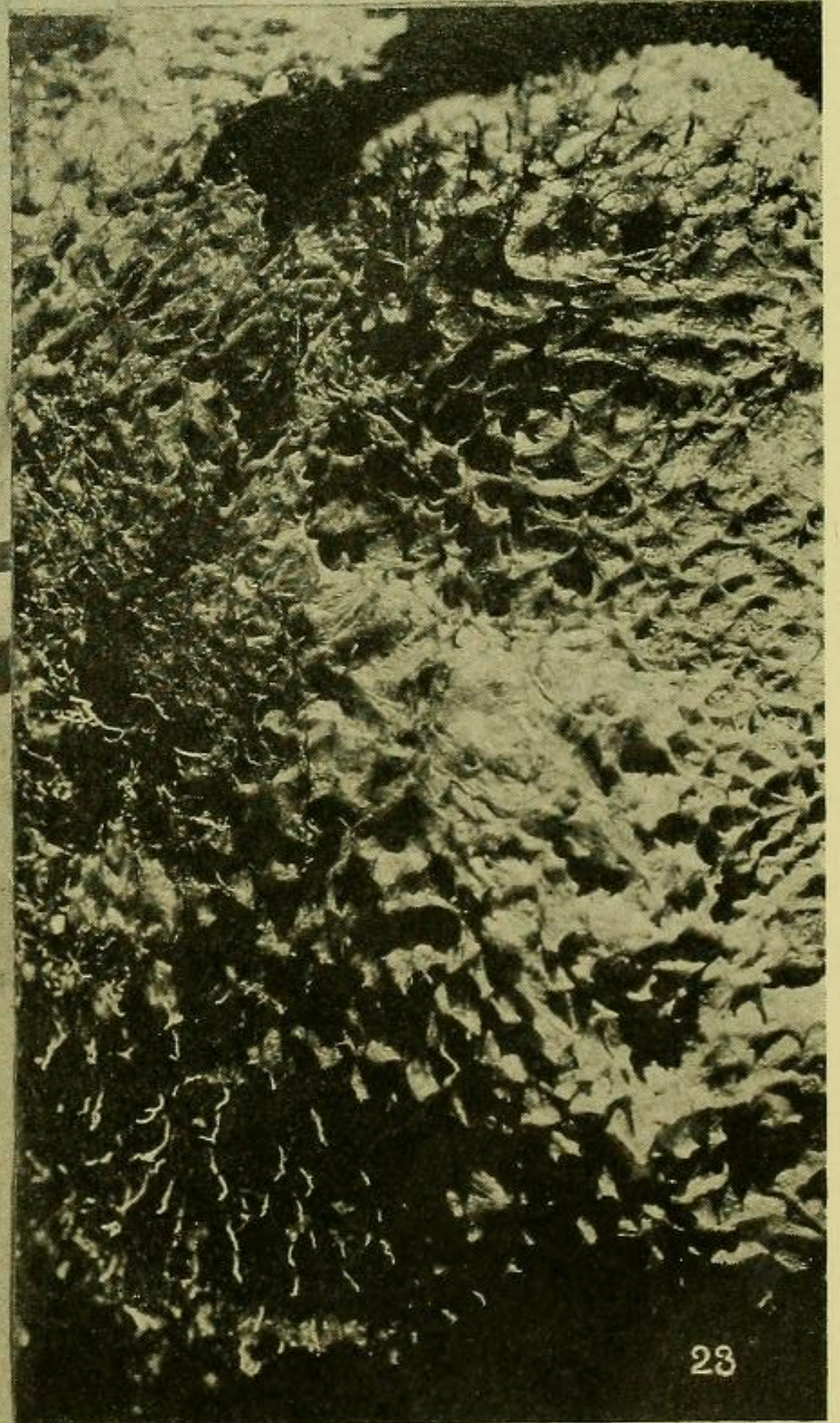
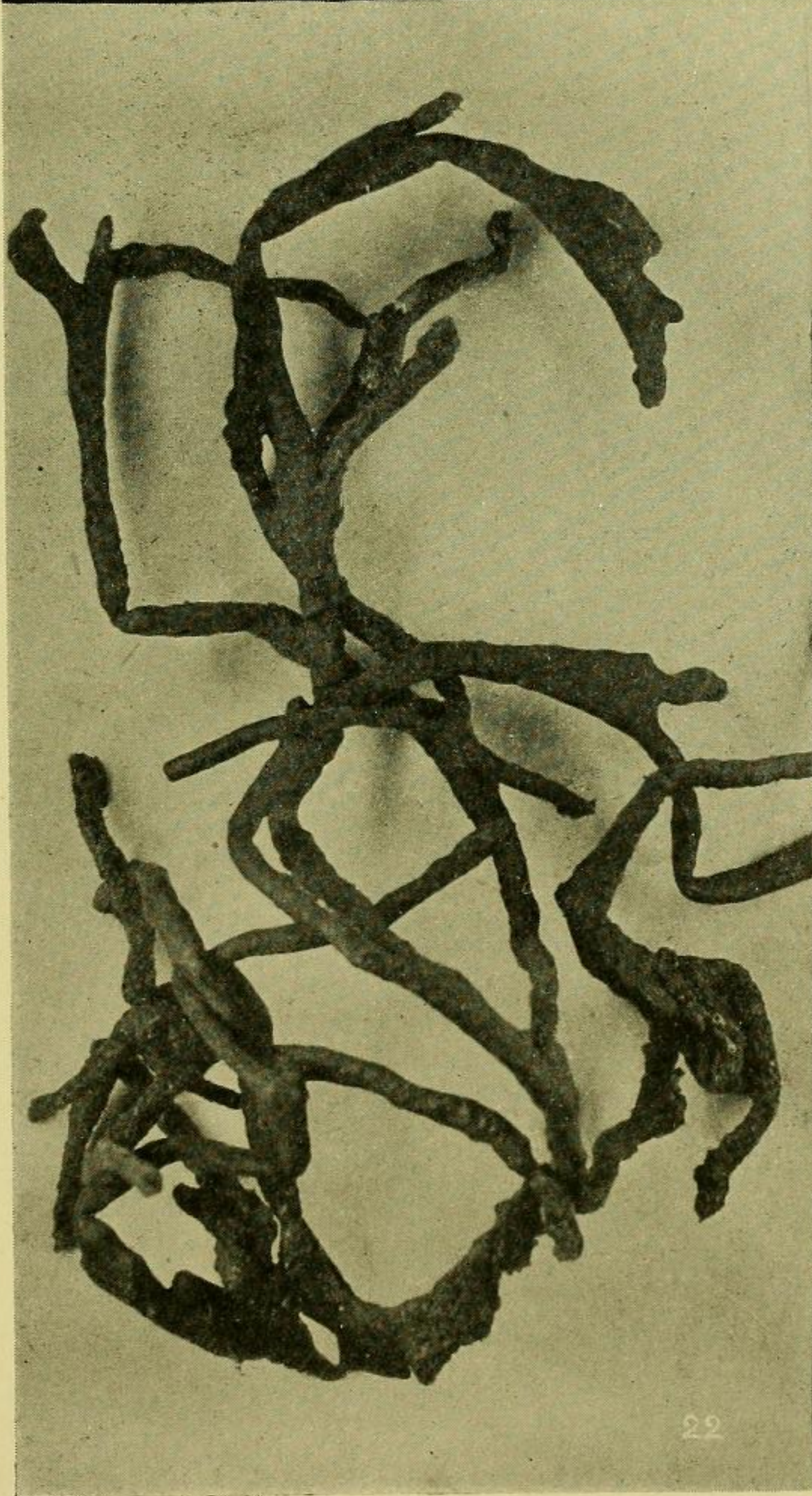
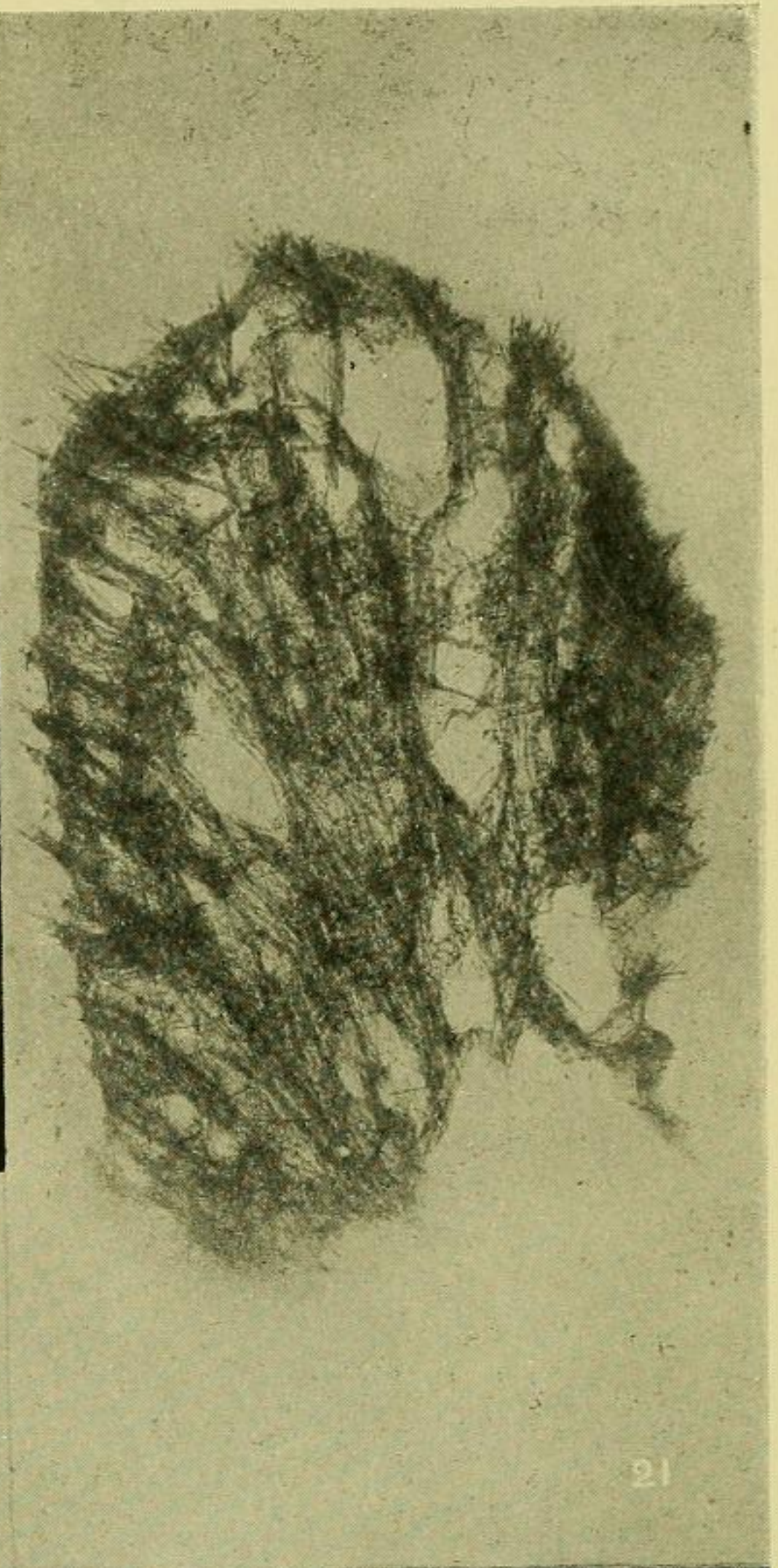
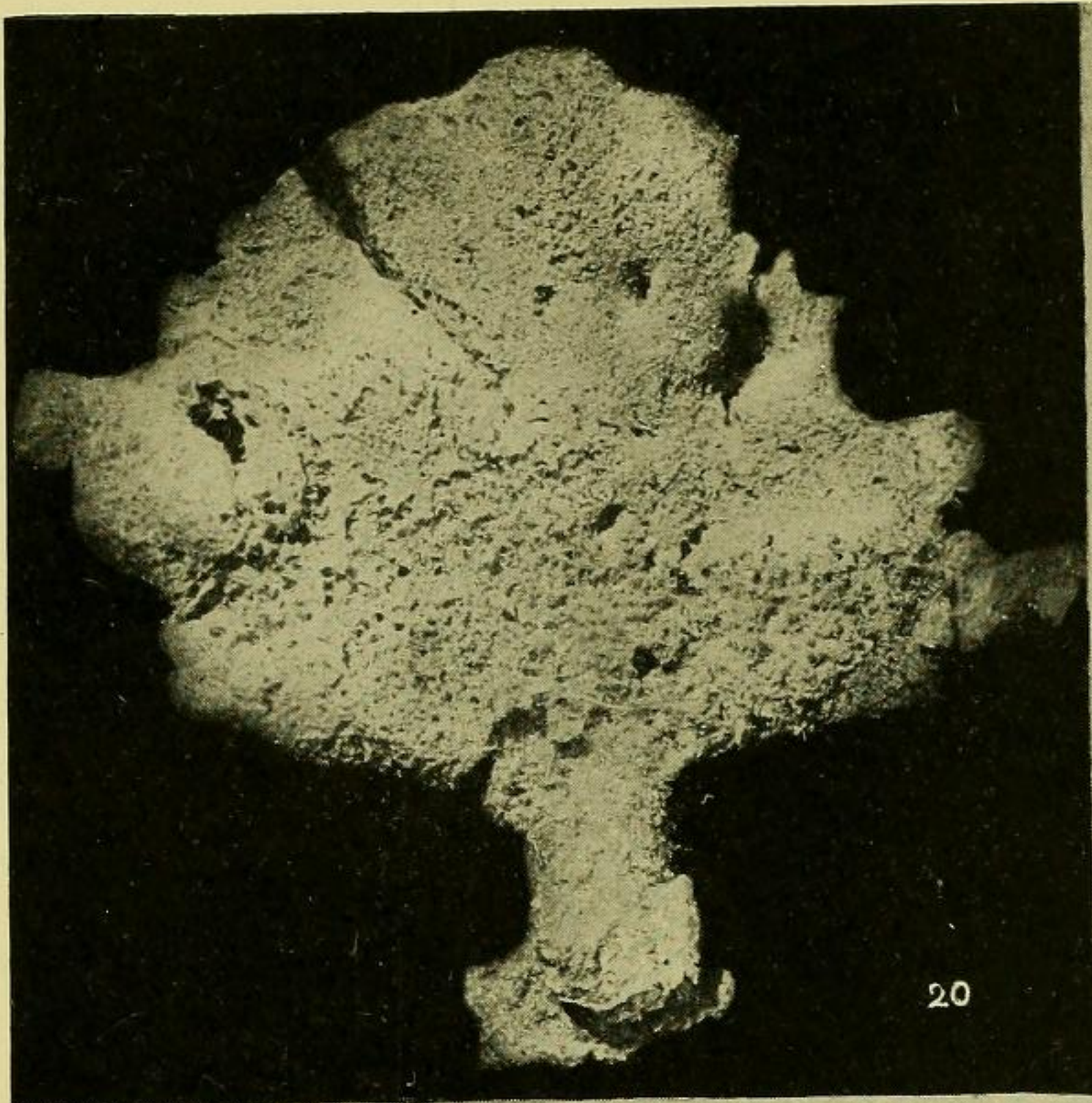


R. W. H. Row, phot.

Grout, sc.

SPONGES FROM THE RED SEA.

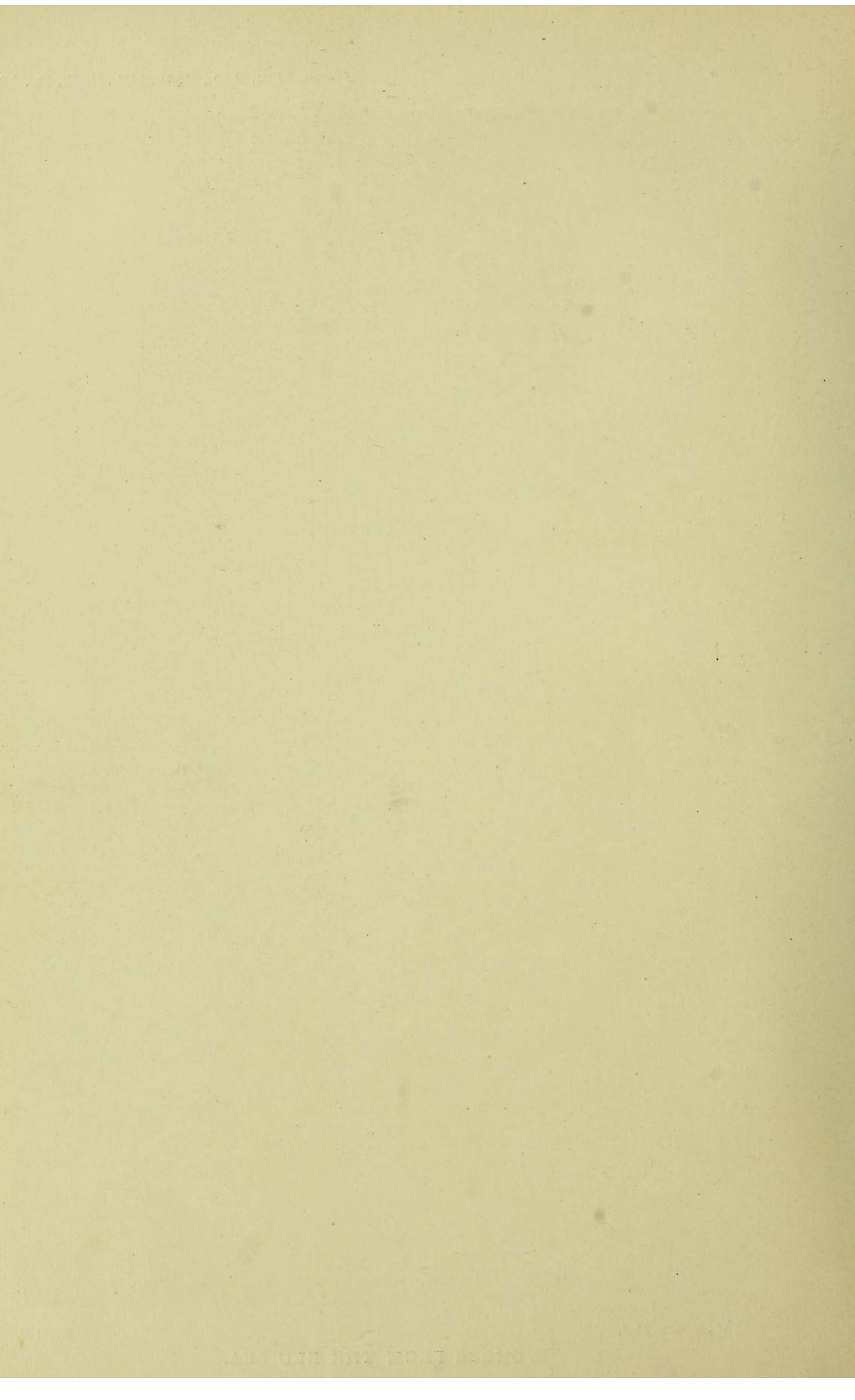


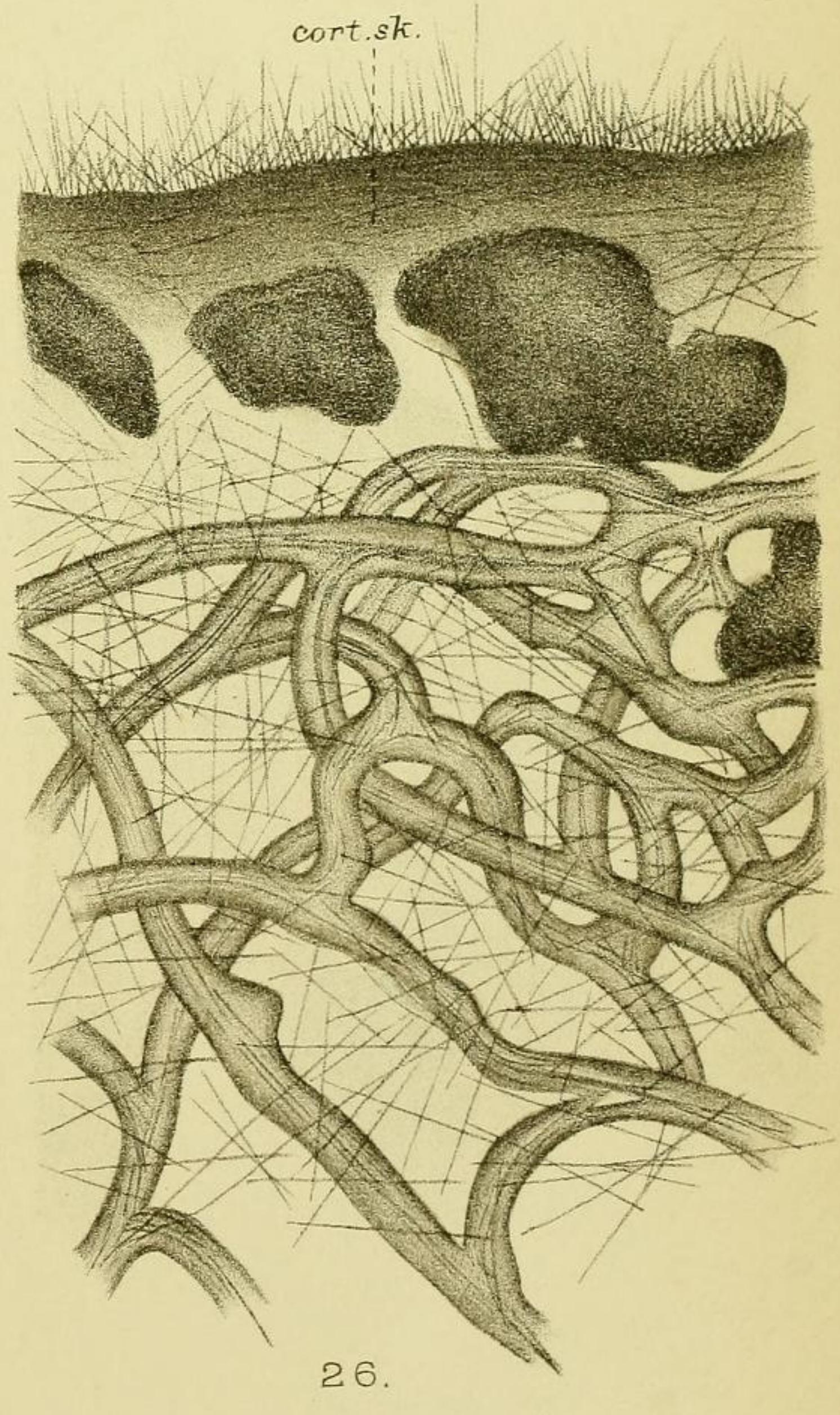
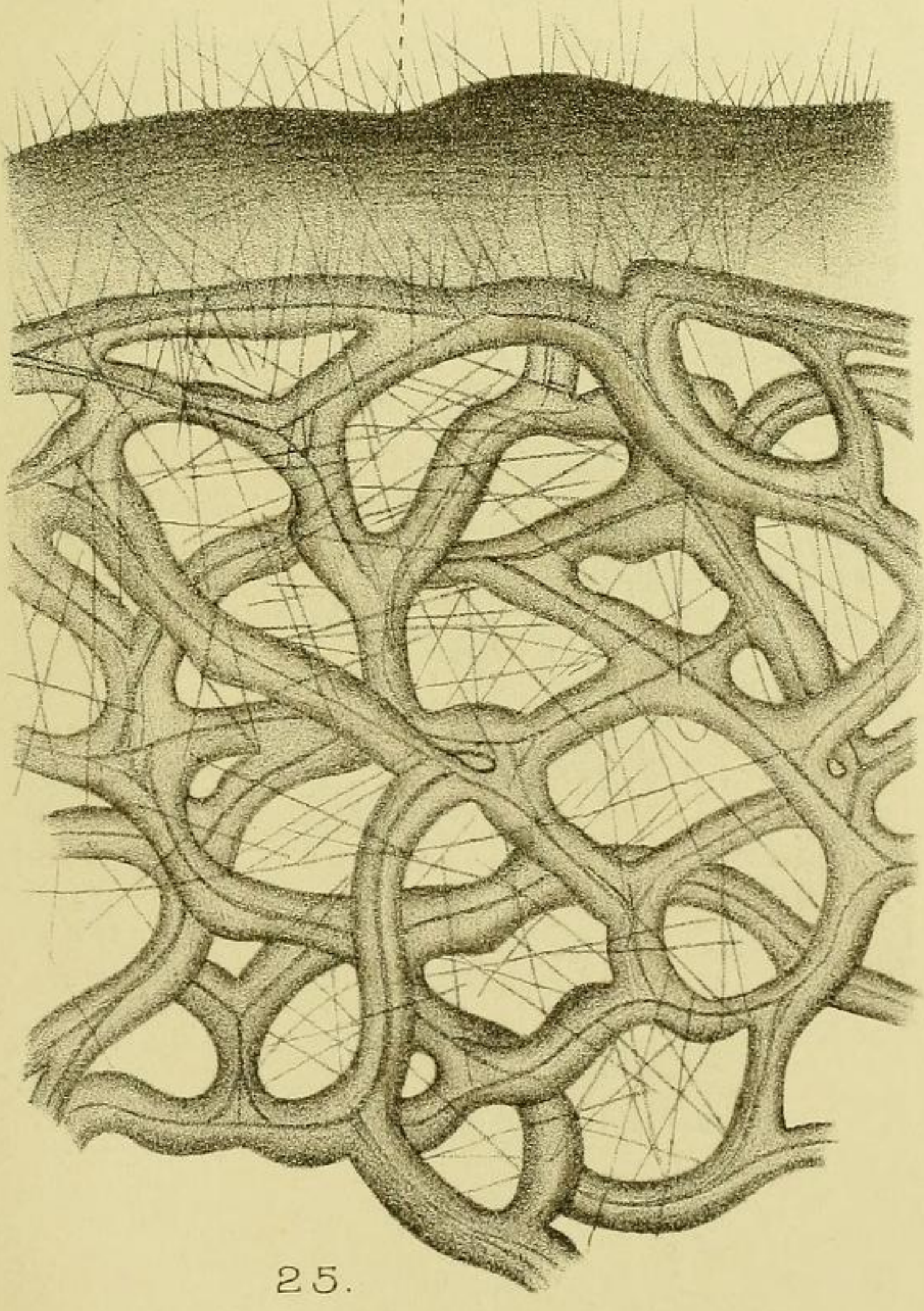
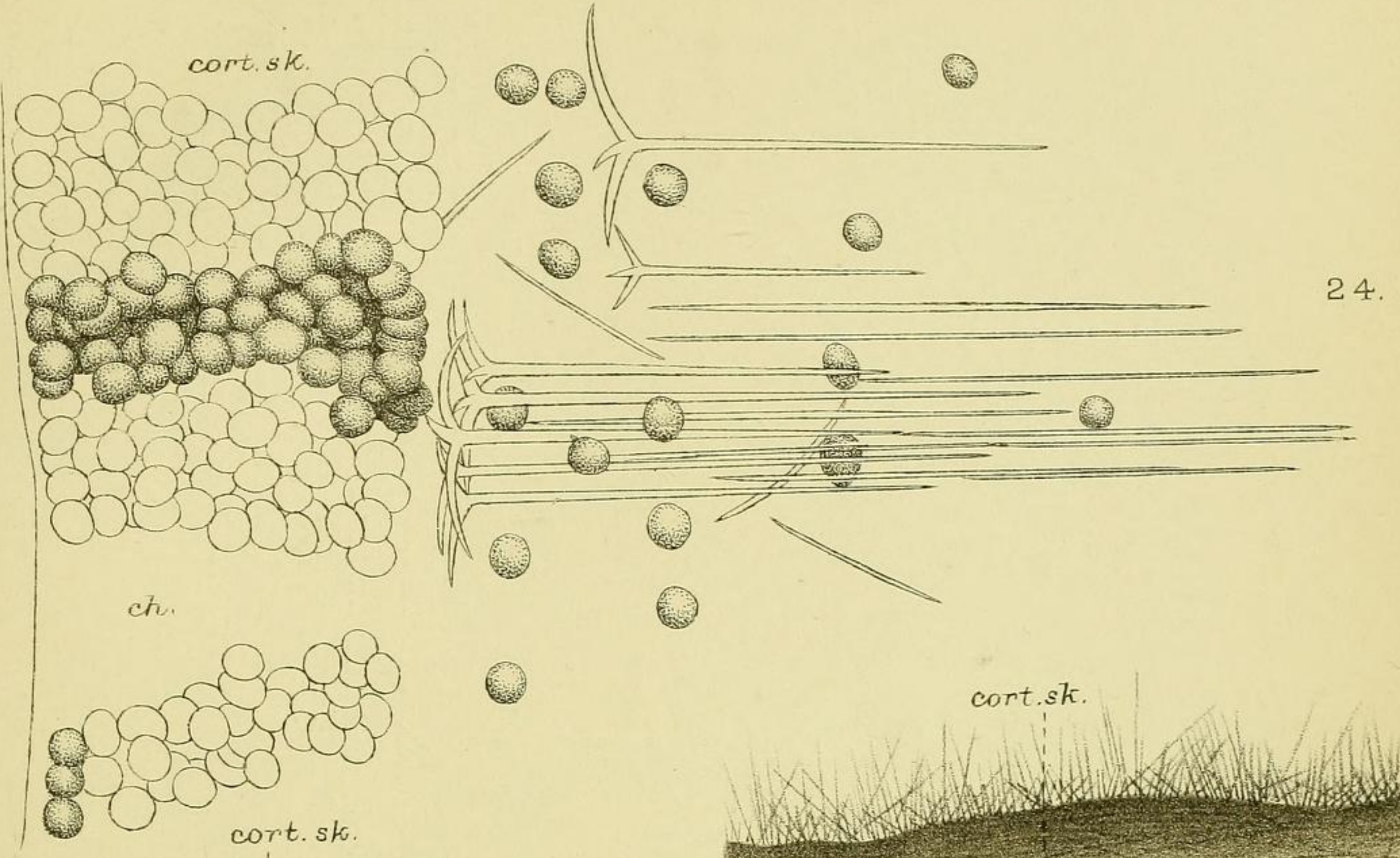


R. W., H. Row, phot.

Grout sc.

SPONGES FROM THE RED SEA.



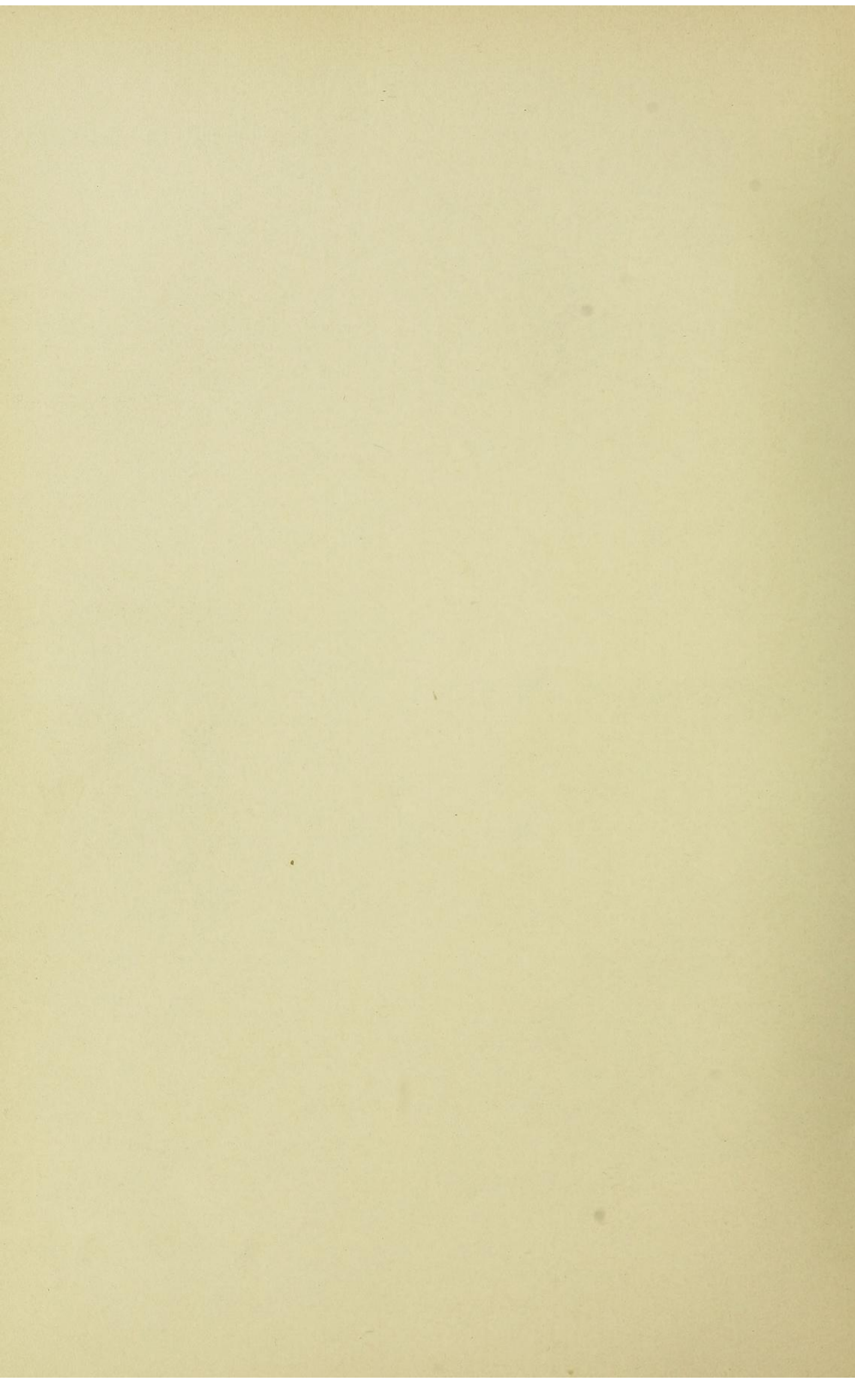


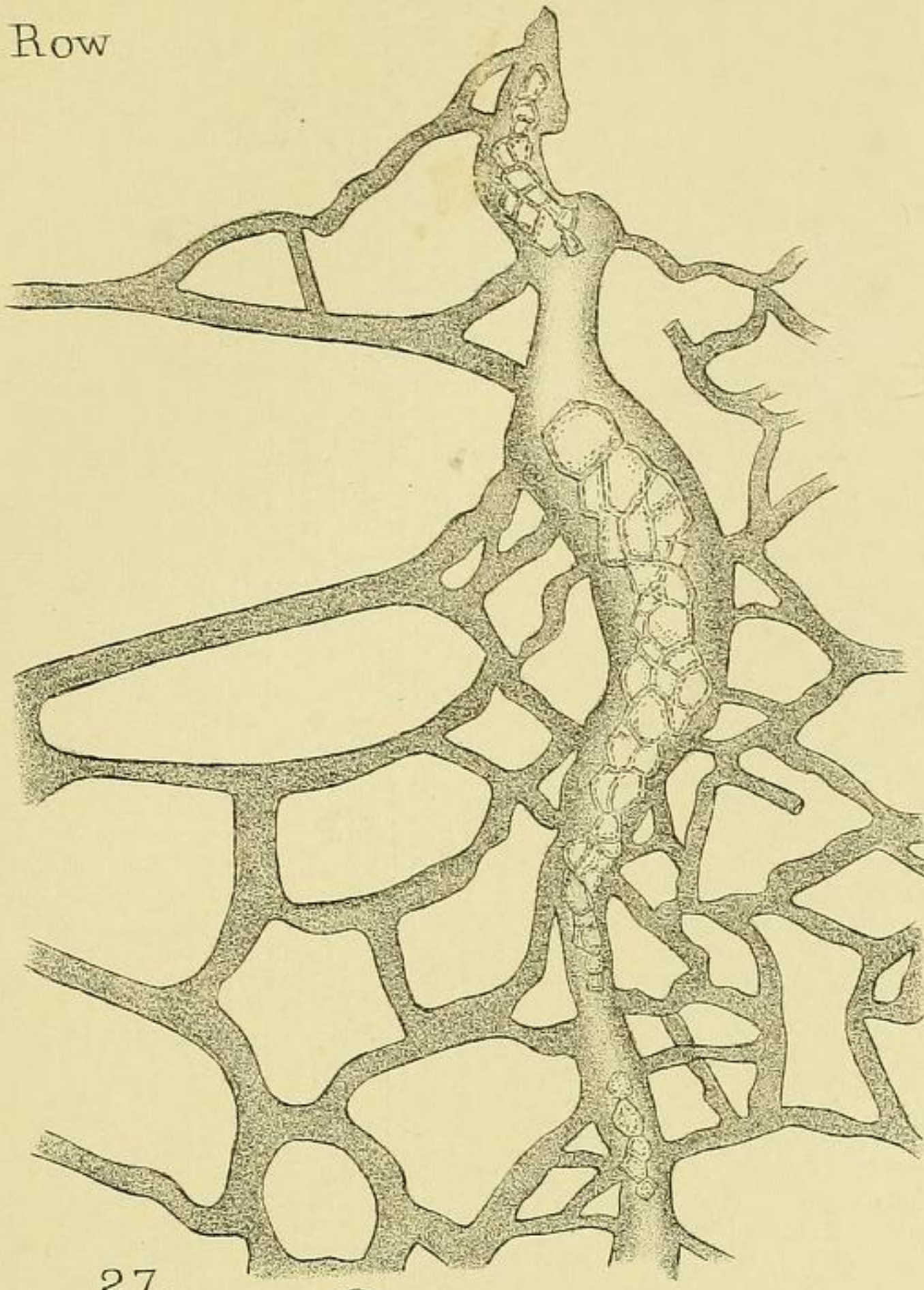
R. W. H. Row, del.

Huth lith. et imp.

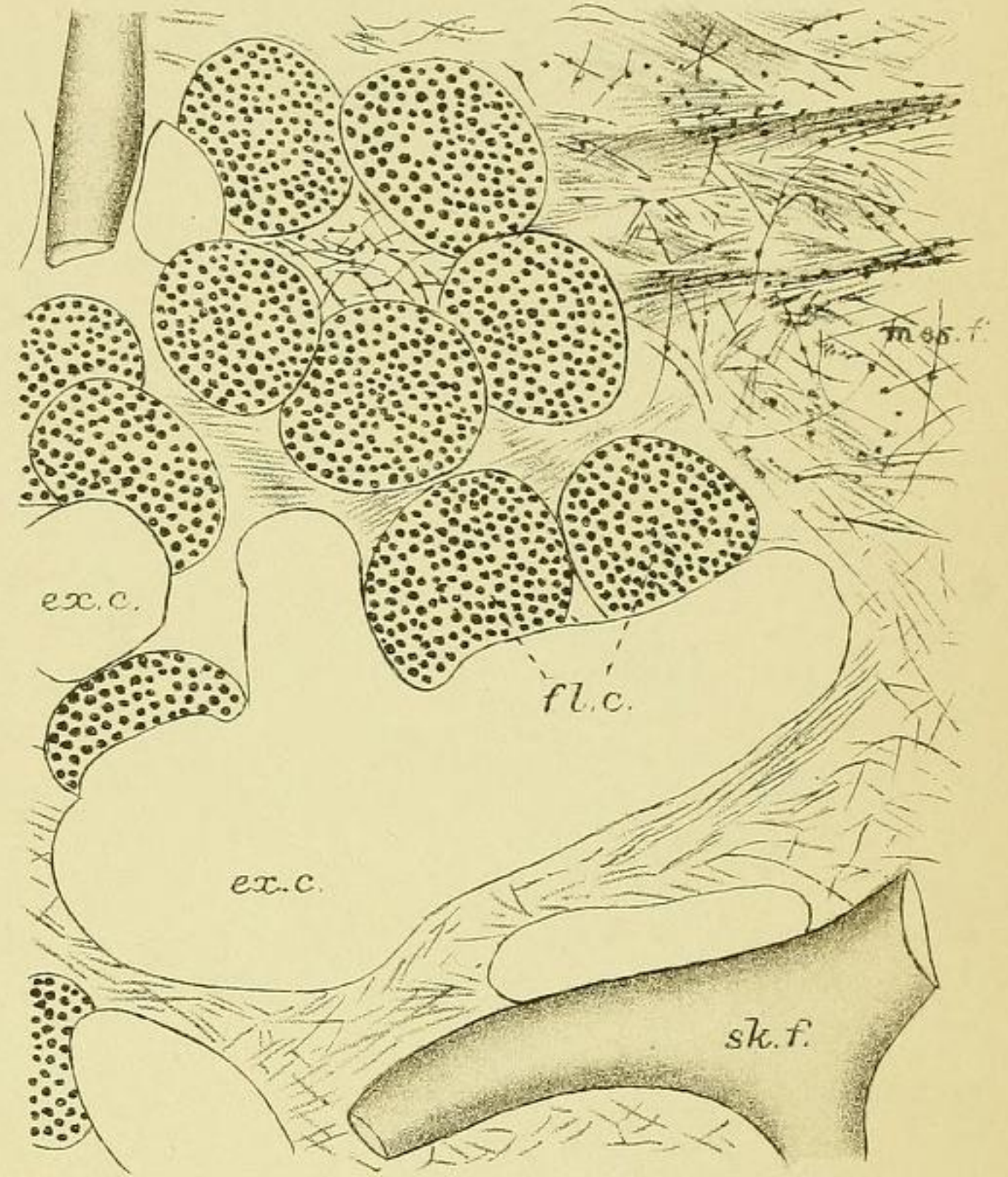
NON-CALCAREOUS RED SEA SPONGES.



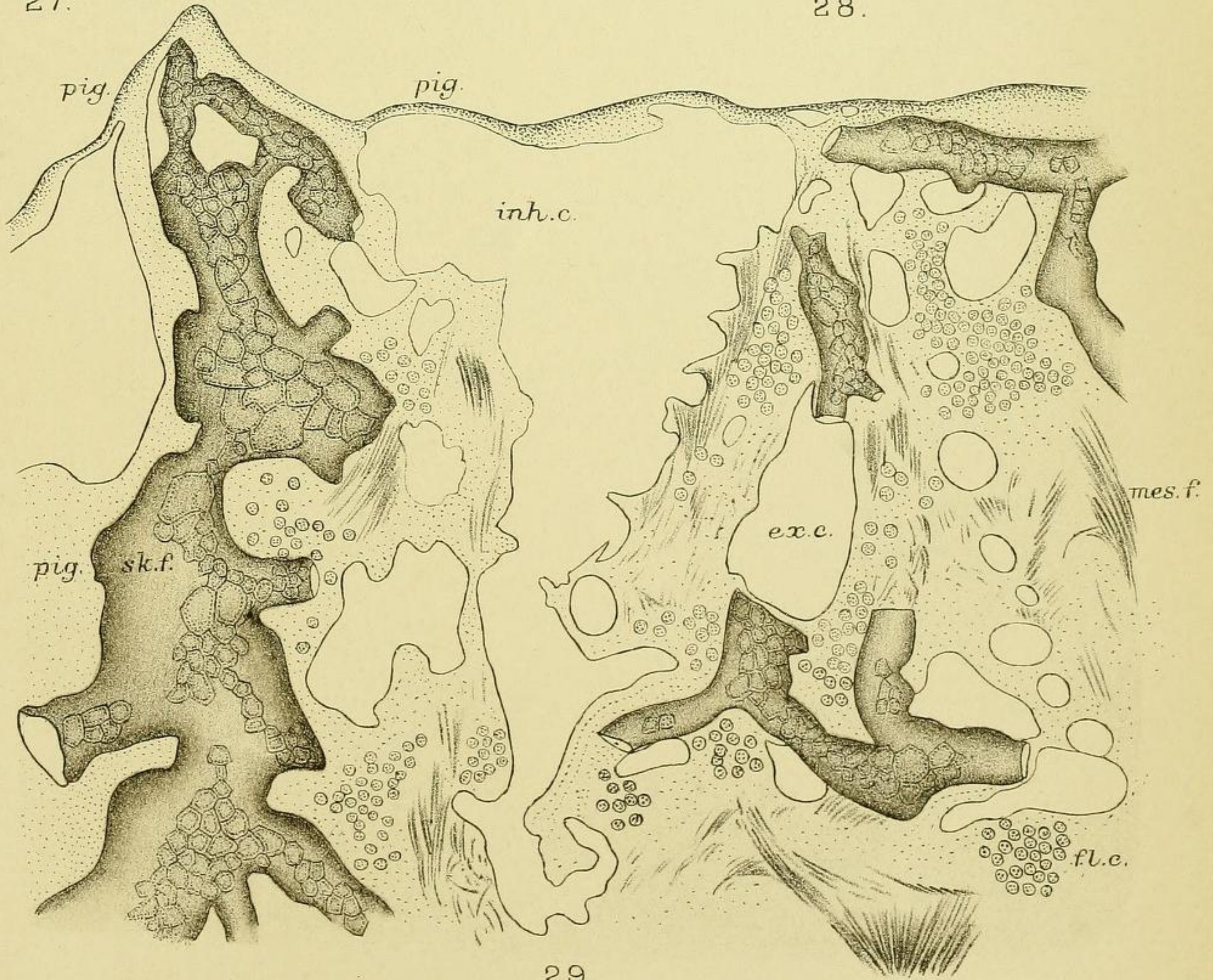




27.



28.



29.

R. W. H. Row del.

Huth, lith et imp.

NON-CALCAREOUS RED SEA SPONGES.